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The social drivers and implications of an ecological risk assessment of both recreational and commercial fishing

— A case study from Port Phillip Bay

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Abbreviations

ABM	Association of Bayside Municipalities (ABM)
ACF	Australian Conservation Foundation
AMA	Australian Maritime Association
EMP	Environmental Management Plan
ERA	Ecological Risk Assessment
FOCBAG	Friends of Corio Bay Action Group
PIRVic	Primary Industry Research Victoria
SBS	Special Broadcasting Service
SETFIA	South East Trawl Fishing Industry Association
SIV	Seafood Industry Victoria
SUP	Stand Up Paddle boarding
VBIFA	Victorian Bays and Inlets Fisheries Association Inc.
VNPA	Victorian National Parks Association
VRFish	Victorian Recreational Fishing (Peak Representative Body)

Executive Summary

This project assessed the social and ecological issues associated with fishing (commercial and recreational) in Port Phillip Bay, Victoria. Port Phillip Bay (including Corio Bay) is a large (1,950 km^2), semi-enclosed, tidal marine embayment with a narrow entrance (Anon, 1973). Much of the Bay's 264 km catchment is inhabited, incorporating Victoria's two largest cities: Melbourne (population ~4.2 million) and Geelong (population ~225,000). Victoria's major commercial shipping ports — Melbourne and Geelong — also operate in Port Phillip Bay, requiring dredged shipping channels. The Bay is one of Victoria's most popular tourist destinations for people simply wanting to enjoy the beach or undertake activities such as fishing, boating, yachting, swimming, snorkelling and SCUBA diving.

Commercial fisheries operating inside the Bay include the Port Phillip–Western Port Fishery that includes haul seine, beach seine, mesh seine and long line fishing methods to variously target King George Whiting, Southern Garfish, Rock Flathead, Southern Bluespotted Flathead, Southern Calamari, Snapper and Gummy Shark, and Purse Seine targeting Australian Sardine or "pilchards" and Australian Anchovy. During 2014/15, 820t of fish was landed from the Bay (excluding Abalone, Blue Mussel, Southern Rock Lobster and Commercial Scallop), comprised mostly of Snapper (144 t), King George Whiting (66 t) and 459 t of other species (of which sardine and anchovies comprised the bulk). The estimated landed value of the commercial catch from the Bay during 2014/15 was $4.7 million. Further to this, intrinsic value of commercial fisheries in the Bay is derived from the availability and supply of premium fresh locally-caught seafood to consumers.

Recreational fishing is a very popular pastime in Port Phillip Bay. More than 350,000 recreational fishing licences were sold in Victoria during 2013/14 and a recent study estimated that there were about 830,000 adult recreational fishers during that time of which about half fished in Port Phillip Bay. It was estimated that about 480,000 fishing trips were undertaken in the Bay during 2010/11. Recreational fishers target many of the same species as commercial fishers, particularly the iconic species such as Snapper and King George Whiting but also Flathead, Southern Calamari, Gummy Shark and Australian Salmon. Current, accurate estimates of recreational catch are difficult to determine but the 2010/11 catch of Snapper in Port Phillip Bay was estimated to be about 314,000 fish (~ 408 t).

With less than 50 commercial licences operating in the Bay at the beginning of this project (and much less at the completion), commercial fishers are far outnumbered by recreational fishers, but perceived competition for species such as Snapper and King George Whiting is a source of tension between recreational anglers and commercial fishers. This ongoing conflict culminated in 2013 with the formation of a recreational fishing lobby group — Friends of Corio Bay Action Group (FOCBAG). This group, based in Geelong, vigorously lobbied for a netting ban in Corio Bay as well as the broader Port Phillip Bay area, arguing that commercial net fishing in the Bay was unsustainable. This project was designed to better understand the sustainability issues relating to both commercial and recreational sectors, but also to investigate the social factors that underpin conflict among commercial and recreational fishers in Port Phillip Bay.

The aims of this project were to:

- Understand the full range of issues underpinning resource sharing by commercial, recreational and other stakeholders in Port Phillip Bay fisheries;
- Develop a framework for assessing the social and ecological issues in Port Phillip Bay fisheries;
- Undertake a qualitative ecological risk assessment (ERA) of the Port Phillip Bay fishery, including both the commercial and recreational sectors;
- Identify significant ecological risks to fisheries in Port Phillip Bay; and,
- Make recommendations for improved cross-sectoral management of Port Phillip Bay fishery resources.

Social studies aimed to identify stakeholder issues and perceived causes/drivers of conflict. Evaluation of social issues relating to fishing in the Bay included: 1) a literature review of the uses and issues relating to fishing and recreational activities in Port Phillip Bay; 2) interviews with recreational fishers to understand motivation, satisfaction and perceived causes thereof; and, 3) qualitative interviews to identify values and beneficial uses of Port Phillip Bay from various stakeholder perspectives (recreational and commercial fishing; charter and dive operators, sailing and recreational boating clubs, bayside environmental NGOs and community members).

The literature review and social study revealed that for all user groups, their greatest concerns were external to fishing and related to effects of pollution, land based activities, and exotic marine pests on Port Phillip Bay's ecology. Although Government assessments regard fisheries as ecologically sustainable, media coverage focuses on resource sharing / allocation rather than ecological risks to the Bay. The social research further found that most of the overt conflict between users was restricted to a relatively small group of recreational fishers opposed to commercial fishers in the western side of the Bay, especially Corio Bay. The main drivers of conflict are (evidently) perceived competition for particular species occurring in this shared fisheries resource (e.g. Snapper, King George Whiting, Flathead). Broadly speaking, across those groups not intimately associated with fishing (i.e. other recreational users of the Bay), most had greater concerns regarding the culture and behaviours of recreational fishers, and the increasing number of them, as a priority over any commercial fishing activities.

Main motivations for recreational fishers from the Melbourne, Mornington and Western Port areas were catch related. Non-catch related motivations (e.g. relaxation) were more important for Bellarine anglers, where the greatest resource conflict exists, but they had a much lower level of satisfaction with their fishing activities than those from other areas, irrespective of motivation. Western Port anglers had the highest personal expectation of catch prospects, and Bellarine anglers had the lowest. The most common causes of perceived issues by Bellarine anglers were related to commercial fishing, whereas expections of anglers from other regions related to the competition for access to fish generally, and conflict arising from lack of facilities (boat ramps / parking) and interactions with other vessels (e.g. crowding). Levels of satisfaction with recreational fishing in the Bay overall were less related to catch rates and the availability of target species and more linked to concepts of 'fair play' and visual amenity. It was generally recognised that increased use of the Bay, by any users, will increase conflict and competition rather than it being ameliorated by the removal of any one particular user group.

The main issues for commercial fishers related to access to fish and loss of seagrass, which they attributed mainly to impacts of pollutants, such as oils and detergents. The main issues for environmental groups were the effects of pollution and urban development on the health of the Bay. However, they were also concerned about recreational user behaviours in and around the Bay and a lack of education / understanding about the environmental impacts of their behaviours. For other recreational users of the Bay, the main issues related to loss of fauna biodiversity and cruelty to marine fauna caused by the behaviour of some recreational fishers.

Complementing the social studies of fishing in the Bay, an ecological risk assessment (ERA) was undertaken using the Level 1 Scale, Intensity, Consequence Analysis (SICA) for assessment of the ecological risks arising from commercial and recreational fishing against five ecological components: target species; by-product and by-catch species; threatened, endangered and protected (TEP) species; habitats; and, communities (ecological). This method was applied to seven sub-fisheries operating in the Bay: commercial haul seine (including Garfish seine and beach seine); commercial long-line; commercial mesh-net; commercial purse-seine; recreational hook and line (including recreational charter fishing); recreational spearfishing; and, hand collection (commercial and recreational). SICA analysis employs a "plausible worst case" approach to evaluation of risk, rather than considering all possible interactions. As part of the assessment, experienced participants from each sub-fishery were interviewed to provide expert opinion on components, hazard identification, scale, intensity and consequences.

By far the greatest risks identified for sub-fisheries in the ERA were associated with 'External Hazards' (both in terms of the number and severity of risks) associated with population, catchment, industry and development impacts on the Bay. Prominent examples included: translocation (e.g. from ship ballast water) and colonisation of exotic marine pests (e.g. fan worms, sea stars, crabs, and shellfish) and pollution (e.g. industrial waste/storm water discharge). Port Phillip Bay, as an almost totally enclosed water body with very low exchange of water with the open sea, is vulnerable to these external hazards. The Bay's physical, chemical and biological characteristics are highly influenced by the activities of the large human population living around the Bay (including major cities and ports). There are a number of pathways whereby these hazards present a risk to fisheries, including impacts on the biology of important fish species through changed water quality and changes to habitat. Careful assessment of the risk pathways to important fish populations would be beneficial in identifying potential management actions that could mitigate risks associated with these hazards. Given that the highest risks identified in the ERAF were for external hazards, a more traditional risk assessment which quantifies likelihood and consequence of identified hazards is required to assess external risks in more detail. The analysis would identify the stressors, pressures and impact pathways posing the greatest risk to fisheries in the Bay. This information could be used by non-fishery managers (e.g. catchment, coastal, water quality) in the policy and planning to reduce external risks to fishing in the Bay.

In contrast to external hazards, risks directly related to commercial and recreational sub-fisheries were assessed to be generally “Moderate”, although there was some variation depending on the nature of the particular sub-fishery. There were a number of risks associated with the recreational hook and line fishery that were related to the incremental effects of the large number of boats active in the fishery. The risks include the potential effects of debris (e.g. plastics) and gear loss (e.g. fishing line), and boat strikes on TEP species. In most cases the consequences were “Moderate” and considered sustainable. Management actions such as education programs to reduce debris and lost gear emanating from the fishery are recommended. Although the direct fishing impacts of recreational fishing are considered to be sustainable based on current fishing levels and management controls, confidence among stakeholders tends to be low because the total recreational fishing effort and catch of key species is poorly known. Estimation of total catch and effort for this sub-fishery on a regular basis is recommended and there is a need to develop methods for determining sustainable catch limits in a recreational dominated fishery to improve confidence in the assessment of sustainability. The recreational spearfishing sub-fishery was assessed as low risk with the exception of potential localised depletion of fish on reefs which are readily accessible from the shore.

Compared with recreational fishing, there are relatively few commercial fishers operating in the Bay. In general, there were a low number of mostly ‘Moderate’ risks for sub-fisheries evaluated. There was more certainty in assessing the direct impacts of commercial fishing on target species due to comprehensive catch and effort data. However, there was much less information available about discarding rates making the assessment of bycatch impacts less certain. There was considered to be a moderate but sustainable consequence for seagrass habitat from haul-seining activities, although a more comprehensive impact assessment is needed. Mesh netting and purse seining carried a risk of TEP species interactions (penguins, seals and dolphins) and mesh netting (and to a lesser extent long-lining) also carried the risk of ghost fishing by lost gear (a rare event).

A risk that requires careful management for both the recreational hook and line and the commercial haul-seine fisheries is the discarding of undersize target species. Given that fish populations tend to be recruitment driven, ensuring the maximum survival of released undersize fish should be a priority. High-grading has been identified as an issue for the recreational Snapper fishery in Port Phillip Bay and this issue may become more of a problem with increasing participation in recreational fishing.

A number of the risks directly attributed to the sub-fisheries relate to TEP species, and particularly the Burrunan Dolphin, where a genetically distinct population of only about 100 individuals lives in Port Phillip Bay. Given the dolphin’s low population size in Port Phillip Bay, even a very small number of fatal boat strkes could impact the population. The recreational hook and line fishery was considered the fishing sector with the highest risk to the Burrunan Dolphin and an increase in boat use in the Bay could increase this risk. Careful management to reduce risks to this population from fishing related activities should be a priority. This management could be by way of increased public education about risks to TEP species.

A high fishery-related risk that was common to all the sub-fisheries was the spread of marine pests. Translocation of introduced species can have major impacts on habitats and communities and flow on effects for target, bycatch and TEP species that depend on those habitats. A recent example of translocation within the Bay is the introduction of Japanese Kelp, *Undaria pinnatifida*, to the Queenscliff Harbour.

In summary the ERA showed that most risks directly associated with the sub-fisheries tend to be of ‘Moderate’ or lower consequence and are considered sustainable given current management controls. A proviso, however, is that many of the assessments have a low confidence associated with them, mostly because of a lack of data. In particular, it is important that assessments of total catch and effort for the recreational fishery are undertaken at regular intervals.

Results of the ERA and the social studies regarding perceived sources of conflict among users were compared and objectively evaluated to address resource sharing issues in the Bay. Both the ERA and the social study supported that the greatest risks identified for all fisheries in Port Phillip Bay were extnal to fishing, including pollution, urban development and introduced species. Recruitment and survival of many species targeted by both commercial and recreational fisheries are related to the Bay's environment including nutrient inputs and habitat availability.

The "Target One Million" plan came into effect during the early stages of this project. This plan aimed to capture the perceived economic and social benefits of recreational fishing by encouraging greater participation of anglers in Port Phillip Bay. The plan included a buyout of existing commercial netting licences operating in Corio Bay by 2018, and throughout Port Phillip Bay by 2022. The removal of commercial netters from the Bay will largely remove the underlying cause of existing conflict in favour of recreational fishers, although some commercial long-lining will continue. Because of this, a planned project outcome (i.e. a management plan for resource sharing between commercial and recreational fishers) was considered to be no longer relevant. Furthermore, improved public awareness of the low ecological risk of the long-line fishery should reduce conflict between the recreational and commercial sectors caused by perceived sustainability issues. Similar resource sharing issues between recreational and commercial sectors apply in Gippsland Lakes and Corner Inlet in Victoria and many other bays and inlets around Australia. While results for Port Phillip Bay may not be directly representative of those other fisheries, the method used here could be applied more broadly.

Further studies are required to evaluate the impact of increasing rates of recreational fishing in the Bay that may occur under the Target One Million plan. While, in general, an increase in participation in recreational fishing might simply increase the risk scores of an ERA, it is difficult to know which subsectors of the recreational fishery will increase the most (i.e. land or boat based, bait or lure / soft plastic fishers), and the attendant access and behavioural conflicts that will continue to be present and increase. In addition, a management plan, taking into account the external hazards identified in this study, needs to be developed based on a robust ecological impact assessment. This reflects stakeholder concerns about the continued health of Port Phillip Bay and the sustainability of existing beneficial uses.

Recommendations

- Develop a better understanding of the hazards to fish and habitat and associated pathways, to recommend management actions to mitigate external risks.
- Continue to support initiatives aimed at reducing the amount of pollution, litter and debris entering the Bay, and develop other management actions including education and awareness programs focussed not just on commercial or recreational fishers, but all users of the Bay.
- While the recreational fishery appears to be sustainable, monitoring of catch and effort should be regularly undertaken, and methods should be developed to determine sustainable catch limits to improve confidence in assessments.
- Expand the existing angler diary program in the Port Phillip Bay fishery.
- Implement a mandatory logbook system for fishing charter operators administered through the commercial catch and effort system.
- Carefully manage the risk associated with high-grading and discarding of undersize target species by recreational hook and line and the commercial haul-seine fisheries.
- Continue to promote educational materials that maximise survival of released undersize fish
- Increase public education about the risk of fishing activities to Burrunan Dolphin and other TEP species.
- Increase public education and awareness of resources available under the National System for the Prevention and Management of Marine Pest Incursions to reduce the risk of spreading marine pests.
- Because the main risks to Port Phillip Bay are external to fishing, a more traditional risk assessment approach should be used to identify the stressors, pressures and impact pathways posing the greatest risk to fisheries in the Bay from external hazards.

Keywords

Port Phillip Bay, Corio Bay, commercial fishing, recreational fishing, resource allocation, social assessment, ERA, ecological risk assessment

1 Introduction

1.1 Port Phillip Bay

Port Phillip Bay (the Bay) including Corio Bay is a large (1,950 km^2), semi-enclosed, tidal marine embayment with freshwater inputs from numerous rivers (Anon, 1973). Although its greatest depth is 24 m, nearly half of the Bay is less than 8 metres deep. The Bay holds about 26 km^3 of water and has a very narrow entrance (~ 3km wide). This limits water exchange resulting in a flushing period of about one year (Harris *et al.*, 1996). The Bay's catchments comprise 21 natural drainage basins covering an area of more than 9,700 km^2 (DEPI, 2015). Much of the 264 km of shore line is inhabited, including Victoria's two largest cities Melbourne (population ~4.2 million[1]) and Geelong (population ~225,000[2]).

With such a densely populated shoreline, the Bay is important for a wide range of recreational and commercial activities. One of the most important recreational pursuits is recreational fishing, with many hundred thousands of people participating in shore-based and/or boat-based fishing around the Bay. Other recreational pursuits include swimming, diving, boating, yachting and simply visiting the beach. Popular holiday destinations surround the shores of the Bay, and commercial operators offer ecotourism activities, SCUBA diving, and fishing charters. The Bay supports active international and domestic shipping trade through the Port of Melbourne and Port of Geelong. The Port of Melbourne hosted 3,152 commercial vessel visits in 2012/13 comprising mostly container (36%) and vehicle carrier (31%) vessels (POM, 2014). This contributed some $2.8 billion to the Australian economy supporting a workforce of 15,900 FTEs (POM, 2014). Commercial fisheries operating inside the Bay include the Central Zone Abalone Fishery, Port Phillip–Western Port Fishery (including beach seine, mesh seine, haul seine and longline fisheries), Purse Seine (Port Phillip Bay) Fishery and the Port Phillip Bay (Mussel Bait) Fishery (Fisheries Victoria, 2012). A commercial dive fishery for scallops has recently commenced. The Bay also supports aquaculture industries for Blue Mussel and Abalone which produced 809 t and 330 t (state-wide) respectively in 2011/12 (DPI, 2012).

1.2 Port Phillip Bay's Commercial Fisheries

Commercial fisheries have been operating in Port Phillip Bay since early European settlement. The history of development is documented in Lynch (1966), Hall and MacDonald (1986) and Coutin (2000). Annual catches landed in Port Phillip Bay during the early 1900s exceeded 1000 t, comprising mostly Barracouta (*Thyrsites atun*), Flathead (all species combined) and Snapper (*Chrysophrys auratus*) increasing to 2000 t during 1933 (Coutin, 2000). Annual landings of fish varied from 1,000-1,200 t from the 1950s until the mid-1980s, after which the expansion of the fishery for Australian Sardine (*Sardinops sagax* – commonly known as Pilchard) increased landings to a peak of 2,673 t in 1992/93. Annual landings have since declined to 400–800t following closure of the Commercial Scallop (*Pecten fumatus*) fishery (dredge) in 1997. The most recent published data shows that during 2011/12, 784 t of fish (excluding abalone, Blue Mussel (*Mytilus planulatus*), Southern Rock Lobster (*Jasus edwardsii*) and Commercial Scallop) was landed in the Bay (DPI, 2012). That catch comprised mostly Snapper (158 t) and King George Whiting (*Sillaginodes punctatus*) (109 t). The value of the catch from that year was not published, but the value of the 682 t landed in 2009/10 was $3.5 million, with $1.4 million coming from King George Whiting alone (DPI, 2012).

There were 42 Western Port / Port Phillip Bay Fishery Access Licence holders (commercial netting in Western Port Bay was banned in 2007) and one Purse Seine (Port Phillip Bay) Fishery Access Licence holder who mostly fish out of small (7–8 m) vessels (VBIFA, 2013). A range of different fishing methods are used in the fishery to target different species. Purse seines are used to target Australian Sardine and Australian Anchovy (*Engraulis australis*). There is only one purse seine licence in Port Phillip Bay (DPI, 2012). Purse seines are usually set in deep water targeting schools of fish near the surface. Haul seines are used to target King George Whiting, Southern Garfish (*Hyporhamphus melanochir*), Rock Flathead (*Platycephalus laevigatus*), Southern Bluespotted Flathead (*Platycephalus speculator*), Southern Calamari (*Sepioteuthis australis*) and Snapper (Coutin, 2000). These nets are

[1] http://www.melbourne.vic.gov.au/about-melbourne/melbourne-profile/pages/facts-about-melbourne.aspx (Accessed 30/12/2015)
[2] http://profile.id.com.au/geelong/population-estimate (Accessed 30/12/2015)

usually deployed with floats on the headline and weights on the leadline to maintain the height of the net. Two main types of haul seine are used in the Bay, beach seines which are usually hauled into shallow water for sorting, and garfish seines which can also be used in deeper water. Mono-filament mesh nets of various sizes are used to target Greenback Flounder (*Rhombosolea tapirina*), Gummy Shark (*Mustelus antarcticus*), King George Whiting and Rock Flathead. Longlines with baited hooks on a mono-filament main line are used to target Snapper and Gummy Shark. Handlines and jig are also used to target Southern Calamari, King George Whiting and Snapper.

The Victorian Fisheries Regulations 2009 authorise a Western Port / Port Phillip Bay Fishery Access Licence holder to the use or possession of a range of fishing gear types applicable to a wide variety of species harvested in commercial fishing operations. These include: seine net, purse seine net, lampara net, mesh net, commercial hoop net, dip net, octopus trap, bay fish trap, fishing line (other than a longline unless licenced for that gear), underwater breathing apparatus, hand operated mussel rake and a hand operated bait pump (or any other commercial fishing equipment specified in the licence under regulation 33) in Port Phillip Bay, and the taking of fish (other than abalone, jellyfish, rock lobster, giant crab, scallop and sea urchin) for sale. The fishery is mainly managed through input controls (controls on fishing effort). There is a range of other restrictions including spatial exclusions, but the key input controls for each of the main gears are as follows:

- Longline
  - Use of only one longline at a time
  - Must not use or possess a longline with more than 200 hooks
- Mesh nets
  - During 1 April to 31 October net length must not exceed 2500 m in length and meshes measuring no more than 13 centimetres
  - During 1 November to 30 November net length must not exceed 360 m in length and meshes measuring no less than 6·3 centimetres or more than 12·4 centimetres
  - During 1 November to 31 March net length must not exceed 2500 m in length with meshes measuring no less than 12.5 centimetres and no more than 13 centimetres and having no more than 12 meshes between the float line and the leadline.
  - Must not use a drum or spool to hold or store any mesh net with meshes measuring 10 centimetres or more
  - Must not use any mechanical assistance to haul any mesh net or combination of mesh nets with meshes measuring 10 centimetres or more if the overall length of the net or nets exceeds 1250 metres.
- Purse seine and lampara nets
  - Must not exceed 460 m length
- Seine net
  - Must not exceed 460 m length
  - Meshes in the bag must not measure between 2.9 cm and 4.5 cm
  - Meshes 25m either side of the bag must not measure between 2.9cm and 4.5cm
  - Between Rickett's Point at Beaumaris and Snapper Point at Mornington, seines must be hauled or winched from the beach and have no more than 660m of rope attached at each end of the net.
  - Must not take fish by dragging or drawing a seine net containing fish on to dry land or into water less than 60 cm deep.

Victorian commercial fishers are generally represented by Victoria's peak industry body Seafood Industry Victoria (SIV). Port Phillip Bay commercial fishers are variously represented by Victorian Bays and Inlets Fisheries Association (VBIFA), Victorian Fishery Association into Resource Management (VFARM). In 2013, VBIFA established an Environmental Management System (EMS) to provide commercial fishers with the knowledge and expertise to develop and implement best practice that meets both environmental needs and food production needs (VBIFA, 2013). Further, VFARM (2013) developed a Code of Practice at the same time, specifically for Commercial Haul Seine Fishing in Port Phillip Bay. These initiatives were intended to address public concern over the actual or potential impact of commercial fishing in Port Phillip Bay.

1.3 Port Phillip Bay's Recreational Fisheries

Recreational fishing on Port Phillip Bay (including Corio Bay) is a very popular pastime. People require a recreational fishing licence to fish in Victoria unless they are in an exempt category (under the age of 18 years, or 70 years and over). The Victorian Fisheries Regulations 2009 authorises recreational fishers to take or attempt to take fish from Victorian waters, and use or possess recreational fishing equipment in, on, or next to, Victorian waters. There are legal minimum size limits and bag and possession limits for many species and a range of other restrictions including spatial exclusions. A wide variety of fishing gears is permitted, but there are restrictions in areas that many of them can be used. For handline and fishing rods in marine waters, a total of four lines can be used per person at any one time, each with a maximum of 2 hooks or one bait jig.

There have been several recreational fishing surveys undertaken in Port Phillip Bay, and more widely across Victoria to estimate participation rates, effort and catch. The national recreational and indigenous fishing survey conducted during 2000/01 estimated that there were 550,000 recreational fishers in Victoria (Henry and Lyle, 2003). They estimated that throughout the State, about 9,562,000 finfish were landed in Victoria from 2,812,000 fishing events over 2,640,000 fishing days. A more recent survey estimated the number of recreational fishers in Victoria to be 721,000, who undertook about 8,700,000 fishing trips during 2008/09 (Ernst and Young, 2009). Focussing on Port Phillip Bay alone, MacDonald and Hall (1987) estimated that about 0.6 million angler days and 3.1 million angler hours were undertaken during day time in 1982/83, whereas Conron *et al.* (In prep.) reported the estimated annual numbers of fishing trips undertaken in the Bay during 2006/07 and in 2010/11 to be about 372,000 and 480,000 respectively. More recently, Ernst and Young (2015) estimated that there were about 830,000 adult recreational fishers in Victoria during 2013/14, of which about 800,000 were between the ages of 18 and 69 and thus required to hold a current fishing licence[3]. The actual number of Victorian recreational fishing licences sold during 2013/14 was 356,622 (DEPI, 2014). This difference is because licenses can be purchased for a three-year period and are therefore not renewed annually; there is no way of knowing how active these licences are over this period.

Coutin *et al.* (1995) estimated that during 1990/91 and 1993/94 annual daytime catches by boat anglers in Port Phillip Bay ranged from 313 t to 503 t, whereas shore anglers over the same period caught an estimated 44 t to 68 t. In comparison, the commercial sector landed 601 t and 414 t of fish (excluding Australian Pilchard, Southern Anchovy and Sprat) in 1990/91 and 1993/94 respectively (Coutin *et al.*, 1995). Boat anglers mostly caught Sand Flathead (66% by number), King George Whiting (15% by weight), Southern Sea Garfish (8%) and Southern Calamari (7% by weight), whereas shore anglers caught mostly Yellow-eye Mullet (23%), Sand Flathead (23%), Southern Sea Garfish (21%) and Southern Calamari (6%). In that study, Snapper only comprised 1% of the catch by number of both boat and shore anglers. A survey of night time fishing was undertaken at around the same time and found that the most common species caught were Sand Flathead (40%) and King George Whiting (28%), while Snapper comprised 6% of the catch (Conron and Coutin, 1995). Ryan *et al.* (2009) estimated the catch of Snapper in the Bay by licenced recreational fishers to be 244,542 fish in 2006/07 and, when recalculated to include fishers in the licence-exempt categories, the annual catch was about 279,000 fish (about 446 t) (Conron *et al.*, In prep.). Conron *et al.* (In prep.) reported that the 2010/11 catch of Snapper in Port Phillip Bay was about 314,000 fish (about 408 t). In January to May 2014, Green *et al.* (2015) undertook a survey to estimate recreational catch and effort in inner and outer Corio Bay. They estimated 11,742 boat trips took place over that time, during which an estimated 47,535 fish weighing 17.7 t were caught and retained, and 112,044 fish were caught and released. The retained catch comprised mostly flathead (20,549 fish or 4.9 t), King George Whiting (15,425 fish or 3.0 t) and Snapper (5,836 fish or 5.3 t). Other main species caught were Southern Calamari, Gummy Shark and Australian Salmon (*Arripis trutta*).

Henry and Lyle (2003) identified that most (94.1%) recreational fishing effort undertaken in Victoria is done using line methods (mostly baited), with the remaining fishing using pots and traps (1.7%), nets (1.8%), diving (1.1%) and other methods including pumps/rakes/spades and hand collection (1.3%). Ernst and Young (2009) reported that 97% of respondents to their State-wide survey undertake bait

[3] Unless in one of the exempt categories including Victorian Seniors Card or interstate equivalent, Veterans' Affairs Pensioner Card, Veterans' Affairs Repatriation Health Card coded (TPI), Commonwealth Pensioner Concession Card coded either (DSP), (DSP Blind), (AGE), (AGE Blind) or (CAR), or a member of a traditional owner group fishing within an area subject to a natural resource agreement relevant to that traditional owner group.

fishing, 65% undertake lure fishing, 14% fly fishing and 6% spearfishing — other fishing methods were grouped together as "other" in that report.

1.4 Resource Sharing

There has been long history of conflict between recreational and commercial fishers in certain areas of Australia, particularly around densely populated coastal regions. Arguments for a greater share of fisheries resources by recreational fishers are often based on perceptions of superior economic returns to the community (Kearney, 2001), but are also prompted as a result of physical interaction between fishing gears (Bower *et al.*, 2014; Pomeroy *et al.*, 2007), competition for space (Arlinghaus, 2005) and the perception that commercial fishing causes high mortality of juvenile fish, habitat degradation and over-exploitation (Kearney, 2002).

Small-scale commercial fisheries can be socially and economically undervalued (Chuenpagdee, 2011, cited in Bower *et al.*, 2014) and participation rates are relatively low compared with those of recreational fishers. Given the popularity of fishing as a recreational activity, particularly for people living in the major coastal cities, recreational fishing is considered an important political issue. This can influence resource allocation decisions by state governments (Peterson, 1993; McPhee *et al.*, 2002).

McPhee *et al.* (2002) provided two Australian examples of how recreational lobby groups shift attention away from possible impacts of recreational fishing and focus public and political attention on other impacts, particularly commercial fishing. This can result in fisheries management decisions that are based on politics, rather than on the long-term sustainability of the resource, where the outcomes favour the recreational sector over the commercial sector. Politically-based fishery management decisions are criticised by both fisheries managers and fishers (Smith, 1980), and can result in management decisions being made contrary to the scientific evidence. For example, a perceived decline in stocks amongst recreational fishers in New South Wales led to conflict between sectors and eventually a ban on commercial fishing in many estuaries, despite research showing no decline in fish stocks had occurred (Momtaz and Gladstone, 2001).

Conflict between commercial and recreational fishers in Victoria's bay and inlet fisheries has been well documented, increasing during the 1980s and 1990s (Kearney, 2002). Kearney (2002) described both angler concerns (perceptions) about commercial fishing, and commercial fisher's concerns (perceptions) about anglers, and addressed each of those concerns through the Fisheries Co-management Council (Table 1 and Table 2). He concluded that environmental degradation posed a far more serious threat to long-term sustainability of the fisheries than commercial fisheries. Even so, before the 2002 State election, the Victorian Government committed to the establishment of fisheries reserves in Anderson Inlet, Mallacoota Inlet and Lake Tyers, for the purpose of improving recreational fishing opportunities (Fisheries Victoria, 2006). These bays and inlets were declared as "recreational fishing only" in 2003 and 2004, and in 2007, commercial netting was banned in Western Port to create a recreational fishing haven (Melbourne Water, 2011).

Similarly, a concerted effort by recreational fishers to have netting banned in Corio Bay was launched during 2013 with the formation of the Friends of Corio Bay Action Group (FOCBAG). This was expanded by VRFish stating in their "State Election 2014 Wishlist": "*For 20 years VRFish has held serious concerns about the impact of some forms of commercial netting on fish stocks in Corio Bay, Corner Inlet and the Gippsland Lakes. Commercial netting in popular recreational areas adversely impacts the quality of recreational fishing experiences. Our policy is to ban commercial netting in bays and inlets, unless it is demonstrated to be sustainable and is managed and conducted in a responsible, community conscious manner*". The current project was developed during late 2013 to explore the sustainability and ecological impacts of both commercial and recreational fishing in Port Phillip Bay. Nevertheless, through social media, public meetings, print media and radio publicity, along with the support of high profile anglers and local political candidates, FOCBAG and Australian Fishing Trade Association (AFTA) garnered popular support and lobbied Government. The result was that both major parties released promises before the November 2014 election to end commercial netting in Port Phillip Bay. Thus the elected Victorian Labor Party passed legislation in November 2015 to end netting in the

Bay through the closure of Corio Bay to all netting by 1 April 2018, and banning netting in the rest of Port Phillip Bay by 2022[4].

[4] https://www.premier.vic.gov.au/legislation-passed-to-phase-out-commercial-netting-in-bay/

Table 1. Recreational anglers concerns (perceptions) about commercial fishers and result of investigation into those concerns (from Kearny, 2002 and references therein).

Angler concerns (perceptions)	Result of investigation
Large numbers of undersized fish are killed during commercial netting.	Available literature, observations and discussions with commercial fishers indicates that seine netting has little impact on juvenile and non-target species
Commercial haul netting damages sea grass beds and other important habitats.	Haul seine netting had little effect on seagrasses and the seabed
Populations of target species have been over-exploited by excessive commercial fishing effort.	It is difficult to support the assertion that commercial fishing in the last decade or so has caused significant declines in the resource base
Increased mobility and efficiency of commercial operators have resulted in excessive effective effort.	The limited data available on commercial effort suggests a decline in total effort targeting key recreational species, however the lack of records on gear levels and usage precludes assessment of changes in the relative fishing power of commercial fishers in bays and inlets
Large commercial catches of baitfish species (pilchards and anchovies) reduce the availability of food for key angling species such as snapper and Australian salmon and also reduce food for other predator species, such as dolphins and penguins, which have high conservation and tourism value	Stock assessment suggests the pilchard resource is in good condition, however in the absence of description of the food web relating pilchard or anchovy abundance to the resources of key fish, or other, predators, it is not possible to assess the importance of commercial harvesting of baitfish species on predator resource levels
Commercial fishing restricts the availability of fish to the recreational sector.	For those species targeted by both sectors, there can be little doubt that catches by either sector influence, to at least some degree, catches in the other, and catches by individuals within each sector influence catches by other individuals in the same or different sectors

Table 2. Commercial fishers concerns (perceptions) about anglers and result of investigation into those concerns (from Kearny, 2002 and references therein).

Commercial fishers concerns (perceptions)	Result of investigation
Illegal sale of fish taken by unlicensed fishers encourages excessive effort and exploitation.	There are no reliable estimates of the magnitude of catches taken by anglers in excess of bag limits and/or for illegal sale
Some anglers ignore bag limits resulting in excessive take	There are few recorded infringements but this is impacted by limited monitoring and enforcement and so available data are inadequate to properly assess this concern
Large numbers of recreational boats and ill-disciplined behaviour results in damage to seagrass beds (by propellers and anchors).	Anchor damage from recreational boats in Victoria's bays and inlets is minor and seagrass damage from propellers appears to be short-term with recovery occurring within months
The sheer numbers of anglers, and their resulting combined fishing effort, gives rise to significant mortality of undersized fish, retained illegally, or killed accidentally	The impact of recreational fishing on the mortality of juvenile fish in the bays and inlets studied was likely to be similar to the impact of commercial fishing
Recreational bait diggers have a negative impact on fish habitats	There are no reliable assessments of this issue.
Anglers' boats on hauling grounds interfere with commercial net hauling operations	As the number of recreational vessels increases, direct competition for space is inevitable, and it is not surprising that angler's boats would concentrate in at least some of the best commercial fishing spots

2 Objectives

1. Understand the full range of issues underpinning resource sharing by commercial, recreational and other stakeholders in Port Phillip Bay fisheries
2. Develop a framework for assessing the social and ecological issues in Port Phillip Bay fisheries
3. To undertake a qualitative ecological risk assessment of the Port Phillip Bay fishery, including both the commercial and recreational sectors
4. To identify the most significant ecological risks to the ecologically sustainable development of fisheries in Port Phillip Bay
5. Make recommendations for improved cross-sectoral management of Port Phillip Bay fishery resources

3 General Methods

A project steering committee was established after inviting members from the key stakeholder groups including Fisheries Victoria (Department of Economic Development, Jobs, Transport and Resources, Victoria - DEDJTR), VRFish, Seafood Industry Victoria (SIV), Friends of Corio Bay Action Group (FOCBAG), Future Fish Foundation (FFF), Victorian Fishery Association into Resource Management (VFARM), the Melbourne Seafood Centre (MSC) and Victorian National Parks Association (VNPA) to join. This Steering Committee actually formed comprised representatives of VRFish, SIV, VFARM, MSC, the Friends of Point Cook, VNPA and the FRDC. The Steering Committee was used to guide the progress of the project, ensure good communication with all relevant stakeholders and have input into the social survey and ERA. Due to changed priorities and limited resources, both VRFish and DEDJTR members withdrew from the Steering Committee, and the project, in mid 2015.

The initial Steering Committee meeting was held on 30 October 2014 with further meetings on 17 March 2015 and 18 August 2015. At the completion of the social assessment and the ecological risk assessment (ERA), a stakeholder workshop was convened on 5 November 2015 to which the Steering Committee and all interviewees were invited. The purpose of that workshop was to obtain feedback on results presented, prior to preparation of the final report.

3.1 Social Assessment

Dr Kate Brooks conducted the social assessment – a social scientist with KAL Analysis. Originally this research proposed using Q methodology (Brown, 1996) which is designed to both study, and attempt to align people's perceptions around use of common resources. However, as conflict over resource access in Port Phillip Bay escalated from early 2014, the window of opportunity to use this methodology was no longer available and it was considered to be inappropriate. Consequently, the social component of this research was modified to undertake a mixed methods approach, including:

1. A literature review of the uses and issues surrounding commercial and recreational fishing and other recreational activity in Port Phillip Bay;
2. Recreational fisher quantitative interviews relating to their fishing experience to identify motivation, satisfaction, issues and perceived causes thereof;
3. Qualitative interviews among a range of fishing and non-fishing stakeholders of perceived beneficial uses of the Bay, issues and causes thereof, to identify commonalities and variances.

Full details of the methods used in undertaking the social assessment are described in section 4.2.

3.2 Ecological Risk Assessment

The ecological risk assessment (ERA) was undertaken by Professor Greg Jenkins of the University of Melbourne using the "Ecological Risk Assessment for Effects of Fishing" method of Hobday *et al.*, (2007, 2011). This provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five ecological components: target species; by-product and by-catch species; threatened, endangered and protected (TEP) species; habitats; and, ecological communities.

Detailed methods used in undertaking the ERA are described in section 5.2.

4 Social Assessment of Fishing in Port Phillip Bay – *by Kate Brooks*

4.1 Introduction

The purpose of this component of the research was to answer two questions identified in the project; being to;

a) Identify the full range of issues under pinning resource sharing by commercial, recreational and other stakeholders in Port Phillip Bay; and
b) Develop a framework to assess the social issues in Port Phillip Bay fisheries.

Issues are the 'subjects' that influence perceptions of the natural resources of Port Phillip Bay. However, a focus on issues alone can often cloud the underpinning beliefs, or believed causes, that drive perceptions of issues. Consequently, this component of the research addressed both the perceived issues and causes of those issues for recreational users, commercial and recreational fishers, seafood retailers and community and environment groups with interests in Port Phillip Bay and its environs. The drivers of social perceptions centre on beliefs, values and previous experiences. In the case of this research, the connection between social drivers (defined here as identified issues and perceived causes) and an ERA is the answer to three questions:

a) What aspects of people's values and enjoyment of the Bay's ecology are perceived to be most at risk and why?
b) How do these relate to an Ecological Risk Assessment of the Bay? and
c) What mismatches are there for users and interest groups in their perception and scientifically substantiated findings for threats to the health and sustainability of Port Phillip Bay?

Figure 1. St Kilda pier courtesy K. Brooks

Understanding why people use and value the Bay and its resources can help guide communication to stakeholders about aspects of the Bay's ecology, according to perceived stakeholder relevance.

4.2 Methods

As discussed earlier, while this research had originally proposed to use Q methodology to identify perceptions and attempt to align understandings and objectives of key interest groups, due to the significant escalation of conflict between recreational and commercial fishers in the Bay from early in 2014, this single method was no longer considered appropriate. Because of this conflict and the underlying positions that had been adopted, any alignment of objectives was no longer possible. Consequently, the social component of the research was reviewed to adopt a mixed methods approach, incorporating a literature review, quantitative survey and qualitative interviews.

The literature review of the uses and issues surrounding fishing and recreational activities in Port Phillip Bay incorporated a media review (including, newspaper, association reports, social media and website forums) and analysis of reports on uses and risks to those uses of Port Phillip Bay since 2009[5].

The second component — the quantitative recreational fisher interviews — used data collected by Fisheries Victoria following the methods of Kent *et al.* (2011). Respondents were identified at boat ramp locations around the Bay over the summer months of 2013/14. Respondents were selected on the basis of their willingness to participate in the survey. Interviewees were assigned by one of four areas fished — either Bellarine, Melbourne, Mornington or Western Port — defined by boat ramp at which interviews were conducted (Table 3). For analyses regarding issues and causes of issues, responses

[5] 2009 with the earliest year identified in terms changes affecting the current review of uses in Port Philip Bay.

which were less than 75% complete were removed from analyses. Questions included in the interviews are shown in Appendix 1.

Responses for motivations for fishing were aggregated as follows (response number in parenthesis):

- Catch – competitions (6), sport of catching fish (7), fresh food (8)
- Social – to spend time with family (4), to spend time with family (5)
- Non-catch – relax and unwind (1), to be outdoors (2), to be on your own (3)

Similarly, responses to question about importance (a reason was considered important if the response was either very important or quite important) of reasons for fishing in each bay were aggregated as follows (question numbers are in parenthesis):

- Familiarity – familiar with area (1)
- Access – it's easy to get to (2), good boat access (6), private spot to fish (7)
- Facilities – access to town services and facilities (3)
- Catch prospect – good chance of catching target species (4)

Interviewees were provided with opportunities to list two different issues and perceived causes of issues that affected their angling satisfaction. These were "free fields", and responses were aggregated into 12 different issue categories (Table 4) and 12 different cause categories (Table 5).

Table 3. Boat ramps that defined each area used in analyses.

Area	Boat ramp	Number of interviews
Bellarine	Limeburner's Point, St Helens, Clifton Springs, Point Richards, St Leonards, Indented Head	208
Melbourne	Werribee, Altona, Black Rock, St Kilda, Newport	52
Mornington	Mordialloc, Frankston, Tootgarook, Rye, Safety Beach, Mornington, Carrum, Sorrento	74
Western Port	Stony Point, Tooradin, Hastings, Corinella, Newhaven, Warneet, Cowes	57

Table 4. Key reasons (issues) for lack of angler satisfaction and corresponding issue codes used in figures.

Issue	Issue code
Beacons	A
Boat Ramp	B
Low catch / lack of fish	C
Habitat/ Habitat Decline	D
Lack of Fish through Overfishing Commercial	E
Lack of Fish through Overfishing Recreational	F
Lack of Fish through Overfishing General	G
Lack of Access	H
Over regulation	I
Expense to catching fish	J
Other craft (Jet skis)	K
Conflict with Commercial Fisherman	L

Table 5. Key perceived causes of factors influencing angler satisfaction and corresponding issue codes used in figures.

Cause	Issue code
Netting in the bay	A
Commercial/professional fishermen	B
Damage to habitat	C
Bad season/weather	D
Greedy recreational fishers	E
Better fishing elsewhere	F
Lack of [appropriate] equipment and/or skill	G
Lack of appropriate (or adherence to) regulations on fish size (too small) and/or catch limits	H
Lack of facilities (boat ramps/parking etc)	I
Lack of time to fish	J
Competition of too many boats generally	K
Lack of appropriate (or adherence to) boating regulations	L

The third component — qualitative interviews — was undertaken with a range of stakeholders, including recreational, charter, and commercial fishers; wholesale and retail seafood merchants; recreational users including divers; spear fishermen; sailors; tour operators; and environmental groups associated with Port Phillip Bay.

The groups of non-fishing stakeholders (seafood merchants, divers, sailors, tour operators and environmental (ENGO) groups) were selected based on their interest in ecological aspects of the Bay due to the ERA focus of the project. Despite the operation of shipping, pilot and other commercial operations in and use of the Bay, their lack of conscious connection with the Bay's ecological systems, and belief that their activities had no effect on the ecology of the Bay, led to the inability to engage them in interviews. As a result of this, and because the greatest public focus was on recreational use versus commercial fishing activity, it was decided to exclude these other commercial operators from the research.

Interviewees for the qualitative interviews, were selected using two methods. In the first instance all operators in key recreational areas of use[6] of the Bay were identified from a white / web pages search. Council community groups who geographically operate across the whole area of the Bay, were also identified by contacting Bayside Councils. Subsequently and in addition to that, a snowball sampling technique was also used, which is a non-probability sampling technique where existing identified study subjects recommend or recruit future subjects from among their acquaintances and networks. This sampling technique is useful where populations are difficult for researchers to access (i.e. either through inadequate funding or disparate contacts as is often the case for community groups; or who require trust to be built up to encourage participation in the study such as some fishers). Such a technique also has the advantage of being useful in identifying information rich informants (Patton, 1990).

The qualitative interview participants were selected on the basis of a secondary filter that they had to be currently engaged in activities or concerns relating to the health of the Bay, and therefore having current and up to date knowledge and/or experience of undertaking activities in and around the Bay. Interviews were undertaken either face to face at a location selected by the interviewee, or by phone (average duration of interview 1 hour and 10 minutes) between March and July 2015. A total of 31 interviews were conducted (Table 6) as permitted by the resources of the study and those interveiwees who would make themselves available. A greater proportion of interviewees came from the western compared the eastern half of the Bay, generated by greater current interest in the activities of and on the Bay in that region, where Corio Bay is situated.

[8] SCUBA diving; charter fishing; sight seeing; sailing; recreational boating; boating and recreational fishing retailers; environmental groups; and wholesale and retail fish outlets with operations or key customer bases focused on the Bay.

Table 6: Interest Group Interviewees - Qualitative interviews

Group Type	Total approached	Total interviewed	Central / Whole of PPB	Eastern half	West'n half
Seafood Retail	4	3	1	1	1
Wholesaler[7]	4	1	1		
Commercial Fishers	5	4	2		2
Recreational Charter & Association	7	4	2	1	1
Recreational Fishers & Associations[8]	6	5	2	1	2
Spear Diving	1	1			1
Retail Equipment	5	1			1
Community Environmental	10	8	4		4
Scuba Diving	4	2	2		
Sailing[9]	3	1		1	
Recreational Tours	4	1	1		
Total	**53**	**31**	**17**	**3**	**11**

4.3 Background

4.3.1 Uses of the Bay

4.3.1.1 Tourism

Port Phillip Bay is one of Victoria's most popular tourist destinations. Many residents of Melbourne holiday annually along the shoreline of the Bay, particularly the eastern and southern shorelines (Frankston and to the south east of the Bay), camping in tents, staying in caravans or villas in caravan parks, sharing rental houses or staying in holiday homes. This is also the case in the less industrialised south western shores of the Bay, east of Geelong.

4.3.1.2 Recreation and sport

The Bay's sheltered aspect and resultant moderate waves make perfect conditions for recreational swimming, kite surfing, windsurfing, sailing, boating, scuba diving, stand up paddle boarding (SUP) and other sports.

Port Phillip is also home to 36 yacht clubs, as well as marinas, including large marinas at St Kilda, Geelong and Brighton. Marinas accommodate both power and sail boats. They also incorporate natural and constructed breakwaters, which attract aquatic fauna making good fishing and dive locations.

Port Phillip is also known as a temperate water scuba diving destination, with some divers boasting that it has "*soft corals and sponges that rival those in the Great Barrier Reef*" and that "*approximately 85% of the marine life is unique to Victoria*"[10]. The shore dives from beaches and piers around the Bay provide a wide variety of experiences on day and night dives. Boat diving in Port Phillip Bay also provides access to a wide variety of diving experiences including wrecks, reefs, drift dives, scallop dives, seal dives and wall dives.

There are at least three dedicated sightseeing and ecotourism adventure operators, while some fishing charters also provide charters for bird watching, school groups or family ash scattering ceremonies in addition to their core businesses. These operators present information about the history, geography, fauna and flora as well as the commercial and recreational activity in the Bay.

Charter fishing operators can be separated into two groups: 'large' – those of more than 12 people and up to 40 (though this was rare); and 'small' – being those of 6 to 12 passengers. The charter boat industry

[7] Only one wholesaler was included in the statistical data presentations, however similar semi-structured discussions were held with wholesalers at Melbourne Seafood Centre on 2 occasions in February and March 2015, and another commercial fisher who also operates as a wholesaler, all of which also inform the general discussion elements of this report.
[8] FOCBAG is included in the statistics under this category due to them being a community group exclusively developed around recreational fishing access in Corio Bay.
[9] While the sailing club included in the statistics is located in the eastern portion of the Bay, members of the club and their activities are conducted across the entire Bay region.
[10] Diver – Pers. Com., Interviewee 15, 18/5/2015

does have an association (the Victorian Fishing Charter Association), formed to protect commercial interests during the development of marine parks, and since that time, other activities that affect charter operators in the Bay. Most recently the focus has been promoting best practice in industry and professionalism. However, since the marine parks have been introduced, the activity of the Association has abated, and there has been a proliferation of small operators generally operated by avid (recreational) fisherman.[11]

Figure 2. Common activities undertaken on and around Port Phillip Bay Photo credits; a) peterskiteboarding.com, b) sand dune protection c) Melbournestouringtriangle.com, d) visitmorningpeninsula.org e) Melbournestouringtriangle.com.

Recreational fishing is undertaken via a number of platforms across the Bay including beach, pier, small boat (from kayak to trailer boats), large boats and charter. The demographics of fishers also ranges widely, from those who undertake it once or twice a year as a family recreational or holiday activity, to those fishers who invest heavily, both financially and time wise, in the activity. The representative body for recreational fishing in Victoria is VRFish, whose focus is on improving recreational fishing infrastructure and access, communication and education with and between fishing stakeholders, and improving the environmental sustainability, water conservation and fish habitat.

[11] Charter Fisherman; Pers. Com., Interviewee 11, 29/5/2015

4.3.1.3 Community Groups & Council Activity

In all regions around the Bay there are a number of community groups, which may have a contact point with local Councils. Local Councils, at the time of the data collection, did not undertake community environmental engagement, but rather outsourced this through funding to community groups[12]. Environmentally-based groups were generally found to operate largely independent of Council albeit with varying levels of support through some funding / provision of meeting and storage space and / or co-ordination services from local or State governments[13]. However, the issues-based groups were identified as operating largely independently and with no overt association with any level of government[14], although some groups may engage in lobbying at arm's length from local or State Government. Some community groups were well supported by corporate interests, and generally have a very specific focus, such as to encourage participation in recreational fishing[15] as a means to address community cohesion, but with support from Councils.

4.3.1.4 Commercial Fishing

Commercial fishing has been undertaken in Port Phillip Bay for more than 150 years. The sale and availability of fresh fish from Port Phillip Bay was reported as a feature of Melbourne, first noted during the gold rush period (Bennet, 2002). Commercial fishers in Port Phillip Bay currently operate under the authority of a Western Port/Port Phillip Bay Fishery Access License and a Purse Seine (Port Phillip Bay) Fishery Access Licence. At the time of writing this report, the total number of these licences was capped at forty-three (including the Purse Seine licence), and existing licences could be transferred to new fishers but no additional licences could be issued. Commercial fishers in the Bay are authorised to use a range of equipment types including long lines, mesh nets and haul seines to catch a variety of fish species such as Sardines, King George Whiting and Snapper. Today, commercial fishers provide fresh, high quality and sustainably (e.g. Fowler *et al.*, 2015; Hamer *et al.*, 2015) harvested seafood to Victorian consumers, many of whom either choose not to, or may be unable to, participate in recreational fishing.[16]

4.3.1.5 Shipping

Following Victoria's separation from NSW in 1851, and the substantial increase in the number of ships due to the gold rush, Melbourne's early days saw large ships unloading cargo at either Hobsons Bay (now Williamstown) or Sandridge (now Port Melbourne) to be transferred either by rail or by cargo into Melbourne proper. Shipping presents hazards in the occasional accidental oil spill and in the translocation of marine pests. One of the most notable events was the grounding of the Petriana in 1903, which was bound for Melbourne laden with 1300 tons of bulk oil, as well as an unrecorded quantity of naptha and benzene. On the 28th of November, despite pilot assistance through the Rip at the entrance to Port Phillip Bay, the ship grounded in thick fog on Portsea Back Beach. Unsuccessful attempts were made to re-float the Petriana resulting in the decision, in a time before modern-day environmental concerns, to lighten the vessel by releasing the cargo of 1300 tons of oil into the sea. The resultant spill was described as "*a film of great beauty, radiating all the colours of the rainbow, spread from Sorrento Back Beach to Point Nepean*"[17].

Coode Island became Melbourne's first container terminal after the Second World War, and in 1991, a large fire at the Island's bulk liquid handling facility blanketed much of Melbourne in toxic fumes[18]. The public outrage initiated a Government investigation into relocating the facility. However, while Point Lillias near Geelong was considered, because of the high cost involved and local opposition, the facility has remained at Coode Island.

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[12] Pers Comm: Geelong Council
[13] Port Phillip Bay Eco-Centre (http://www.ecocentre.com/) and Bellarine Catchment Network (http://corangamite.landcarevic.net.au/bcn) are both examples of this.
[14] Friends of Corio Bay (FOCBAG) – (https://www.facebook.com/pages/Friends-of-Corio-Bay-Action-Group/208010909343052) is one such group.
[15] 'Future Fish Foundation' - http://www.futurefish.com.au/ undertakes political lobbying as well as public educational activities
[16] http://agriculture.vic.gov.au/fisheries/commercial-fishing/proposal-to-establish-a-commercial-dive-fishery-for-scallops-in-port-phillip-bay/overview-of-the-port-phillip-bay-commercial-wild-catch-fishery Accessed 8/8/15
[17] Australian Maritime Safety Authority, quoted https://www.amsa.gov.au/environment/major-historical-incidents/Petriana/index.asp accessed 10/8/15
[18] ABC News, 21st August 1991 https://www.youtube.com/watch?v=TZ8eEnE2CkA

Dredging took place from 2008 to deepen shipping channels in and out of the Port of Melbourne[19] (Victorian Government, 2007). This process was completed in November 2009, and it involved removing more than 22 million cubic metres of sand and silt to provide a minimum 14 metre draught at all times. Opposition to this project occurred and stemmed from posited potential damage to fragile marine environments, silting and loss of amenity for bay side residents due to the noise produced by the dredges[20]. It was, and in many quarters remains, a contentious decision and activity. Further to this the Port of Melbourne receives the highest number of ship visits to Victoria. These ships discharge more than 1 million tonnes of ballast water annually, with the potential to introduce exotic marine pests, with biofouling (seaweed, sponges, crustaceans, molluscs) presenting additional pathways for exotic pests. Marine pests have had a substantial ecological impact on the Bay (Cohen *et al*., 2001).

4.3.2 Literature review

The following literature review has been undertaken with a focus on stakeholder and community issues and concerns that may relate to an Ecological Risk Assessment of fishing in Port Phillip Bay. The objective has been to attempt to collate the variety of views regarding issues and causes of ecological concerns in Port Phillip Bay in one document.

4.3.2.1 Government (and Commissioned) Reports

A number of published and publicly-available reports from 2006 and 2015 were identified, that contain elements that may be considered in a fisheries-related ERA.

In 2003 and 2006 Parks Victoria recognised the value of marine fauna and flora in Port Phillip Bay leading to implementation of the Port Phillip Heads Marine National Park. The park comprises six separate areas (Swan Bay, Mud Island, Point Lonsdale, Point Nepean, Pope's Eye, Portsea Hole). There are also three marine sanctuaries (Point Cooke, Jawbone, and Ricketts Point) within Port Phillip Bay closer to Melbourne.[21] The marine parks and sanctuaries were chosen to conserve: popular recreational dive sites; rock platforms and coastal landscapes; Bottlenose Dolphin (now called the Burrunan Dolphin – *Tursiops australis*) populations; internationally significant Ramsar-listed conservation sites (Swan Bay and Mud Island) and resident bird life, along with seagrass meadows (Swan Bay). The establishment of marine parks was also to preserve culturally significant sites for Indigenous communities and maritime history (shipwrecks)[22]. The objective of the Management plan is to clearly articulate those areas and features of Port Phillip Bay that have either unique environmental or cultural value and need to be protected either completely, or through modified access from activities that could cause damage. The management plan restricts activities that would disturb natural processes or threaten biodiversity[23].

With the increasing population of Melbourne and its catchment area, one of the issues that has become most pressing in recent decades is that of marine pollution. This was addressed in the Australian Government's case study on Port Phillip Bay into the effect on the Marine Environment of land-based activities[24]. This identified that pollution, in the form of litter, debris and silt, were the largest challenges facing the management of water quality in Port Phillip Bay. While nutrient discharge was identified as an issue in water quality management, it was noted that this had been reasonably stable since 1984 and had reduced significantly since the 1970s with the upgrading of the Melbourne sewerage treatment processes. Today, all sewage at the Western Treatment Plant (Werribee) is treated to remove nitrogen and generate high quality recycled water. Ten bay-side municipalities collaborated to form the Association of Bayside Municipalities (ABM) in 1974, with the aim of improving the effectiveness of local government management of beaches and coastal waters of Port Phillip Bay. This association was closely involved in the management of Port Phillip Bay waters in the individual Council's

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19 http://www.dtpli.vic.gov.au/__data/assets/pdf_file/0008/232991/FINAL_CDP_ASSESSMENT_301007.pdf
20 http://www.theage.com.au/multimedia/dredge/main.html
21 Parks Victoria (2003) *Port Phillip Heads Marine National Park – the Jewel of the Bay*, http://parkweb.vic.gov.au/__data/assets/pdf_file/0008/315791/Park-note-Port-Phillip-Heads-Marine-National-Park.pdf (Accessed 15/03/2015);
22 Ibid., (pp. vii-viii)
23 Parks Victoria (2006) *Port Phillip Heads Marine National Park Management Plan*, Parks Victoria Melbourne, July. http://parkweb.vic.gov.au/__data/assets/pdf_file/0003/313374/Port-Phillip-Heads-Marine-National-Park-Management-Plan.pdf (accessed 15/3/2015)
24 Natural Resource Management Ministerial Council (2006), *Australia's National Programme of Action for the Protection of the Marine Environment from Land-based Activities*. Australian Government, Department of the Environment and Heritage, Canberra, ACT (http://www.environment.gov.au/system/files/pages/2c223360-76b9-45e9-b1f9-caea4def637b/files/npa.pdf Accessed 16/3/2015)

responsibilities for beach cleaning, local creeks and drains and in developing a coordinated approach to public education around beach and water quality. These Councils also work to support the Port Phillip Bay Environmental Management Plan[25] in managing two key risks facing the bay: nutrients and marine pests. One of the key causes of pollution in the Bay is stormwater discharge. Capital works programs are proceeding to install gross pollution and sediment traps into drains, rivers and estuaries running into the Bay.

Following on from the Australian Government Report (Natural Resource Management Ministerial Council, 2006), the Victorian EPA published a five-year Water Quality Improvement Plan for the regions around Port Phillip and Westernport Bays (EPA Victoria and Melbourne Water, 2012). This plan addressed issues of diffuse pollution (phosphorus and nitrogen being the key targets), urban expansion and climate change effects. The Plan outlined a strategy of community and catchment engagement and actions to address these three key areas, while also aligning with existing activities such as the Port Phillip Bay Environmental Management Plan (EMP). Evaluation of this Plan was undertaken through continued water quality monitoring and community perceptions of water quality (Ibid., pp. 132-137). The report noted that urban growth presented the biggest challenge to achieving the objectives of the Plan (Ibid, p.6).

In 2009 the then Victorian Department of Primary Industries undertook a three-year trial to assess the impacts of artificial reefs on fish communities; invertebrates and algal communities. The trial also evaluated recreational fishing catch rates and angler satisfaction, damage and disturbance of the reef structures and other environmental factors (Department of Primary Industries, 2009). The results showed that artificial reefs were positive both for fish stocks and for recreational fisher experience and satisfaction (Hamer *et al.*, 2009).

The Department of Environment and Primary Industries published an overview of the Port Phillip Bay Commercial Wild Catch Fishery in 2013 (Department of Environment and Primary Industries, 2013). This was an educational brochure targeted at the general public to provide detail on fishing activities in Port Phillip Bay (both commercial and recreational). The overview showed fishing in the Bay to be sustainable and that "*So popular is recreational fishing in PPB that on an annual basis its catch may exceed that of the commercial sector*" and that "*the recreational harvest of snapper is four times larger than the commercial catch.*" It also identified that the assessment of sustainability was according to the Australian Conservation Foundation's "Sustainable Australian Seafood Assessment Program" (Ibid, p.2).

In response to ongoing concerns expressed by recreational fishers about access, sustainability and stock depletion, Fisheries Victoria published a report in 2015 (Green, *et. al.*, 2015). The report found that despite concerns expressed by recreational fishers regarding decreased catch rates of King George Whiting, catch rates of other key species had remained relatively stable in the Bay between 2003 and 2014, and the reduction in King George Whiting stocks was identified as consistent with the population dynamics of the species, and not caused by effects of commercial fishing.

In summary, the government reports identified the key concerns including the increasing impact of pollution caused by urban growth and catchment runoff (storm water), the implementation of protection of key species, habitats and culturally significant sites, the second of which has been a priority following community concern for the environment. The government reports do not regard the activity of commercial fishing as a threat to the ecosystem or sustainability of targeted fish species in Port Phillip Bay. Where examined, commercial fishing has been identified as being sustainable. In contrast, pervasive threats to the ecological health of Port Phillip Bay, including fish, are highlighted as being land-based pollution and exotic marine pests.

4.3.2.2 Newspaper media

Most news articles relating to fishing and the ecological sustainability of Port Phillip Bay appeared in the closing months of 2014. This accompanied the November 2014 State election and public pressure exerted by the recreational fishing sector to address the activity of commercial fishing in Port Phillip Bay. Media releases of the two major political parties have also been included.

[25] http://www.depi.vic.gov.au/forestry-and-land-use/coasts/marine/bays-inlets-estuaries-and-lakes/port-phillip-bay (Accessed 16/3/2015)

The closure of commercial fishing in Port Phillip Bay was proposed as an election issue following social media activity by recreational and conservation groups, many with quite differing objectives. Proposals ranged from: removing netting from the licenced practices of commercial fishing in Corio Bay only; to removing the option to net from all commercial fishers in the Bay; to removing all commercial fishing in Port Phillip Bay. This prompted articles that began to appear in the print media, such as '*End of line looms for commercial fishing in Port Phillip Bay'* (The Age, 2014). This particular article described a proposal to ban commercial netting of fish in Port Phillip Bay, and the resultant necessary buy back of those licences. It promoted the desire to provide "*more fish for amateur anglers*" as a key issue at hand rather than sustainability concerns under current resource sharing arrangements. The *Age* article also discussed the commercial impacts that local commercial (Corio Bay region) fishermen would experience if this were to proceed, which were posited to be 'ruinous' to the livelihoods of commercial fishermen. Similarly, the article presents the response of a representative of a recreational fishing community action group in Corio Bay (Friends of Corio Bay Action Group - FOCBAG), as being *"'ecstatic' about the announcement that commercial fishing would be banned*" (Ibid). The article also highlighted the confusion over the proposals and objectives — to ban only netting in some areas or all areas, or to ban *all* commercial fishing in some areas or all areas.

The apparent concern expressed in the media, is not the ecological sustainability of fish, but rather resource sharing and access arrangements. This was reflected in the reader comments that were generated by the *Age* article[26] questioning the 'science' on which the proposed commercial fishing ban had been based upon. The Special Broadcasting Service (SBS) also ran a piece[27] on the announcement by the government, citing the then Premier's (Dennis Napthine) plan to buy back commercial net fishing licences over a 10-year period to generate a '"*boost to 750,000 recreational fishers, who will be guaranteed a better catch*"'. He was further cited as saying '"*It will be a huge boost to the marine environment, because there are real risks to the bay environment from the netting processes.*"'[28] Despite previous government findings noting the greatest threat to the Bay's ecological health was that of pollution, only one line in the article was devoted to plans to reduce litter, marine pests and erosion if the Coalition were re-elected. Subsequent media releases by the government promoted the economic benefit of increased recreational fishing activity that was posited would result from a commercial fishing netting ban[29&30]. The opposition Labor party issued an equivalent policy, based on similar premises (Andrews, 2014).

Contrary to the proponents of commercial netting bans for Port Phillip Bay[31], restaurateurs of Melbourne bemoaned the prospective loss of locally caught fresh fish (as commercial fishing is the sole source of fish such as Rock Flathead, Southern Garfish, King George Whiting and Bluestriped Goatfish (*Upeneichthys lineatus*) — locally knbown as Red Mullet); prized among seafood consumers (Holroyd, 2014).

The social drivers identified in the media review do not reflect the ecological risk of commercial fishing — or even pollution — on the health of fish in the Bay. Rather the social drivers identified here are for a reallocation of access; i.e. greater access (and catch) for recreational fishers. Ecological threats such as marine pests and pollution did not attract the same media attention as prominent concerns of the recreational fishing lobby.

4.3.2.3 Social media, association reports and web pages

The following is a review of community organisational reports, webpages, media releases, and Facebook pages that relate to the perceptions of environmental issues in Port Phillip Bay, with a particular focus on the sustainability of fish. There is also a much larger body of social media dealing exclusively with the netting /commercial fishing ban in Port Phillip Bay. These have been selectively represented here to highlight the key arguments that emerge from the different sectors including: community environmental groups, general community concerns, the recreational fishers, and commercial fishers.

[26] Which appeared following the article in the online version: http://www.theage.com.au/victoria/victoria-state-election-2014/end-of-the-line-looms-for-commercial-fishing-in-port-phillip-bay-20141102-11fqg0.html (accessed 21/1/15)
[27] SBS – "Victoria's commercial net-fishing ban election promise" November 2nd, 2014 12.31pm www.sbs.com.au/news/article/2014/11/02
[28] Ibid.
[29] Dixon, M., 2014, Coalition delivers $65 million Better Bay Plan, November 2. Melbourne. http://www.martindixon.org/coalition-delivers-65-million-better-bay-plan/
[30] CHQ Media Office (2014) "*Voluntary Buy Back for Gippsland Lakes commercial fishing licences*", Melbourne, November 7th.
[31] Dundas, Greg, "*Anglers celebrate netting ban*" Geelong Advertiser 16/11/2014 www.geelongadvertiser.com.au/news/geelong

The Victorian National Parks Association (VNPA) completed a report in 2013 (Ford and Gilmour, 2013), which reviewed the marine and coastal recreational fishery in Victoria. It concluded that the direct impact of recreational fishing on fish stocks was far greater than ecosystem impacts, and that current management methods were not adequate / appropriate to the (developing) nature of recreational fishing in Victoria (Ibid., pp.6-7). The report included a large number of recommendations on fisheries management, action of recreational fishers and Associations, licencing and stock assessment. A number of these recommendations are reflected in the issues and causes identified by stakeholders in the interview process (see section 4.3.3), such as the potentially negative impact of recreational fishing competitions on stocks, particularly that of Snapper.

There are a broad range of community groups with interests in the Port Phillip Bay for more general reasons than fishing alone. Groups are interested variously in the protection of the Bay's fauna and flora including: research on Little Penguins (*Eudyptula minor*) at St Kilda; removal of the Northern Pacific Seastar (*Asterias amurensis*); foreshore and reserve revegetation; litter removals; and seagrass surveys. These organisations, arrange activities such as some 10 volunteer "seastar collection dates" during 2015[32] for example. The Altona Boating and Angling Club also worked with Parks Victoria (as did the various Marine Care groups) promoting a Parks Victoria Talk on Invasive Marine Species at Queenscliff[33]. Similarly, the 'Bluewedges' group, which covers Western Port as well as Port Phillip Bay, is focused on "*preserv[ing] the ecosystems of the Bays and the interface between land and sea, the catchments and estuaries*."[34] They assert that the "*biodiversity must be protected from threats including the proposal to deepen the shipping channels in the Rip and Port Phillip Bay, unbridled development in catchment areas and ill-thought proposals for breakwaters and marina developments around the coastlines*."[35] The Bluewedges claim that the scallop dredging (banned since 1997) has had a "*profound effect across the bay, disturbing and smothering benthic communities, altering tidal conditions and distributing sediments, sometimes toxic, around Port Phillip Bay…*"[36]. Bluewedges further assert that both recreational and commercial fisheries will pay the price with "*dramatically reduced bag limits or face other misleading options such as closed seasons; all based on the flawed assumption that fish only die by being caught*"[37]. In summary, Bluewedges identifies as being primarily concerned with the need to address environmental damage caused by some marine-based industries, including shipping, and commercial (coastal) developments around Port Phillip Bay.

The Victorian Bays and Inlets Fisheries Association Inc. (VBIFA) commissioned a report on developing an Environmental Management System (EMS) for Victorian inshore commercial fisheries (VBIFA, 2013). This work was published with the support of Oceanwatch, Sea Net, Caring for our Country, Seafood Industry Victoria, Seafood Services Australia, National Heritage Trust, Primary Industry Research Victoria (PIRVic), and Phillip Island Nature Park. The report noted "*Scientific research has generally found that commercial fishing activities in Victorian bays and inlets have no adverse impact on fish stocks or the environment*" (Ibid., p.iv) but that, despite this, there were still negative public perceptions of fishing activities. The VBIFA believed that the development of an EMS would improve public perception of commercial fishing, based on demonstrable sustainable practice. The report states that: "*VBIFA members feel that one way to help the broader community understand their practices and their relationship with the environment is through the development of an Environmental Management System. …VBIFA members believe that as we harvest fish on the community's behalf, the community is entitled to feel confident that their fish are being harvested in an environmentally conscious and sustainable manner*"(Ibid). However, the EMS has evidently not had the desired public resonance given the ongoing adverse community perception around fishing activities, particularly among recreational fishers.

In collaboration with the University of Technology, Sydney, the Australian Conservation Foundation (ACF) designed a sustainable Australian Seafood Program (Australian Conservation Foundation, 2012).

[32] Earthcare St Kilda, Northern Pacific Seastar Removal, http://www.earthcarestkilda.org.au/get-involved/northern-pacific-seastar-removal/ Accessed 08/06/15

[33] Altona Boating Angling Club, Free Marine Invasive Species Talk, https://www.facebook.com/altonabaac/photos/a.740561735954073.1073741831.555348017808780/944081538935424/?type=1&theater Accessed 21/05/15

[34] Bluewedges, A Vision for our Bays, waterways and beaches, http://www.bluewedges.org.au/index.php?page=about_us Accessed 29/1/15

[35] Ibid.

[36] White, B., Why is the iconic Port Phillip Bay Snapper disappearing?, Bluewedges, June 2011 http://www.bluewedges.org.au/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=243&cntnt01returnid=65 Accessed 27/1/15

[37] Ibid.

It was developed to help make the definition of sustainable seafood more specific and credible, on the basis of robust assessment criteria that was deemed independent, transparent, scientifically rigorous and time and cost effective. Increasingly, consumers are seeking evidence of sustainable harvest in choosing seafood and the Australian Seafood Program addresses this demand. This program also identifies as being of benefit to the Seafood Industry in its promotion of sustainably harvested product. A further objective was to create a program of collaborative engagement with the seafood industry that was about ‘improvement not punishment’. Among assessments of fisheries across Australia, the following species from Port Phillip Bay were assessed as being harvested sustainably; Southern Calamari, King George Whiting, Blue Mussel (*Mytilus galloprovincialis*); Snapper; Rock Flathead, and Silver Trevally (*Pseudocaranx georgianus*), being those high profile species targeted by recreational anglers. However, the extent to which this program has influenced public opinion since the final report was released in February 2012 is unclear.

The blog ‘GoodFishBadFish’ targets both consumers and restaurateurs, and deals with seafood-related issues of public interest. In November 2013 the blog posted an article regarding the proposal to end commercial fishing in Port Phillip Bay[38]. It called for the proposed ban on commercial fishing to be more realistically balanced against the losses accrued to not only commercial fishers, but to the wider Australian public from the lack of access to fresh local fish. Michael Bacash of Restaurant Bacash (South Yarra, Melbourne) together with Frank Camorra of MoVida (Melbourne city) voiced similar opinions to those of Oliver Edwards (Chef at Cumulus Inc. and author of ‘GoodFishBadFish’) in an article published in the *Age* ‘Good Food’ (Holroyd, 2014). Bacash maintained that: “…*the difference between fresh fish and product that has been transported across states is huge*. [and that…] he can't understand the Coalition's pledge to fix something he says is not broken and will deny Melburnians a "*birthright* […] *There's all this fish available and if someone is prepared to catch it in an ethical way then why shouldn't you be able to buy it if you're prepared to pay for it?*” (Ibid). Both Bacash and Edwards refer to the verification of ethical commercial fishing practices by the Australian Conservation Foundation in recent years, for Port Phillip Bay fish consumed at their restaurants. They advocate for equitable sharing of the resource between all users, rather than restricting access to select sectors (i.e. recreational fishers).

As a counterpoint to the positions put by the environmental groups and restauranteurs, *Fishing World* released information that addressed economic, rather than sustainability benefits from removing commercial fishers from the Bay. *Fishing World* stated that there will be “*broad ranging benefits of recreational fishing to the Victorian community*” by increasing recreational fishers from the current estimated number of approximately 750,000 to 1,000,000 by 2020 (Fishing World, 2015). However, the comments elicited by such releases and announcements devolve into emotional exchanges including “*ordinary people, who don’t fish*” (Ibid), and consideration for commercial Bay fishers who, as a minority group will lose their livelihoods[39]. In contrast, issues of pollution, invasive marine pests, and other ecological issues for Port Phillip Bay attract no comment or apparent consideration.

Similar to *Fishing World*, a press release from ‘Keep Australia Fishing’ focuses on the economic benefits that recreational fishing generates. The release promotes the social (presumably to recreational fishers) and environmental benefits; “*It’s about recognising the significant economic, social and environmental benefits recreational fishing can bring to the residents of Melbourne and Victoria*”[40]. The online discussions following articles in the *Geelong Advertiser* and *the Age* relating to the netting bans in Port Phillip Bay, are largely generated by recreational fishers noting the (perceived) threat to the sustainability of fisheries in the Bays from commercial fishing (netting or otherwise) (Dundas, 2014; Cowie, 2014). However, a recreational fisher noted that *“...when they’ve gotten up at sunrise or before and headed down, unloaded the boat and are heading to their favourite fishing spot, only to see a commercial fisher pulling in his nets and arranging his boxes of fish, or discarding fish out of the nets; there is a real gut reaction of feeling that the area has been ‘fished out’ already. It’s like the one thing*

[38] Edwards, O., & Ford, J., (2014) A note on the State Government proposal to end commercial fishing in Port Phillip and Corio Bays, Victoria, Nov. 3., Melbourne. http://goodfishbadfish.com.au/?review=a-note-on-the-state-government-proposal-to-end-commercial-fishing-in-port-phillip-and-corio-bays-victoria Accessed 27/1/2015. GoodFishBadFish is a website set up by Oliver Edwards, (Chef) supported by a group of five passionate foodies and marine and biological scientists.

[39] http://www.abc.net.au/lateline/content/2015/s4355906.htm Accessed 12/7/17

[40] Keep Australia Fishing, 2014, Leading Anglers Support a Recreational Fishing Reserve for Port Phillip Bay, October, https://www.keepaustraliafishing.com.au/images/PDF/Port-Phillip-Bay-Media.pdf Accessed 24/3/15

of relaxation has just been taken away."[41] This quote is potentially a more realistic example of the cause of the tension between commercial and recreational fishers in Port Phillip Bay; that is, a perception and social concern issue of resource access rather than concerns for environmental sustainability.

In representing the recreational fishing sector, VRFish is the government-recognised peak body for Victoria's recreational fishers. VRFish promotes an environmentally responsible approach to fishing through its adoption of the 'National Code of Practice for Recreational and Sport Fishing' (Recfish Australia, 2012), and its own specific Victorian Code of Conduct (VRFish, 2014a). Furthermore, VRFish is committed to advancing fisheries co-management for fish habitat improvement and resource sharing (VRFish, 2014b).

Seafood Industry Victoria (SIV) set up a 'Community Run' campaign to promote commercial fishing activity in Port Phillip Bay and to protest against the proposed buy back of commercial net licences (Davey, 2014). It included a petition which presented the netting ban as a resource sharing rather than a sustainability issue, and urged support of the fishing industry to retain its allocated share of the resource. This petition had received 1645 signatures submitted online as of November 2015 (in an 11-month period). Similarly, the South East Trawl Fishing Industry Association (SETFIA) issued a release on their web site[42] querying the scientific basis of the ban on commercial (net) fishing in Port Phillip Bay. SETFIA further pointed out that 500-600 tonnes of fish would be removed from the market, and seafood consumers as a result.

The Australian Marine Alliance (AMA), an organisation set up to represent all those with interests in commercial fishing, recreational fishing, boating, light marine, manufacturing and outboard engine sectors, issued a media release to assert that while environmental protection was paramount in the management of fisheries, no scientific evidence was presented that commercial netting was threatening the fish or the environment of Port Phillip Bay. The release questioned the sustainability of the recreational take of snapper in the Bay, citing the confirmation by the Australian Conservation Foundation of the commercial fishery's sustainability[43]. The AMA called for "*ENGOs to support a science driven debate and therefore support a more mature discourse around resource access in Port Phillip Bay*"[44].

Since the SIV petition (Davey, 2014), along with the AMA and SETFIA media releases (which were when the Liberal government of the day was promoting the net fishery buy back as related to sustainability issues), the newly elected Labour government (November 2014) recognised the issue as one of resource sharing. However, given putative economic benefits of increased recreational fishing, it opted to continue the policy of a net ban and buy backs of commercial fishery licences.

This section highlights, the two different positions of a variety of representative interest groups in the Bay. The first being environmental groups who are concerned for the fauna and flora of the Bay given extant urban development and related marine pollution. The second, is advocacy for recreational fishing groups, for (exclusive) access to fish stocks due to their perceived concerns over the health of fish stocks and the Bay's habitat with continued commercial netting. This advocacy incorporates both partial and/or complete commercial net bans for the Bay.

4.3.2.4 Literature Review - Summary

Over the past twelve years, government documents and reports have identified a priority need in protecting Port Phillip Bay's aquatic fauna and flora to mitigate the negative and harmful effects of land-based activities and associated pollution. Furthermore, the continued ecological impact of exotic marine pests remains an issue. Both ecological impacts (pollution and marine pests) are not identified by any group or agency as being controlled through the proclamation of marine parks and/or sanctuaries, or through commercial netting bans. The media analysis identifies that the social drivers of fisheries management of the Bay and its environs cannot be linked to the ecological risks of activities in the Bay, but rather on a reallocation of fishery access to recreational fishers. Evidence that pollution and land-based activities are key threats and that commercial fishing activity, as currently managed, is

[41] Pers. Com. Recreational fisher, Interviewee 21, 5/2/2015
[42] SETFIA, 2014, "*An end to Victorian caught inshore Fish?"*, November 26. www.setfia.org.au/item/an-end-to-Victorian-caught-inshore-fish Accessed 2/12/2014
[43] Australian Marine Alliance, 2014, *"3rd Party endorsement of trial as environmental lobby stand up against Port Phillip Bay professional closures*", December 4th. http://media.wix.com/ugd/0c1fd6_dafeb34015064806a8caea0f4c895f33.pdf
[44] Ibid.

demonstrably sustainable (EPA Victoria and Melbourne Water, 2012; Department of Environment and Primary Industries, 2013; Green, *et. al*., 2015), have not featured prominently in the media.

KEY POINT 1. LITERATURE REVIEWED SUGGESTS THAT THE GREATEST THREATS TO THE ECOLOGY OF PORT PHILLIP BAY ARE THE EFFECTS OF POLLUTION, LAND-BASED ACTIVITIES, AND EXOTIC MARINE PESTS.

KEY POINT 2. GOVERNMENT ASSESSMENTS REGARD PORT PHILLIP BAY'S FISHERIES AS ECOLOGICALLY SUSTAINABLE.

KEY POINT 3. REVIEW OF MEDIA COVERAGE REVEALS A FOCUS ON RESOURCE SHARING/ALLOCATION RATHER THAN ECOLOGICAL RISKS TO THE BAY.

4.3.3 Stakeholder/Interest Group Interviews

Two separate activities — quantitative and qualitative — were undertaken in relation to interviewing stakeholders and interest groups:

a) A quantitative survey of recreational fishers (implemented by Fisheries Victoria) to identify motivation, satisfaction with and issues and concerns around their recreational fishing activities in and around Port Phillip and Westernport Bays (refer section 4.3.3.1 was undertaken between November 2013 and February 2014.
b) Individual qualitative interviews with recreational fishers, commercial fishers, recreational users of the Bay, and environmental groups with interests covering the whole of Port Phillip Bay (refer section 4.3.4) were undertaken between January and June 2015.

The inclusion of a specific 'recreational fisher' quantitative survey was utilised to address the concern expressed by recreational fishers' that their concerns were not adequately considered in assessments of the ecological health of the Bay, and to update Victorian government departmental information.

4.3.3.1 Fisheries Victoria Recreational Fishing Survey

A total of 391 angler satisfaction surveys were undertaken during January–December 2014 at boat ramps across Port Phillip Bay and Western Port (this excludes 164 surveys which either had missing fields or no associated catch records). More than half of surveys were undertaken in the Bellarine area (53%), which includes boat ramps in the Geelong Arm of Port Phillip Bay (Limeburner's Point, St Helens Clifton Springs and Point Richards), together with a smaller number of interviews from boat ramps at Indented Head and St Leonards. Most interviewees were aged between 18– 49 years. In the Bellarine and Western Port Bay this group was closely followed by 50–69 year (Figure 3).

KEY POINT 4. MAIN MOTIVATIONS FOR MELBOURNE, MORNINGTON AND WESTERN PORT ANGLERS WERE CATCH RELATED, WHEREAS NON-CATCH (E.G. RELAXATION) RELATED MOTIVATIONS WERE MORE IMPORTANT FOR BELLARINE ANGLERS, WHERE THE GREATEST RESOURCE CONFLICT EXISTS

The surveys revealed that anglers were mostly motivated by catch-related reasons in Mornington and Western Port, approximately equally motivated by catch and non-catch reasons in Melbourne, and largely non-catch reasons (mostly to relax and unwind) on the Bellarine (Figure 4). The numbers of fishers citing social interaction reasons for fishing were very highest in Mornington, and lowest in Melbourne.

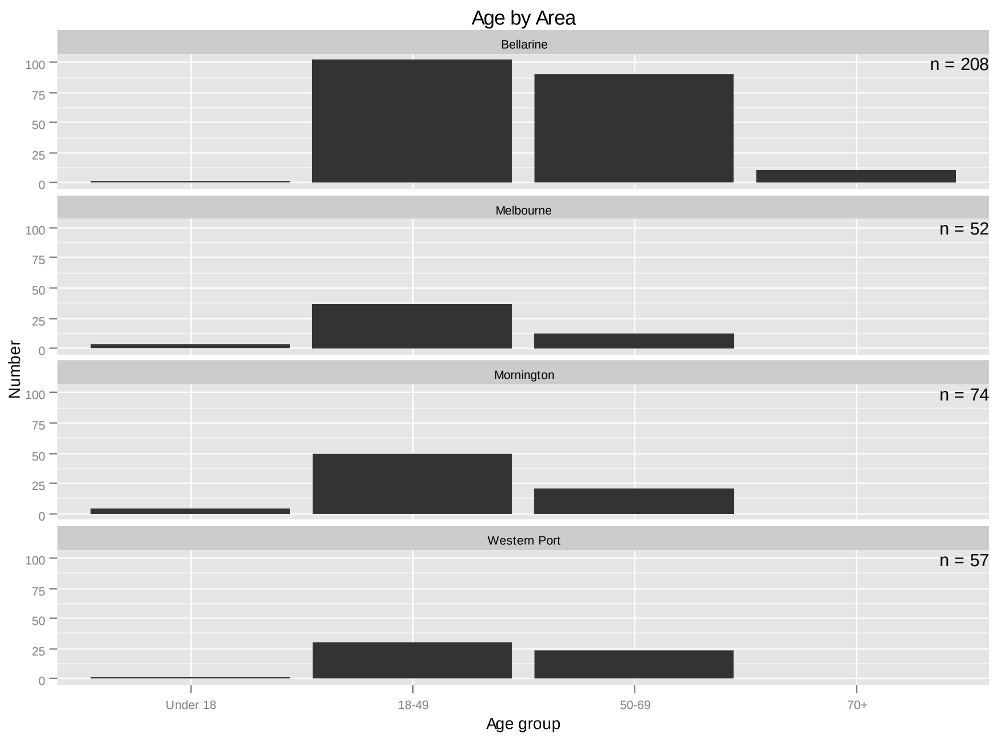

Figure 3. Age category of interviewees by area.

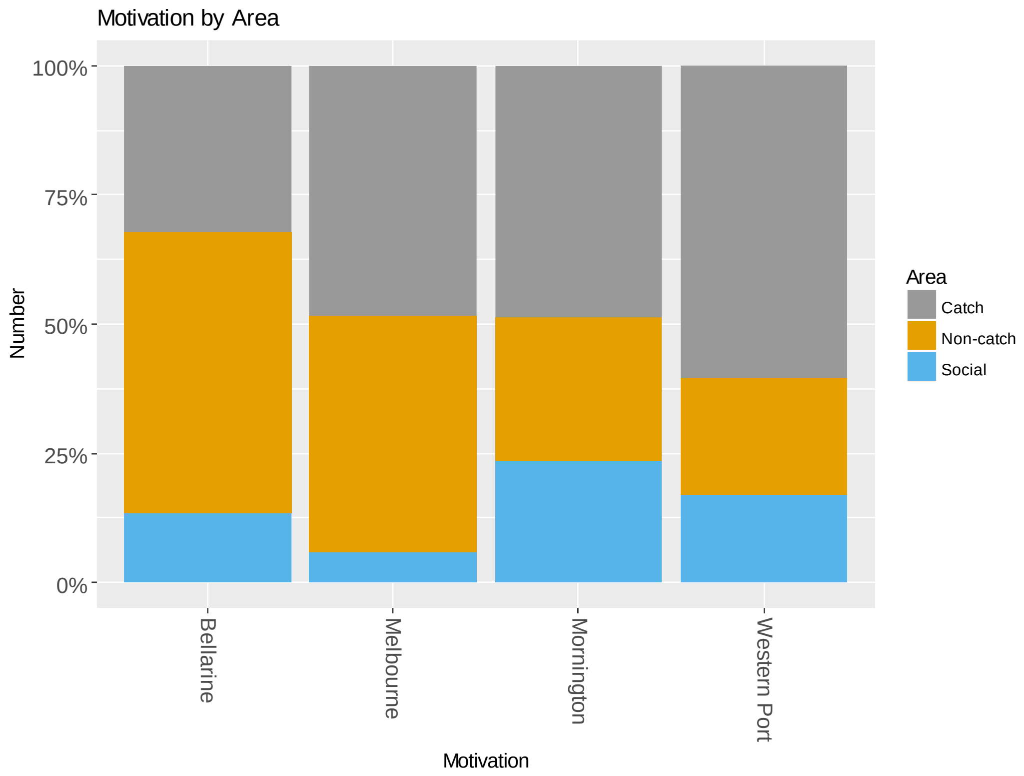

Figure 4: Main source of motivation to fish by Area. Summary of responses to question "why you go recreational fishing" grouped into "catch" "non-catch" and "social" motivations by fishing area. Data were omitted where main source of motivation could not be determined as it was either not recorded or there were multiple categories selected. Catch = competitions, food, sport; Non-catch = relax / unwind, to be outdoors, in the fresh air, to enjoy nature, to be on your own, to get away from people and; Social = to spend time with your family and to spend time with friends (other than family).

KEY POINT 5. WESTERN PORT ANGLERS HAD THE HIGHEST PERSONAL EXPECTATION OF CATCH PROSPECTS, AND BELLARINE ANGLERS HAD THE LOWEST.

In all areas, the main (30 – 40%) reason for fishing in that area was attributed to access, either easy to get to or it has good boat access (Figure 5). The percentage of those for whom 'catch prospects' was the reason for selecting a location, was lowest in the Bellarine area (21%) compared with the other two areas in Port Phillip Bay (23% and 25%) and notably lower than for Western Port (29%). By contrast, the responses were similar across all areas within Port Phillip Bay (15 – 16%) for 'facilities' being the motivation for location selection, and 9% for Western Port. Similarly, where 'familiarity' was given as the motivation for location selection, this was between 24% and 27% of anglers across all areas, with responses from Bellarine fishers being similar to those from Mornington. Additionally, the highest response for 'access' as a reason for selecting to fish in a location was for Bellarine fishers, with the other three locations being lower and similar to each other.

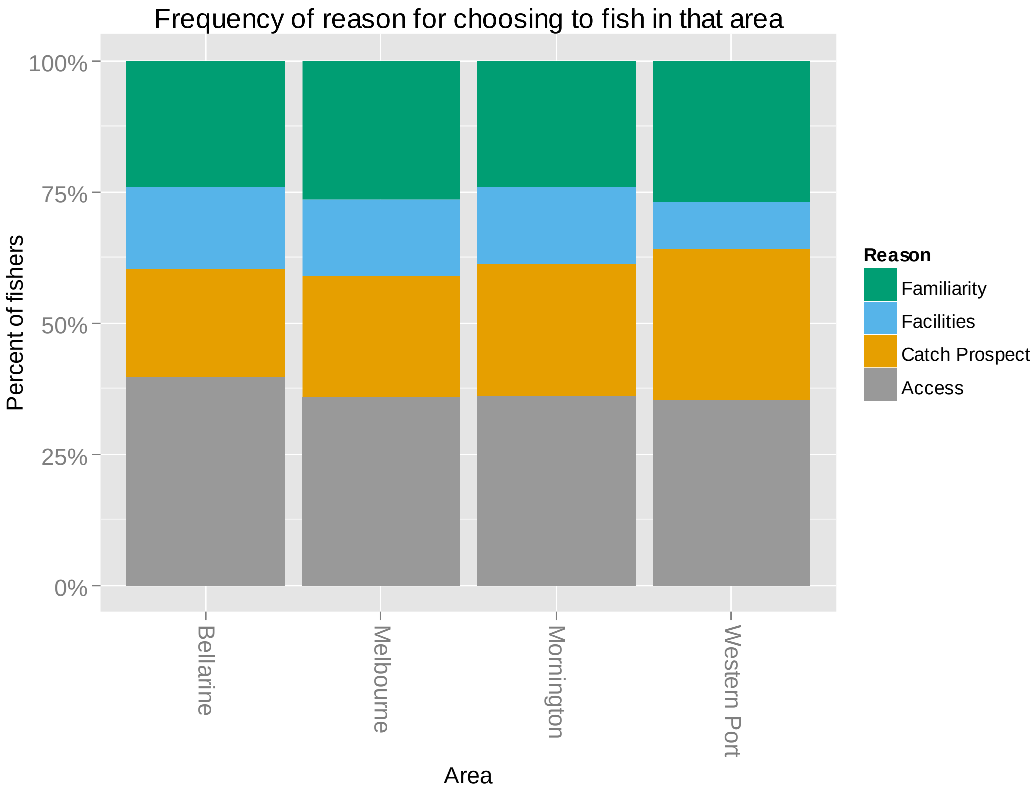

Figure 5: Reasons for selecting areas to fish. Percent of "very important" and "quite important" responses to question regarding importance of factors in determining reason to fish in Port Phillip Bay or Western Port.

KEY POINT 6. BELLARINE ANGLERS HAD A MUCH LOWER LEVEL OF SATISFACTION THAN THOSE FROM OTHER AREAS.

Nearly half of all respondents from the Bellarine were either very satisfied or quite satisfied with their angling experience. This was a lower level of satisfaction than the other three areas where 71–81% of anglers were 'quite' or 'very' satisfied (Figure 6). The Bellarine had the highest percentage of 'not very satisfied' anglers (33%), and by far the most 'not at all satisfied' anglers (16% compared with 2% of Western Port being the next highest). There was only one 'not at all satisfied' angler from each of the areas of Mornington and Western Port.

KEY POINT 7. THE LOWER LEVEL OF SATISFACTION OF BELLARINE ANGLERS WAS IRRESPECTIVE OF MOTIVATION - I.E. EVEN THOSE ANGLERS MOTIVATED BY NON-CATCH

AND SOCIAL REASONS WERE LESS SATISFIED THAN SIMILARLY MOTIVATED ANGLERS FROM OTHER AREAS.

Socially-motivated anglers from Melbourne and Westernport had higher satisfaction rates (100% and 80% respectively) with their fishing experience. Those with 'catch' motivations had lower satisfaction overall, . The percentage of Bellarine fishers who were 'not at all satisfied' was highest for those who were 'catch' motivated (28%), followed by social-motivated (18%) and non-catch motivated anglers (8%). It is noteworthy that most Bellarine anglers fished for 'non-catch' purposes (Figure 5) yet they were equally satisfied with both their catch and non catch motivations. Further, those Bellarine anglers motivated by social interaction, had a significantly lower level (45%) of satisfaction than anglers from any other area, (Figure 7).

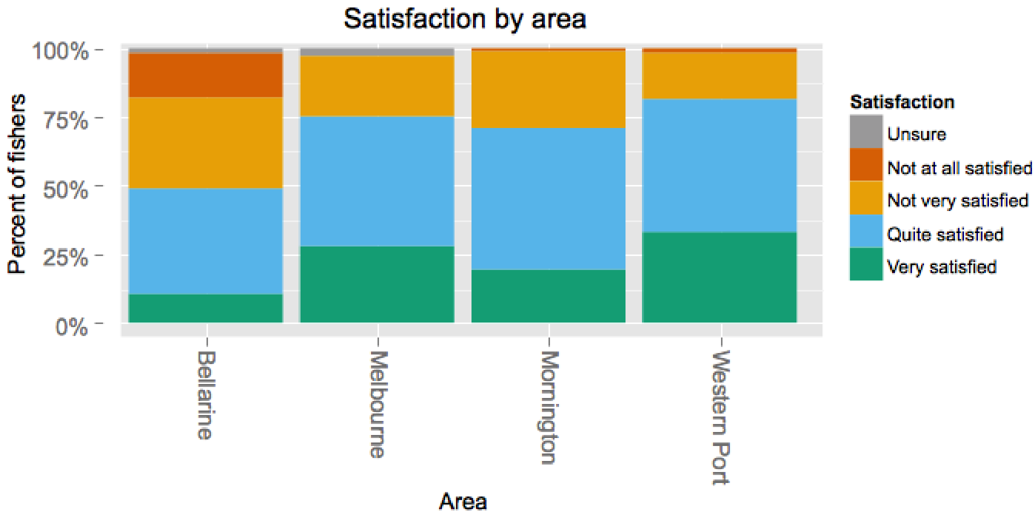

Figure 6: Level of satisfaction amongst interviewed anglers from each area.

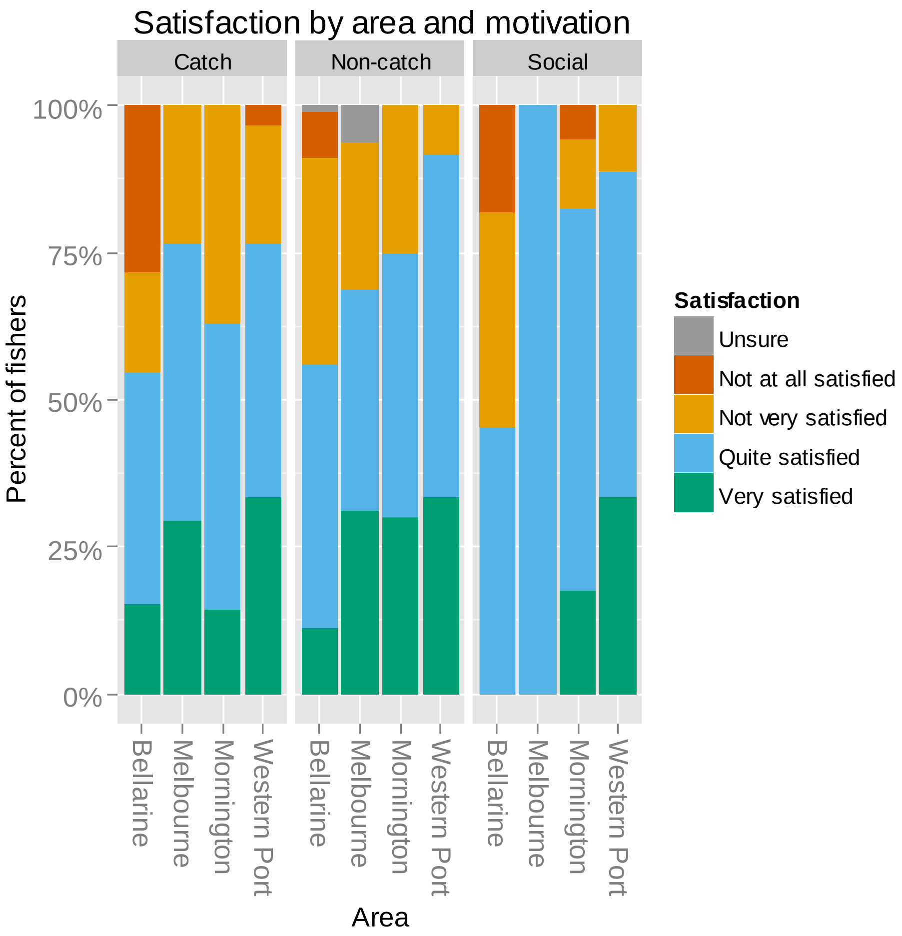

Figure 7: Satisfaction by Area & Motivation to Fish. ***Catch = competitions, food, sport; Non-catch = relax / unwind, to be outdoors, in the fresh air, to enjoy nature, to be on your own, to get away from people and; Social = to spend time with your family and to spend time with friends (other than family).***

KEY POINT 8. INCREASED USE OF THE BAY, BY ANY USERS, WILL INCREASE CONFLICT AND COMPETITION RATHER THAN IT BEING AMELIORATED BY THE REMOVAL OF ANY ONE GROUP.

The median number of retained fish caught during the fishing trip that preceded the survey was 1 for all three Port Phillip Bay areas, and 2 for Western Port (Figure 8). The proportion of zero retained catches ranged from 0.31 in Western Port to 0.47 in Melbourne, and was 0.38 for Bellarine. Mean total catches (retained and discarded individuals) were similar (5.0–6.5) for Melbourne, Mornington and Western Port, but nearly three times higher for the Bellarine (13.5 fish), indicating a relatively large number of fish caught in that region discarded due to size, sport, catch and release etc., which concurs with the highest number of fishers who fish for non-catch reasons. Mean satisfaction was lowest in the Bellarine (1.4 out of a possible 4) compared with Melbourne at 2.1, Mornington at 1.8 and Western Port at 2.1. This finding was despite the highest mean total catch being in the Bellarine area.

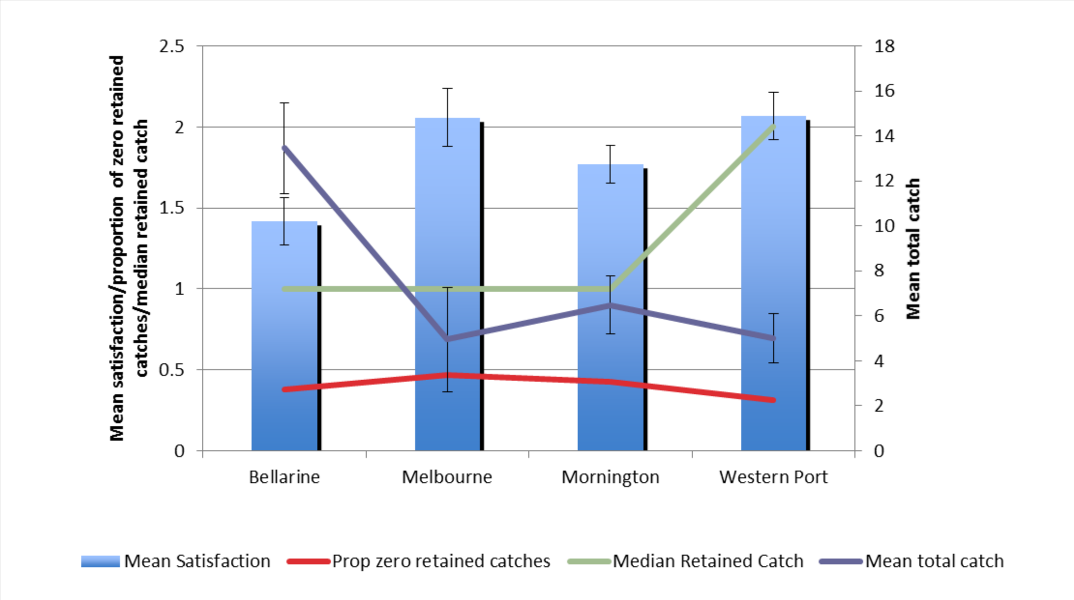

Figure 8. Mean (±SE) satisfaction against proportion of zero retained catches, median retained catch (number of fish) and mean (±SE) total catch (number of retained and discarded fish). Note that for more intuitive display, mean satisfaction was calculated from the highest possible value (4 = not at all satisfied) minus the mean satisfaction (where the lower the value the more satisfied).

KEY POINT 9. WHEREAS THE MOST COMMON CAUSES OF PERCEIVED ISSUES BY BELLARINE ANGLERS WERE RELATED TO COMMERCIAL FISHING, THE MAIN CAUSES OF PERCEIVED ISSUES BY ANGLERS FROM OTHER REGIONS RELATED TO THE LACK OF FACILITIES (BOAT RAMPS / PARKING) AND INTERACTIONS WITH OTHER VESSELS (E.G. CROWDING).

KEY POINT 10. CATCH RATES AND THE AVAILABILITY OF FISH ARE NOT RELATED TO THE LEVELS OF SATISFACTION WITH FISHING IN THE BAY.

There was a consistent trend in the perception of Bellarine anglers, across all types of motivation and levels of satisfaction, that commercial fishing was the main issue affecting their satisfaction. Anglers surveyed believed this to be due to a lack of fish caused by commercial overfishing (Figure 9). Other main issues for Bellarine were: lack of fish through overfishing in general, and low catch / lack of fish. Surprisingly, those anglers who identified as “not very satisfied” but motivated by non-catch purposes, provided the greatest number of responses of “overfishing by commercial fishers”, “overfishing in general” and “low catch / lack of fish”, as being the cause of their dissatisfaction. The main issues for Melbourne anglers were (access to) boat ramps and low catch / lack of fish. Mornington anglers revealed a wider range of issues, with boat ramps, other craft (jet skis) and overfishing by commercial fishers most common. At Western Port, the main issues were boat ramps, low catch/lack of fish and lack of fish through overfishing by recreational. The range of issues, beyond the availability of fish, relating to dissatisfaction noted by anglers surveyed from the other areas of Port Phillip Bay (aside from Bellarine) indicate that competition for access to facilities and space, not primarily the fisheries resource, is the overall key issue affecting all recreational fishers.

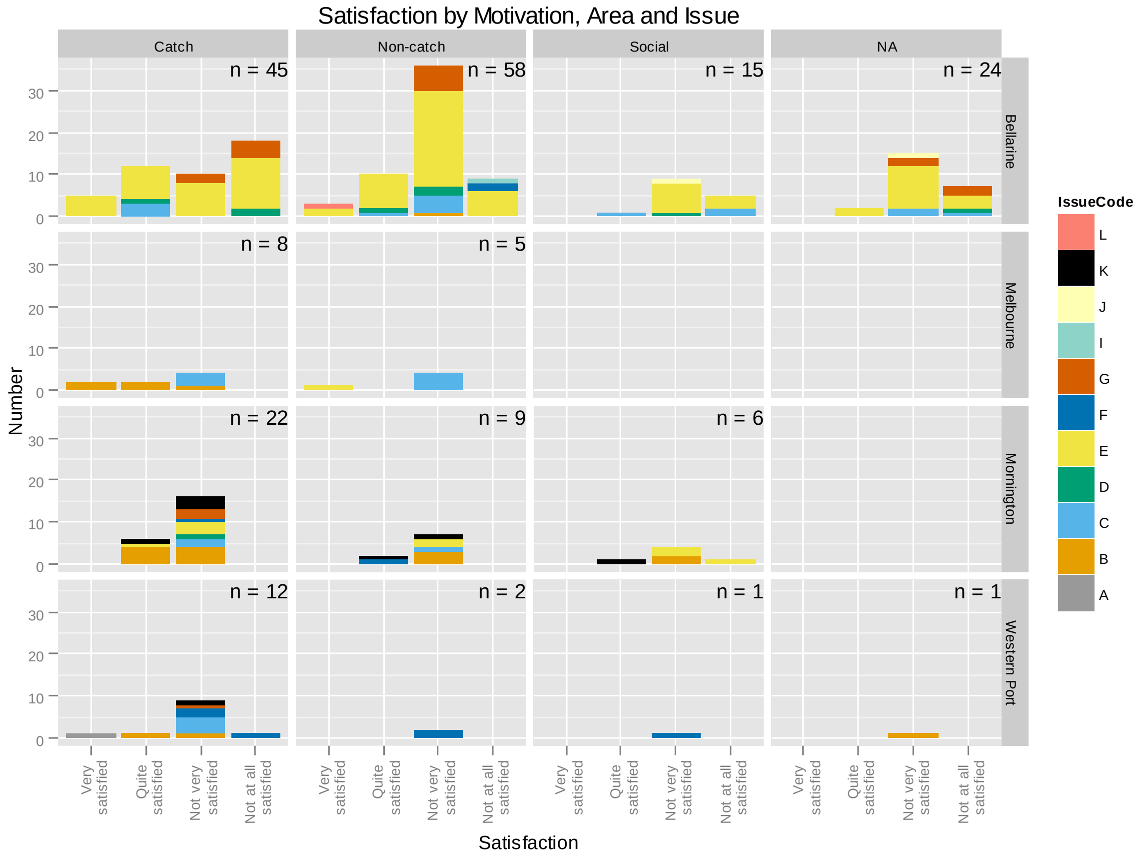

Figure 9: Satisfaction by motivation and Issue. Issue codes are as follows: A = Beacons, B = Boat Ramp, C = Low catch / lack of fish, D = Habitat/ Habitat Decline, E = Lack of Fish through Overfishing Commercial, F = Lack of Fish through Overfishing Recreational, G = Lack of Fish through Overfishing General, H = Lack of Access, I = Over regulation, J = Expense to catching fish, K = Other craft (Jet skis), L = Conflict with Commercial Fisherman.

KEY POINT 11. ISSUES WITH FISHING ENJOYMENT ARE PRIMARILY RELATED TO COMPETITION FOR SPACE AND VISUAL AMENITY.

In regard to the cited causes of the perceived issues, the Bellarine respondents again revealed a consistent trend. Respondents regardless of motivations for fishing or most satisfaction levels, cited “netting in the Bay” as a driver of (dis)satisfaction (Figure 10). Other common drivers of (dis)satisfaction for anglers interviewed on the Bellarine were “commercial/professional fishers in general”, “lack of appropriate regulations on fish size and bag limits”, “lack of appropriate equipment and / or skill” and “bad season / weather”. This suggests that the cause of dissatisfaction in the Bellarine is not related to the availability of fish, but rather to the visual and other amenity impacts of commercial fishing activities, together with skills and equipment associated with catching fish. The main issues for Melbourne anglers were lack of facilities (boat ramps / parking), with the response of anglers that were “not very satisfied” relating to the perception of too many boats and bad weather. Mornington anglers also identified causes of dissatisfaction as being related to facilities and interactions with other vessels, with the most common issue cited being lack of facilities (boat ramps / parking) and appropriate (or adherence to) boating regulations. Other main issues identified in Mornington were “netting in the Bay”, “commercial / professional fishers in general” and “lack of appropriate (or adherence to) regulations on fish size (too small) and/or catch limits”. The main issues identified in Western Port were more varied, with the most common responses being “lack of facilities (boat ramps / parking)”, “bad season/weather”, “lack of [appropriate] equipment and / or skill” and “competition of too many boats generally”.

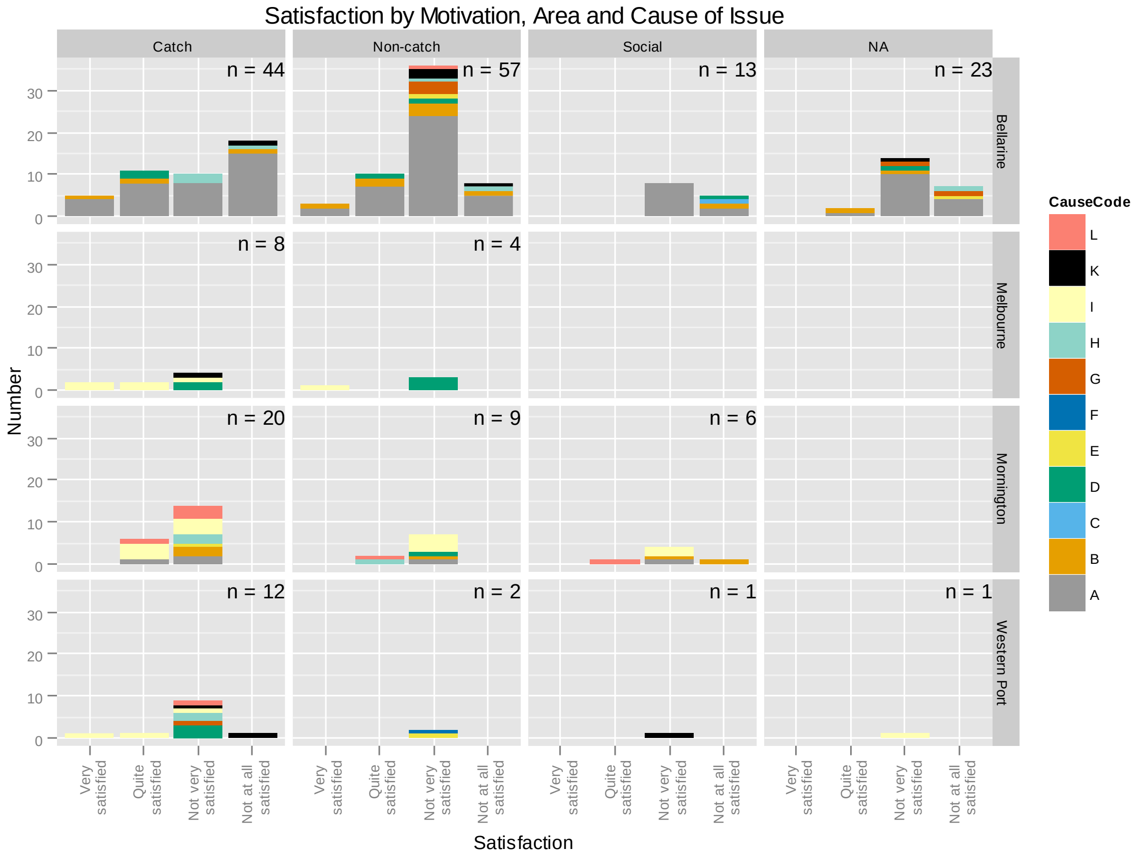

Figure 10: Satisfaction by perceived cause and motivation. Issue codes are as follows: A = Netting in the bay, B = Commercial/professional fishermen, C = Damage to habitat, D = Bad season/weather, E = Greedy recreational fishers, F = Better fishing elsewhere, G = Lack of [appropriate] equipment and/or skill, H = Lack of appropriate (or adherence to) regulations on fish size (too small) and/or catch limits, I = Lack of facilities (boat ramps/parking), J = Lack of time to fish, K = Competition of too many boats generally, L = Lack of appropriate (or adherence to) boating regulations.

4.3.3.2 Summary of recreational fishing survey

The survey data suggest that, amongst recreational fishers, perceived catch rates and the availability of fish are not related to the levels of satisfaction with fishing in the Bay, despite claims to the contrary. Rather, issues with fishing enjoyment are primarily related to competition for space and visual amenity. This is noteworthy given plans to increase the number of recreational fishers in the Bay by some 250,000, compared with 26 commercial fishers facing removal from the Bay.

4.3.4 Qualitative Interviews

In contrast to the Fisheries Victoria survey discussed in the previous section, the qualitative interviews discussed in the following section sought to include a broader range of stakeholders in the Bay, beyond just recreational fishers. The following presents findings from interviews with other stakeholders including: commercial fishers, fish wholesalers and retailers, environmental groups, charter operators, recreational fishing retailers, scuba divers, and spear fishers (Table 6).

4.3.4.1 Interest Group – Identity and Benefits

Interviews undertaken with stakeholders and interest groups were structured around four themes: elements of their *identity* they associated with their activity in or on Port Phillip Bay, the direct *benefits* they derive from that activity; any *issues* that they were concerned about in relation to the uses of Port Phillip Bay, and any *interactions* — positive or negative — that they had with other users of the Bay. These themes were analysed both individually and by interest group to identify commonalities and variances, within and across groups. The results of that qualitative (and some quantitative) analysis are presented below. A full list of: 'Identity'; 'Benefits'; 'Issues', and 'Interaction' themes cited by all interviewees is attached (Appendix 2).

In relation to ***identity***, across all user groups of Port Phillip Bay, regardless of that use, activities on and in the Bay generate a means to connect; and represents tradition, family and social networks, which are fundamental in creating and reinforcing personal and group identity (Stryker and Burke, 2000). Activities undertaken in and around the Bay are seen by all groups as a means to build and sustain a stronger community.

Community groups, identified activities which also allowed them to express concerns, and (re-) establish good management of the Bay, which aligned with their identity and purpose of being engaged citizens.

For commercial and recreational fishers, as well as for wholesale and retail seafood supplier and tackle retailers, the activity of fishing is very much associated with tradition and family as well as supporting strong social community networks. For recreational fishers, there is also an element of sentimental attachment to the activity of fishing that was commonly cited as being associated with their childhood activities, and was therefore an important intergenerational activity to share with their own children.

In relation to ***benefits***, commonly these were that Port Phillip Bay provides an easy, safe, and cost efficient venue to access both recreational activities and commercial fishing. Furthermore, ease of access and safety promotes social/family interaction. Community environmental groups cited further benefits in the protection of social values relating to the environment, and ensuring environmental protection into the future.

Commercial fishers also valued the benefit of being able to undertake work outdoors. Recreational fishers together with wholesale and retail suppliers of seafood and tackle retailers identified the benefit of the Bay as a source of food, either for their own family or their customers.

4.3.4.2 Interest Group – Perceived Issues and Interactions

Across all user groups, with regard to the environment in which fish occur, pollution was the issue identified as being of the greatest threat to fishing activities and to the health of the Bay, both now and into the future. In this context, 'pollution' includes rubbish along with oils, detergents and fertilisers which enter the Bay from coastal activity and urban development, together with fishing debris (e.g. plastics, fishing line and litter). 'Access to fish' was an issue of major concern across all groups. This is a generic term utilised in discussions, incorporating the ability to catch fish (skill, equipment, and regulations), facilities to access fishing grounds (jetties, boat ramps) and general scarcity of fish. Conflict with, or in regard to the methods used by, commercial fishers was, surprisingly, the 7^{th} issue of most concern. This was after, 'pollution', 'access to fish', 'overfishing by recreational fishers', 'loss of fauna biodiversity', 'local depletion' (largely attributed to the effect of commercial fishing) and 'seagrass loss'.

4.3.4.3 Discussion - Interest Group Detailed Interview Results

Not surprisingly, a broader range of issues was identified from the interest group interviews, than those identified in the DPI recreational survey. Whereas the following data are derived from this broader set of stakeholder respondents (Table 6), those with interests in fishing predominate (61%), with recreational fishers comprising the greatest percent of interviewees (35%). The remaining 39% of respondents (being other recreational users and environmental groups), raised similar concerns to those expressed by recreational and commercial fishers. Notably, the interview discussions were less concerned with issues of gear, skill, infrastructure and weather, and were more focussed on broader environmental issues. However, both the DPI recreational fisher survey and interviews addressed all issues and the perceived causes of those issues.

Table 7: Interviewee interest group composition

Group	Number Interviewed	% Of Total
Environmental Groups	8	26%
Other recreational users (Scuba, sailing, & tour operators)	4	13%
Commercial Seafood (Fishers/ Wholesalers & Retailers)	8	26%
Recreational Fishers (Individual, Charter, Retail & Spear)	11	35%
Total	31	100%

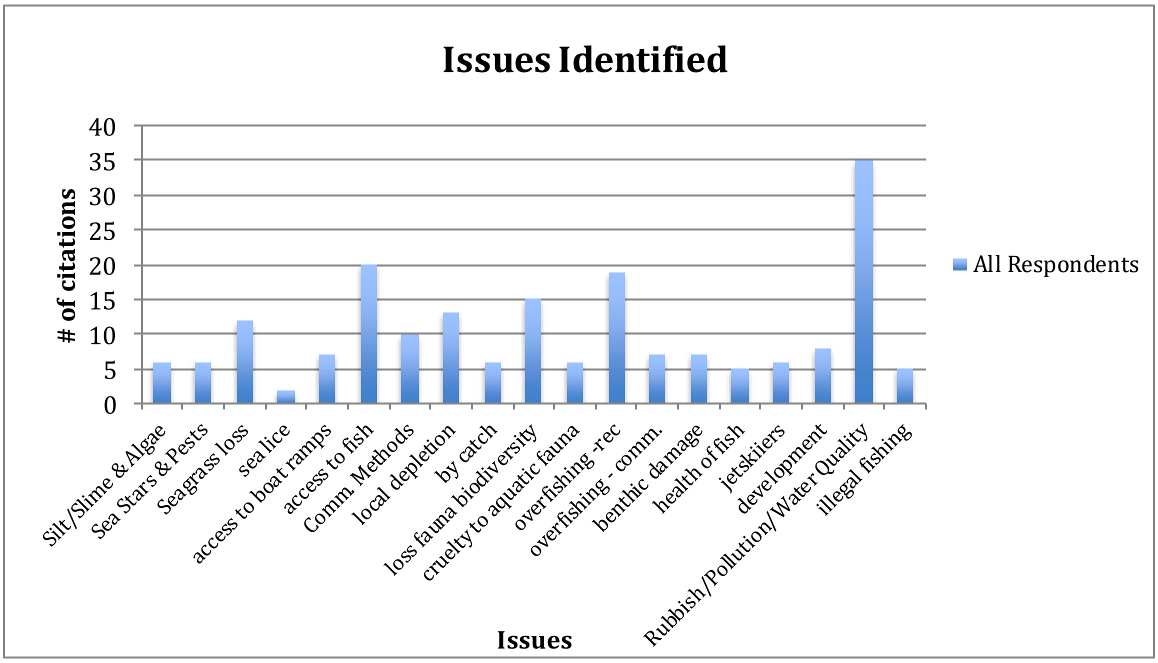

Figure 11: Issues identified during interviews with interest groups[45].

KEY POINT 12. POLLUTION AND RUBBISH WERE THE MOST COMMON ISSUES RAISED, AND WERE CITED BY ALL USER GROUPS.

The key issues most commonly raised across all interest groups from the interviews were (Figure 11):

- Rubbish and Pollution (26 citations – cited by ALL interest groups, but mostly environmental groups.)

[45] Note where the following terms are used in figures, they were defined by interviewees as follows:
'Rubbish': household rubbish generally washed or deposited into the Bay
'Pollutants': toxins and other chemicals excluding oils and detergent (e.g. fertiliser)
'Overfishing': overfishing by both recreational and commercial fishers
'Rec fishing debris': recreational fishing line, hooks, nets etc.
'Dredging': Channel deepening and other dredging activity in the Bay.
'Rec Fishers': overfishing by recreational fishers
'Commercial fishers': overfishing by commercial fishers
'Lack Comm Eng./Education': refers to a lack of community engagement or education about environmental issues.
'Development': coastal development most commonly cited being residential
'Pests': most commonly, Northern Sea stars and sea urchins
'Rec Boating': yachts, speedboats, and other on water recreational boating activity

- Access to fish (20 citations – cited by ALL interest group, but mostly recreational charter groups)
- Overfishing by recreational fishers (19 citations – cited mostly by recreational fishers)
- Loss of aquatic fauna biodiversity (15 citations – cited mostly environmental community groups)
- Local depletion of fish stocks (and aquatic fauna) (13 citations – cited mostly from recreational fishers).

Rubbish, pollution, and water quality, and loss of biodiversity were the issues that were cited by all user groups (Figure 12). Notably, commercial fishing methods were the only issue to be cited by a single group: recreational fishers.

In terms of 'rubbish, pollution and water quality' the commonly cited elements identified in discussions included litter, oil from roads, and nutrients (or fertiliser and other chemicals that are used both agriculturally and in domestic homes) that make their way into the Bay through sewerage overflows and storm water drains. Respondent comments included:

> "[at] *Werribee – sometimes the water gets brown…I think that it has to do with the detergents being discharged into the water or something'*[46]
>
> "*the sediment at the bottom of the Bay that is pulled up with the anchor is putrid*"[47]
>
> "*If anything we want them out of the Bay. It is the recreational fishers that are the major problem as they leave rubbish behind.*"[48]
>
> "[the] *culture of recreational fishers* [..is an issue] *in regard to ….rubbish and littering, which is mostly the loss of their gear.*"[49]

However, public awareness of pollutants other than just the visual amenity aspect was an issue noted by one environmental group[50]. 'Nurdles' were cited as a major emerging pollution issue for waterways — fresh, estuarine and marine — challenging the health of fauna in the environment. Nurdles (Figure 13) are very small pellets of plastic that serve as raw material in the manufacture of plastic products, and have been found on a number of the Bay's beaches (for example see Maillard *et al*., 2013). They can be very easily spilt and difficult to remove as they readily integrate with natural sediment. They present a significant risk to natural fauna through ingestion[51].

[46] Per Com., Interviewee 1, 13/3/2015
[47] Pers Com. Recreational Fisher, Interviewee 22, 12/3/15
[48] Pers Com. Environmental Group, Interviewee 8, 21/5/15
[49] Pers Com. Diver, Interviewee 15, 18/5/15
[50] Pers Com. Community Environmental Group, Interviewee 7, 28/5/15
[51] Pers Com. Community Environmental Group, Interviewee 7, 28/5/15.

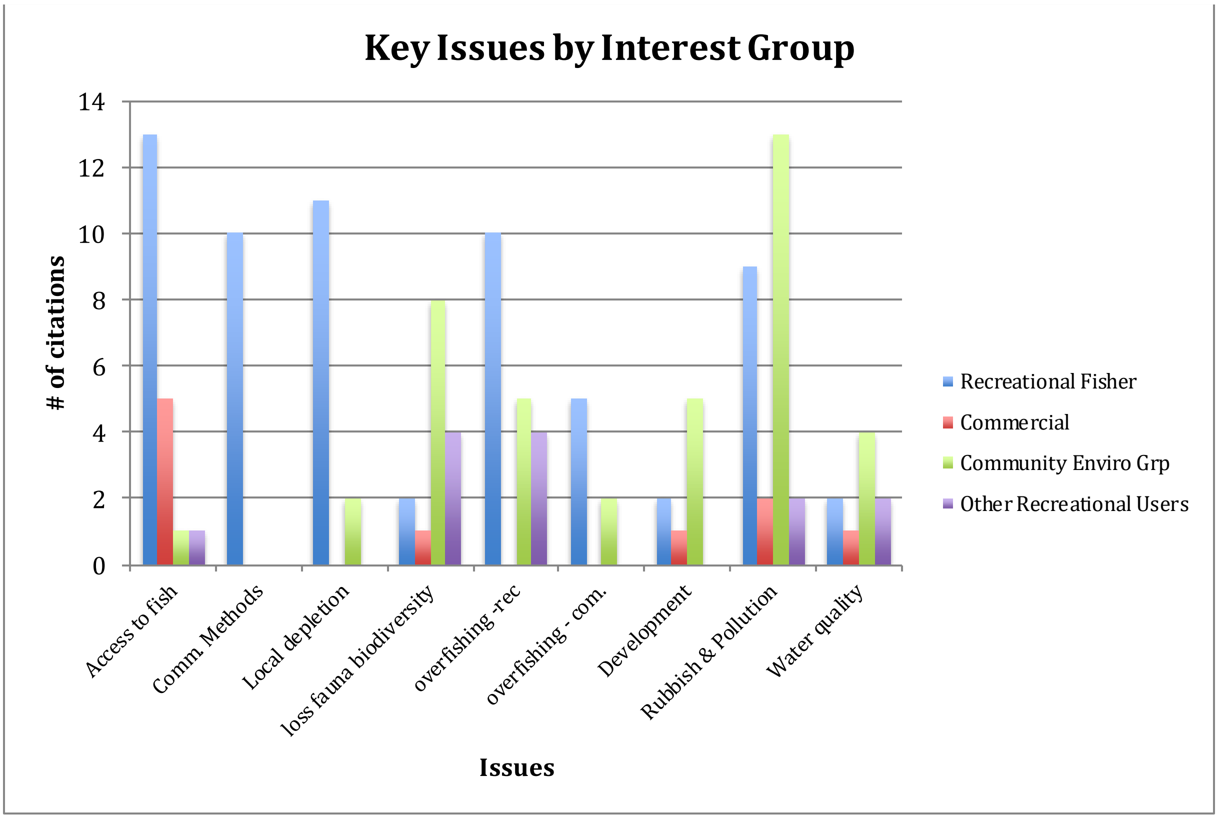

Figure 12: Key issues cited during interviews by Interest group.

Figure 13. Nurdles have been found on several beaches in Port Phillip Bay.

Competition for access to fish was cited by a range of recreational fishers, and encompassed competition for fish, boat ramps, key fishing spots and visual congestion (too many boats or fishers fishing in the one area).

> "*Overfishing is a major issue. There are more recreational fishers than ever fishing in the bay. The number is at a peak and is having an effect on the number of fish in the Bay.*"[52]

> "[there is…] *an increasing number of very successful fishers. Competitions are not supportive of sustainability.*"[53]

[52] Pers Com. Spear Fisher, Interviewee 23, 12/3/15
[53] Pers Com. Recreational Fisher, Interviewee 19, 28/5/15

> *"When snapper come into the Bay – its gets very crowded and competitive which means things get agro at times. But generally that only lasts a few weeks with the excitement of it* - [we call it] *'seasonal enthusiasm'!"*[54]

> "*the madness to catch a snapper that takes hold– it's like a religious experience."*[55]

> "[There is internal conflict] *amongst trailer boats with ramp access and to areas to fish.....Carrum in the Snapper season is 'game on' – groups get together to shut others out.*[56]

KEY POINT 13. COMPETITION FOR ACCESS TO FISH WAS THE MAIN ISSUE CITED BY RECREATIONAL FISHERS.

'Bycatch' was only cited by three groups as an issue: the environmental groups, recreational charter operators and spear fishers. Recreational charter operators noted the indiscriminate nature of commercial nettin; the spear fishers noted that their activities actively avoided any bycatch; and the environmental group noted that both commercial and recreational bycatch was an issue. Differing from commercial fishery bycatch, recreational fisher's bycatch is caused by angling and not as easily identifiable to a specific individual or mode of recreational fishing[57].

The data were further analysed for those causes that were 'attached' or perceived to be related to issues identified by interviewees. Figure 14 shows that recreational fishers were the most frequently cited cause of key issues across all respondents. This was primarily due to the issues of competition and conflict created at boat ramps and other infrastructure. Other recreational users of the bay identified the culture of recreational shore fishers (most often from wharves and piers) as being detrimental to the environment of the Bay and having little direct appreciation for marine fauna, due to witnessing of recreational fishers "unnecessarily" killing rays and squid, or through the unseen effects of discarded rubbish or (lost) fishing line and gear. It was noted by several fishers that recreational fishers dislike catching Southern Fiddler Rays (*Trygonorrhina dumerilii*) and consequently often kill them, along with other rays and octopus, when they catch them because they are not target species but take the angler's bait [58 & 59]. Recreational fishers were often cited as a cause of issues due to the general proliferation of recreational fisher boating, and the attendant increase in coastal traffic, infrastructure use, and generation of rubbish and recreational fishing debris that was specifically attributed to them.

KEY POINT 14. THE MOST CITED CAUSE OF ISSUES RELATED TO RECREATIONAL FISHERS, MAINLY DUE TO COMPETITION AND CONFLICT CREATED AT BOAT RAMPS AND USE OF OTHER INFRASTRUCTURE.

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[54] Pers Com. Recreational Retailer, Interviewee 18, 20/5/15
[55] Pers Com. Charter Fisher, Interviewee 14, 14/5/15
[56] Pers Com. Charter Fisher, Interviewee 11, 28/5/15
[57] Pers Com. Community Environmental Group, Interviewee 7, 28/5/15
[58] Pers Com. Charter Fisher, Interviewee 12, 18/5/15
[59] Pers Com. Dive operator, Interviewee 16, 19/5/15

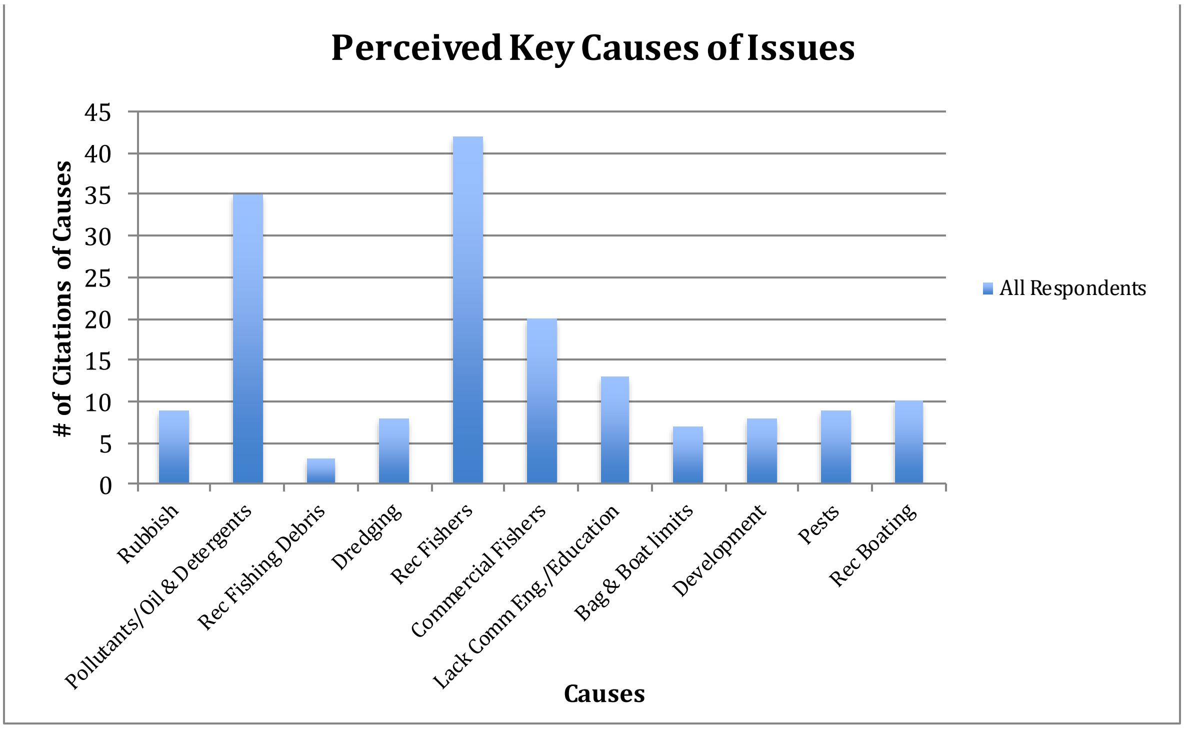

Figure 14: Perceived Causes of Issues

Apart from "recreational fishers", "pollutants, oils and detergents" and "dredging" were the other most commonly cited causes of issues by three of the four interest groups (Figure 15). 'Other recreational users' were the only group not to cite 'pollutants, oils and detergents' as the cause for any of the issues; rather they identified "general rubbish" being the cause of their issues associated with use of the Bay. 'Recreational fishers' (including charter), 'rubbish general' and dredging were the only causes of issues to be cited by all stakeholder groups. The key reasons for recreational fishers being cited as a cause of issues were related to; an attributed lack of knowledge of, or adherence to, bag and boat limits[60&61]; competition in peak seasons[62&63]; or littering and overfishing[64.65,66,67, 68,69,70,71.] Perceptions of overfishing (by recreational anglers) related to the significant improvements in gear and equipment that '*have the potential to make average fishers good or greater fishers*'[72&73]. Commercial fishers were cited most often by recreational fishers as the cause of issues, though an environmental group also mentioned commercial fishers as a cause once.

The recreational fishers' concern over access to fish and overfishing by other recreational fishers is noteworthy, particularly given the balance in interviewees between charter operators to individual recreational fishers interviewed (each representing 36% of the group of 'Recreational Fisher', which also included recreational fishing retailers and spear fishing).

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60 Pers Com. Tour Operator, Interviewee 17, 18/5/15
61 Pers Com. Recreational Charter, Interviewee 13, 19/5/15
62 Pers Com. Charter Fisher, Interviewee 13, 19/5/15
63 Pers Com. Charter Fisher, Interviewee 11, 28/5/15
64 Pers Com. Spear Fisher, Interviewee 23, 12/3/15
65 Pers Com. Rec Fisher, Interviewee 19, 29/5/15
66 Pers Com. Charter Fisher, Interviewee 14, 14/5/15
67 Pers Com. Community Environmental Group, Interviewee 9, 20/2/15
68 Pers Com. Recreational Tourism, Interveiwee 17, 18/5/15
69 Pers Com. Community Environmental Group, Interviewee 7, 29/5/15
70 Pers. Com. Charter Fisher, Interviewee 11, 28/5/15
71 Pers Com. Diver Operator, Interviewee 15, 18/5/15
72 Pers Com. Charter Fisher, Interviewee 14, 14/5/15
73 Pers Com. Charter Fisher, Interviewee 19, 29/5/15

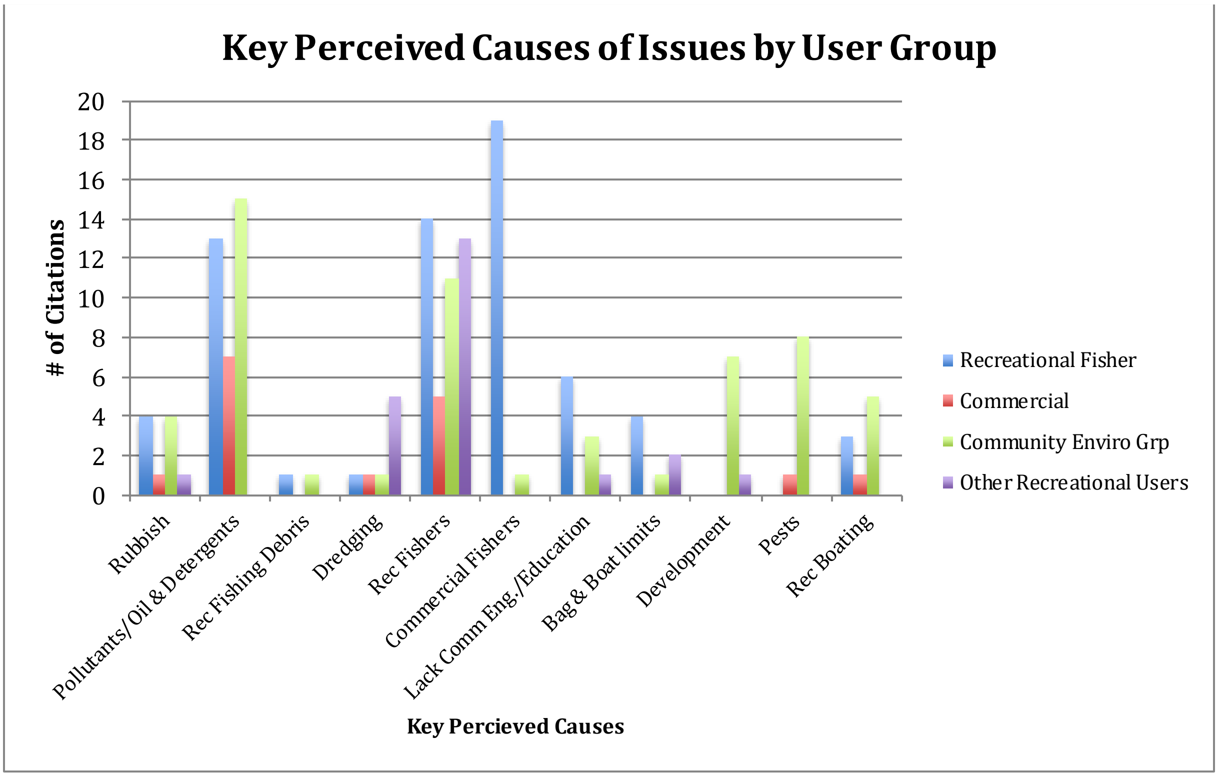

Figure 15: Key Perceived Causes of Issues by User Group

Recreational Fishing

Key issues (most often raised) identified by recreational fishing groups (including individual recreational, charter, spear and retail) are shown in Figure 16.

In order of most to least often raised were:

- Access to fish (13) (attributed to being impeded by commercial fishers, but also included access to boat ramps and other bayside fishing infrastructure used by both commercial and recreational fishers.)
- Local depletion of fish stocks (11) (attributed to commercial fishers)
- Commercial methods (10) (Netting)
- Overfishing by recreational fishers (seasonality and competitions) (10)

Breaking these data down by specific interest group within recreational fishing groups is revealing (Figure 17). The two key issues are 'access to fish' and 'local depletion of stocks'. However, given the Fisheries Victoria recreational fisher survey identified relatively positive levels of satisfaction (above 50%) for those seeking to catch fish in all areas, this is likely related to competition for space (boat ramps; parking areas; cleaning tables; common fishing spots etc), rather than the availability of fish. For recreational fishers, this is exacerbated during competitions or peak times such as the opening of the Snapper season.

However, both recreational fishers and charter operators do make a clear connection to the activity of commercial fishers and their experience of depleted fish stocks/availability of fish. Commercial fishers were cited to have targeted local concentrations of Snapper or King George Whiting (associated with aggregations of recreational anglers), resulting in these areas being '*cleaned out overnight*'. It is believed commercial fishers come in at night and net these areas, depleting all stocks in specific geographical zones in very short periods of time, thus creating a conflation of the issues of local depletion and access to stock.

> *"Commercial fishers – if you start catching whiting they'll come in at night and sweep it – so there's nothing left the next day"*[74]

> *"Who wants to get out there and the place has been raped* [by commercial fishers] *and will be the same for the next 2 – 3 weeks ….it's an expensive hobby."*[75]

> *"There are also a lot of commercial fishers around inner and outer Corio Bay which has only occurred as a result of the closure of Western Port Bay…* [it is] *open slather and opportunistic harvesting."*[76]

There is a core group of recreational fishers located in the western part of the Bay who also express deep concerns about damage to the benthos from commercial fishing and netting activities. Issues cited included[77 & 78]:

> *"Stripping and hauling up of sea grass meadows with haul seine nets"*
>
> *"…the bottom looked like a ploughed field."*
>
> *"Netting and displacement of the natural ecology"*

Furthermore, some recreational fishers were concerned about the effect of a perceived depletion of available fish on the attractiveness of fishing as both family and social time. This was specifically noted in regard to being able to raise children so as to enjoy the activity of catching fish, and being able to provide a '*feed for the family*'[79]

> *"Providing a feed for your family — a feed for your kids — in the last 3 ½ years this has been very rewarding in particular".* [80]

Key causes that recreational fishers (individual, charter, spear and recreational fishing retailers) attribute to issues were: commercial fishers, (other) recreational fishers, and pollutants, oils and detergents (Figure 18). If rubbish were aggregated with pollutants, oils and detergents, this would be the second highest concern of recreational fishers. The concern of the retail fishing gear suppliers around commercial fishing activity was underpinned by their discussions with other recreational fishers and their own recreational fishing activity.

[74] Pers Com. Charter Fisher, Interviewee 13, 19/5/15
[75] Pers Com. Recreational Fisher, Interviewee 10, 10/3/15
[76] Pers Com. Recreational Fisher, Interviewee 22, 12/3/15
[77] Pers Com. Recreational Fisher, Interviewee 22, 12/3/15
[78] Pers Com. Recreational Fisher, Interviewee 10, 10/3/15
[79] Pers Com. Recreational Fisher, Interviewee 22, 12/3/15
[80] Pers Com. Spear Fisher, Interviewee 23, 12/3/15

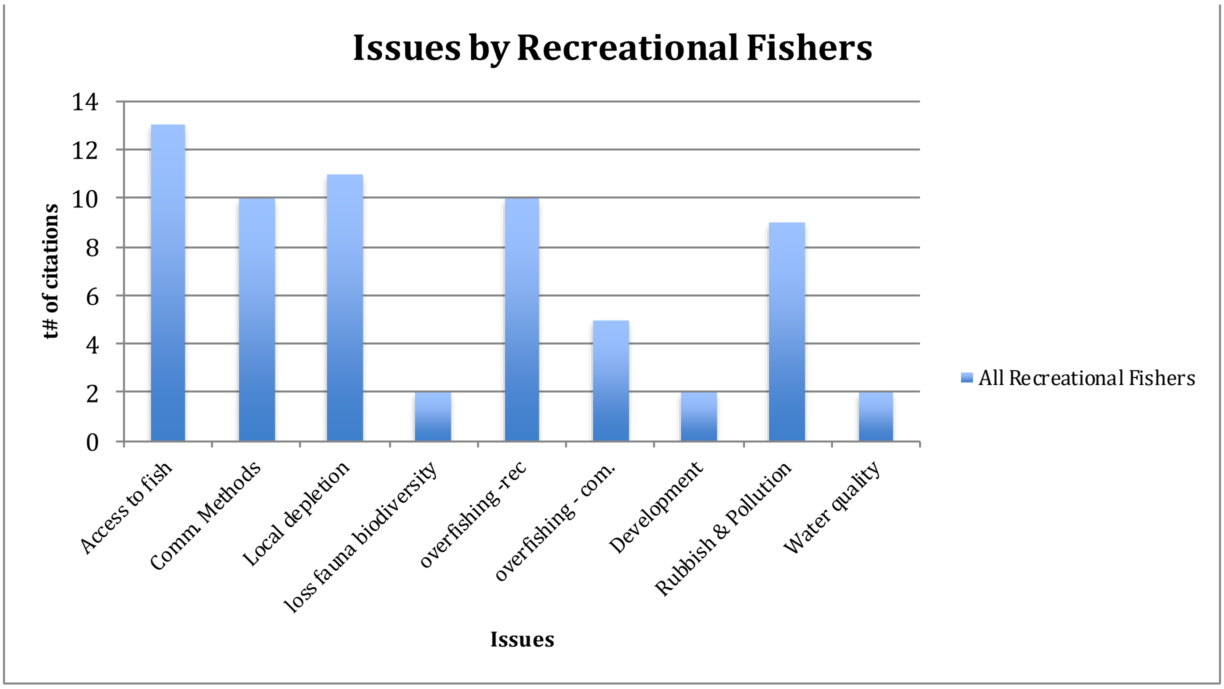

Figure 16: Issues cited by recreational fishers (individuals, charter, spear and retail)

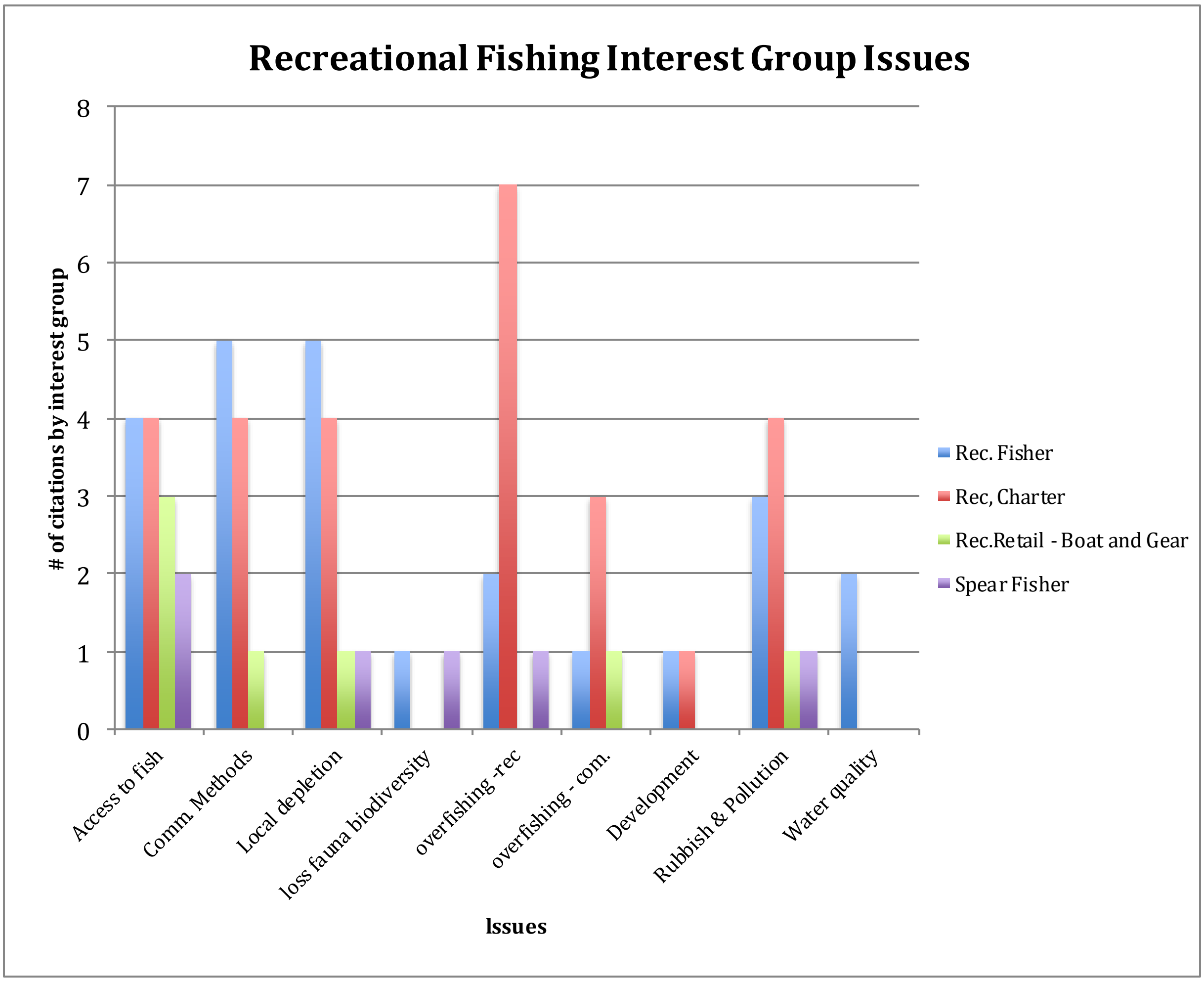

Figure 17: Issues cited by recreational fishing interest group.

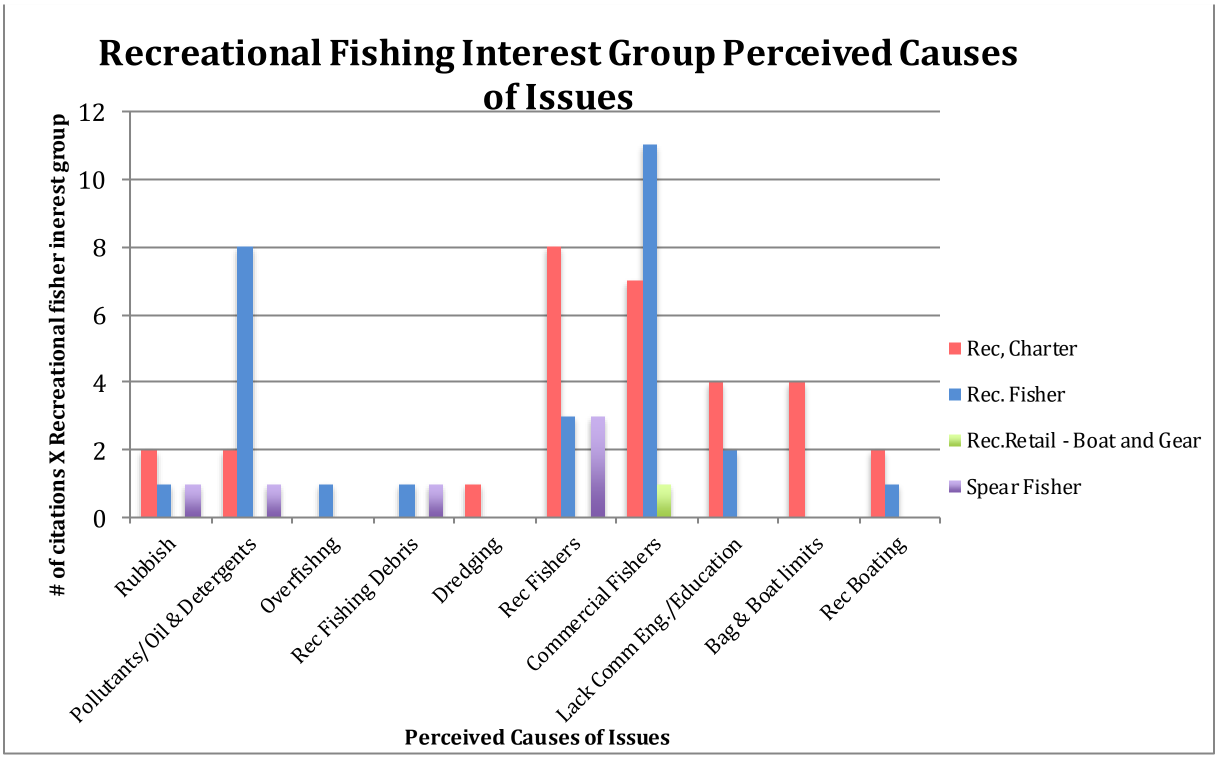

Figure 18: Percieved causes of issues attributed by recreational fishing interest groups.

KEY POINT 15. RECREATIONAL FISHER SATISFACTION IS MORE LINKED TO CONCEPTS OF 'FAIR PLAY' AND VISUAL AMENITY THAN AVAILABILITY OF TARGET SPECIES.

Overall, the key issues and causes that are expressed in these Figures, are that recreational fishers believe commercial fishers are negatively affecting their ability to fish; the amount of fish available to be caught; and are concerned that current commercial netting activities are not what is 'fair' and 'reasonable'.

> *"Nets are a cheating way. Stuffs up the bottom. It's not a friendly way to fish."*[81]

Despite the very clear and heartfelt sentiment expressed by a number of recreational fishers, results of both the Fisheries Victoria recreational fisher survey and the ERA undertaken as part of this project (section 5) found no evidence to suggest that commercial fishers impact fish stocks more than recreational fishers, or that recreational fisher satisfaction with fishing is based soley upon their ability to catch fish. Taking into account these findings, together with the interview data, the results suggest that recreational fisher satisfaction is more linked to concepts of 'fair play' (related to local depletion), visual amenity and perceived bethic/ecological damage. The issue of localised depletion is an issue that would require further investigation and is likely to continue to be an issue, potentially compounded if the Bay is to attract increasing numbers of recreational fishers.

Commercial Fishing Interests

KEY POINT 16. THE MAIN ISSUES FOR COMMERCIAL FISHERS RELATED TO ACCESS TO FISH AND LOSS OF SEAGRASS.

KEY POINT 17. THE PERCEIVED CAUSE OF LOSS OF SEAGRASS WERE POLLUTANTS, OILS AND DETERGENTS.

Commercial fishers, wholesalers and retailers expressed concern about a wide range of issues, however, the issue of 'access to fish' (specifically in relation to the buy-back of netting licenses in Port Phillip Bay) dominated (Figure 19). Most interviewees from this group were reluctant to discuss the proposed net ban for feelings of anger, depression and hopelessness about the ability to be heard. Rather, concerns were expressed about the sustainability of their businesses given the need for 'access to fish'.

[81] Pers Com. Charter Fisher, Interviewee 12, 18/5/15

The frustration expressed by commercial fishers arose from their inability to gain public support for their position, despite working with the Australian Conservation Foundation and VNPA to demonstrate the sustainability of their fishing practices. Instances of vandalism of commercial fisher's cars and trailers was cited by one fisher as evidence of lack of public support or understanding of their genuine interest in sustainable practices. However, those surveyed noted that most recreational fishers don't cause any conflict or distress for commercial fishers — a sentiment expressed by all commercial fishing operators interviewed.

Commercial fishers expressed concerns about seagrass loss and the proliferation of sea lice and other pests. It was believed by commercial fishermen that these issues are primarily caused (or exacerbated) by pollutants, oils and detergents, that are washing into the Bay (Figure 20).

> *"Pollution is the biggest influencer of the health of the Bay and therefore the fish – general rubbish that comes down with rain and other flushing events into the Bay.....green slime and lack of sea grass is really bad - 2015 is the worst year ever from Clifton Springs down.* […] *Oil and diesel being washed into the Bay from roads and drains about the edge* [is an issue]*".*[82]

> *"Impacts on fish are land based and around the treatment plants – these generate lice, which will eat fish in no time."* [83]

> *"...off Point Wilson it was fabulous for both sea grass and whiting but now its is barren. The lack of sea grass doesn't seem to be permanent because it seems to come back so you have to wonder if its from too much nutrient run off into the water. 'Slimy mulch' in the water often – don't know where it comes from or what causes it but wonder if it is a result of the phosphate plant and the phosphate blowing into the water."* [84]

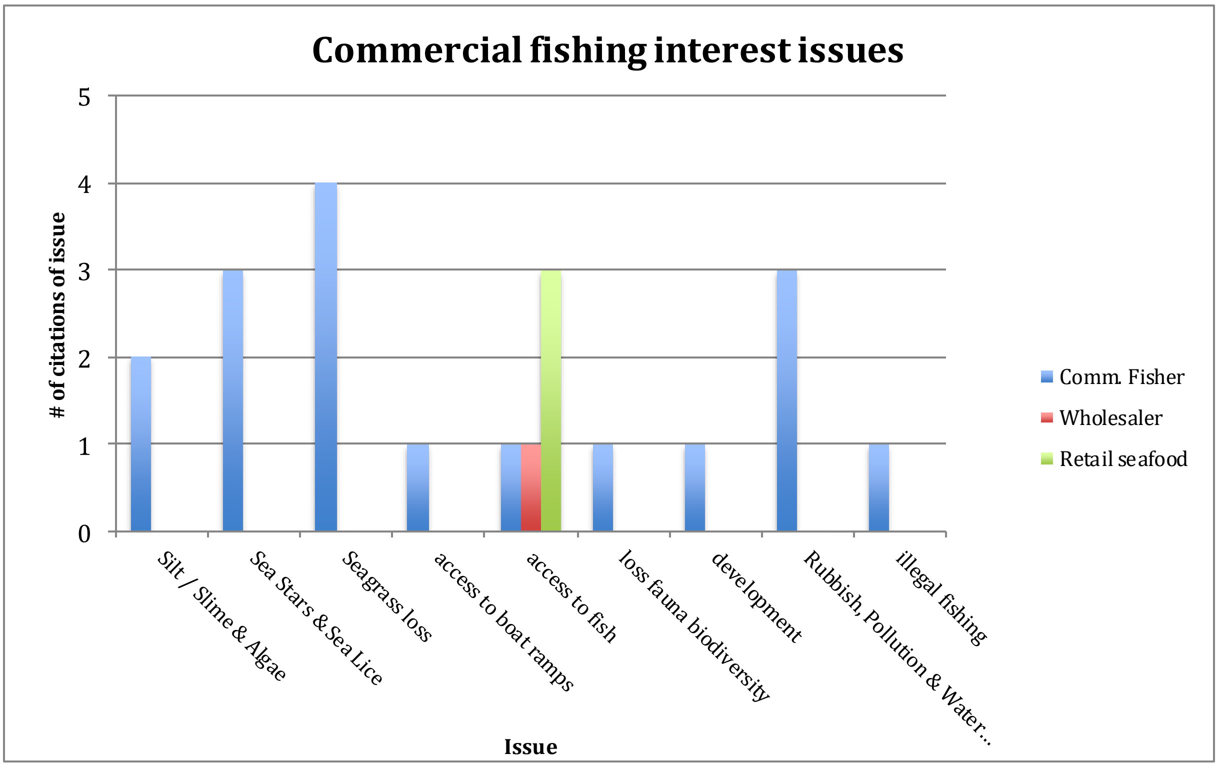

Figure 19: Issues cited by commercial fishing interest groups.

[82] Pers. Com., Commercial Fisher, Interviewee 1, 13/3/15
[83] Pers. Com., Commercial Fisher, Interviewee 3, 12/2/15
[84] Pers. Com., Commercial Fisher, Interviewee 2, 27/2/15

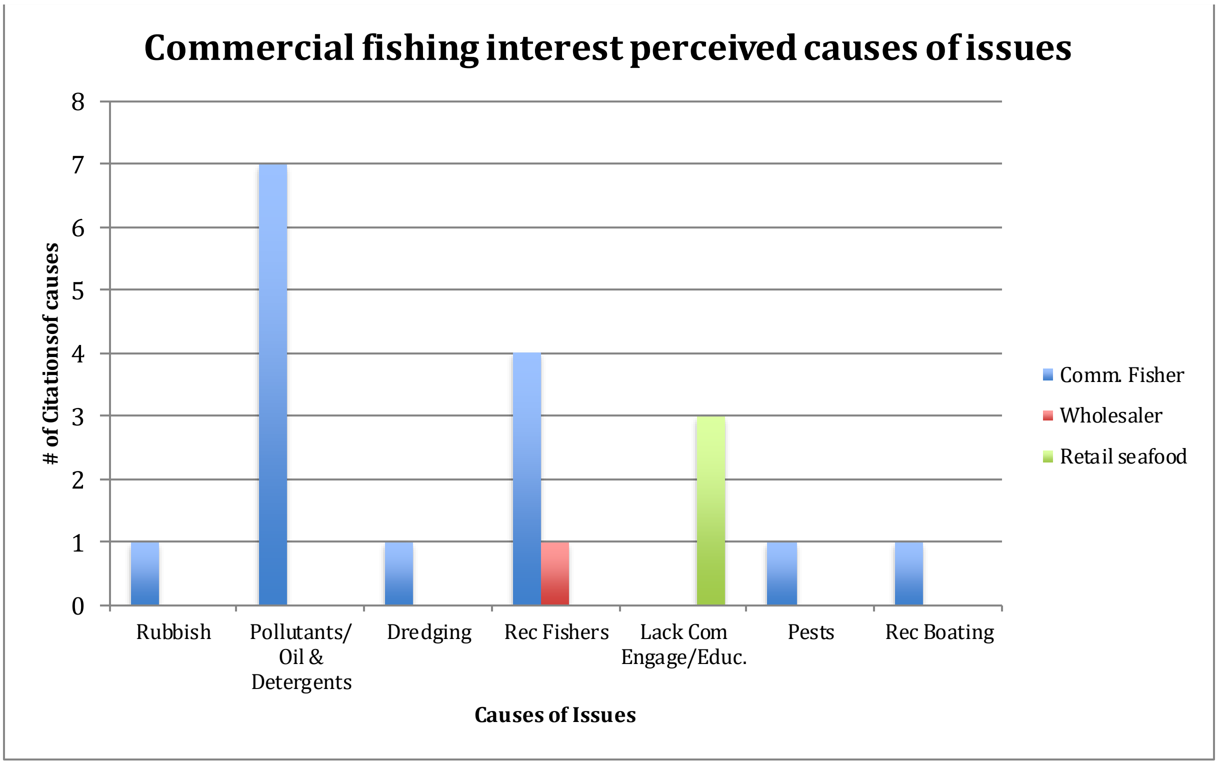

Figure 20: Perceived causes of issues attributed by commercial fishing interest groups.

Environmental and other Recreational User Groups

KEY POINT 18. THE MAIN ISSUES FOR ENVIRONMENTAL GROUPS WERE THE EFFECTS OF POLLUTION (STORM WATER AND OTHER) TOGETHER WITH THE ISSUES OF URBAN DEVELOPMENT AND RUBBISH ON THE HEALTH OF THE BAY.

Environmental and other recreational user (water sports and scuba divers) groups expressed the broadest range of issues (Figure 21). These groups were mostly concerned with: pollution and rubbish; access to fish for observation and biodiversity purposes; the effects of overfishing by recreational fishers; and the environmental effects of coastal development.

The overriding issues of concern for environmental groups are: the loss of biodiversity and pollution (closely followed by recreational rubbish – recreational fisher and general public). By contrast, the top three issues for other recreational user groups were: loss of biodiversity; cruelty to aquatic fauna; and overfishing by recreational fishers.

Environmental groups consistently highlighted effects of pollution (storm water and other) together with the effects of urban development and of rubbish deposition on the health of the Bay. They saw these as primary concerns for the base level ecosystem, importantly because they are largely 'unseen' by the majority of Melbournians. This was illustrated by comments such as:

> *"What goes on in the burbs (sic) impacts the Bay... getting people to be aware of other aspects of pollutants rather than just the amenity aspect is a challenge."*[85]
>
> *"Poor design of infrastructure: Boat ramps and car parks cause much more marine damage with disturbance and pollution run off than is identified or monitored."*[86]
>
> *"Increasing populations in many coastal towns puts further strain on an already fragile coastal habitat and like other coastal areas, Swan Bay has been challenged by the impact of agricultural and recreational activities."*[87]

[85] Pers Com. Environmental Group – Interviewee 7, 29/5/15
[86] Pers Com. Environmental Group – Interviewee 6, 10/3/15
[87] Pers Com. Environmental Group – Interviewee 5, 26/5/15

> *"New residential development* [cause] *concerns about the types of discharge into the Bay.* […] *this has involved water monitoring for various elements.*[88]

> *"The* [recreational] *fishing community need to understand that rubbish in drains and oil etc ends up in the Bay"*[89]

For many, these issues were linked to seagrass loss, silting, and algae, the proliferation of seastars and other exotic marine pests (such as *Undaria* and Urchins), together with the health of fish and of marine fauna generally. Dredging for the deepening of the shipping channel generated attention generally to the environmental health of the Bay[90], and this was reflected in comments such as:

> *"Everyone talks about the dredging...but don't really know how it has affected the Bay. But it is really quite murky – whether it's a result of the dredging or other things like fresh water inflows or nutrient influxes (which increase the algae, which can be a problem) – not sure."*[91]

> *"Dumping of dredged sediments – [it's] too complicated an issue for many, including scientists, to come to grips with. The changes caused by it are insidious and can be attributed to all sorts of other causes..... Concerns include the disturbed toxins being taken up by fish"*[92]

> *"The damage to the fauna and flora around the pier is a very sore point with the divers – they assume from visual correlations* […] *that is directly linked to the increased wave and water movement facilitated by the dredging."*[93]

Although dredging was raised as an issue in relation to benthic damage, it was not directly linked to the issues of biodiversity loss by any of the interviewees. Overriding this or any other single issue, pollution and rubbish were consistently raised by environmental groups, in relation to all issues relating to biodiversity loss and general ecosystem health.

KEY POINT 19. FOR OTHER RECREATIONAL USERS OF THE BAY, THE MAIN ISSUES WERE RELATED TO LOSS OF FAUNA BIODIVERSITY AND CRUELTY TO MARINE FAUNA CAUSED BY THE BEHAVIOUR OF SOME RECREATIONAL FISHERS.

Key issues of concern identified by other recreational users (scuba divers, tourism operators, sailing clubs) of the Bay (on and under the water), were loss of fauna biodiversity and cruelty to marine fauna. This related to behaviour, primarily of some recreational fishers, of either not caring or not knowing about the impacts of their actions on the biota of the Bay. Comments reflecting this included;

> *"The only concern would not be around commercial fishing* […]. *It is the poachers and rec* (sic) *fishers who don't comply with regulations that are the real problem and VDPI doesn't do anything about it.* […] *...people who don't know where the marine park boundaries are."*[94]

> *"Fishers are a pain on the piers, because of the rubbish — fishing line, around and under the piers."*[95]

> *"Aggressive people are a big problem — killing big octopus and fisherman not liking their bait being taken....*[96]

> *"Just killing sharks and rays, or things they don't want, then chuck it back. They kill them because they don't want them to take their bait again. It's more noticeable now."* [97]

However, it is not only recreational fishers that cause concern for many in and around the Bay. One group (jet skiers) was consistently singled out for their anti-social behaviour, which caused detriment to the enjoyment of the Bay, concern for both safety and perceived negative environmental impacts:

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[88] Pers Com. Environmental Group – Interviewee 8, 21/5/15
[89] Pers Com. Environmental Group – Interviewee 5, 26/5/15
[90] Pers Com. Environmental Group – Interviewee 6, 10/3/15
[91] Pers Com. Environmental Group – Interviewee 9, 20/2/15
[92] Pers Com. Environmental Group – Interviewee 7, 29/3/15
[93] Pers Com. Environmental Group – Interviewee 15, 18/5/15
[94] Pers Com. Environmental Group – Interviewee 17, 18/5/15
[95] Pers Com. Environmental Group – Interviewee 15, 18/5/15
[96] Pers Com. Environmental Group – Interviewee 16, 19/5/15
[97] Pers Com. Environmental Group – Interviewee 15, 18/5/15

"Jet skiers are a really big problem as they don't respect dive flags or keep an eye out"[98]

There was a marked difference in the perceived causes of these issues between environmental and recreational tourism interest groups (Figure 22). Environmental groups (not surprisingly) were most concerned about pollutants, development and pests for the environmental impacts of these. By contrast, recreational tourism groups were most concerned with negative effects of recreational fishing and dredging. Surprisingly, recreational tourism users were the only group *not* to cite pollution as a concern. This is despite their citing rubbish as an issue, which they largely attributed to recreational fishers.

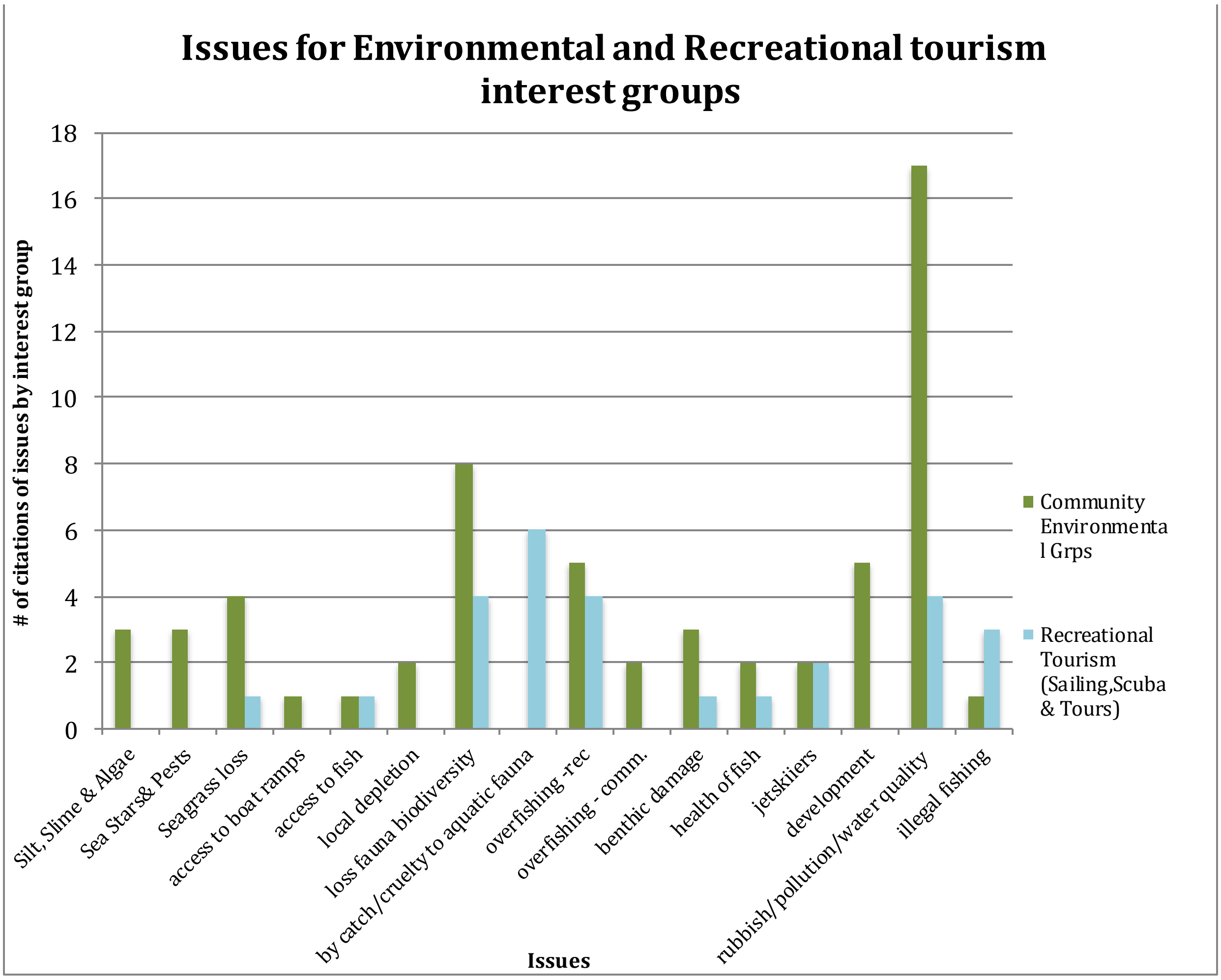

Figure 21: Issues cited by environmental and recreational tourism groups

98 Pers Com. Environmental Group – Interviewee 16, 19/5/15

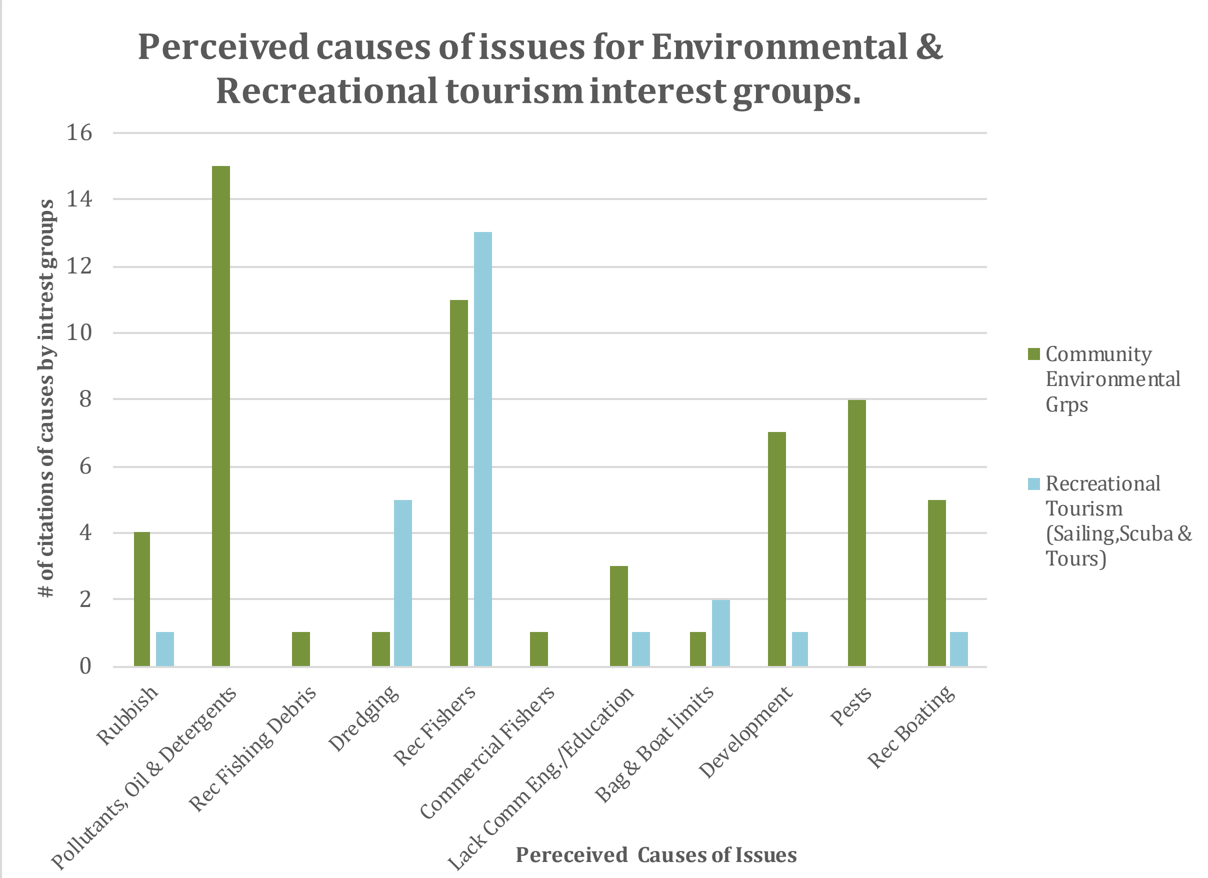

Figure 22: Perceived causes of issues attributed by environmental groups and recreational tourism interest groups. (NB: Overfishing was not cited as a cause of issues by these interest groups; and this is the only collection of interest groups who specifically identified recreational fishing debris as a cause of issues.)

Recreational tourism groups equated the loss of marine life to: recreational overfishing; changes in wave action; effects of dredging and channel deepening; or, in some cases, to learnt fish behaviour, whereby they prefer to inhabit protected zones. This is reflected in the following comments:

> "*Portsea Pier has changed dramatically in terms of loss of marine life and suspect it's mostly due to wave action. The bottom has changed from sand to pebbly consistency.*"[99]

> *"Anecdotally we are seeing a thinning of fish in non sanctuary areas; species in sanctuary zones seem to benefit and … include snapper, leather jackets, flat heads….Mullet and black bream are seen in good numbers."*[100]

> *"There has also been a change in the activity of juvenile fish… they seem to be collecting in specific areas –* [I] *don't know if fish behaviour has changed."*[101]

Of those observations made by recreational tourism users, most noted that marine fauna in the Bay was apparently healthy and thriving.

> *"*[The] *Australian* [sic] *gannet population is really healthy at the moment and* [we] *are seeing the birds really increasing and healthy – not seeing any changes in salmon, whales, dolphins etc.*" [102]

However, both groups — recreational users and environmental — cite a lack of awareness or education as the underpinning factor for problem behaviour. It was noted that people often react to aesthetic issues rather than ecological threats. For example, in the Sandringham area the comment was made:

[99] Pers Com. Environmental Group – Interviewee 15, 18/5/15
[100] Pers Com. Environmental Group – Interviewee 9, 20/2/15
[101] Pers Com. Environmental Group – Interviewee 16, 19/5/15
[102] Pers Com. Environmental Group – Interviewee 17, 18/5/15

> "*There's been concern about the black sludge on the beach which is often complained about, but it was all tested recently and found to be completely natural and just aesthetically unpleasant. […] Concerns about pollution* [are] *generally things that are floating on the Bay*"[103]

KEY POINT 20. FOR ENVIRONMENTAL GROUPS, THE KEY FACTOR AFFECTING RECREATIONAL USER BEHAVIOURS IN AND AROUND THE BAY WAS EDUCATION AND A LACK OF UNDERSTANDING ABOUT THE ENVIRONMENTAL IMPACTS OF THEIR BEHAVIOURS.

Many of these organisations and groups cater to people who would never go fishing or get out on the water or engage with the biota of the Bay regularly. They come from all walks of life — '*crown solicitors to electricians*'; international visitors and retirees. It was noted that:

> *"What we show them really blows them away most of the time"*[104]

> "[The] *first reaction of customers is "Wow! I didn't realise there was so much to see!"*[105]

> *"If you haven't seen it you don't understand it"*[106]

Although one community group expressed the sentiment that "*we need to* [each] *be looking after our own patch*"[107], it was equally noted that "*The green movement in general needs to stop talking amongst themselves*" [108] in order for there to be significant change.

All of these groups recognised that individual users of the Bay are often unaware of their impact and their effect on the ecology of the Bay:

> *"They think when they can't see it any more it disappears…. It's just about lack of awareness … they don't think about the animals living in the shells."*[109]

To this end, organisations such as the Port Phillip Bay Eco Centre have been established specifically for education and to raise community awareness. Accordingly, many of the larger groups are striving to engage and resource smaller community groups. For example, groups such as Port Phillip Bay Eco Centre; Port Phillip Conservation Council and the Bellarine Catchment Network use this approach to maximise their resources and optimise effectiveness in terms of community engagement and education around environmental issues of the Bay.

4.3.4.4 Summary - Interest Group Interviews

KEY POINT 21. THE COMMON CONCERN AMONG ALL USER GROUPS WAS THAT POLLUTION FROM LAND-BASED ACTIVITIES IS THE GREATEST ECOLOGICAL THREAT TO PORT PHILLIP BAY.

The key finding from interviews of all user groups is that, while the Bay is considered to be in good ecological health, there are perceived to be increasing threats from urban development and pollution.

The overt, and at times aggressive or vocalised, conflict amongst users is contained to a relatively small group of recreational fishers opposed to commercial fishers in the western side of the Bay, especially Corio Bay. The issues and perceived causes in this regard, emerge as an issue of spatial management and/or resource sharing, rather an environmental issue relating to the sustainability of commercial fishing activities.

Non-fishing users of the Bay rarely cited commercial fishers as a user or activity of concern. Rather, many believe that there is an educational opportunity for the recreational fishers to improve behaviour relating to gear loss, rubbish, humane practices toward marine life, bag limits and overfishing.

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[103] Pers Com. Environmental Group – Interviewee 24, 14/5/15
[104] Pers Com. Environmental Group – Interviewee 17, 18/5/15
[105] Pers Com. Environmental Group – Interviewee 15, 18/5/15
[106] Pers Com. Environmental Group – Interviewee 16, 19/5/15
[107] Pers Com. Environmental Group – Interviewee 8, 21/5/15
[108] Pers Com. Environmental Group – Interviewee 7, 29/5/15
[109] Pers Com. Environmental Group – Interviewee 15, 18/5/15

Regardless of fishing activity, all user groups identified pollution as a primary issue, which involved education of all Melbournians, not just users of the Bay, due to its catchment of regional activity run off.

4.4 Frameworks for future assessments

This study was originally proposed to identify a collaborative pathway for future uses of the Bay by all interest groups — private, commercial, extractive and non-extractive. However, the political environment and lobbying by select groups overtook the project, requiring a change in the approach taken.

The Q methodology originally proposed is a worthwhile approach in a situation where there is latitude for stakeholder engagement, collaboration and compromise, to achieve mutually agreed outcomes of overarching benefit: for example, environmental sustainability. However, the polar positions of politically-active interest groups evident among Bay users, renders the Q methodology inappropriate.

Instead, the methodology used in this study involved a relatively small number of interviews across a diverse group of stakeholders, exploring a set group of themes within each group. This approach was useful in identifying the perceived effects and causes of fishing activity in the Bay. It is important to note that this approach was intent on broadening the scope beyond those only and immediately concerned with the consumption of fish, to ensure that a more holistic perspective was undertaken.

This approach, as a framework for future use, demonstrates that the broader areas of concern around social, as well as ecological sustainability can be incorporated in resource allocation assessments. Social issues such as perceptions of resource access equity (space and infrastructure access — not just fish) are equally important as those perceptions relating to the ecological health of the Bay (e.g. pollution impacts), when it comes to managing access and use of the resources in marine areas.

5 Ecological Risk Assessment of Fishing in Port Phillip Bay – *by Greg Jenkins*

5.1 Introduction

In recent decades there has been an increasing recognition that fishing practices have effects far wider than those imposed on the target species (Hobday *et al*., 2011). This recognition has led to the implementation of Ecosystem Based Fisheries Management (EBFM) policy in many parts of the world including Australia (Hobday *et al*., 2011). Ecological Risk Assessment (ERA) is a key tool used in the implementation of EBFM. Ecological risk is the probability that some property of the ecological system will change beyond acceptable limits (and therefore is the risk of not achieving predefined ecological objectives).

This assessment of the ecological risks of fishing in Port Phillip Bay was undertaken using the ERAEF "Ecological Risk Assessment for Effects of Fishing" (ERAEF) method (Hobday et. al., 2007, 2011). ERAEF provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five ecological components:

- Target species
- By-product and by-catch species
- Threatened, endangered and protected (TEP) species
- Habitats
- Communities (ecological)

The Port Phillip Bay fishery was divided into seven sub-fisheries for the purposes of assessment:

- Commercial haul seine (including Garfish seine and beach seine)
- Commercial long-line
- Commercial mesh-net
- Commercial purse-seine
- Recreational hook and line (including recreational Charter)
- Recreational Spearfishing
- Hand collection (commercial and recreational)

ERAEF proceeds through four stages of analysis: scoping; an expert judgment based Level 1 analysis (SICA – Scale Intensity Consequence Analysis); an empirically based Level 2 analysis (PSA — Productivity Susceptibility Analysis); and a model based Level 3 analysis. This hierarchical approach provides a cost-efficient way of screening hazards, with increasing time and attention paid only to those hazards that are not eliminated at lower levels in the analysis. The assessment of risk at each level takes into account current management strategies and arrangements. Risk management responses may be identified at any level in the analysis.

Application of the ERAEF methods to a fishery can be thought of as a set of screening or prioritisation steps that work towards a full quantitative ecological risk assessment. At the start of the process, all components are assumed to be at high risk. Each step, or level, potentially screens out issues that are of low concern. The Scoping stage screens out activities that do not occur in the fishery. Level 1 screens out activities that are judged to have low impact, and potentially screens out whole ecological components as well. Level 2 is a screening or prioritisation process for individual species, habitats and communities at risk from direct impacts of fishing. The Level 2 methods do not provide absolute measures of risk. Instead they combine information on productivity and exposure to fishing to assess potential risk — the term used at Level 2 is risk. Because of the precautionary approach to uncertainty, there will be more false positives than false negatives at Level 2, and the list of high risk species or habitats should not be interpreted as all being at high risk from fishing. Level 2 is a screening process to identify species or habitats that require further investigation. Some of these may require only a little further investigation to identify them as a false positive; for some of them managers and industry may decide to implement a management response; others will require further analysis using Level 3 methods, which do assess absolute levels of risk.

For the purposes of this project, the ERAEF for Port Phillip Bay was conducted at Level 1 only. Level 1 analysis involves a scoping stage followed by a Scale, Intensity, Consequence Analysis (SICA). The SICA analysis employs a "plausible worst case" approach to evaluation of risk, rather than considering all possible interactions. In assigning a consequence score for each activity/component combination, the highest scoring (worst case) plausible scenario is selected. For example, in scoring the direct impact of fishing on the bycatch component, the stakeholders would consider the relative vulnerability to the gear amongst the bycatch species, and select the most vulnerable species based on the combination of exposure to the gear and potential rate of recovery of the species to impact.

Although in this project the assessment was concluded at Level 1, the results could be used as the basis for future Level 2 and Level 3 analysis, or application of other risk assessment methods as might be required to assess the risk of hazards external to the fishery.

5.2 Methods

The risk assessment in this study was based on the Level 1 SICA (Scale, Intensity, Consequence Analysis) described by Hobday *et al.* (2007, 2011). Before the Level 1 SICA is undertaken, a profile of the fishery being assessed is developed during the initial "Scoping stage". The Port Phillip Bay fishery, which was divided into 7 sub-fisheries: Commercial haul seine (including Garfish seine and beach seine); commercial long-line; commercial mesh-net; commercial purse-seine; recreational hook and line (including recreational charter); recreational spearfishing; and, hand collection (commercial and recreational).

5.2.1 Scoping stage

Scoping involved six steps:

Step 1. Documenting the general fishery characteristics.

The information used to complete this step came from commercial and recreational catch and effort databases, fishery assessment reports, fishery status reports, fisheries regulations and fishery production bulletins; as well as a range of other documentation on issues relevant to the fishery.

Step 2. Generating "unit of analysis" lists (species, habitat, communities components)

Units of analysis were generated for species (target, bycatch, discard, TEP), habitat and communities components. Species units for target and retained bycatch were initially generated based on data from catch and effort databases, and checked by expert fishers in each sub-fishery. Species units for discard species were generated with the assistance of expert fishers in each sub-fishery. TEP species units were generated using the federal government's Department of Environment search tool for EPBC Act (*Environment Protection and Biodiversity Conservation Act 1999*) listed species[110] as well as information from the *Victorian Flora and Fauna Guarantee Act 1988* and the *Victorian Fisheries Act 1995*. Units of analysis for habitat were chosen based on the Victorian habitat classification developed by Ball *et al.* (2006). Units of analysis for communities came from a number of sources including Cohen *et al.* (2000).

Step 3. Selection of objectives

For each component and subcomponent, operational management objectives were identified based on Hobday *et al.* (2007). Subcomponents for each component were as follows:

- Target species: Population size; Geographic range; Genetic structure; Age/Size/Sex structure; Reproductive capacity; and, Behaviour/Movement
- Byproduct and Bycatch species: Geographic range; Genetic structure; Age/Size/Sex structure; Reproductive capacity; and, Behaviour/Movement
- TEP species: Geographic range; Genetic structure; Age/Size/Sex structure; Reproductive capacity; and, Behaviour/Movement
- Habitats: Water quality; Air quality; Substrate quality; Habitat types; and, Habitat structure and function

110 http://www.environment.gov.au/

- Communities: Species composition; Functional group composition; Distribution of the community; Trophic/size structure; and, Bio- and geo-chemical cycles

Step 4. Hazard identification

Hazards are the activities undertaken in the process of fishing, as well as any external activities which have the potential to lead to harm. The effects of fishery/sub-fishery specific hazards were identified under the following categories (Hobday *et al.*, 2007):

- capture
- direct impact without capture
- addition/movement of biological material
- addition of non-biological material
- disturbance of physical processes
- external hazards

These fishing and external activities were scored on a presence/absence basis for each sub-fishery. An activity was scored as a zero if it did not occur and as a one if it did occur.

Step 5. Bibliography

Step 6. Decision rules to move to Level 1 SICA

Any hazards that were identified at Step 4 as occurring in the fishery were carried forward for analysis at Level 1.

Once the scoping documentation was completed, the content was checked with and reviewed by experienced fishers from each sub-fishery (see acknowledgements).

5.2.2 Level 1 Scale, Intensity and Consequence Analysis (SICA)

The Level 1 aims to identify which hazards lead to a significant impact on any species, habitat or community. Analysis at Level 1 is for whole components (target; bycatch and byproduct; TEP species; habitat; and communities). Level 1 analysis for each component was accomplished by considering the most vulnerable sub-component and the most vulnerable unit of analysis (e.g. most vulnerable species, habitat type or community). At Level 1, each fishery/sub-fishery was assessed using a scale, intensity and consequence analysis as follows:

Step1: The hazard identification score (absence (0) presence (1) scores) identified at step 3 at the scoping level was recorded on the SICA table.

Step 2: The spatial scale of the activity was scored on the SICA table as follows:

<1 nm:	1-10 nm:	10-100 nm:	100-500 nm:	500-1000 nm:	>1000 nm:
1	2	3	4	5	6

Step 3: The temporal scale of the activity was scored on the SICA table as follows:

Decadal (1 day every 10 years or so)	Every several years (1 day every several years)	Annual (1-100 days per year)	Quarterly (100-200 days per year)	Weekly (200-300 days per year)	Daily (300-365 days per year)
1	2	3	4	5	6

Step 4: The sub-component most likely to be affected by activity was chosen and entered into the SICA table.

Step 5: The most vulnerable unit of analysis for the component (e.g. species, habitat type or community assemblage) was chosen and entered into the SICA table.

Step 6: The most appropriate operational objective was selected and entered into the SICA table.

Step 7: The intensity (similar to likelihood) of the activity for that sub-component was scored in accordance with Table 8 and entered into the SICA table.

Table 8. Intensity scores of activity used in step 7 (modified from Fletcher *et al.*, 2002).

Level	Score	Description
Negligible	1	Remote likelihood of detection at any spatial or temporal scale
Minor	2	Occurs rarely or in few restricted locations and detectability even at these scales is rare
Moderate	3	Moderate at broader spatial scale, or severe but local
Major	4	Severe and occurs reasonably often at broad spatial scale
Severe	5	Occasional but very severe and localized or less severe but widespread and frequent
Catastrophic	6	Local to regional severity or continual and widespread

Step 8: The consequence resulting from the intensity for that sub-component was scored in accordance with Table 9 and entered into the SICA table.

Table 9. Consequence scores used in step 8.

Level	Score	Description
Negligible	1	Impact unlikely to be detectable at the scale of the stock/habitat/community
Minor	2	Minimal impact on stock/habitat/community structure or dynamics
Moderate	3	Maximum impact that still meets an objective (e.g. sustainable level of impact such as full exploitation rate for a target species)
Major	4	Wider and longer term impacts (e.g. long-term decline in CPUE)
Severe	5	Very serious impacts now occurring with relatively long time period likely to be needed to restore to an acceptable level (e.g. serious decline in spawning biomass limiting population increase)
Intolerable	6	Widespread and permanent/irreversible damage or loss will occur-unlikely to ever be fixed (e.g. extinction)

Step 9: The confidence/uncertainty for the consequence scores (Table 10) was entered into the SICA table.

Table 10. Confidence/uncertainty scores used in step 9.

Confidence	Score	Rationale for the confidence score
Low	1	Data exists, but is considered poor or conflicting No data exists Disagreement between experts
High	2	Data exists and is considered sound Consensus between experts Consequence is constrained by logical consideration

Step 10: The rationale for the scores associated with each hazard was entered into the SICA table.

Step 11: A summary table of the SICA results was generated presenting the consequence (= risk) scores for the components of each sub-fishery and highlighting any consequence scores of 3 (Moderate) or greater.

Step 12: Evaluation/discussion of Results.

5.2.3 Review of results

Results were reviewed by a project staff member, and then independently by Dr John Ford (Mezo Research). Both reviews resulted in minor changes. Results were also presented at the stakeholder workshop from which comments were also received.

5.3 Results

5.3.1 Scoping Step 1 – Documenting the general fishery characteristics

Fishery Name: Port Phillip Bay finfish fishery

Date of assessment: January 2015

Assessor: Greg Jenkins

General Fishery Characteristics	
Fishery Name	Port Phillip Bay Finfish Fishery
Sub-fisheries assessed	1. Commercial haul seine (including Garfish seine and beach seine) 2. Commercial long-line 3. Commercial mesh-net 4. Commercial purse-seine 5. Recreational hook and line (including recreational Charter) 6. Recreational Spearfishing 7. Hand collection (commercial and recreational)
Start date/history	There is a record of a seine net being used to catch fish in Port Phillip Bay in 1802 (http://www.ladynelson.org.au/history/discovery-port-phillip-bay). The haul seine fishery has been operating for 170 years (VFARM, 2012) and commercial catch records date back to 1903 (Lynch, 1966).
Geographic extent of fishery	The managed area of the fishery encompasses the entirety of Port Phillip Bay (Figure 23). Port Phillip Bay has a coastline of 264 km and covers an area of 1,950 km^2. It has an average depth of 8 m and a maximum depth of 25 m.

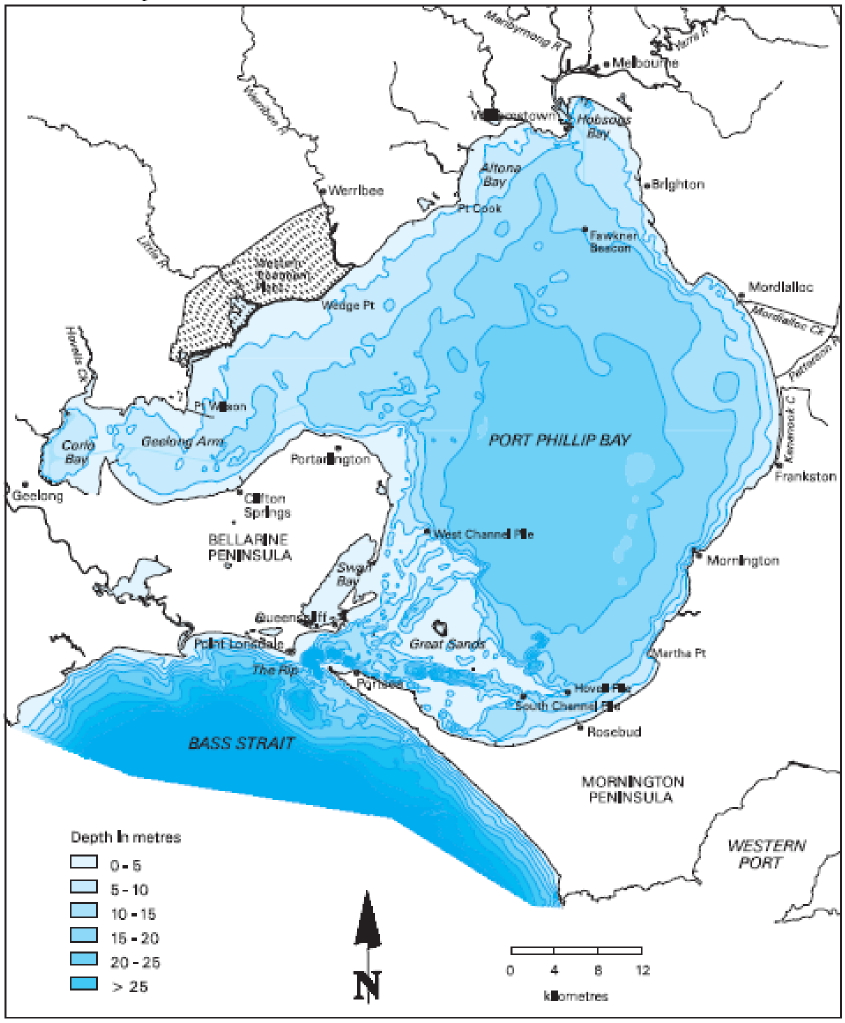

Figure 23. Map of Port Phillip Bay (courtesy of Melbourne Water and CSIRO)

	Port Phillip Bay is a largely enclosed water body connected to Bass Strait by a narrow entrance at Port Phillip Heads (Figure 23). The exchange of water with Bass Strait is limited both by the narrow entrance and the shallow area of sand banks inside the Heads known as the 'Great Sands' (Figure 23). The limited exchange with Bass Strait means that the residence time of water in the Bay is long; between 12 and 18 months. The influence of the narrow entrance and the Great Sands also means that the 2–3 m tidal range on the Bass Strait coast is attenuated to less than 1 m within the Bay. The long residence time of water in the Bay also means that the salinity is influenced by freshwater flow from the catchment, with salinity generally below that of Bass Strait in wet periods and above Bass Strait in dry periods (e.g. drought). Much of the deeper part of the Bay is sedimentary bottom, however in the west and south where there is less wave fetch generated by the predominant south-westerly winds, the seagrass *Zostera nigricaulis* grows at depths down to approximately 8 m. Major seagrass areas are Corio Bay and the Geelong Arm, and Swan Bay. Seagrass is a highly productive habitat and also serves as nursery area for species such as King George Whiting and a feeding area for species such as Rock Flathead. The strong influence of catchment inputs on Port Phillip Bay means that nutrients entering from the catchment are a major driver of the ecology of the Bay. Nutrients drive the productivity of plankton that are the food for larvae of key fish species such as Snapper and Sand Flathead. Variation in flows and associated nutrient inputs is reflected in high variability in recruitment of these species over time, which in turn leads large fluctuations in catch over time. Nutrients also affect seagrass growth in the Bay, with seagrass loss occurring in low flow periods (i.e. drought) due to nutrient limitation. Port Phillip Bay has not faced significant issues of eutrophication from excess nutrients that has occurred in many parts of the world because there is efficient microbial recycling of nutrients in the sediment. Another major driver of the ecology of the Bay is the high abundance of introduced species, having one of the highest rates of pest introductions of any marine water body with more than 100 species introduced. Species such as Northern Pacific Seastar, European Fan Worm and Japanese Kelp have had major impacts on native species, habitats and communities. In addition to introduced species, outbreaks of native species can have a significant impact on the ecology of the Bay, in particular, outbreaks of the native White Urchin have caused a major loss of kelp species on reefs in the north of the Bay, leaving "barrens" of bare rock.
Regions or Zones within the fishery	Port Phillip Bay is divided into a spatial grid of 40 cells for reporting of commercial catch and effort and recreational catch. The cells are defined by 5 x 5 minutes of latitude and longitude which is approximately 9 x 9 km.
Fishing season	Fishing in all sub-fisheries occurs all year round but there are seasonal trends in some. The long-line commercial fishery tends to have higher effort in spring/summer to coincide with seasonal occurrence of the main target species, large Snapper. Purse seine fishing is mainly in autumn/winter when fish school up more. The main recreational fishing season is from October to May, when the weather is warmer and daylight is longer, and coinciding with seasonal occurrence of Snapper, one of the main target species. Winter recreational fishing occurs for Southern Calamari and King George Whiting. Charter boat fishing occurs year round. Spearfishing and hand collection is mainly concentrated in the summer months when the water is warmer although some spearfishing occurs year round (e.g. spearfishing for Southern Calamari in spring).
Target species and stock status	• Snapper (*Chrysophrys auratus*) – Sustainable[1], Environmentally limited[2] • King George Whiting (*Sillaginodes punctatus*) – Sustainable[1], Environmentally limited[2] • Sand Flathead (*Platycephalus bassensis*) – unknown • Rock Flathead (*Platycephalus laevigatus*) – unknown • Australian Sardine (*Sardinops sagax*) – Sustainable[1] • Australian Anchovy (*Engraulis australis*) – unknown • Southern Calamari (*Sepioteuthis australis*) – Undefined[1] • Southern Garfish (*Hyporhamphus melanochir*) – unknown • Gummy Shark (*Mustelus antarcticus*) – Sustainable[1] • Yellow-eye Mullet (*Aldrichetta forsteri*) – unknown • Australian Salmon (*Arripis* sp.) – Sustainable[1] • Yellowtail Kingfish (*Seriola lalandi*) – unknown • Flounder (*Rhombosolea tapirina* and *Ammotretis rostratus*) – unknown • Black Bream (*Acanthopagrus butcheri*) – Environmentally limited[2] • Blacklip Abalone *(Haliotis rubra)* – Sustainable (Central Zone)[1] • White Urchin (*Heliocidaris erythrogramma*) – Developing fishery [1]Flood *et al*. (2012) [2]DPI (2010)

Bait Collection and Usage

Bait is used in the commercial longline and recreational hook and line fisheries. Most bait is purchased; however, collection of wild mussels (limited by restrictions on intertidal collecting), and capture of Southern Calamari and a wide variety of fish where fillets are used for bait is also common. Yellowtail Scad and Slimy (Blue) Mackerel are caught and used as live bait for Yellowtail Kingfish near Port Phillip Heads. Bass yabby pumping does occur for recreational fishing bait. Traps are used to capture octopus for long-line bait. Commonly purchased baits include Pipis, pilchards (Australian Sardine) and Silver Whiting for recreational rod and line, and Barracouta for longline fishing. Squid are also purchased for bait in both of those sub-fisheries. Some purchased baits are caught by commercial purse seining in Port Phillip Bay (e.g. pilchards, glassies).

Current Entitlements

Commercial fishers in the Bay operate under the authority of a Western Port/Port Phillip Bay Fishery Access Licence and a single Purse Seine (Port Phillip Bay) Fishery Access Licence. The total number of these licences is capped at forty-two and currently twenty-seven are active. The existing licences can be transferred to new fishers but no additional licences can be issued. The abalone, urchin and scallop commercial hand-collection fisheries are operated under separate licensing arrangements.

Recreational fishers must purchase a recreational fishing licence (RFL), or be eligible for an exemption (Seniors Card holders and those under 18 years of age), to fish in any Victorian waters. These licences are effectively unlimited, with 268,484 sold in 2010–2011. Note that this figure does not account for fishers with licences valid for more than one year — i.e. those who purchased a three-year licence one or two years previously (Ford and Gilmour, 2013).

Current and recent TACs, quota trends by method

Catch quotas are not used in managing Port Phillip Bay finfish fisheries. The central zone abalone quota was 307.7 t in 2014/15 (declining trend since 2002). The TAC for the Port Phillip Bay White Urchin fishery has been set at 60 t. The recently-established hand collection commercial fishery for scallops in Port Phillip Bay had an initial TAC of 12 t for Commercial Scallops and 6 t for Doughboy Scallops.

Current and recent fishery effort trends by method

The most recent estimate of effort levels in the fishery by fishing method (sub-fishery). Summary of the recent effort trends in the fishery by fishing method (sub-fishery). In table Form

	Haul seine 2013 (days)	Mesh net 2013 (days)	Long line 2013 (days)	Purse seine 2013 (days)	Recreational hook and line	Spear fishing	Hand collection
Most recent effort	1019	872	783	170	Unknown total effort	Unknown	N/A[2]
Trend	Decreasing trend since 2002	Decreasing trend since 2002	Increasing trend since 2002	Decreasing then increasing since 2002	Increasing relative effort[1]	Unknown	N/A[2]

[1]Snapper only (Conron *et al*. unpublished)
[2]Information for individual commercial hand fisheries is confidential under "5 fisher" rule

Current and recent fishery catch trends by method

The most recent estimate of catch levels in the fishery by fishing method (sub-fishery) (Total and/or by target species). Summary of the recent catch trends in the fishery by fishing method (sub-fishery). In table form

	Haul seine 2013 (kgs)	Mesh net 2013 (kgs)	Long line 2013 (kgs)	Purse seine 2013 (kgs)	Recreational hook and line 2006/07[1] (kgs)	Spear fishing	Hand collection
Most recent catch	187,300	89,921	111,592	253,686	446,000[1]	Unknown	N/A[2]
Trend	Variable but no obvious trend	Variable but no obvious trend	Increasing trend since 2002	Decreasing then increasing since 2002	Decreasing[1]	Unknown	N/A[2]

[1]Snapper only (Conron *et al*. unpublished)
[2]Information for individual commercial hand fisheries is confidential under "5 fisher" rule

Current and recent value of fishery ($)

Note current and recent value trends by sub-fishery. In table form

Commercial value as estimated from Melbourne Fish Market auction prices [1].

	Value ($'000)				
Year	2005/06	2006/07	2007/08	2008/09	2009/10
Anchovy, Australian	107	80	263	158	109
Australian Salmon	25	40	28	26	22
Calamari, Southern	366	399	335	329	451
Flathead, Rock	91	158	213	211	206
Flathead, Southern Bluepotted	34	43	35	45	60
Flathead, Southern Sand	13	18	17	17	8
Flounder, Greenback	50	52	37	42	38
Garfish, Southern	101	144	165	152	128
Mullet, Yelloweye	16	22	23	35	35
Shark, Gummy	118	93	102	44	33
Snapper	528	708	669	685	630
Whiting, King George	964	867	1,477	1,553	1,415
Other	181	257	335	368	397
Total	2,594	2,881	3,699	3,665	3,532

[1](DPI, 2012)

Relationship with other fisheries

Commonwealth and State licenced commercial fishers operate offshore from Port Phillip Bay and there are possible interactions between fisheries where species migrate between Port Phillip Bay and coastal waters (e.g. Snapper).

Gear

Fishing gear and methods

Description of the methods and gear in the fishery, average number days at sea per trip.

1. Commercial haul seine
The mesh sizes in haul seines may vary along the length of the net with the end sections (referred to as 'wings') usually having larger mesh sizes than the mid or inner sections (referred to as 'shoulders'). Hauling ropes of variable length are attached to the ends of the wings. The nets are generally deployed in a semi-circle and during retrieval the hauling ropes wings and shoulders serve to herd and eventually surround the enclosed fish.

2. Commercial long-line
Long lines consist of long monofilament mainlines, weighted at each end, with up to 200 hooks attached by 0.5 to 1.5 m snoods. The snoods are spaced at variable intervals (i.e. 9–12 m) along the mainline which is set in a straight line between two vertical end lines held in place by buoys and weights (Coutin, 2000). Each snood carries a single 4/0 to 6/0 hook which is usually baited with Barracouta, octopus or squid. If the mainline is very long, intermediate buoys and anchors are also deployed (D.K.O. Services, 1997).

Hooks are usually baited as the long-line is sequentially laid out, usually at night, and subsequently retrieved after 1–2 hours. Long-lines selectively catch large Snapper, and most of the commercial Snapper catch is taken with this method. The small by-catch consists of Gummy Shark and flathead, although Gummy Shark are targeted by a small number of commercial fishers using long lines (D.K.O. Services, 1997).

3. Commercial mesh net
Mesh or gill nets are flat rectangular nets with an upper float line and weighted leadline acting to maintain the net in an upright position in the water. However, they are not hauled or towed but set in a straight line, usually anchored to the bottom although they can be set at mid-depth or surface (for example to catch Southern Garfish). The depth at which mesh nets are set and the mesh size used vary according to the choice of target species. Mesh nets passively entangle fish as they attempt to pass through the meshes. The type and size of fish caught being determined by the size of the mesh in the net (NREC 1991). Nets are set over night or for shorter periods.

4. Commercial purse seine
Purse seine nets are large, deep, small meshed nets specifically designed to catch pelagic schooling fish, such as Australian Sardine and Australian Anchovy, near the surface (Coutin 2000). Nets are equipped with sufficient floats to suspend the net from the surface. Schools of fish are located by

	eye or echo sounder. Nets are laid in circular configuration around the school of fish and a purse line, threaded through purse rings and attached to the leadline, is used to close the bottom of the net thereby surrounding the fish in a bowl-shaped configuration of netting. The depth of the net is approximately 3 x the water depth. The net is then brought alongside the vessel and hauled onboard (D.K.O. Services, 1997). Purse seines take most of the commercial catch of Australian Sardine, Australian Anchovy and Sandy Sprat in Port Phillip Bay. Smaller "pods" of fish are targeted for easier handing and also to suit market demand. 5. Recreational hook and line Recreational fishers operating in Port Phillip Bay are entitled to use no more than four lines with no more than two hooks, baits or lures attached to each line. The fishing lines consist of monofilament nylon or braided lines and the line weight, tackle design, bait type and method of deployment vary according to the target species (D.K.O. Services, 1997) or angler preference. Lure and soft plastic fishing is popular for a number of species and flyfishing is sometimes practiced. Baits and lures can be used from a stationary or drifting boat, or can be trolled behind the boat while underway. Land-based recreational fishing from the beach, rocks, and piers is also popular. 6. Recreational spearfishing Recreational fishers are able to use a handheld spear or speargun. 7. Hand collection (commercial and recreational) Due to the restriction on intertidal collection in Port Phillip Bay, hand collection fisheries generally involve diving (hookah, SCUBA, snorkelling). *The overwhelming majority of both commercial and recreational fishing trips in Port Phillip Bay occur within one day.*
Fishing gear Restrictions	*Any restrictions on gear* 1. Commercial haul seine Cannot be in excess of 460 m in length, have meshes in the bag that measure between 2.9 cm and 4.5 cm, or have meshes 25 m either side of the bag that measure between 2.9 cm and 4.5 cm (Anon, 2009). Haul seine catches must be sorted in water at least 60 cm deep before the net is removed from the water (Anon, 2009). 2. Commercial long-line Only one longline can be used at a time with a maximum of 200 hooks (Anon, 2009). 3. Commercial mesh net There are restrictions on the length of mesh net than can be used and the allowable mesh sizes that depend on the time of year (Anon, 2009). 4. Commercial purse seine A purse seine cannot exceed 460 m in length (Anon, 2009). In practice nets are usually not this long. 5. Recreational hook and line A maximum of 4 handlines or rods and reels and 2 hooks or one bait jig on any one line (Anon, 2009). 6. Recreational spearfishing A hand-held spear is a spear without barbs and no more than two prongs. 7. Hand collection (commercial and recreational) The only equipment allowed to take commercial abalone is an abalone tool and a catch bag.
Selectivity of gear and fishing methods	*Description of the selectivity of the sub-fishery methods* 1. Commercial haul seine (including Garfish seine and beach seine) Relatively non-selective with the catch determined to some extent by the mesh sizes used. Haul seines are used to take most of the commercial catch of King George Whiting, Southern Garfish, Southern Calamari, Australian Salmon, and Silver Trevally, and smaller proportions of commercial catches of Black Bream, flathead, flounder, mullet, Snapper and Gummy Shark (D.K.O. Services, 1997, Knuckey *et al*., 2002).

	2. Commercial long-line Quite selective with the catch primarily made up of Snapper but also including small quantities of Gummy Shark and flathead. 3. Commercial mesh net Relatively non-selective although species caught will be strongly influenced by the mesh size used. Large meshed nets are designed to target flounder and Gummy Shark, and small meshed nets are used to target Rock Flathead and King George Whiting (Coutin, 2000). Occasionally these nets are used for Snook (*Sphyraena novaehollandiae*), Longfin Pike (*Dinolestes lewini*) and Snapper (NREC, 1991). 4. Purse seine Selective for small pelagic species (Australian Anchovy, Australian Sardine, Sandy Sprat etc.). 5. Recreational hook and line (including recreational charter) Ranging from relatively non-selective (general bait fishing) to very selective (squid jig). 6. Recreational Spearfishing Very selective, not only for species but for fish size. 7. Hand collection (commercial and recreational) Very selective, not only for species but for fish size.
Spatial gear zone Set	*Description where gear set i.e. continental shelf, shelf break, continental slope (range nautical miles from shore)* 1. Commercial haul seine (including Garfish seine and beach seine) Generally near shore, on shallow gradient bottom without hard structure such as reef. 2. Commercial long-line Generally offshore in deeper water on soft bottom. 3. Commercial mesh net Generally set near shore but can also be set in deeper water depending on the target species . 4. Purse seine Generally offshore, deeper water. 5. Recreational hook and line (including recreational charter) Throughout the bay depending on the species targeted. 6. Recreational Spearfishing Most popular in nearshore reef areas. 7. Hand collection (commercial and recreational) Throughout the Bay but below the depth of the intertidal zone (defined as from high water mark to 2 m below the water level). Mostly in areas with depth 2–15 m.
Depth range gear Set	*Depth range gear set at in metres* 1. Commercial haul seine (including Garfish seine and beach seine) 1 – 6 m 2. Commercial long-line 7 – 25 m 3. Commercial mesh net 2 – 25 m 4. Purse seine 5 – 25 m 5. Recreational hook and line (including recreational charter) 1 – 25 m 6. Recreational Spearfishing 1 – 10 m 7. Hand collection (commercial and recreational) 2 – 25 m (mostly in areas with depth 2–15 m)

How gear set	*Description how set, pelagic in water column, benthic set (weighted) on seabed* 1. Commercial haul seine (including Garfish seine and beach seine) Haul seine and beach seine benthic set (weighted) on seabed, garfish seine is pelagic in water column. 2. Commercial long-line Benthic set (weighted at each end) on seabed. 3. Commercial mesh net Benthic set (weighted) on seabed (except when targeting garfish). 4. Purse seine Pelagic in water column – positively buoyant with leadline on the bottom. 5. Recreational hook and line (including recreational charter) Benthic set using sinkers or pelagic in water column (floats, lures). 6. Recreational spearfishing N/A 7. Hand collection (commercial and recreational) N/A
Area of gear impact per set or shot	*Description of area impacted by gear per set (square metres)* 1. Commercial haul seine (including Garfish seine and beach seine) Maximum length of net is 460 m, length of warps (ropes) is variable and therefore area impacted by gear is variable. 2. Commercial long-line Maximum number of hooks is 200, assuming 10 between snoods the maximum length of the line is 2000 m (linear not area). Area of impact will depend on the characteristics of the bait plume (affected by many variables including type of bait, strength and direction of current). 3. Commercial mesh net Maximum length of mesh net or combination of mesh nets is 2500 m except between 1 and 30 November when the maximum length is 360 m (linear not area) (Anon, 2009) 4. Purse seine Maximum length of purse seine net is 460 m; when set in a circle this is an area of 166,190 m^2. 5. Recreational hook and line (including recreational charter) Area of impact will depend on casting distance from shore or boat, and the characteristics of the bait/berley plume (affected by many variables including type of bait, strength and direction of current). Area will impact will relate to the distance travelled when drifting or trolling. 6. Recreational spearfishing Variable depending on factors such as swimming ability and water visibility. 7. Hand collection (commercial and recreational) Variable depending on factors such as swimming ability and water visibility.
Capacity of gear	*Description number hooks per set, net size weight per trawl shot* 1. Commercial haul seine (including Garfish seine and beach seine) Maximum length of 460 m. 2. Commercial long-line Maximum of 200 hooks. 3. Commercial mesh net Maximum length of mesh net or combination of mesh nets is 2500 m except between 1 and 30 November when the maximum length is 360 m (linear not area) (Anon, 2009) 4. Purse seine Maximum length of purse seine net is 460 m. 5. Recreational hook and line (including recreational charter) Maximum of 4 lines with 2 hooks on each per fisher.

	6. Recreational spearfishing One hand spear or spear gun 7. Hand collection (commercial and recreational) N/A
Effort per annum all boats	*Description effort per annum of all boats in fishery by shots or sets and hooks, d for all Boats* See section "Current and recent fishery catch trends by method" above
Lost gear and ghost fishing	*Description of how gear is lost, whether lost gear is retrieved, and what happens to gear that is not retrieve, and impacts of ghost fishing* 1. Commercial haul seine (including Garfish seine and beach seine). Gear rarely lost and in most cases retrieved. Ghost fishing by lost net would rarely if ever occur. Snagging on reef may occur with inexperienced operators. Seine not unlikely to catch fish when not hauled. 2. Commercial long-line Gear rarely lost and in most cases retrieved. Gear can be lost through breakages by seals or Sharpnose Sevengill Sharks (*Heptranchias perlo*). Ghost fishing would only occur while hooks were still baited. Baits such as Barracouta only last an hour or two. Wildlife, TEPS may later become entangled in line. 3. Commercial mesh net Gear rarely lost and in most cases retrieved, therefore ghost fishing by lost net would rarely occur. Loss of gear would normally only occur through interference by poachers or through sharks biting through the mesh. Ghost fishing by mesh net would potentially have a greater impact than by seine net because it would continue to fish. 4. Purse seine Gear rarely lost and in most cases retrieved. Ghost fishing by lost net would rarely if ever occur. Net unlikely to catch fish when not actively pursed. Snagging minimised by using lead-core rope for leadline. 5. Recreational hook and line (including recreational charter) Hooks and line may be lost through snagging (e.g. reefs, piers) and breakoffs by rays or bite-offs by Barracouta or Snook. Wildlife, TEPS may later become entangled in line 6. Recreational spearfishing N/A 7. Hand collection (commercial and recreational) N/A
Issues	
Target species issues	*List any issues, including biological information such as spawning season and spawning location, major uncertainties about biology* Port Phillip Bay is the primary spawning area for the west Victorian stock of Snapper (ranging from Wilsons Promontory to the South Australian border) (Hamer *et al*., 2011). Spawning occurs in late spring / early summer and to a lesser extent autumn, and is most concentrated on the eastern side of the Bay (i.e. Carrum Bight). A proportion of large fish migrate into the Bay for spawning and leave after spawning. Juveniles occur in deeper soft bottom habitat. King George Whiting in Port Phillip Bay are juveniles (up to 4 years age) and spawning does not occur in the Bay. Spawning takes place in autumn / early winter and is likely to occur a considerable distance from the Bay (i.e. far west Victoria, south-eastern SA) (Jenkins *et al*., 2000). Larvae enter the Bay in spring after drifting in Bass Strait for 3 to 4 months and settle into shallow seagrass beds (Jenkins and May, 1994; Jenkins and Wheatley, 1998). As juveniles grow they move into deeper habitats with patchy seagrass and sand. Southern Sand Flathead and Rock Flathead spawn in the spring. The importance of Southern Sand Flathead spawning within the Bay versus offshore is uncertain. There has been a 10-fold decrease in the Southern Sand Flathead population in the Bay over the past 25 years. Juvenile Rock Flathead are associated with unvegetated sediment near seagrass while adults live within seagrass beds. Southern Sand Flathead are associated with unvegetated sediment throughout life.

	Gummy Sharks, like all sharks and rays, are slow to reach sexual maturity and have low reproductive rates compared to finfish, making them vulnerable to overfishing.
Byproduct and bycatch issues and interactions	*List any issues, as for the target species above* A number of shark and ray species are caught as bycatch by seine netting, mesh netting and hook and line methods. As mentioned previously, sharks and rays are slow to reach sexual maturity and have low reproductive rates compared to finfish, making them vulnerable to overfishing.
TEP issues and Interactions	*List any issues. This section should consider all TEP species groups: marine mammals, chondrichthyans (sharks, rays etc.), marine reptiles, seabirds, teleosts (bony fishes), include any key spawning/breeding/aggregation locations that might overlap with the fishery/sub-fishery.* Fishery interaction with TEP species may occur in the process of fishing or remotely when wildlife is entangled in discarded fishing gear or litter. The most likely TEP species interactions for Port Phillip Bay fisheries involve seals (primarily Australian Fur Seals) (VBIFA, 2013). Australian Fur Seals in Port Phillip Bay most likely enter the Bay from the major breeding colony at Seal Rocks (Kirkwood *et al*., 2010). Seals are adept at taking fish caught in nets or hooked on lines. Interactions are also possible with listed seabirds (e.g. Fleshy-footed Shearwater (*Puffinus carneipes*), Australasian Gannets (*Morus serrator*), Little Penguins (*Eudyptula minor*) and listed species of tern). Birds (particularly Australasian Gannets) sometimes take recreational fishing baits or lures. Diving birds may collide with ropes and rigging in commercial operations. Interactions with birds are very limited where fishing occurs at night (e.g. longline, mesh net, purse seine). There is a resident population of Burrunan Dolphins (*Tursiops australis*), in the Bay and whales (Southern Right Whale (*Eubalaena australis*) and Humpback Whale (*Megaptera novaeangliae*)) also enter the Bay occasionally. School Shark is a listed species even though they are fished both commercially and recreationally. Areas of seagrass in Port Phillip Bay (Swan Bay, Geelong Arm) are considered to be important pupping and nursery habitats for the species. Great White Sharks have also been known to enter Port Phillip Bay. Pipefishes and seahorses occur in seagrass beds and are protected by the Victorian Fisheries Act. Small numbers of pipefish may be associated with weed in haul seine nets and are released.
Habitat issues and Interactions	*List any issues for any of the habitat units identified in Scoping Document S1.2. This should include reference to any protected, threatened or listed habitats* Seagrass beds can be damaged by propellers, anchoring and moorings associated with seining, mesh netting and recreational hook and line fishing. Concerns have been expressed about the possible effects of seining methods on seagrass beds in Port Phillip Bay. Seine nets are hung loosely and generally retain little seagrass (most of which would have been floating). Recent research on seagrass in Port Phillip Bay has shown that sediments from the catchment and resuspension may affect light for seagrass along the north-west coast of the bay (Jenkins *et al*., 2015). The greatest environmental influence on seagrass cover in the Bay, however, relates to rainfall delivering flows carrying nutrients (Jenkins *et al*., 2015). Seagrass cover is lost in periods of low rainfall such as during drought indicating nutrient limitation (Jenkins *et al*., 2015). Native sea urchins have denuded many reefs in the north-west of the Bay in recent years creating extensive urchin barrens. Reasons for the increase in urchin activity and barren formation are uncertain.
Community issues and interactions	*List any issues for any of the community units identified in Scoping Document S1.2.* The deep-reef community in Port Phillip Heads has been listed as a threatened community under the Flora and Fauna Guarantee Act. Research has shown that the composition of the plankton community has a strong influence on the survival of larval Snapper, with recruitment variability related to the availability of preferred plankton food (Murphy *et al*., 2012). In turn, plankton community composition depends on freshwater flows and the input of nutrients, with good year classes of Snapper related to intermediate flows (Jenkins *et al*., 2010).
Discarding	*Summary of discarding practices by sub-fishery, including bycatch, juveniles of target species, high-grading, processing at sea.* 1. Commercial haul seine (including Garfish seine and beach seine). Discard species (including juveniles of target species) are sorted from the net bag in the water using

	hand nets, survival of these fish is estimated to be around 90% (Kumar *et al*., 1995; Knuckey *et al*., 2002). Meshing of juveniles in the net wings is uncommon due to the relatively large mesh size, and the use of relatively thick netting material (Knuckey *et al*., 2002; VBIFA, 2013). Large incidental catches of jellyfish can cause mortality of discard species in the bag (fishers avoid shooting nets if jellyfish are present). 2. Commercial long-line Discard species unhooked upon gear retrieval and released if still alive. A de-hooking device is used to release Southern Fiddler Ray (*Trygonorrhina dumerilii*). Hook and bait size targets large fish and there is minimal juvenile bycatch. Heading and gutting of Gummy Sharks occurs at sea. 3. Commercial mesh net Discard species unmeshed by hand and released when net retrieved if still alive. Mesh sizes targeted at larger fish so meshing of undersize fish is uncommon. 4. Purse seine Generally target single species schools of fish so there is little discarding. 5. Recreational hook and line (including recreational charter) Discard species including juveniles of target species are unhooked (or the line may be cut if gut-hooked) upon retrieval and released. The prevalence of gut-hooking has reduced in recent years with the increasing popularity of circle hooks. Post release survival of undersize Snapper is estimated to be > 80 % (Conron *et al*., 2010). High-grading may occur in fishing for species such as Snapper or Gummy Shark where there is a low limit on the number of larger fish that can be kept. 6. Recreational spearfishing N/A 7. Hand collection (commercial and recreational) N/A
Management: planned and those implemented	
Management Objectives	*The management objectives from the most recent management plan* There is no management plan for Port Phillip Bay fisheries or key target species
Fishery management plan	*Is there a fisheries management plan, is it in the planning stage or implemented and what are the key features?* As above
Input controls	*Summary of any input controls in the fishery, e.g. limited entry, area restrictions (zoning), vessel size restrictions and gear restrictions. Primarily focused on target species as other species are addressed below.* 1. Commercial haul seine (including Garfish seine and beach seine) There is limited entry (licences are capped) to the Western Port/Port Phillip Bay Fishery Access Licence (see "Current Entitlements" above). Fishing gear restrictions also apply (see "Fishing Gear Restrictions" above). In the area between Rickett's Point at Beaumaris and Snapper Point at Mornington, a seine net must be hauled or winched from the beach; and no more than 660 m of rope can be attached at each end of the net (Anon, 2009). 2. Commercial long-line There is limited entry (licences are capped) to the Western Port/Port Phillip Bay Fishery Access Licence (see "Current Entitlements" above). Fishing gear restrictions also apply (see "Fishing Gear Restrictions" above). 3. Commercial mesh net There is limited entry (licences are capped) to the Western Port/Port Phillip Bay Fishery Access Licence (see "Current Entitlements" above). Fishing gear restrictions also apply (see "Fishing Gear Restrictions" above). 4. Purse seine There is limited entry (licences are capped) to the Western Port/Port Phillip Bay Fishery Access Licence (see "Current Entitlements" above). There is also a separate licence category (Purse Seine [Port Phillip Bay] Fishery Access Licence) that can cover purse seining in Port Phillip Bay (Anon, 2009). The fishing vessel must not exceed 20 m in length (Anon, 2009). Fishing gear restrictions also apply (see "Fishing Gear Restrictions" above).

	5. Recreational hook and line (including recreational charter) There is no limit to participation in the recreational fishery (see "Current Entitlements" above) as long as fishers are appropriately licenced or exempt. Fishing gear restrictions apply (see "Fishing Gear Restrictions" above). 6. Recreational spearfishing There are area restrictions where spearfishing cannot be undertaken in waters that are within 30 metres from any jetty or the mouth of any creek or river (Anon, 2009). Southern Rock Lobster can only be taken by hand (apart from recreational hoop nets). 7. Hand Collection (commercial and recreational) There is limited entry (licences are capped) for the commercial abalone, sea urchin and scallop (1 license only) hand collection fisheries in Port Phillip Bay. There is a ban on taking Greenlip Abalone in Port Phillip Bay. There are areas restricted to recreational scallop hand collection only.
Output controls	*Summary of any output controls in the fishery, e.g. quotas. Effort days at sea. Primarily focused on target species as other species are addressed below.* There are species specific catch limits for recreational fishing (Anon, 2009). For Snapper, the catch limit depends on size; the bag limit is 10, but only 3 fish can be equal to or exceed 40 cm. Commercial hand collection fisheries for abalone, scallops and sea urchins are controlled by Total Allowable Catch (TAC) quotas.
Technical measures	*Summary of any technical measures in the fishery, e.g. size limits, bans on females, closed areas or seasons. Gear mesh size, mitigation measures such as TEDs. Primarily focused on target species as other species are addressed below.* Species-specific minimum size limits apply to all sub-fisheries (Anon, 2009). For mesh netting there are complex regulations relating to net length and mesh size. Between 1 April and 31 October in each year, a mesh net or combination of mesh nets cannot exceed 2500 m in length with meshes measuring no more than 1 cm; between 1 November and 30 November in each year, a mesh net cannot exceed 360 m in length with meshes measuring no less than 6·3 cm or more than 12·4 cm; and, between 1 November and 31 March in the following year, a mesh net or combination of mesh nets not exceeding 2500 m in length with meshes measuring no less than 12.5 cm and no more than 13 cm and having no more than 12 meshes between the float line and the leadline (Anon, 2009). For seine nets, the meshes in the bag of the net cannot measure between 2·9 cm and 4· cm, and within meshes 25 metres either side of the bag of the net cannot measure between 2·9 cm and 4·5 cm (Anon, 2009). The quota year for the sea urchin hand collection fishery is 1 August to 30 June. Recreational take of abalone is only allowed on nominated days of the year.
Regulations	*Regulations regarding species (bycatch and byproduct, TEP), habitat, and communities; Marpol and pollution; rules regarding activities at sea such as discarding offal and/or processing at sea.* The discharge of oil residues, chemicals, garbage, sewage, litter or any other waste is prohibited in any waters of Victoria (Environment Protection Act 1970; Pollution of Waters by Oil and Noxious Substances Act 1986; Marine Safety Act 2010) (VBIFA, 2013). Total prohibition on the disposal of plastics into the sea (International Convention for the Prevention of Pollution from Ships [MARPOL 73/78]). (VBIFA, 2013). Marine debris is listed as a threatening process; it includes plastic garbage, recreational and commercial fishing gear and solid non-biodegradable floating materials. Risks to wildlife include entanglement in nets and ropes and ingestion of pieces of filament and hooks (EPBC Act 1999) (VBIFA, 2013).
Initiatives and strategies	*Bycatch Action Plans; TEDs; industry codes of conduct, MPAs, Reserves* The Victorian Bays and Inlets Fisheries Association has developed a voluntary Environmental Management System (VBIFA, 2013). Commercial fishers in Port Phillip Bay also have an Industry Code of Practice for haul seining (VFARM, 2012).

	There are a number of Marine Protected Areas in Port Phillip Bay (Barton *et al*., 2012). Port Phillip Heads Marine National Park is discontinuous and consists of six sites in the southern region of Port Phillip Bay. Three are also three Marine Sanctuaries: Point Cooke, Jawbone and Ricketts Point. There are a series of Aquaculture Fisheries reserves in Port Phillip Bay (ECC, 2000). There are also Industry (e.g. Shell refinery, Geelong) and Military (e.g. Point Wilson) closed areas.
Enabling processes	*Monitoring (logbooks, observer data, scientific surveys); assessment (stock assessments); performance indicators (decision rules, processes, compliance; education; consultation process* Commercial fishers must complete log books in which they record daily catch by species, including details of fishing area, fishing gear used and fishing effort. Stock assessments are carried out periodically on key species by Fisheries Victoria. Compliance and education activities related to both commercial and recreational fishing are carried out by Fisheries Victoria. Catch sampling of the commercial catch is undertaken monthly to measure lengths and extract otoliths for ageing of King George Whiting, Snapper and flathead. The Port Phillip Bay trawl survey was undertaken for 20 years up until 2011 (Hirst *et al*., 2011) to provide a fishery independent time series of demersal fish populations in the Bay. There is an ongoing fishery independent dive survey to monitor abalone populations and more recently dive surveys have also been used to monitor scallop abundances There are ongoing pre-recruit netting surveys of small juvenile King George Whiting (October-November) and Snapper (March/April).
Other initiatives or Agreements	*State, national or international conventions or agreements that impact on the management of the fishery/sub-fishery being evaluated.* Ramsar wetlands are wetlands of international importance listed under the Convention on Wetlands (Ramsar, Iran 1971). There are two wetlands listed under this convention in Port Phillip Bay, the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Sites (DEPI, 2013).
Data	
Logbook data	*Verified logbook data; data summaries describe programme* Commercial logbook return data is collated by the Catch and Effort unit of Fisheries Victoria. Data that is aggregated at the level of less than 5 fishers is confidential and cannot be released to the public. An annual summary of catch data is published in the commercial fisheries production bulletin (DPI, 2013). Western Port/Port Phillip Bay Fishery Access Licence holders have been required to record TEP interactions on the daily activity rows of their monthly logbook returns sine April 2015 (Bill Lussier, pers. comm.).
Observer data	*Objective observer programme; describe parameters, how many years run; coverage – random or full coverage; comments on interactions with species; observer training, species identification, and length of service; data summaries* There are no observer programs for fishing in Port Phillip Bay.
Other data	*Studies, surveys* Information is available from recreational fishing from creel surveys (Bruce *et al*., 2012) as well as research angler and angler diary programs.

5.3.2 Scoping Step 2 – Unit of Analysis Lists

5.3.2.1 Species

- Target species *[commercial haul seine]*

Taxon	Family name	Scientific name	Common Name
Teleost	Sillaginidae	*Sillaginodes punctatus*	King George Whiting
Teleost	Sparidae	*Chrysophrys auratus*	Snapper
Teleost	Sparidae	*Acanthopagrus butcheri*	Black Bream
Teleost	Hemiramphidae	*Hyporhamphus melanochir*	Southern Garfish
Teleost	Sphyraenidae	*Sphyraena novaehollandiae*	Snook
Teleost	Platycephalidae	*Platycephalus laevigatus*	Rock Flathead
Invertebrate	Loliginidae	*Sepioteuthis australis*	Southern Calamari

- Target species *[commercial long line]*

Taxon	Family name	Scientific name	Common Name
Teleost	Sparidae	*Chrysophrys auratus*	Snapper

- Target species *[commercial mesh net]* (Preferred species)

Taxon	Family name	Scientific name	Common Name
Teleost	Platycephalidae	*Platycephalus laevigatus*	Rock Flathead
Teleost	Sillaginidae	*Sillaginodes punctatus*	King George Whiting
Teleost	Sparidae	*Chrysophrys auratus*	Snapper
Teleost	Platycephalidae	*Platycephalus speculator*	Yank Flathead
Teleost	Sphyraenidae	*Sphyraena novaehollandiae*	Snook
Teleost	Sparidae	*Acanthopagrus butcheri*	Black Bream
Teleost	Rhombosoleidae	*Ammotretis rostratus*	Longsnout Flounder
Teleost	Rhombosoleidae	*Rhombosolea tapirina*	Greenback Flounder
Teleost	Platycephalidae	*Platycephalus bassensis*	Sand Flathead
Teleost	Arripidae	*Arripis georgianus*	Australian Herring
Teleost	Mullidae	*Upeneichthys vlamingii*	Red Mullet
Teleost	Carangidae	*Pseudocaranx georgianus*	Silver Trevally
Teleost	Carangidae	*Pseudocaranx wrighti*	Skipjack Trevally
Teleost	Hemiramphidae	*Hyporhamphus melanochir*	Southern Garfish
Teleost	Pomatomidae	*Pomatomus saltatrix*	Tailor
Teleost	Ophidiidae	*Genypterus tigerinus*	Rock Ling
Teleost	Sciaenidae	*Argyrosomus japonicus*	Mulloway
Chondrichthyan	Triakidae	*Mustelus antarcticus*	Gummy Shark
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark

- Target species *[commercial purse seine]*

Taxon	Family name	Scientific name	Common Name
Teleost	Clupeidae	*Sardinops sagax*	Australian Sardine
Teleost	Engraulidae	*Engraulis australis*	Australian Anchovy
Teleost	Clupeidae	*Hyperlophus vittatus*	Sandy Sprat

- Target species *[recreational hook and line]* (preferred species)

Taxon	Family name	Scientific name	Common Name
Teleost	Sillaginidae	*Sillaginodes punctatus*	King George Whiting
Teleost	Sparidae	*Chrysophrys auratus*	Snapper
Teleost	Platycephalidae	*Platycephalus bassensis*	Sand Flathead
Teleost	Platycephalidae	*Platycephalus speculator*	Yank Flathead
Teleost	Platycephalidae	*Platycephalus laevigatus*	Rock Flathead
Teleost	Arripidae	*Arripis truttaceus*	Western Australian Salmon
Teleost	Arripidae	*Arripis trutta*	Eastern Australian Salmon
Teleost	Hemiramphidae	*Hyporhamphus melanochir*	Southern Garfish
Teleost	Carangidae	*Pseudocaranx georgianus*	Silver Trevally
Teleost	Carangidae	*Pseudocaranx wrighti*	Skipjack Trevally
Teleost	Sparidae	*Acanthopagrus butcheri*	Black Bream
Teleost	Carangidae	*Seriola lalandi*	Yellowtail Kingfish
Teleost	Sphyraenidae	*Sphyraena novaehollandiae*	Snook
Teleost	Dinolestidae	*Dinolestes lewini*	Longfin Pike
Teleost	Arripidae	*Arripis georgianus*	Australian Herring
Teleost	Mugilidae	*Aldrichetta forsteri*	Yelloweye Mullet
Teleost	Centrolophidae	*Seriolella brama*	Blue Warehou
Teleost	Sciaenidae	*Argyrosomus japonicus*	Mulloway
Chondrichthyan	Triakidae	*Mustelus antarcticus*	Gummy Shark
Chondrichthyan	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler
Invertebrate	Loliginidae	*Sepioteuthis australis*	Southern Calamari

- Target species *[recreational spear fishing]* (preferred species)

Taxon	Family name	Scientific name	Common Name
Teleost	Sillaginidae	*Sillaginodes punctatus*	King George Whiting
Teleost	Sparidae	*Chrysophrys auratus*	Snapper
Teleost	Platycephalidae	*Platycephalus bassensis*	Sand Flathead
Teleost	Platycephalidae	*Platycephalus speculator*	Yank Flathead
Teleost	Platycephalidae	*Platycephalus laevigatus*	Rock Flathead
Teleost	Arripidae	*Arripis truttaceus*	Western Australian Salmon
Teleost	Arripidae	*Arripis trutta*	Eastern Australian Salmon
Teleost	Carangidae	*Pseudocaranx georgianus*	Silver Trevally
Teleost	Carangidae	*Pseudocaranx wrighti*	Skipjack Trevally
Teleost	Sparidae	*Acanthopagrus butcheri*	Black Bream
Teleost	Carangidae	*Seriola lalandi*	Yellowtail Kingfish
Teleost	Sphyraenidae	*Sphyraena novaehollandiae*	Snook
Teleost	Cheilodactylidae	*Cheilodactylus nigripes*	Magpie Perch
Teleost	Monacanthidae	*Nemadactylus macropterus*	Horseshoe Leatherjacket
Teleost	Monacanthidae	*Meuschenia freycineti*	Sixspine Leatherjacket
Teleost	Rhombosoleidae	*Rhombosolea tapirina*	Greenback Flounder
Teleost	Kyphosidae	*Scorpis aequipinnis*	Sea Sweep
Invertebrate	Loliginidae	*Sepioteuthis australis*	Southern Calamari

- Target species *[hand collection]*

Taxon	Family name	Scientific name	Common Name
Invertebrate	Haliotidae	*Haliotis rubra*	Blacklip Abalone
Invertebrate	Pectinidae	*Pecten fumatus*	Commercial Scallop
Invertebrate	Pectinidae	*Chlamys asperrimus*	Doughboy Scallop
Invertebrate	Echinometridae	*Heliocidaris erythrogramma*	White Urchin
Invertebrate	Palinuridae	*Jasus edwardsii*	Southern Rock Lobster

- Byproduct species *[commercial haul seine]*

Taxon	Family name	Scientific name	Common Name
Teleost	Arripidae	*Arripis truttaceus*	Western Australian Salmon
Teleost	Arripidae	*Arripis trutta*	Eastern Australian Salmon
Teleost	Mugilidae	*Aldrichetta forsteri*	Yelloweye Mullet
Teleost	Dinolestidae	*Dinolestes lewini*	Longfin Pike
Teleost	Arripidae	*Arripis georgianus*	Australian Herring
Teleost	Carangidae	*Pseudocaranx georgianus*	Silver Trevally

Teleost	Carangidae	*Pseudocaranx wrighti*	Skipjack Trevally
Teleost	Rhombosoleidae	*Ammotretis rostratus*	Longsnout Flounder
Teleost	Rhombosoleidae	*Rhombosolea tapirina*	Greenback Flounder
Teleost	Platycephalidae	*Platycephalus speculator*	Yank Flathead
Teleost	Platycephalidae	*Platycephalus bassensis*	Sand Flathead
Teleost	Monacanthidae	*Meuschenia freycineti*	Sixspine Leatherjacket
Teleost	Monacanthidae	*Scobinichthys granulatus*	Rough Leatherjacket
Teleost	Mugilidae	*Mugil cephalus*	Sea Mullet
Teleost	Mugilidae	*Myxus elongatus*	Sand Mullet
Teleost	Pomatomidae	*Pomatomus saltatrix*	Tailor
Teleost	Gempylidae	*Thyrsites atun*	Barracouta
Teleost	Carangidae	*Trachurus novaezelandiae*	Yellowtail Scad
Teleost	Carangidae	*Trachurus murphyi*	Peruvian Jack Mackerel
Teleost	Carangidae	*Trachurus declivis*	Common Jack Mackerel
Teleost	Mullidae	*Upeneichthys vlamingii*	Red Mullet
Teleost	Centrolophidae	*Seriolella brama*	Blue Warehou
Teleost	Centrolophidae	*Seriolella punctata*	Silver Warehou
Teleost	Labridae	*Haletta semifasciata*	Blue Weed Whiting
Teleost	Sciaenidae	*Argyrosomus japonicus*	Mulloway
Teleost	Scombridae	*Scomber australasicus*	Blue Mackerel
Teleost	Sillaginidae	*Sillago bassensis*	School Whiting
Teleost	Labridae	*Notolabrus tetricus*	Bluethroat Wrasse
Teleost	Carangidae	*Seriola lalandi*	Yellowtail Kingfish
Teleost	Platycephalidae	*Platycephalus richardsoni*	Tiger Flathead
Teleost	Kyphosidae	*Girella tricuspidata*	Luderick
Teleost	Ophidiidae	*Genypterus tigerinus*	Rock Ling
Teleost	Pentacerotidae	*Pentaceropsis recurvirostris*	Longsnout Boarfish
Teleost	Anguillidae	*Anguilla australis*	Southern Shortfin Eel
Teleost	Engraulidae	*Engraulis australis*	Australian Anchovy
Teleost	Triglidae	*Pterygotrigla polyommata*	Latchet
Teleost	Neosebastidae	*Neosebastes scorpaenoides*	Common Gurnard Perch
Teleost	Triglidae	*Lepidotrigla vanessa*	Butterfly Gurnard
Teleost	Triglidae	*Chelidonichthys kumu*	Red Gurnard
Teleost	Triglidae	*Lepidotrigla papilio*	Spiny Gurnard
Teleost	Clupeidae	*Sardinops sagax*	Australian Sardine
Chondrichthyan	Rajidae	*Spiniraja whitleyi*	Melbourne Skate
Chondrichthyan	Rajidae	*Dentiraja lemprieri*	Thornback Skate
Chondrichthyan	Triakidae	*Mustelus antarcticus*	Gummy Shark
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark
Chondrichthyan	Callorhinchidae	*Callorhinchus milii*	Elephant Shark
Chondrichthyan	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler
Chondrichthyan	Hexanchidae	*Heptranchias perlo*	Sevengill Shark
Invertebrate	Portunidae	*Ovalipes australiensis*	Sand Crab
Invertebrate	Sepiidae	*Sepia apama*	Giant Cuttlefish
Invertebrate	Octopodidae	*Octopus pallidus*	Pale Octopus
Invertebrate	Ommastrephidae	*Nototodarus gouldi*	Gould's Squid

- Byproduct species *[commercial long line]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Platycephalidae	*Platycephalus bassensis*	Sand Flathead
Teleost	Ophidiidae	*Genypterus tigerinus*	Rock Ling
Chondrichthyan	Triakidae	*Mustelus antarcticus*	Gummy Shark
Chondrichthyan	Rajidae	*Spiniraja whitleyi*	Melbourne Skate
Chondrichthyan	Rajidae	*Dentiraja lemprieri*	Thornback Skate
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark

- Byproduct species *[commercial mesh net]* (non-preferred species)

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Dinolestidae	*Dinolestes lewini*	Longfin Pike
Teleost	Arripidae	*Arripis truttaceus*	Western Australian Salmon
Teleost	Arripidae	*Arripis trutta*	Eastern Australian Salmon
Teleost	Mugilidae	*Aldrichetta forsteri*	Yelloweye Mullet
Teleost	Cheilodactylidae	*Dactylophora nigricans*	Dusky Morwong
Teleost	Monacanthidae	*Meuschenia freycineti*	Sixspine Leatherjacket
Teleost	Monacanthidae	*Scobinichthys granulatus*	Rough Leatherjacket

Teleost	Gempylidae	*Thyrsites atun*	Barracouta
Teleost	Labridae	*Haletta semifasciata*	Blue Weed Whiting
Teleost	Mugilidae	*Mugil cephalus*	Sea Mullet
Teleost	Mugilidae	*Myxus elongatus*	Sand Mullet
Teleost	Pentacerotidae	*Pentaceropsis recurvirostris*	Longsnout Boarfish
Teleost	Clupeidae	*Sardinops sagax*	Australian Sardine
Teleost	Centrolophidae	*Seriolella brama*	Blue Warehou
Teleost	Centrolophidae	*Seriolella punctata*	Silver Warehou
Teleost	Scombridae	*Scomber australasicus*	Blue Mackerel
Teleost	Triglidae	*Pterygotrigla polyommata*	Latchet
Teleost	Salmonidae	*Salmo trutta*	Brown Trout
Teleost	Platycephalidae	*Platycephalus richardsoni*	Tiger Flathead
Teleost	Carangidae	*Trachurus novaezelandiae*	Yellowtail Scad
Teleost	Carangidae	*Trachurus murphyi*	Peruvian Jack Mackerel
Teleost	Carangidae	*Trachurus declivis*	Common Jack Mackerel
Teleost	Kyphosidae	*Girella tricuspidata*	Luderick
Chondrichthyan	Rajidae	*Spiniraja whitleyi*	Melbourne Skate
Chondrichthyan	Rajidae	*Dentiraja lemprieri*	Thornback Skate
Chondrichthyan	Myliobatidae	*Myliobatis australis*	Southern Eagle Ray
Chondrichthyan	Callorhinchidae	*Callorhinchus milii*	Elephant Fish
Chondrichthyan	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler
Chondrichthyan	Hexanchidae	*Heptranchias perlo*	Sevengill Shark
Chondrichthyan	Squatinidae	*Squatina australis*	Australian Angelshark
Invertebrate	Loliginidae	*Sepioteuthis australis*	Southern Calamari
Invertebrate	Octopodidae	*Octopus pallidus*	Pale Octopus

- Byproduct species *[commercial purse seine]* (non-preferred species)

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Arripidae	*Arripis truttaceus*	Western Australian Salmon
Teleost	Arripidae	*Arripis trutta*	Eastern Australian Salmon
Teleost	Sparidae	*Chrysophrys auratus*	Snapper
Teleost	Pomatomidae	*Pomatomus saltatrix*	Tailor
Teleost	Clupeidae	*Spratelloides robustus*	Blue Sprat
Teleost	Hemiramphidae	*Hyporhamphus melanochir*	Southern Garfish
Teleost	Mugilidae	*Aldrichetta forsteri*	Yelloweye Mullet
Teleost	Sillaginidae	*Sillaginodes punctatus*	King George Whiting
Invertebrate	Loliginidae	*Sepioteuthis australis*	Southern Calamari
Teleost	Carangidae	*Trachurus novaezelandiae*	Yellowtail Scad
Teleost	Carangidae	*Trachurus murphyi*	Peruvian Jack Mackerel
Teleost	Carangidae	*Trachurus declivis*	Common Jack Mackerel
Teleost	Scombridae	*Scomber australasicus*	Blue Mackerel

- Byproduct species *[recreational hook and line]* (non-preferred species)

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Rhombosoleidae	*Ammotretis rostratus*	Longsnout Flounder
Teleost	Rhombosoleidae	*Rhombosolea tapirina*	Greenback Flounder
Teleost	Gempylidae	*Thyrsites atun*	Barracouta
Teleost	Monacanthidae	*Meuschenia hippocrepis*	Horseshoe Leatherjacket
Teleost	Monacanthidae	*Meuschenia freycineti*	Sixspine Leatherjacket
Teleost	Monacanthidae	*Scobinichthys granulatus*	Rough Leatherjacket
Teleost	Monacanthidae	*Meuschenia australis*	Brownstripe Leatherjacket
Teleost	Monacanthidae	*Meuschenia flavolineata*	Yellowstriped Leatherjacket
Teleost	Mugilidae	*Mugil cephalus*	Sea Mullet
Teleost	Mugilidae	*Myxus elongatus*	Sand Mullet
Teleost	Cheilodactylidae	*Dactylophora nigricans*	Dusky Morwong
Teleost	Mullidae	*Upeneichthys vlamingii*	Red Mullet
Teleost	Labridae	*Notolabrus tetricus*	Bluethroat Wrasse
Teleost	Labridae	*Notolabrus fucicola*	Purple Wrasse
Teleost	Labridae	*Notolabrus parilus*	Brownspotted Wrasse
Teleost	Labridae	*Ophthalmolepis lineolatus*	Southern Maori Wrasse
Teleost	Moridae	*Pseudophycis barbata*	Bearded Rock Cod
Teleost	Moridae	*Pseudophycis bachus*	Red Cod
Teleost	Carangidae	*Trachurus novaezelandiae*	Yellowtail Scad
Teleost	Carangidae	*Trachurus murphyi*	Peruvian Jack Mackerel
Teleost	Carangidae	*Trachurus declivis*	Common Jack Mackerel

Teleost	Scombridae	*Scomber australasicus*	Blue Mackerel
Teleost	Centrolophidae	*Seriolella punctata*	Silver Warehou
Teleost	Neosebastidae	*Neosebastes scorpaenoides*	Common Gurnard Perch
Teleost	Ophidiidae	*Genypterus tigerinus*	Rock Ling
Teleost	Labridae	*Haletta semifasciata*	Blue Weed Whiting
Teleost	Pomatomidae	*Pomatomus saltatrix*	Tailor
Teleost	Kyphosidae	*Girella tricuspidata*	Luderick
Teleost	Platycephalidae	*Platycephalus richardsoni*	Tiger Flathead
Teleost	Platycephalidae	*Platycephalus aurimaculatus*	Toothy Flathead
Teleost	Sillaginidae	*Sillago bassensis*	School Whiting
Teleost	Triglidae	*Pterygotrigla polyommata*	Latchet
Teleost	Triglidae	*Lepidotrigla vanessa*	Butterfly Gurnard
Teleost	Triglidae	*Chelidonichthys kumu*	Red Gurnard
Teleost	Triglidae	*Lepidotrigla papilio*	Spiny Gurnard
Teleost	Kyphosidae	*Scorpis aequipinnis*	Sea Sweep
Teleost	Kyphosidae	*Scorpis lineolata*	Silver Sweep
Teleost	Scombridae	*Sarda australis*	Australian Bonito
Teleost	Hemiramphidae	*Hyporhamphus regularis*	River Garfish
Chondrichthyan	Hexanchidae	*Heptranchias perlo*	Sevengill Shark
Chondrichthyan	Callorhinchidae	*Callorhinchus milii*	Elephant Fish
Chondrichthyan	Carcharhinidae	*Prionace glauca*	Blue Shark
Chondrichthyan	Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson Shark
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark
Chondrichthyan	Alopiidae	*Alopias vulpinus*	Thresher Shark
Chondrichthyan	Sphyrnidae	*Sphyrna zygaena*	Smooth Hammerhead
Chondrichthyan	Myliobatidae	*Myliobatis australis*	Southern Eagle Ray
Chondrichthyan	Rajidae	*Spiniraja whitleyi*	Melbourne Skate
Chondrichthyan	Rajidae	*Dentiraja lemprieri*	Thornback Skate
Invertebrate	Sepiidae	*Sepia apama*	Giant Cuttlefish
Invertebrate	Octopodidae	*Octopus pallidus*	Pale Octopus
Invertebrate	Ommastrephidae	*Nototodarus gouldi*	Gould's Squid

- Byproduct species *[recreational spear fishing]* (non-preferred species)

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Hemiramphidae	*Hyporhamphus melanochir*	Southern Garfish
Teleost	Dinolestidae	*Dinolestes lewini*	Longfin Pike
Teleost	Cheilodactylidae	*Cheilodactylus spectabilis*	Banded Morwong
Teleost	Cheilodactylidae	*Nemadactylus valenciennesi*	Blue Morwong
Teleost	Cheilodactylidae	*Dactylophora nigricans*	Dusky Morwong
Teleost	Cheilodactylidae	*Nemadactylus macropterus*	Jackass Morwong
Teleost	Monacanthidae	*Thamnaconus degeni*	Bluefin Leatherjacket
Teleost	Monacanthidae	*Eubalichthys mosaicus*	Mosaic Leatherjacket
Teleost	Monacanthidae	*Scobinichthys granulatus*	Rough Leatherjacket
Teleost	Monacanthidae	*Meuschenia flavolineata*	Yellowstriped Leatherjacket
Teleost	Monacanthidae	*Acanthaluteres vittiger*	Toothbrush Leatherjacket
Teleost	Gempylidae	*Thyrsites atun*	Barracouta
Teleost	Bothidae	*Arnoglossus bassensis*	Bass Strait Flounder
Teleost	Rhombosoleidae	*Ammotretis rostratus*	Longsnout Flounder
Teleost	Labridae	*Notolabrus tetricus*	Bluethroat Wrasse
Teleost	Labridae	*Olisthops cyanomelas*	Herring Cale
Teleost	Labridae	*Notolabrus fucicola*	Purple Wrasse
Teleost	Labridae	*Ophthalmolepis lineolatus*	Southern Maori Wrasse
Teleost	Labridae	*Haletta semifasciata*	Blue Weed Whiting
Teleost	Kyphosidae	*Scorpis lineolata*	Silver Sweep
Teleost	Kyphosidae	*Girella tricuspidata*	Luderick
Teleost	Kyphosidae	*Tilodon sexfasciatus*	Moonlighter
Teleost	Kyphosidae	*Kyphosus sydneyanus*	Silver Drummer
Teleost	Kyphosidae	*Girella zebra*	Zebrafish
Teleost	Latridae	*Latridopsis forsteri*	Bastard Trumpeter
Teleost	Serranidae	*Caesioperca rasor*	Barber Perch
Teleost	Serranidae	*Caesioperca lepidoptera*	Butterfly Perch
Teleost	Moridae	*Pseudophycis barbata*	Bearded Rock Cod
Teleost	Moridae	*Lotella rhacina*	Largetooth Beardie
Teleost	Moridae	*Pseudophycis bachus*	Red Cod
Teleost	Tripterygiidae	*Neosebastes pandus*	Bighead Gurnard Perch
Teleost	Neosebastidae	*Neosebastes scorpaenoides*	Common Gurnard Perch
Teleost	Triglidae	*Lepidotrigla vanessa*	Butterfly Gurnard

Teleost	Triglidae	*Chelidonichthys kumu*	Red Gurnard
Teleost	Scombridae	*Scomber australasicus*	Blue Mackerel
Teleost	Centrolophidae	*Seriolella brama*	Blue Warehou
Teleost	Mullidae	*Upeneichthys vlamingii*	Red Mullet
Teleost	Carangidae	*Trachurus novaezelandiae*	Yellowtail Scad
Teleost	Carangidae	*Trachurus declivis*	Common Jack Mackerel
Teleost	Ophidiidae	*Genypterus tigerinus*	Rock Ling
Teleost	Mugilidae	*Aldrichetta forsteri*	Yelloweye Mullet
Teleost	Mugilidae	*Mugil cephalus*	Sea Mullet
Teleost	Congridae	*Conger verreauxi*	Southern Conger
Teleost	Uranoscopidae	*Kathetostoma laeve*	Common Stargazer
Teleost	Pentacerotidae	*Pentaceropsis recurvirostris*	Longsnout Boarfish
Teleost	Pentacerotidae	*Paristiopterus labiosus*	Giant Boarfish
Teleost	Sciaenidae	*Argyrosomus japonicus*	Mulloway
Teleost	Aulopidae	*Aulopus purpurissatus*	Sergeant Baker
Teleost	Zeidae	*Cyttus australis*	Silver Dory
Teleost	Pomatomidae	*Pomatomus saltatrix*	Tailor
Chondrichthyan	Orectolobidae	*Orectolobus halei*	Gulf Wobbegong
Chondrichthyan	Triakidae	*Mustelus antarcticus*	Gummy Shark
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark
Chondrichthyan	Callorhinchidae	*Callorhinchus milii*	Elephant Shark
Invertebrate	Portunidae	*Ovalipes australiensis*	Sand Crab
Invertebrate	Sepiidae	*Sepia apama*	Giant Cuttlefish
Invertebrate	Octopodidae	*Octopus pallidus*	Pale Octopus
Invertebrate	Ommastrephidae	*Nototodarus gouldi*	Gould's Squid

- Discard species *[commercial haul seine]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Cheilodactylidae	*Nemadactylus macropterus*	Jackass Morwong
Teleost	Cheilodactylidae	*Dactylophora nigricans*	Dusky Morwong
Teleost	Diodontidae	*Diodon nicthemerus*	Spiky Globefish
Teleost	Tetraodontidae	*Tetractenos glaber*	Smooth Toadfish
Teleost	Tetraodontidae	*Contusus brevicaudus*	Prickly Toadfish
Teleost	Tetraodontidae	*Contusus richei*	Barred Toadfish
Teleost	Aracanidae	*Aracana aurita*	Shaws Cowfish
Teleost	Aracanidae	*Aracana ornata*	Ornate Cowfish
Teleost	Tetrarogidae	*Gymnapistes marmoratus*	Cobbler
Teleost	Clinidae	*Heteroclinus perspicillatus*	Common Weedfish
Teleost	Clinidae	*Cristiceps australis*	Southern Crested Weedfish
Teleost	Labridae	*Neoodax balteatus*	Little Weed Whiting
Teleost	Neosebastidae	*Maxillicosta scabriceps*	Little Gurnard Perch
Teleost	Callionymidae	*Foetorepus calauropomus*	Common Stinkfish
Chondrichthyan	Dasyatidae	*Dasyatis brevicaudata*	Smooth Stingray
Chondrichthyan	Rhinobatidae	*Trygonorrhina dumerilii*	Southern Fiddler Ray
Chondrichthyan	Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson Shark
Chondrichthyan	Urolophidae	*Urolophus gigas*	Spotted Stingaree
Chondrichthyan	Urolophidae	*Urolophus paucimaculatus*	Sparsely-spotted Stingaree
Chondrichthyan	Urolophidae	*Trygonoptera imitata*	Eastern Shovelnose Stingaree
Chondrichthyan	Myliobatidae	*Myliobatis australis*	Southern Eagle Ray
Invertebrate	Lychnorhizidae	*Pseudorhiza haeckeli*	Haekel's Jellyfish
Invertebrate	Cyaneidae	*Cyanea annaskala*	Lion's Mane Jellyfish
Invertebrate	Ulmaridae	*Aurelia sp.*	Moon Jellyfish
Invertebrate	Majidae	*Leptomithrax gaimardii*	Giant Spider Crab
Invertebrate	Majidae	*Microhalimus deflexifrons*	Decorator Crab
Invertebrate	Portunidae	*Nectocarcinus integrifrons*	Rough Rock Crab
Invertebrate	Asteriidae	*Asterias amurensis*	Northern Pacific Seastar
Invertebrate	Asteriidae	*Coscinasterias muricata*	Eleven-armed Seastar

- Discard species *[commercial long line]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Chondrichthyan	Dasyatidae	*Dasyatis brevicaudata*	Smooth Stingray
Chondrichthyan	Rhinobatidae	*Trygonorrhina dumerilii*	Southern Fiddler Ray
Chondrichthyan	Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson Shark
Chondrichthyan	Hexanchidae	*Heptranchias perlo*	Sevengill Shark
Chondrichthyan	Urolophidae	*Urolophus paucimaculatus*	Sparsely-spotted Stingaree

Chondrichthyan	Urolophidae	*Urolophus gigas*	Spotted Stingaree
Chondrichthyan	Urolophidae	*Trygonoptera imitata*	Eastern Shovelnose Stingaree
Invertebrate	Asteriidae	*Asterias amurensis*	Northern Pacific Seastar
Invertebrate	Asteriidae	*Coscinasterias muricata*	Eleven-armed Seastar

- Discard species *[commercial mesh net]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Chondrichthyan	Dasyatidae	*Dasyatis brevicaudata*	Smooth Stingray
Chondrichthyan	Rhinobatidae	*Trygonorrhina dumerilii*	Southern Fiddler Ray
Chondrichthyan	Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson Shark
Chondrichthyan	Urolophidae	*Urolophus gigas*	Spotted Stingaree
Chondrichthyan	Urolophidae	*Urolophus paucimaculatus*	Sparsely-spotted Stingaree
Chondrichthyan	Urolophidae	*Trygonoptera imitata*	Eastern Shovelnose Stingaree
Invertebrate	Portunidae	*Nectocarcinus integrifrons*	Rough Rock Crab
Invertebrate	Portunidae	*Ovalipes australiensis*	Sand Crab

- Discard species *[commercial purse seine]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Chondrichthyan	Dasyatidae	*Dasyatis brevicaudata*	Smooth Stingray
Chondrichthyan	Rajidae	*Spiniraja whitleyi*	Melbourne Skate
Chondrichthyan	Rajidae	*Dentiraja lemprieri*	Thornback Skate
Chondrichthyan	Hexanchidae	*Heptranchias perlo*	Sevengill Shark
Chondrichthyan	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler

- Discard species *[recreational hook and line]*

Taxon	**Family name**	**Scientific name**	**Common Name**
Teleost	Tetraodontidae	*Tetractenos glaber*	Smooth Toadfish
Teleost	Tetraodontidae	*Contusus brevicaudus*	Prickly Toadfish
Teleost	Tetraodontidae	*Contusus richei*	Barred Toadfish
Teleost	Aracanidae	*Aracana aurita*	Shaws Cowfish
Teleost	Aracanidae	*Aracana ornata*	Ornate Cowfish
Teleost	Tetrarogidae	*Gymnapistes marmoratus*	Cobbler
Teleost	Labridae	*Neoodax balteatus*	Little Weed Whiting
Teleost	Neosebastidae	*Maxillicosta scabriceps*	Little Gurnard Perch
Teleost	Enoplosidae	*Enoplosus armatus*	Old Wife
Teleost	Uranoscopidae	*Kathetostoma laeve*	Common Stargazer
Teleost	Labridae	*Pictilabrus laticlavius*	Senator Wrasse
Teleost	Labridae	*Pseudolabrus psittaculus*	Rosy Wrasse
Teleost	Ophichthidae	*Scolecenchelys breviceps*	Shorthead Worm Eel
Chondrichthyan	Orectolobidae	*Orectolobus halei*	Gulf Wobbegong
Chondrichthyan	Parascylliidae	*Parascyllium variolatum*	Varied Carpetshark
Chondrichthyan	Scyliorhinidae	*Cephaloscyllium laticeps*	Draughtboard Shark
Chondrichthyan	Dasyatidae	*Dasyatis brevicaudata*	Smooth Stingray
Chondrichthyan	Rhinobatidae	*Trygonorrhina dumerilii*	Southern Fiddler Ray
Chondrichthyan	Urolophidae	*Urolophus gigas*	Spotted Stingaree
Chondrichthyan	Urolophidae	*Urolophus paucimaculatus*	Sparsely-spotted Stingaree
Chondrichthyan	Urolophidae	*Trygonoptera imitata*	Eastern Shovelnose Stingaree
Invertebrate	Asteriidae	*Asterias amurensis*	Northern Pacific Seastar
Invertebrate	Asteriidae	*Coscinasterias muricata*	Eleven-armed Seastar
Invertebrate	Portunidae	*Nectocarcinus integrifrons*	Rough Rock Crab
Invertebrate	Portunidae	*Ovalipes australiensis*	Sand Crab
Invertebrate	Pyuridae	*Pyura stolonifera*	Cunjevoi

5.3.2.2 TEP species

Taxon	Family name	Scientific name	Common Name	Source
Marine Plant	Potamogetonaceae	*Lepilaena marina*	Sea Water-mat	FFG
Marine Invertebrate	Phyllophoridae	*Thyone nigra*	Sea Cucumber	FFG
Marine Invertebrate	Alpheidae	*Athanopsis australis*	Southern Hooded Shrimp	FFG
Marine Invertebrate	Callianassidae	*Calliax tooradin*	Western Port Ghost Shrimp	FFG
Marine Invertebrate	Acanthochitonidae	*Bassethullia glypta*	Chiton	FFG
Teleost	Retropinnidae	*Prototroctes maraena*	Australian Grayling	EPBC, FFG
Teleost	Syngnathidae	*Heraldia nocturna*	Upside-down Pipefish	EPBC, VF
Teleost	Syngnathidae	*Hippocampus abdominalis*	Big-belly Seahorse	EPBC, VF
Teleost	Syngnathidae	*Hippocampus breviceps*	Short-head Seahorse	EPBC, VF
Teleost	Syngnathidae	*Hippocampus minotaur*	Bullneck Seahorse	EPBC, VF
Teleost	Syngnathidae	*Histiogamphelus briggsii*	Crested Pipefish	EPBC, VF
Teleost	Syngnathidae	*Histiogamphelus cristatus*	Rhino Pipefish	EPBC, VF
Teleost	Syngnathidae	*Hypselognathus rostratus*	Knifesnout Pipefish	EPBC, VF
Teleost	Syngnathidae	*Kaupus costatus*	Deepbody Pipefish	EPBC, VF
Teleost	Syngnathidae	*Leptoichthys fistularius*	Brushtail Pipefish	EPBC, VF
Teleost	Syngnathidae	*Lissocampus caudalis*	Australian Smooth Pipefish	EPBC, VF
Teleost	Syngnathidae	*Lissocampus runa*	Javelin Pipefish	EPBC, VF
Teleost	Syngnathidae	*Maroubra perserrata*	Sawtooth Pipefish	EPBC, VF
Teleost	Syngnathidae	*Mitotichthys mollisoni*	Mollison's Pipefish	EPBC, VF
Teleost	Syngnathidae	*Mitotichthys semistriatus*	Halfbanded Pipefish	EPBC, VF
Teleost	Syngnathidae	*Notiocampus ruber*	Red Pipefish	EPBC, VF
Teleost	Syngnathidae	*Phycodurus eques*	Leafy Seadragon	EPBC, VF
Teleost	Syngnathidae	*Phyllopteryx taeniolatus*	Weedy Seadragon	EPBC, VF
Teleost	Syngnathidae	*Pugnaso curtirostris*	Pugnose Pipefish	EPBC, VF
Teleost	Syngnathidae	*Solegnathus robustus*	Robust Pipehorse	EPBC, VF
Teleost	Syngnathidae	*Solegnathus spinosissimus*	Spiny Pipehorse	EPBC, VF
Teleost	Syngnathidae	*Stigmatopora argus*	Spotted Pipefish	EPBC, VF
Teleost	Syngnathidae	*Stigmatopora nigra*	Widebody Pipefish	EPBC, VF
Teleost	Syngnathidae	*Stipecampus cristatus*	Ringback Pipefish	EPBC, VF
Teleost	Syngnathidae	*Urocampus carinirostris*	Hairy Pipefish	EPBC, VF
Teleost	Syngnathidae	*Vanacampus margaritifer*	Mother-of-pearl Pipefish	EPBC, VF
Teleost	Syngnathidae	*Vanacampus phillipi*	Port Phillip Pipefish	EPBC, VF
Chondrichthyan	Lamnidae	*Carcharodon carcharias*	Great White Shark	EPBC
Chondrichthyan	Lamnidae	*Lamna nasus*	Porbeagle	EPBC
Chondrichthyan	Triakidae	*Galeorhinus galeus*	School Shark	EPBC
Marine Reptile	Cheloniidae	*Caretta caretta*	Loggerhead Turtle	EPBC
Marine Reptile	Cheloniidae	*Chelonia mydas*	Green Turtle	EPBC
Marine Reptile	Dermochelyidae	*Dermochelys coriacea*	Leatherback Turtle	EPBC
Marine Bird	Diomedeidae	*Diomedea epomophora epomophora*	Southern Royal Albatross	EPBC
Marine Bird	Diomedeidae	*Diomedea epomophora sanfordi*	Northern Royal Albatross	EPBC
Marine Bird	Diomedeidae	*Diomedea exulans antipodensis*	Antipodean Albatross	EPBC
Marine Bird	Diomedeidae	*Diomedea exulans exulans*	Tristan Albatross	EPBC
Marine Bird	Diomedeidae	*Diomedea exulans gibsoni*	Gibson's Albatross	EPBC
Marine Bird	Diomedeidae	*Diomedea exulans (sensu lato)*	Wandering Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche bulleri*	Buller's Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche cauta cauta*	Shy Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche cauta salvini*	Salvin's Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche cauta steadi*	White-capped Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche chrysostoma*	Grey-headed Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche melanophris*	Black-browed Albatross	EPBC
Marine Bird	Diomedeidae	*Thalassarche melanophris impavida*	Campbell Albatross	EPBC
Marine Bird	Procellariidae	*Macronectes giganteus*	Southern Giant-Petrel	EPBC
Marine Bird	Procellariidae	*Macronectes halli*	Northern Giant-Petrel	EPBC

Marine Bird	Procellariidae	*Pterodroma leucoptera leucoptera*	Gould's Petrel	EPBC
Marine Bird	Procellariidae	*Puffinus carneipes*	Fleshy-footed Shearwater	EPBC
Marine Bird	Laridae	*Sternula nereis nereis*	Australian Fairy Tern	EPBC
Marine Bird	Laridae	*Sterna albifrons*	Little Tern	EPBC
Marine Bird	Laridae	*Sterna caspia*	Caspian Tern	EPBC
Marine Bird	Laridae	*Sterna fuscata*	Sooty Tern	EPBC
Marine Bird	Laridae	*Larus novaehollandiae*	Silver Gull	EPBC
Marine Bird	Charadriidae	*Thinornis rubricollis rubricollis*	Hooded Plover (eastern)	EPBC
Marine Bird	Spheniscidae	*Eudyptula minor*	Little Penguin	EPBC
Marine Bird	Hydrobatidae	*Pelagodroma marina*	White-faced Storm-Petrel	EPBC
Marine Bird	Sulidae	*Morus capensis*	Cape Gannet	EPBC
Marine Bird	Sulidae	*Morus serrator*	Australasian Gannet	EPBC
Marine Mammal	Balaenopteridae	*Balaenoptera musculus*	Blue Whale	EPBC
Marine Mammal	Balaenopteridae	*Balaenoptera edeni*	Bryde's Whale	EPBC
Marine Mammal	Balaenopteridae	*Balaenoptera acutorostrata*	Minke Whale	EPBC
Marine Mammal	Balaenopteridae	*Megaptera novaeangliae*	Humpback Whale	EPBC
Marine Mammal	Balaenidae	*Eubalaena australis*	Southern Right Whale	EPBC
Marine Mammal	Cetotheriidae	*Caperea marginata*	Pygmy Right Whale	EPBC
Marine Mammal	Balaenopteridae	*Megaptera novaeangliae*	Humpback Whale	EPBC
Marine Mammal	Delphinidae	*Orcinus orca*	Killer Whale	EPBC
Marine Mammal	Delphinidae	*Lagenorhynchus obscurus*	Dusky Dolphin	EPBC
Marine Mammal	Delphinidae	*Delphinus delphis*	Common Dolphin	EPBC
Marine Mammal	Delphinidae	*Grampus griseus*	Risso's Dolphin	EPBC
Marine Mammal	Delphinidae	*Tursiops aduncus*	Indian Ocean Bottlenose Dolphin	EPBC
Marine Mammal	Delphinidae	*Tursiops truncatus*	Bottlenose Dolphin	EPBC
Marine Mammal	Delphinidae	*Tursiops australis*	Burrunan Dolphin	FFG
Marine Mammal	Otariidae	*Arctocephalus forsteri*	New Zealand Fur-seal	EPBC
Marine Mammal	Otariidae	*Arctocephalus pusillus*	Australian Fur-seal	EPBC

5.3.2.3 Habitats

Substratum Type			
Rock / Reef	Rock / Reef – Sediment		Sediment
Substratum category			**Substratum category**
Low profile reef/platform (<1 m) High profile reef/platform (>1 m)	Low profile reef/platform (<1 m) High profile reef/platform (>1 m)		Bare sediment Vegetated sediment Sand beach Sand flat Sand-mud flat
Substratum structure			**Substratum structure**
Continuous	Continuous	Patchy	Flat Ripples Mounds Hills
Substratum texture			**Substratum texture**
Solid Boulders Broken Gutters	Cobble Rubble	Boulders Cobble Rubble Solid Broken Gutters Pavement Ripple sand veneer	Gravel/Pebble Shelly sand Sand Silt Clay

Habitats (Cont.)

Reef		**Sediment**		
Substratum biota type (Reef)	**Dominant biota (Reef)**	**Substratum biota type (Sediment)**	**Substratum biota density (Sediment)**	**Dominant biota species (Sediment)**
Bare Seagrass Macroalgae Seagrass / Macroalgae	*Phyllospora* *Macrocystis* *Durvillaea* *Ecklonia* *Cystophora* spp. *Sargassum* *Amphibolis* *Hormosira* Mixed brown algae Mixed green algae Mixed red algae Mixed algae Urchin barren Sponges Ascidians Turf algae Combinations of above categories	Bare Seagrass Macroalgae Seagrass / Macroalgae Mangrove Saltmarsh	Dense Medium Sparse Dense patchy Medium patchy Sparse patchy	*HalophilaAmphibolis* *Zostera* sp. *Caulerpa* spp. *Pyura* Mixed green algae Mixed brown algae Drift algae Combinations of above categories

5.3.2.4 Communities

- Pelagic (water column) Community
- Port Phillip Bay Entrance Deep Reef Community
- *Avicennia* Mangrove Community
- *Zostera* Seagrass Community
- Intertidal mudflat Community
- *Amphibolis* Seagrass Community
- *Caulerpa* Algae Community
- Reef/*Ecklonia* Community
- Reef/*Cystophora* Community
- Artificial Reef Community
- Drift Algae Community
- Pyura Community
- High Diversity Sands Community
- Intermediate Sediments Community
- Central Muds Community
- Western Muds Community

5.3.3 ERA Summary

The Ecological Risk Assessment for Effects of Fishing (ERAEF) method was applied to seven sub-fisheries in Port Phillip Bay:

- Commercial haul seine (including Garfish seine and beach seine)
- Commercial long-line
- Commercial mesh-net
- Commercial purse seine
- Recreational hook and line (including recreational Charter)
- Recreational Spearfishing
- Hand collection (commercial and recreational)

The ERAEF method allowed for the assessment of the ecological risks arising from fishing, with impacts assessed against five ecological components:

- Target species
- By-product and by-catch species
- Threatened, endangered and protected (TEP) species
- Habitats
- Communities (ecological)

Hazards are activities specific to each sub-fishery that are undertaken in the process of fishing, or any external activities that have the potential for ecological impact. Potential risks in each sub-fishery were selected from a list of 34 hazards (26 fishery-related, 8 external). Hazards were assessed against six categories: capture (e.g. fishing); direct impact without capture (gear loss, anchoring), addition/removal of biological material (e.g. bycatch, restocking); addition of non-biological material (e.g. rubbish, chemical pollution, oil spill); disturbance of physical processes (e.g. trawling, bait collection, anchoring); and external hazards (e.g. coastal development, marine pests). These hazards are then scored on a binary (presence/absence) basis i.e. 1 if it does occur and 0 if it does not.

The assessment of these hazards follows a qualitative risk assessment which is based on the scale, intensity and consequence analysis (SICA) Level 1. This is similar to formal risk assessments which consider consequence and likelihood (of a hazard). Level 1 screens out activities that are judged to have a low ecological impact. Higher level risk assessment is more resource intensive and thus, this approach is a cost-effective way of examining ecological risk in the context of fisheries impacts. Vulnerable species (within subfisheries) were selected to link fishing impacts (and external activities) to natural processes that are affected by fishing (e.g. growth, recruitment, mortality),

SICA involves 10 steps including:

- Evaluation of the temporal and spatial scale of the activity (on a scale of 1 = negligible to 6 = catastrophic)
- Evaluation of the intensity of the activity (i.e. likelihood)
- Evaluation of the consequence of each activity (as above)
- Record the confidence associated with the consequence score.

5.3.4 Results of SICA assessment (Level 1).

Commercial haul seine (including Garfish seine and beach seine)

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 21 of 25 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were: direct capture by fishing, direct impact without capture (habitat), translocation of species, discarding catch and addition of debris (TEP species).

Commercial long-line

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 21 of 25 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, translocation of species, discarding catch, addition of debris (TEP species) and gear loss (TEP species).

Commercial mesh-net

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 16 of 21 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, gear loss (TEP species), translocation of species, and addition of debris (TEP species).

Commercial purse-seine

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 16 of 21 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, direct impact without capture (TEP species), translocation of species, and addition of debris (TEP species).

Recreational hook and line (including recreational Charter)

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 17 of 25 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, navigation and steaming (TEP species), direct impact without capture (TEP species), discarding catch, provisioning (Communities), translocation of species, addition of debris, and gear loss (TEP species).

Recreational Spearfishing

No components were excluded at Level 1 (all components had at least one consequence >2). A total of 18 of 21 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, translocation of species, and addition of debris (TEP species).

Hand collection (commercial and recreational)

Byproduct (non-target species that are retained) and bycatch (non-target species that are discarded) species were not relevant to this sub-fishery. Of the remaining 4 components, none were excluded at Level 1 (all components had at least one consequence >2). A total of 17 of 20 identified fishery-related hazards were excluded at Level 1. Hazards with a Moderate or higher consequence were direct capture by fishing, translocation of species, and addition of debris (TEP species).

External Hazards

No components were excluded at Level 1 for hazards (all components had at least one consequence >2). A total of 1 of 8 identified hazards external to the sub-fisheries was excluded at Level 1. Hazards with a Moderate or higher consequence were other capture methods, aquaculture, coastal development, catchment inputs, shipping activities, port activities and other anthropogenic activities.

5.3.5 Scoping Step 3 – Identification of Objectives for Components and Sub-components

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators
Target Species	Avoid recruitment failure of the target species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Maintain biomass above a specified level 1.3 Maintain catch at specified level 1.4 Species do not approach extinction or become extinct	Biomass, numbers, density, CPUE, yield
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of Population across PPB
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (Ne), number of spawning units
		4. Age / size / sex structure	4.1 Age / size / sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age / size / sex classes Biomass of Spawners Mean size, sex ratio
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity)	Egg production of population Abundance of recruits

			5.2 Recruitment to the population does not change outside acceptable bounds	
		6. Behaviour / Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)
Byproduct and Bycatch	Avoid recruitment failure of the byproduct and bycatch species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Maintain biomass above a specified level 1.3 Maintain catch at specified level 1.4 Species do not approach extinction or become extinct	Biomass, numbers, density, CPUE, yield
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of Population across PPB
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (Ne), number of spawning units
		4. Age / size / sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of Spawners Mean size, sex ratio
		5. Reproductive Capacity	5.1 Fecundity of the population does not change	Egg production of population

			outside acceptable bounds (e.g. more than X% of reference population fecundity) 5.2 Recruitment to the population does not change outside acceptable bounds	Abundance of recruits
		6. Behaviour / Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)
TEP Species	Avoid recruitment failure of the TEP species Avoid negative consequences for TEP species or population sub-components Avoid negative impacts on the population from fishing	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of Population across PPB
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (Ne), number of spawning units
		4. Age / size / sex structure	4.1 Age / size / sex structure does not change outside acceptable	Biomass, numbers or relative proportion in age / size / sex classes

			bounds (e.g. more than X% from reference structure)	Biomass of Spawners Mean size, sex ratio
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) 5.2 Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits
		6. Behaviour /Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)
		7. Interactions with fishery	7.1 Survival after interactions is maximised 7.2 Interactions do not affect the viability of the population or its ability to recover	Survival rate of species after interactions Number of interactions, biomass or numbers in population
Habitats	Avoid negative impacts on the quality of the environment Avoid reduction in the amount and quality of habitat	1. Water quality	1.1 Water quality does not change outside acceptable bounds	Water chemistry, noise levels, debris levels, turbidity levels, pollutant concentrations, light pollution from artificial light
		2. Air quality	2.1 Air quality does not change outside acceptable bounds	Air chemistry, noise levels, visual pollution, pollutant concentrations, light pollution from artificial light
		3. Substrate quality	3.1 Sediment quality does not change outside acceptable bounds	Sediment chemistry, stability, particle size, debris, pollutant concentrations

		4. Habitat types	4.1 Relative abundance of habitat types does not vary outside acceptable bounds	Extent and area of habitat types, % cover, spatial pattern, landscape scale
		5. Habitat structure and function	5.1 Size, shape and condition of habitat types does not vary outside acceptable bounds	Size structure, species composition and morphology of biotic habitats
Communities	Avoid negative impacts on the Composition / function / distribution/ structure of the community	1. Species composition	1.1 Species composition of communities does not vary outside acceptable bounds	Species presence / absence, species numbers or biomass (relative or absolute) Richness Diversity indices Evenness indices
		2. Functional group composition	2.1 Functional group composition does not change outside acceptable bounds	Number of functional groups, species per functional group (e.g. autotrophs, filter feeders, herbivores, omnivores, carnivores)
		3. Distribution of the community	3.1 Community range does not vary outside acceptable bounds	Geographic range of the community, continuity of range, patchiness
		4. Trophic / size structure	4.1 Community Size spectra / trophic structure does not vary outside acceptable bounds	Size spectra of the community Number of octaves, biomass / number in each size class Mean trophic level Number of trophic levels
		5. Bio- and geo-chemical cycles	5.1 Cycles do not vary outside acceptable bounds	Indicators of cycles, salinity, carbon, nitrogen, phosphorus flux

5.3.6 Scoping Step 4 – Hazard Identification

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Commercial haul seine (including Garfish seine and beach seine)

Date: 13 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Fish are captured in the process of fishing
	Incidental behaviour	1	Possible that other methods (i.e. line fishing) could be used incidentally during "down time"
Direct impact without capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Animals may be damaged by the fishing gear and not captured. These animals may later die.
	Incidental behaviour	1	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing
	Gear loss	1	Would expect a very low rate of gear loss. Animals could potentially be entangled in a lost net
	Anchoring/mooring	1	Fishing method involves anchoring while net is retrieved
	Navigation/steaming	1	Boat travel is required to reach fishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Fishery involves trailer boats so translocation of species is possible
	On board processing	1	Gummy shark may be gutted at sea
	Discarding catch	1	Occurs, undersize target species and bycatch species are discarded.
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	0	No bait/berley is used to attract the target species
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as nets, buoys etc
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Net hauling may disturb sediment
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor

	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams etc); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Commercial long-line

Date: 15 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	1	Bait is used with this fishing method and may be collected (e.g. squid, octopus using traps)
	Fishing	1	Fish are captured in the process of fishing
	Incidental behaviour	1	Possible that other methods (i.e. line fishing) could be used incidentally during “down time”
Direct impact without capture	Bait collection	1	Bait is used with this fishing method and may be collected (e.g. squid, octopus using traps), may escape before capture
	Fishing	1	Animals may be damaged by the fishing gear and not captured. For example fish may be hooked but then break free before capture. This is unusual however, and they are more often torn off by seals. These fish may later die.
	Incidental behaviour	1	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing
	Gear loss	1	Would expect a very low rate of gear loss. Mostly though breakage of main line by seal or seven-gill shark. A lost long-line could continue fishing for a period and also cause entanglement. Will only fish while bait is present. Couta bait will only last an hour or so. Interference from recreational fishers could also cause gear loss.
	Anchoring/mooring	1	Fishing method does not involve anchoring. Anchoring will only occur in the event of breakdown or for safety. Some vessels are moored.
	Navigation/steaming	1	Boat travel is required to reach fishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Fishery involves boat movement so translocation of species is possible. Pests such as Northern Pacific Seastar are kept on board and placed in a bin at the harbour
	On board processing	1	Gummy Shark may be gutted at sea
	Discarding catch	1	Occurs, undersize target species and bycatch species are discarded.
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	1	Bait is used to attract the target species
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol/diesel
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as long-lines, snoods and hooks, buoys
	Navigation/steaming	1	Introduces noise, visual stimulus to environment

	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	1	Bait collection methods (i.e. Octopus trap) could disturb sediment
	Fishing	1	Weights used to set the long-line may disturb sediment
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor (anchoring is rare for this fishing method)
	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor in shallow water
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams etc); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Commercial mesh net

Date: 15 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Fish are captured in the process of fishing
	Incidental behaviour	1	Possible that other methods (i.e. line fishing) could be used incidentally during “down time”
Direct impact without capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Animals may be damaged by the fishing gear and not captured (i.e. partially meshed but then escape). These animals may later die.
	Incidental behaviour	1	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing
	Gear loss	1	Would expect a very low rate of gear loss. Usually only occurs if stolen. Animals could potentially be meshed or entangled in a lost net
	Anchoring/mooring	1	Anchoring does not occur in the process of fishing, may occur in emergency or for safety
	Navigation/steaming	1	Boat travel is required to reach fishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Fishery involves trailer boats so translocation of species is possible
	On board processing	1	Gummy shark may be gutted at sea
	Discarding catch	1	Occurs, undersize target species and bycatch species are discarded.
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	0	No bait/berley is used to attract the target species
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as nets, buoys
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Net hauling may disturb sediment
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor
	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor

External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Purse seine

Date: 15 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Fish are captured in the process of fishing
	Incidental behaviour	1	Possible that other methods (i.e. long line, mesh net) could be used incidentally during "down time"
Direct impact without capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Animals may be damaged by the fishing gear and not captured. These animals may later die.
	Incidental behaviour	1	May occur, e.g. if there is a hole in the net fish may escape (unharmed)
	Gear loss	1	Would expect a very low rate of gear loss. Animals could potentially be entangled in a lost net
	Anchoring/mooring	1	Anchoring can occur in the process of fishing (e.g. when removing fish from net in rough weather)
	Navigation/steaming	1	Boat travel is required to reach fishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Fishery involves trailer boats so translocation of species is possible (e.g. Northern Pacific Seastar, fan worm *Sabella*)
	On board processing	0	No processing occurs at sea (only salting)
	Discarding catch	1	Occurs, bycatch species are discarded.
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	0	No bait/berley is used to attract the target species
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol/diesel
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as nets, buoys
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Net hauling may disturb sediment
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor
	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor

External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Recreational hook and line (including recreational Charter)

Date: 15 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	1	Bait is used with this fishing method and may be collected/caught (e.g. mussels, squid, fish)
	Fishing	1	Fish are captured in the process of fishing
	Incidental behaviour	1	Possible that other methods (e.g. spearfishing) could occur on same fishing trip
Direct impact without capture	Bait collection	1	Bait is used with this fishing method and may be collected/caught (e.g. mussels, squid, fish)
	Fishing	1	Animals may be damaged by the fishing gear and not captured. For example, fish may be hooked but then break free before capture. These animals may later die.
	Incidental behaviour	1	May occur, e.g. if fish are speared but not captured when undertaking incidental spearfishing
	Gear loss	1	Lost fishing line from snagging, break-offs, bite-offs can cause entanglement
	Anchoring/mooring	1	Fishing method often involves anchoring while fishing
	Navigation/steaming	1	Boat travel is required to reach fishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Fishery involves trailer boats so translocation of species is possible
	On board processing	1	Bleeding, gutting or filleting may occasionally occur at sea (Gummy Shark, Southern Calamari, Southern Sand Flathead). Processing often occurs at boat ramps
	Discarding catch	1	Occurs, undersize target species and bycatch species are discarded.
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	1	Bait and berley is used to attract the target species
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Often occurs with snagging; loss of line, hooks, sinkers, swivels
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
	Bait collection	1	Bait collection methods (i.e. yabby pump) could disturb sediment

Disturb physical Processes	Fishing	0	Physical disturbance from recreational fishing is negligible
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor
	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor in shallow water
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Recreational spearfishing

Date: 15 January 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Fish are captured in the process of spearfishing
	Incidental behaviour	1	Possible that other methods (e.g. rod and line fishing) could occur on same fishing trip
Direct impact without capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Animals may be damaged by the fishing gear and not captured. For example, fish may be speared but then break free before capture. These animals may later die (some survive depending on where hit).
	Incidental behaviour	1	May occur, e.g. if fish are hooked but not captured when undertaking incidental rod and line fishing
	Gear loss	1	May occur, fish may escape with spear attached
	Anchoring/mooring	1	Fishing method may involve anchoring while spearfishing
	Navigation/steaming	1	Boat travel may be required to reach spearfishing locations
Addition / movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Spearfishing may involve trailer boats so translocation of species is possible
	On board processing	1	Bleeding, gutting or filleting may occasionally occur at sea. Processing often occurs at boat ramps
	Discarding catch	0	No discards with this fishing method
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	0	Some berley may be used (e.g. pilchards to attract Snapper).
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as spears, fins
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Physical disturbance could occur from contact with reef/substrate

	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor
	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor in shallow water
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

Fishery Name: Port Phillip Bay Finfish Fishery

Sub-fishery Name: Hand collection (commercial and recreational)

Date: 1 June 2015

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Invertebrates are captured in the process of hand collection
	Incidental behaviour	1	Possible that other methods (e.g. rod and line fishing) could occur on same fishing trip
Direct impact without capture	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Animals may escape or be damaged in the process of fishing
	Incidental behaviour	1	May occur, e.g. if fish are hooked but not captured when undertaking incidental rod and line fishing
	Gear loss	1	May occur, e.g. loss of catch bag containing catch
	Anchoring/mooring	1	Fishing method may involve anchoring while hand collecting
	Navigation/steaming	1	Boat travel may be required to reach hand collection locations
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	Hand collection may involve trailer boats so translocation of species is possible
	On board processing	1	Not legal to shuck abalone, but some processing may occur (e.g. recreational collection of mussels, scallops)
	Discarding catch	0	No discards with this fishing method
	Stock enhancement	0	Does not occur in Port Phillip Bay fishery
	Provisioning	0	No bait or berley is used
	Organic waste disposal	1	Disposal of organic wastes (e.g. food scraps) from boats.
Addition of non-biological material	Debris	1	Assume some debris (e.g. rubbish, plastic) is occasionally blown or washed overboard
	Chemical pollution	1	Possible small leakage of oil/petrol
	Exhaust	1	Exhaust introduced to the atmosphere and water while vessel underway or idling
	Gear loss	1	Unlikely but possible loss of gear such as abalone irons, catch bags
	Navigation/steaming	1	Introduces noise, visual stimulus to environment
	Activity/presence on water	1	Introduces noise, visual stimulus to environment, possible attraction of foraging/scavenging animals
Disturb physical Processes	Bait collection	0	No bait is used with this fishing method
	Fishing	1	Physical disturbance could occur from contact with reef/substrate
	Boat launching	1	Propeller may disturb sediment in shallow water when launching/retrieving. Some dredging may occur at boat ramps
	Anchoring/mooring	1	Anchor and chain will disturb sediment on sea floor

	Navigation/steaming	1	Propeller turbulence and wake may disturb sediment on sea floor in shallow water
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fishing methods listed in this report likely to occur in the same fishing areas
	Aquaculture	1	Mainly mussel aquaculture, mussel farms occur in the fishing area
	Coastal development	1	Intense coastal development from large urban population (including beach renourishment)
	Catchment Inputs	1	Sediments, nutrients and pollutants from catchment runoff; freshwater flows (dams); major sewage outfall (Western Treatment Plant)
	Shipping activities	1	Shipping (including oil spills)
	Port activities	1	Shipping channels and dredging; spoil disposal
	Other extractive activities	0	Pipelines from extractive activities such as gas
	Other anthropogenic activities	1	Scuba diving; snorkelling; jet skiing; yachting; power-boating; eco-tourism

5.3.7 Scoping Step 5 – Bibliography

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5.3.8 Summary of SICA results.

The report provides a summary table of consequence scores for all activity/component combinations with those that scored 3 or above for consequence shaded, and differentiating those that did so with high confidence (in bold).

Table 11. Summary table of consequence scores for all activity/components combinations for the commercial haul seine fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	3	3	2	3	3
	Incidental behaviour	1	1	1	1	1
Direct impact without capture	Bait collection					
	Fishing	2	1	2	3	2
	Incidental behaviour	1	1	1	1	1
	Gear loss	1	1	1	2	2
	Anchoring/ mooring	2	2	1	2	2
	Navigation/ steaming	1	1	2	2	2
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing	1	1	1	2	2
	Discarding catch	3	3	1	2	2
	Stock enhancement					
	Provisioning					
	Organic waste disposal	1	1	1	2	2
Addition of non-biological material	Debris	1		3	2	2
	Chemical pollution	1	1	2	2	2
	Exhaust	1	1	2	1	1
	Gear loss	1	1	1	2	2
	Navigation/ steaming	1	1	2	1	2
	Activity/ presence on water	1	1	2	1	1
Disturb physical processes	Bait collection					
	Fishing	2	2	2	2	2
	Boat launching	2	2	2	2	2
	Anchoring/ mooring	2	2	1	2	2
	Navigation/ steaming	1	1	1	2	2
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3	3	4	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	4	4	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 12. Summary table of consequence scores for all activity/components combinations for the commercial long-line fishery.

Direct Impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection	2	2	1	1	1
	Fishing	3	3	2	1	3
	Incidental behaviour	1	1	1	1	1
Direct impact without capture	Bait collection	1	1	1	1	1
	Fishing	2	2	2	1	2
	Incidental behaviour	1	1	1	1	1
	Gear loss	2	2	2	1	2
	Anchoring/ mooring	1	1	1	2	1
	Navigation/ steaming	1	1	2	1	1
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing	1	1	1	1	2
	Discarding catch	1	2	1	1	2
	Stock enhancement					
	Provisioning	1	1	1	1	2
	Organic waste disposal	1	1	1	1	1
Addition of non-biological material	Debris	2	2	3	2	2
	Chemical pollution	1	1	2	2	1
	Exhaust	1	1	2	1	1
	Gear loss	2	2	3	1	2
	Navigation/ steaming	1	1	2	1	1
	Activity/ presence on water	1	1	2	1	1
Disturb physical processes	Bait collection	1	1	1	1	1
	Fishing	1	1	1	1	1
	Boat launching	1	1	1	2	2
	Anchoring/ mooring	1	1	1	2	2
	Navigation/ steaming	1	1	1	1	1
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3	3	4	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	3	3	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 13. Summary table of consequence scores for all activity/components combinations for the commercial mesh-net fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	3	3	3	2	3
	Incidental behaviour	1	1	1	1	1
Direct impact without capture	Bait collection					
	Fishing	2	2	2	2	1
	Incidental behaviour	1	1	1	1	1
	Gear loss	2	2	3	2	2
	Anchoring/ mooring	1	1	1	2	1
	Navigation/ steaming	1	1	2	2	2
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing	1	2	1	2	2
	Discarding catch	1	2	1	2	2
	Stock enhancement					
	Provisioning					
	Organic waste disposal	1	1	1	2	2
Addition of non-biological material	Debris	1	1	3	2	2
	Chemical pollution	1	1	2	2	2
	Exhaust	1	1	2	1	1
	Gear loss	2	2	3	2	2
	Navigation/ steaming	1	1	2	1	2
	Activity/ presence on water	1	1	2	1	1
Disturb physical processes	Bait collection					
	Fishing	2	2	1	1	2
	Boat launching	2	2	1	2	2
	Anchoring/ mooring	1	1	1	1	1
	Navigation/ steaming	1	1	1	2	2
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3	3	4	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	4	4	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 14. Summary table of consequence scores for all activity/components combinations for the commercial purse-seine fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	2	2	3	2	3
	Incidental behaviour	1	1	1	1	1
Direct impact without capture	Bait collection	1				
	Fishing	1	1	3	2	2
	Incidental behaviour	1	1	2	1	1
	Gear loss	1	1	1	2	1
	Anchoring/ mooring	1	1	1	2	1
	Navigation/ steaming	1	1	2	1	1
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing					
	Discarding catch	1	2	1	1	2
	Stock enhancement					
	Provisioning					
	Organic waste disposal	1	1	1	1	1
Addition of non-biological material	Debris	1	1	3	2	2
	Chemical pollution	1	1	2	2	2
	Exhaust	1	1	2	1	1
	Gear loss	1	1	1	1	2
	Navigation/ steaming	1	1	2	1	1
	Activity/ presence on water	1	1	2	1	1
Disturb physical processes	Bait collection					
	Fishing	1	1	1	1	2
	Boat launching	1	1	2	2	2
	Anchoring/ mooring	1	1	1	2	2
	Navigation/ steaming	1	1	2	1	1
External hazards (specify the particular example within each activity area)	Other capture fishery methods	2	3	4	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	4	3	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 15. Summary table of consequence scores for all activity/components combinations for the recreational hook and line fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection	2	2	2	2	2
	Fishing	3	3	3	2	3
	Incidental behaviour	2	2	2	2	2
Direct impact without capture	Bait collection	2	2	2	2	2
	Fishing	2	2	2	2	2
	Incidental behaviour	1	1	1	2	1
	Gear loss	2	2	2	2	2
	Anchoring/ mooring	2	2	1	2	2
	Navigation/ steaming	2	2	3	2	2
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing	2	2	2	2	2
	Discarding catch	3	3	1	2	2
	Stock enhancement					
	Provisioning	2	2	2	2	3
	Organic waste disposal	2	2	2	2	2
Addition of non-biological material	Debris	2	2	4	3	3
	Chemical pollution	2	2	2	2	2
	Exhaust	2	2	2	2	2
	Gear loss	2	2	4	2	2
	Navigation/ steaming	2	2	3	2	2
	Activity/ presence on water	2	2	2	2	2
Disturb physical processes	Bait collection	1	1	2	2	2
	Fishing	1	1	1	1	1
	Boat launching	2	2	2	2	2
	Anchoring/ mooring	2	2	2	2	2
	Navigation/ steaming	2	2	2	2	2
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3	3	3	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	4	4	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 16. Summary table of consequence scores for all activity/components combinations for the recreational spearfishing fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	3	3	2	2	4
	Incidental behaviour	2	2	2	2	2
Direct impact without capture	Bait collection					
	Fishing	2	2	2	2	2
	Incidental behaviour	2	2	2	2	2
	Gear loss	1	1	1	1	2
	Anchoring/ mooring	2	2	1	2	2
	Navigation/ steaming	1	1	2	1	2
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4	4	4	4	4
	On board processing	1	2	2	2	2
	Discarding catch					
	Stock enhancement					
	Provisioning	2	2	2	2	2
	Organic waste disposal	1	1	1	1	2
Addition of non-biological material	Debris	2	2	3	2	2
	Chemical pollution	2	2	2	2	2
	Exhaust	1	2	2	1	1
	Gear loss	1	1	2	1	1
	Navigation/ steaming	2	2	2	1	2
	Activity/ presence on water	2	2	2	1	1
Disturb physical processes	Bait collection					
	Fishing	1	1	1	1	1
	Boat launching	2	2	2	2	2
	Anchoring/ mooring	2	2	2	2	2
	Navigation/ steaming	2	2	2	2	2
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3	3	4	3	3
	Aquaculture	2	2	2	3	3
	Coastal development	4	4	4	4	4
	Catchment inputs	4	4	4	4	4
	Shipping activities	4	4	4	4	4
	Port activities	3	3	3	3	4
	Other extractive activities					
	Other anthropogenic activities	2	2	4	3	3

Table 17. Summary table of consequence scores for all activity/components combinations for the hand collection (commercial and recreational) fishery.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	3		2	2	3
	Incidental behaviour	2		2	2	2
Direct impact without capture	Bait collection					
	Fishing	2		1	2	2
	Incidental behaviour	2		2	2	2
	Gear loss	1		1	1	2
	Anchoring/ mooring	2		1	2	2
	Navigation/ steaming	1		2	1	2
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	4		4	4	4
	On board processing	1		2	2	2
	Discarding catch					
	Stock enhancement					
	Provisioning					
	Organic waste disposal	1		1	1	2
Addition of non-biological material	Debris	2		3	2	2
	Chemical pollution	2		2	2	2
	Exhaust	2		2	1	1
	Gear loss	2		2	1	1
	Navigation/ steaming	1		2	1	2
	Activity/ presence on water	1		2	1	1
Disturb physical processes	Bait collection					
	Fishing	2		2	1	1
	Boat launching	2		2	2	2
	Anchoring/ mooring	2		2	2	2
	Navigation/ steaming	1		2	2	2
External hazards (specify the particular example within each activity area)	Other capture fishery methods	3		4	3	3
	Aquaculture	2		2	3	3
	Coastal development	4		4	4	4
	Catchment inputs	4		4	4	4
	Shipping activities	4		4	4	4
	Port activities	3		3	3	4
	Other extractive activities					
	Other anthropogenic activities	2		4	3	3

5.4 Evaluation/Discussion

5.4.1 Overview

KEY POINT 22. THE GREATEST RISKS IDENTIFIED FOR ALL SUB-FISHERIES WERE ASSOCIATED WITH ACTIVITIES EXTERNAL TO THE FISHERIES.

By far the greatest risks identified for sub-fisheries in this ERA were associated with 'External Hazards' (both in terms of the number and severity of risks). These risks were not associated with the sub-fisheries themselves but rather related to activities external to the fisheries. This finding relates largely to the fact that Port Phillip Bay is an almost totally enclosed water body with very low exchange of water with the open coast. This means that the water's physical, chemical and biological characteristics of the Bay are highly dependent on the input from the catchment and the influence of the large human population living on the Bay (including major cities and ports).

5.4.2 External Hazards

KEY POINT 23. RECRUITMENT AND SURVIVAL OF MANY TARGET SPECIES ARE RELATED TO THE ENVIRONMENT INCLUDING NUTRIENT INPUTS AND HABITAT AVAILABILITY.

RECOMMENDATION 1 DEVELOP A BETTER UNDERSTANDING OF THE HAZARDS AND ASSOCIATED PATHWAYS TO FISH AND HABITAT, TO RECOMMEND MANAGEMENT ACTIONS TO MITIGATE EXTERNAL RISKS.

RECOMMENDATION 2 CONTINUE TO SUPPORT INITIATIVES AIMED AT REDUCING THE AMOUNT OF LITTER AND DEBRIS ENTERING THE BAY, AND DEVELOP OTHER LITTER MANAGEMENT ACTIONS INCLUDING EDUCATION AND AWARENESS PROGRAMS FOCUSSED NOT JUST ON COMMERCIAL OR RECREATIONAL FISHERS, BUT ALL USERS OF THE BAY.

The catches of many of the key species examined in this report appear to primarily driven by recruitment variation (the number of young fish entering the population each year) that is in turn related to variation in the environment. For some species this variation is related to catchment and sewage nutrient inputs driving production of plankton food for larvae (e.g. Snapper, Southern Sand Flathead). For other species it is the environmental influence on habitat that drives recruitment variation. For example, seagrass is a key habitat for the reproduction and survival of species such as King George Whiting, Rock Flathead, Southern Calamari and Gummy and School Sharks. Seagrass, in turn, shows dramatic fluctuations in relation to nutrients and sediments entering from the catchment.

Risks to water quality and habitat from inputs such as nutrients, sediments and contaminants from the catchment and sewage treatment, together with port activities such as ship movement (and potential oil spill or introduction of marine pests) and channel deepening, and coastal development affecting sediment transport processes, are key risks to the fish populations in Port Phillip Bay. Changes to nutrient inputs can present a risk in both directions. Excess nutrients can lead to algal blooms and anoxic zones affecting fish and habitats such as seagrass, but conversely too few nutrients may lead to lower seagrass growth and fish productivity. Contaminants are likely to be a major issue for high trophic level TEP species such as Burrunan Dolphins and seals (for example, see Monk *et al.*, 2014). Another common concern to all fisheries, and the ecosystem of Port Phillip Bay more generally, is the translocation of marine pests that can have dramatic effects on productivity and habitat.

External hazards were not a major focus of this ERA and a more detailed assessment of these hazards and their associated pathways to fish and habitat with potential flow on to management actions is a recommended outcome of this report to help ensure the future sustainability of fishing in the Bay. A more comprehensive understanding of the ecology of the Bay, given extant human impacts and hazards, is required to adequately manage this important coastal ecosystem. Thus, a broader focus is required beyond just fisheries management to mitigate external risks/impacts on the Bay. At present there are a number of management plans/efforts aimed at maintaining or improving the ecological integrity of the bay in relation to external risk factors, including the Port Phillip Bay Environmental Management Plan (PPBEMP) and the State Environmental Protection Plan (SEPP).

5.4.3 Fishery Related Hazards

KEY POINT 24. THERE WAS GENERALLY MORE CERTAINTY IN ASSESSMENTS OF THE COMMERCIAL FISHERIES BECAUSE OF THE RELATIVELY LOW NUMBER OF PARTICIPANTS AND THE MANDATORY REPORTING OF CATCH AND EFFORT DATA.

KEY POINT 25. RISKS OF TRANSLOCATION OF INTRODUCED SPECIES WAS A FISHERY-RELATED RISK COMMON TO ALL FISHERIES.

RECOMMENDATION 3 WHILE THE RECREATIONAL FISHERY APPEARS TO BE SUSTAINABLE, MONITORING OF CATCH AND EFFORT SHOULD BE REGULARLY UNDERTAKEN, AND METHODS SHOULD BE DEVELOPED TO DETERMINE SUSTAINABLE CATCH LIMITS TO IMPROVE CONFIDENCE IN ASSESSMENTS.

In terms of the risks directly associated with the activities of the sub-fisheries, there was some variation depending on the nature of the particular sub-fishery. For example, there were a number of risks associated with the recreational hook and line fishery that were related to the incremental effects of the large number of boats active in the fishery. The risks include the potential effects of debris (e.g. plastics) and gear loss (e.g. fishing line), and boat strikes on TEP species. In most cases the consequences were moderate and considered sustainable. Management actions such as education programs to reduce debris and lost gear emanating from the fishery (where the consequence was rated as Major) are recommended.

RECOMMENDATION 4 EXPAND THE EXISTING ANGLER DIARY PROGRAM TO THE PORT PHILLIP BAY FISHERY

RECOMMENDATION 5 IMPLEMENT A MANDATORY LOGBOOK SYSTEM FOR FISHING CHARTER OPERATORS ADMINISTERED THROUGH THE COMMERCIAL CATCH AND EFFORT SYSTEM.

Although the direct fishing impacts of recreational fishing are considered to be sustainable based on current management controls, confidence among stakeholders tends to be low because the total effort and catch of key species is poorly known. Estimation of total catch and effort for this sub-fishery on a regular basis is recommended. Furthermore, there is a need to develop methods for determining sustainable catch limits in a recreational dominated fishery to improve confidence in the assessment of sustainability.

Compared with recreational fishing, participation rates (e.g. boats) for commercial fishing in the Bay is relatively low. In general, there were a low number of mostly 'Moderate' risks for sub-fisheries evaluated. There was more certainty in assessing the direct impacts of fishing on target species due to comprehensive catch and effort data. However, there was much less information available about discarding rates making the assessment of bycatch impacts much less certain. There was considered to be a moderate but sustainable consequence for seagrass habitat from haul-seining activities. However more comprehensive impact assessment is needed. Mesh netting and purse seining carried a risk of TEP species interactions (penguins, seals and dolphins) whereas mesh netting (and to a lesser extent long-lining) also carried the risk of ghost fishing by lost gear (a very rare event).

The recreational spearfishing sub-fishery was assessed as low risk with the exception of potential localised depletion of fish for reefs which are readily accessible from the shore.

RECOMMENDATION 6 CAREFULLY MANAGE THE RISK ASSOCIATED WITH HIGH-GRADING DISCARDING OF UNDERSIZE TARGET SPECIES BY RECREATIONAL HOOK AND LINE AND THE COMMERCIAL HAUL-SEINE FISHERIES.

RECOMMENDATION 7 CONTINUE TO PROMOTE EDUCATIONAL MATERIALS THAT MAXIMISE SURVIVAL OF RELEASED UNDERSIZE FISH.

A risk that requires careful management for both the recreational hook and line and the commercial haul-seine fisheries is the discarding of undersize target species. Given that fish populations tend to be recruitment driven, ensuring the maximum survival of released undersize fish should be a priority. High-grading has been identified as an issue for the recreational Snapper fishery in Port Phillip Bay (Ford and Gilmour, 2013), and this issue may become more of a problem with increasing participation in recreational fishing.

RECOMMENDATION 8 INCREASE THE PUBLIC EDUCATION ABOUT THE RISK OF FISHING ACTIVITIES TO BURRUNAN DOLPHIN AND OTHER TEP SPECIES.

A number of the risks directly attributed the sub-fisheries relate to TEP species, and particularly the Burrunan Dolphin, where a genetically distinct population of only about 100 individuals lives in Port Phillip Bay (Charlton-Robb *et al.*, 2015). Careful management to reducing risks to this population from fishing related activities should be a priority. This management could be by way of increased public education about risks to TEP species.

RECOMMENDATION 9 INCREASE PUBLIC EDUCATION AND AWARENESS OF RESOURCES AVAILABLE UNDER THE NATIONAL SYSTEM FOR THE PREVENTION AND MANAGEMENT OF MARINE PEST INCURSIONS TO REDUCE REDUCE THE RISK OF SPREADING MARINE PESTS.

A high fishery-related risk that was common to all the sub-fisheries was the spread of marine pests. Translocation of introduced species (and potentially native species such as White Urchins) can have major impacts on habitats and communities and flow on effects for target, bycatch and TEP species that depend on those habitats. An example of the potential risk from this hazard is posed by the introduced alga *Caulerpa taxifolia* that has replaced native seagrass in coastal areas of New South Wales and South Australia. If this species were translocated to Port Phillip Bay, for example by way of a trailer boat or fishing vessel, there would potentially be replacement of seagrass habitat and the associated community, as well as target species and bycatch species (e.g. King George Whiting, Gummy Shark), and TEP species (e.g. pipefish and seahorses). A recent example of translocation within the Bay is the introduction of Japanese Kelp, *Undaria pinnatifida*, to the Queenscliff Harbour (Werner and Hirst, 2012).

5.4.4 Further Analysis

RECOMMENDATION 10 BECAUSE THE MAIN RISKS ARE EXTERNAL TO FISHING, A MORE TRADITIONAL RISK ASSESSMENT APPROACH SHOULD BE USED TO IDENTIFY THE STRESSORS, PRESSURES AND IMPACT PATHWAYS POSING THE GREATEST RISK TO FISHERIES IN THE BAY

The ERAF method allows for sub-fishery related risks at Level 1 (SICA) of 'Moderate' or higher. More detailed risk assessment, Level 2 includes the Productivity and Susceptibility Analysis (PSA) approach. This is a method of assessment which allows all units (individual species, habitats etc.) within any of the ecological components (Target species etc.) to be effectively and comprehensively screened for risk. The units of analysis are the complete set of species, habitats or communities identified at the scoping stage. The Level 2 PSA is based on the assumption that the risk to an ecological component will depend on two characteristics of the component units: (1) the extent of the impact due to the fishing activity, which will be determined by the susceptibility of the unit to the fishing activities (Susceptibility) and (2) the productivity of the unit (Productivity), which will determine the rate at which the unit can recover after potential depletion or damage by the fishing. The PSA approach examines attributes of each unit that contribute to or reflect its productivity or susceptibility to provide a relative measure of risk to the unit. Full details of the methods are described in Hobday *et al.*, (2007). At this stage a PSA analysis has not been developed for the "Community" component.

A different methodology is required to assess external risks in more detail. This methodology is more in line with traditional risk assessment which quantifies likelihood and consequence of identified hazards. Such analysis considers stressors (e.g. stormwater in catchment inputs) and the pressures that result from them (e.g. heavy metals) together with the impact pathways that lead them to the values under consideration (e.g. a pathway where the stressor has an effect on fish health leading to an effect on fishing). This approach could be more valuable than a Level 2 PSA analysis given that the highest risks identified in the ERAF were for external hazards. The analysis would identify the stressors, pressures and impact pathways posing the greatest risk to fisheries in the Bay. This information could be used by non-fishery managers (e.g. catchment, coastal, water quality) in the policy and planning to reduce external risks to fishing in the Bay.

5.4.5 Summary

Most risks directly associated with the sub-fisheries tend to be of 'Moderate' or lower consequence and are considered sustainable given current management controls. A proviso, however, is that many of the assessments have a low confidence associated with them, mostly because of a lack of data. In particular, it is important that assessments of total catch and effort for the recreational fishery are undertaken at regular intervals. By far the greatest risks to the ecologically sustainability of fishing in Port Phillip Bay come from 'External Hazards' associated with population, catchment, industry and development impacts on the Bay. Careful assessment of the risk pathways to important fish populations would be beneficial in identifying potential management actions that could mitigate risks associated with these hazards.

5.5 Glossary of Terms for ERA

Bycatch species	A non-target species captured in a fishery, usually of low value and often discarded (see also Byproduct).
Byproduct species	A non-target species captured in a fishery, but it may have value to the fisher and be retained for sale.
Community	A complete set of interacting species.
Component	A major area of relevance to fisheries with regard to ecological risk assessment (e.g. target species, bycatch and byproduct species, threatened and endangered species, habitats, and communities).
Consequence	The effect of an activity on achieving the operational objective for a sub-component.
Core objective	The overall aim of management for a component.
Ecosystem	The spatially explicit association of abiotic (non-living) and biotic (living) elements within which there is a flow of resources, such as nutrients, biomass or energy.
External factor	Factors other than fishing that affect achievement of operational objectives for components and subcomponents.
Eutrophication	Excess growth of algae caused by high levels of nutrients that can impact other habitats
Fishery method	A technique or set of equipment used to harvest fish in a fishery (e.g. long-lining, purse-seining, trawling).
Fishery	A related set of fish harvesting activities regulated by an authority (e.g. South-East Trawl Fishery).
Habitat	The place where fauna or flora complete all or a portion of their life cycle.
Hazard identification	The identification of activities (hazards) that may impact the components of interest.
Indicator	Used to monitor the effect of an activity on a subcomponent. An indicator is something that can be measured, such as biomass or abundance.
Likelihood	The chance that a sub-component will be affected by an activity.
Operational objective	A measurable objective for a component or subcomponent (typically expressed as "the level of X does not fall outside acceptable bounds")
PSA	Productivity-Susceptibility Analysis. Used at Level 2 in the ERAEF methodology.
Recruitment	The number of young of a species entering the population each year
Scoping	A general step in an ERA or the first step in the ERAEF involving the identification of the fishery history, management, methods, scope and activities.
SICA	Scale, Impact, Consequence Analysis. Used at Level 1 in the ERAEF methodology.
Sub-component	A more detailed aspect of a component. For example, within the target species component, the sub-components include the population size, geographic range, and the age/size/sex structure.
Sub-fishery	A subdivision of the fishery on the basis of the gear or areal extent of the fishery. Ecological risk is assessed separately for each sub-fishery within a fishery.
Sustainability	Ability to be maintained indefinitely

Target species	A species or group of species whose capture is the goal of a fishery, sub-fishery, or fishing operation.
Trophic position	Location of an individual organism or species within a foodweb.
Unit of analysis	The entities that occur within each component. For example, the units of analysis for the Target Species component are individual "species"
Vulnerability	Susceptibility to negative effects from a hazard

6 Implications

6.1 Key Threats

Key environmental threats to Port Phillip Bay are described in the Port Phillip Bay Environmental Management Plan: Background Document (DNRE, 2002). In no particular order, the environmental risks are: deterioration of water quality through increased nutrient loading and detrimental changes to nutrient cycling; toxicant inputs; increased suspended solids levels and the presence of pathogens; presence of litter; exotic marine organisms; physical disturbance of habitats; and harvesting activities. This list of threats was used as the basis for the social survey questionnaires and also to modify the standard template of external risks for the ERA.

Port Phillip Bay is nitrogen limited (Harris *et al.*, 1996). Denitrification occurring within the sediment maintains high water quality within the Bay (Longmore and Nicholson, 2008), helping to avoid major algal blooms and eutrophication (DNRE, 2002). Sources of nitrogen into the Bay include catchment waterways (including storm water run-off into those waterways), the Western Treatment Plant and other licenced discharged, the atmosphere and groundwater.

Toxicants can enter the Bay via a large range of pathways including shipping and boating, rivers, drains, licensed discharges, groundwater, and the atmosphere (DNRE, 2002). Through killing, or otherwise affecting systems and behaviours of biota, toxicants can alter composition of ecological communities by changed species abundance. Toxicants can also bioaccumulate, posing health risks to humans.

Suspended solids can enter the Bay from erosion, storm water, airborne particles, sewerage, and bacteria and other micro-organisms, and can be re-suspended by dredging (DNRE, 2002). They can affect seagrass by reducing light penetration, smother biota and carry nutrients, toxicants and pathogens. Suspended solids also result in murky water, reducing the aesthetics and beneficial uses of the Bay, potentially negatively affecting recreational activities such as swimming and diving.

Sources of pathogens (including viruses, bacteria, fungi and parasites) to the Bay include sewerage treatment plants, rivers, drains and sewerage discharge from vessels (DNRE, 2002). Pathogens in the water can make swimming in contaminated areas unsafe.

Litter in the Bay comes mostly from the metropolitan area, with some also coming from beach goers, boats or ships (DNRE, 2002). Apart from reducing the aesthetics of the Bay, litter can also be harmful to wildlife, particularly seabirds and mammals.

Port Phillip Bay is one of the most invaded marine ecosystems in the Southern Hemisphere, with 160 introduced and cryptogenic species having been identified (Hewitt *et al.*, 2004). Translocation can occur from shipping (via hull fouling and ballast water) and recreational boating. Introduced marine species can affect the composition of ecological communities, reduce visual amenity, and impact on aquaculture, commercial and recreational fishing, water sports industries, and domestic and international tourism (DNRE, 2002).

Dredging, spoil disposal, harvesting techniques that involve contact with the sea floor, and engineering works (e.g. marina constructions) that change water and sediment movement patterns (DNRE, 2002) can re-suspend suspended solids, pathogens and toxicants, reduce light penetration and impact on the ecological communities in the immediate area.

Commercial and recreational fishing can have direct effects on the abundance of target and non-target species, also potentially affecting their population age and size structure (DNRE, 2002).

6.2 Findings

The Target One Million plan aims to increase the number of recreational fishers in Victoria to 1 million by 2020 [111], and it can reasonably be expected that the distribution of growth in recreational fishing participation will be in proportion to population distribution. Recreational fishers commonly identified crowding of boat ramps and fishing locations and overfishing by recreational fishers as major issues impacting the level of satisfaction with their fishing experience. The cause of these issues relate to a lack of facilities (e.g. boat ramps), too many boats and a lack of appropriate (or adherence to) regulations on fish size (too small) and/or catch limits. Logically, each of those issues could be made worse as the number of recreational fishers in the Bay increases. Crowding at boat ramps can be addressed by improving existing (and building new) boat ramps and car parking facilities. Crowding on the water could (to a small extent) be reduced by building artificial reefs and land-based fishing platforms. However, recreational fishers often aggregate in popular areas, and unless management arrangements are introduced, an increase in recreational fishing could lead to an increase in the recreational catch, potentially threatening the sustainability of popular species.

The social assessment highlighted that pollution is the greatest commonly perceived issue and cause of other identified issues relating to fisheries sustainability in the Bay. Similarly, the ERA identified the greatest risks to Port Phillip Bay's fisheries to be "external hazards" to water quality and habitat from inputs such as nutrients, sediments and contaminants from the catchment and sewage treatment, together with port activities such as ship movement (and potential oil spill or introduction of marine pests) and channel deepening, and coastal development affecting sediment transport processes. These findings highlight the following needs:

- the importance of continued environmental monitoring of the Bay,
- improved catchment management practices to reduce pollution and rubbish;
- mitigation against translocation and spread of exotic marine organisms;
- planning and preparation for risks posed by oil spills; and,
- community and fisher education as to the effects of rubbish and pollution on the environment that they seek to enjoy.

6.3 Outcomes

The final report together with the one-page summary of this project will be made publicly available, and provided to DEDJTR, SIV, VRFish, FOCBAG, VFARM, VNPA and CMAs (Port Phillip and Westernport CMA and Corangamite CMA). The planned outcome of the project was that fisheries management decisions regarding resource sharing of Port Phillip Bay's fisheries would be informed by scientifically defensible information on the ecological risks associated with the fisheries of Port Phillip Bay, and the social drivers underpinning the conflict regarding shared access to the resources by the commercial and recreational fishing sectors. However, the 'Target One Million' plan (the Plan) which came into action during the early stages of this project has committed to phasing out commercial netting in Corio Bay by 2018, and throughout Port Phillip Bay during 2022[112], affected the intended outcome of this research. In banning commercial netting, the Plan is expected to reduce conflict arising from resource sharing among commercial and recreational fishers, despite the continuance of some commercial fishing using long-lining (88 t quota spread amongst 8 licences) in Port Phillip Bay. Despite this, the authors of this study believe that the results may be used to inform the manner in which future management decisions for the fisheries sector are approached.

Commercial netting continues to be undertaken in Corner Inlet and the Gippsland Lakes, where there has also been some resource sharing conflict between recreational and commercial fishers (for example, see[113]). While the results of this study cannot be directly applied to the Corner Inlet and the Gippsland Lakes fisheries, some attempt to understand the ecological risks and social drivers of each fishery should be made when making management decisions. The methods used in this report could be undertaken for any fishery for which there are resource sharing issues.

[111] ibid
[112] http://agriculture.vic.gov.au/fisheries/recreational-fishing/target-one-million/pulling-nets-out-of-the-bay
[113] http://www.abc.net.au/news/2015-05-28/fishers-urge-gippsland-lakes-commercial-fishing/6502970

An improved factual understanding of the ecological risks of both the long-line and recreational sectors by the general public and recreational fishers will assist in reducing the risk of inflammation and further conflict between those two sectors.

6.4 Recommendations for improved cross-sectoral management of Port Phillip Bay fishery resources

This report provides descriptions of the social issues and a qualitative ecological risk assessment relating to fishing in Port Phillip Bay. An understanding of issues affecting concerns and perceptions of stakeholders has emerged. Conflict in resource sharing has led to the implementation of a commercial netting ban. This reflects the advocacy and political potency of organised recreational anglers (a numerically greater representative group than commercial fishers in the Bay). Removal of commercial netters will not reduce ecological impacts of pollution and of introduced marine pests (among other identified external hazards). The commitment to completely remove one sector involved in the conflict (commercial netters) negates the need for recommendations for improved cross-sectoral management, and so this section instead makes recommendations for management of the Bay's fisheries resources in general.

In their review of the ban on fishing in estuarine waters of NSW, Momtaz and Gladstone (2001) concluded that meaningful consultation with commercial fishers and a social impact assessment could have resulted in a better decision making processes and outcomes. It is clearly too late for this report to influence decisions regarding the banning of netting in Port Phillip Bay, but in light of the Target One Million plan, this report highlight's that with a better understanding of the social drivers of the conflict and of the actual ecological risks posed by fishing, that more equitable management arrangements may have been implemented to reduce the conflict. Some commercial long-lining will continue, and it is hoped that the results of this study will inform management arrangement for that sector. Further, improved factual understanding of the ecological risk of the long-line and recreational sectors by the general public and recreational fishers will reduce the risk of continued conflict between those two sectors.

Of no surprise, one of the main issues cited by recreational fishers is a lack of facilities, in particular, boat ramps and parking at boat ramps. A lack of boat ramps and boat ramp parking has been an issue for many years. A report undertaken by VRFish (2010) reviewing boat ramp facilities around Westernport and Port Phillip Bays, found excessive queuing times at many ramps (sometimes more than two hours), whereas boaters considered acceptable queuing times were in the range of 10–15 minutes. They also suggested that achieving the acceptable queuing time during peak times was unrealistic, even if their recommendations for improving boat ramp facilities were implemented. While boat launching facilities have been improved, it is clear that congestion is still an issue, and exacerbates conflict of any kind. This will be further exacerbated by the Target One Million policy, which is reasonably likely to result in more boats and / or more boat-based fishing trips.

The common theme throughout both the social and ecological components of this study highlight that by far the greatest issues, perceived causes of issues, and risks to the ecologically sustainable fishery in Port Phillip Bay, come from 'External Hazards' associated with population increases and attendant development, catchment and industry impacts on the Bay. An improved understanding of those hazards and effective mitigation actions for the associated risks should be the focus of further work. A better understanding of the hazards' associated pathways to fish and habitat is required to recommend management actions to mitigate external risks.

There are a number of initiatives aimed at reducing the amount of litter and debris entering the Bay. In 2012–13 alone, the Victorian Government removed 7,850 t of litter and debris from waterways around Melbourne[114]. The "Seal the Loop" program places fishing line bins around land-based fishing platforms to promote and facilitate correct disposal of waste by anglers. We recommend continued support for these initiatives, and that other litter management actions including education and awareness programs be developed focussed not just on commercial or recreational fishers, but all users of the Bay and in areas where activities can have downstream effects on the health of the Bay.

[114] http://yarraandbay.vic.gov.au/issues/litter

The estimation of total catch and effort by the recreational sub-fishery should be undertaken on a regular basis. Furthermore, there is a need to develop methods for determining sustainable catch limits in a recreational dominated fishery to improve confidence in the assessment of potentially vulnerable fish stocks. Commercial catch and effort is currently one of the main indicators of change in relative stock size for commercial and recreational species in Port Phillip Bay. The removal of netting from the Bay brings the long time series of catch, effort and CPUE data to an end. While some longlining will remain, the value of the CPUE data from that sector as an indicator of abundance is uncertain, but in any case, will only include the main target species (Snapper) and possibly major byproduct species. Annual pre-recruit and larval surveys are carried out for Snapper (Kemp *et al*., 2012a) and King George Whiting (Kemp *et al*., 2012b) respectively, however, there is no monitoring of adult populations in the Bay. Existing monitoring programs could be expanded. For example, Fisheries Victoria currently run an angler diary program for Anderson Inlet, Mallacoota Inlet, Lake Tyers and the Kiewa River, and angler diaries were used to monitor fish stocks during and after the Port Phillip Bay Channel Deepening Project [115]. As recommended by Ford and Gilmour (2013), this program should be expanded to monitor Port Phillip Bay's fish stocks. In line with most other Australian states (including South Australia, NSW, Queensland, Western Australia), a mandatory logbook system for fishing charter operators could be implemented that is administered through the commercial catch and effort system.

Ensuring the maximum survival of released undersize fish should be a priority for management, especially considering the plan to increase the number of recreational fishers in the state to 1 million. There have been many studies estimating the post-released survival of recreationally caught fish (e.g. Grixti *et al*., 2010), and ways of maximising their survival (e.g. Lenarton *et al*., 2009). Results of these studies have been used to produce best practice guides (e.g. NSW DPI, 2013), posters / fact sheets (e.g. see various posters and fact sheets at [116]) and videos (e.g. see [117]), as well as the "National strategy for the survival of released line-caught fish: tropical reef species" (Brown *et al*., 2008). Recfishing Research hosts species-specific best practice guides for release on their website[118], including main target species in Port Phillip Bay (including King George Whiting, Snapper, Sand Flathead, Trevally, Sharks and Rays, Bream and Australian Salmon). These, together with other relevant educational materials, should continue to be promoted throughout the state via a wide range of media and events.

Reducing risks to the Burrunan Dolphin population from fishing-related activities should be a priority. DSE (2011) have produced a document titled "A guide to boating and swimming around whales, dolphins and seals", that should be promoted, while the Dolphin Research Institute[119] are currently running a "Keep our dolphins safe" campaign. There is also potential to reach all registered boat owners via post with annual registration renewal notices.

As a part of the National System for the Prevention and Management of Marine Pest Incursions, the "National Biofouling Management Guidelines for Recreational Vessels"[120] describes best practices to reduce the risk of spreading marine pests by managing biofouling on vessels, and they have also produced similar guidelines for other types of vessels including commercial fishing and aquaculture, commercial ships and non-trading vessels. We recommend that the availability and key messages of these resources be promoted amongst the relevant sectors.

[115] http://agriculture.vic.gov.au/fisheries/science-in-fisheries/fisheries-research-findings/angler-diary-program
[116] http://recfishingresearch.org/fact-sheets/
[117] https://www.youtube.com/watch?v=PXBGArmhts
[118] http://recfishingresearch.org/fact-sheets/
[119] http://www.dolphinresearch.org.au/
[120] http://www.marinepests.gov.au/national-system/Documents/biofouling_guidelines_rec.pdf

7 Extension and Adoption

The objectives of the extension and adoption plan are to provide scientifically defensible information on the ecological risks associated with the fisheries of Port Phillip Bay and the social drivers underpinning the conflict regarding shared access to the resources by the commercial and recreational fishing sectors to key stakeholders. The objective is for this information:

- To be available for fisheries management to make informed decisions regarding the management of commercial and recreational fishing sectors; and
- To help understand the values of each sector that puts them at odds with each other to help resolve potential conflicts based on inadequate or incorrect information.

The target audience are a wide range of stakeholder groups including, but not limited to: DEDJTR; SIV; VRFish; FOCBAG; VFARM; VNPA; CMAs (Port Phillip and Westernport CMA and Corangamite CMA); recreational anglers; and, the general public.

The key messages from this project are that:

- The main issues and perceived causes identified by different sectors relate to external factors that are not directly related to impacts of fishing on fish stocks or the environment.
- The main issues and perceived causes are:
    - environmental impacts from pollution caused by land based activities, and
    - crowding due to too many recreational vessels on the water and at boat ramps.
- The ERA revealed that the highest risks to the Bay's ecology were from external factors on fish stocks or the environment, not directly related to impacts of fishing. These are environmental impacts of development from within the catchments.

Extension and adoption during the project was undertaken through a range of methods, primarily being face to face meetings, which were held with a wide range of stakeholders to inform and received feedback on both the ERA and social assessment.

Presentations were made to invited stakeholders at a workshop on 5 November 2015 to discuss findings and recommendations. This was used as an opportunity to receive critical feedback of results. A one-page summary of the project will be published on the FRDC website and the URL will be sent to stakeholders who have been involved in the research. A media release will be distributed after approval from the FRDC (using their distribution list) and an article will be published in their FISH magazine describing the results of the project. After completion of this project, results will be presented at a relevant national conference (e.g. Seafood Directions, the Australian Recreational Fishing Conference). A manuscript will also be written for publication in a peer reviewed journal such as Fisheries Management.

Table 18. Measures of success of extension and adoption plan.

Method	Measure of success
Face to face meetings with stakeholders to inform ERA and social assessment	The required information was obtained from stakeholders to adequately inform ERA and social assessment.
Information release (FRDC Facebook)	FRDC released information about this project on their Facebook site on 31 October 2014[121]
Presentations to stakeholders	Workshop presentations were made to key stakeholder groups on 5 November 2015.
One page summary	A project summary has been produced. After approval from the FRDC, it will be published on the Fishwell Consulting website. URL sent to DEDJTR; SIV; VRFish; FOCBAG; VFARM; VNPA; CMAs (Port Phillip and Westernport CMA and Corangamite CMA); recreational anglers; and the general public.
Media release	One media release was produced at the start of the project and was distributed. Another media release was written and distributed after approval from the FRDC.
FRDC FISH magazine article	We have requested that an article describing results of this project is published in FISH magazine.
Conference presentation	Subsequent to submission of the Final Report, we will request a spot at a National or International conference to present results of this project.
Final report	The final report has been submitted after addressing suggested changes.
Peer reviewed publication	A peer review publication submitted and accepted. Potential journals include: • Fisheries Management and Ecology • Marine Policy Marine Policy • Marine and Coastal Fisheries

[121] www.facebook.com/FRDCAustralia/posts/800348000004234:0

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9 Appendix 1: Angler survey interview questions

Q1. INTRODUCTION: BRIEFLY EXPLAIN SURVEY (OPINIONS ETC). In the next few questions we would like to know about the reasons why you go fishing in Port Phillip Bay.

Have you been asked about this before in a survey? Yes (*Thank & Terminate*) 1
No 2sa

Q2. What are the species of fish that you prefer to catch at Port Phillip Bay?

1.____________________________ 2.____________________________ 3.____________________________

Q2. Now I'm going to read out some reasons why people go recreational fishing. As I read each one, please tell me how important each reason is for you.

	Very important?	Quite important?	Not very important?	Not at all important?	UNSURE
(1) To relax or unwind	1	2	3	4	5
(2) To be outdoors, in the fresh air, to enjoy nature	1	2	3	4	5
(3) To be on your own, to get away from people	1	2	3	4	5
(4) To spend time with your family	1	2	3	4	5
(5) To spend time with friends (other than family)	1	2	3	4	5
(6) To compete in fishing competitions of any kind	1	2	3	4	5
(7) For the enjoyment or sport of catching fish.	1	2	3	4	5
(8) To catch fresh fish for food	1	2	3	4	5

SG1 • *interviewer: if main reason evident in q2 (e.g. only one rated extremely important), otherwise, go to q3*

Q3. Interviewer: quickly read back/reference for the respondent Main reason (No.) ☐
Those reasons rated equally and highest in Q2, then ask:
Which of these would say is the main reason why you go fishing in Port Phillip Bay?

Q4. Now can you rate how important the following reasons are when you go fishing in Port Phillip Bay:

I fish in Port Phillip Bay because	Very important?	Quite important?	Not very important?	Not at all important?	UNSURE
(1) It is somewhere that I am familiar with	1	2	3	4	5
(2) It is a location that is easy to get to	1	2	3	4	5
(3) There is access to town services and facilities	1	2	3	4	5
(4) I have a good chance of catching [target species]	1	2	3	4	5
(5) removed shoreline access fishing option					
(6) It has good boat fishing assess	1	2	3	4	5
(7) To find a private spot to fish without anyone else around	1	2	3	4	5

Q5 (a) (And) thinking of (all) the fishing, that you've done over the last 12 months in Port Phillip Bay, how satisfied are you with the overall quality of the fishing in that time? Would you say

Very satisfied? *(end survey)* 1
Quite satisfied? (*end survey)* 2
Not very satisfied? 3
Not at all satisfied? 4
UNSURE *(end survey)* 5

(b) (And) why do you say that? Any other reason (why you're dissatisfied etc.)? (INTERVIEWER: PROBE FOR/RECORD UP TO TWO REASONS BELOW, INCLUDING ANY PERCEIVED CAUSES OF PROBLEMS ETC.)

(i) Issue/problem: ______________________________
Perceived cause: ______________________________
Issue/problem: ______________________________
Perceived cause: ______________________________

10 Appendix 2: Themes emerging from interviews

Identity:

- Community Groups:
  - Concerned with the ecological health of the bay's sanctuary's
  - Provide information on usage patterns of sanctuary's
  - Monitor illegal fishing
  - Focussed on giving fish a chance to develop and mature naturally
  - Stand for exposing the truth.
  - A means to connect with local Bay issues and express concerns
  - Protection and management of the maritime coast
  - Combatting the inertia of government
  - Assisting in the establishing and re-establishing good management practices
  - Older 'baby boomer' demographic and those who have sought out interest and participation in the group.
- Commercial Fishers
  - It's my backyard – where I grew up and know
  - Family tradition
  - Social circles and networks are built around fishing for multiple generations.
- Recreational Fishers
  - Emerging conservation and green ethic in younger fishers
  - Family activity to involve children
  - An activity that allows interaction with 'mates' and partners
  - Fishing generates a positive experience
  - Has a sentimental attachment to the sport from its origins in childhood and family holidays.
  - Like having the idea of generations of fishers in the family.
  - Spearfishing can be more rewarding when using skill and technical knowledge to hunt specific species.
  - There is a strong community of spear fishers that know each other – it's a bit like a "tribe or clan" - is very rewarding.
  - Fishing is associated with friends of the family, grandparents and friends, as well as being enjoyed as a solitary activity.
  - Has got spots that he goes back to (logs them on the GPS) at certain times of the year that have been proven to be good.
- Wholesale/Retail sector
  - Family tradition – both for the seller and customer
  - Members of the family are or have often been involved in the industry in some form.

Benefits:

- Community Groups:
  - Sanctuary zones are great nursery areas.
  - Being involved gives an opportunity to do something that values the whole environment.
  - "Feel like you're on a mini holiday – its really nice"
  - Work of the group gives the benefit of more mature fish to catch
  - Ensures the future of the opportunity of family interactions around recreational fishing.
  - Looking after the future of a past time that is on the 'doorstep.'
  - Looking after the economic and social future for local businesses through recreational fishing.
  - Increasing the number of marine parks in the bay
  - The Bay represents the playground of the residents of Melbourne and its environs.
  - Benefits accrue for people from both the natural and social value of the coast (terrestrial and marine)

- Commercial Fishers
    - The Bay is easier and more cost efficient to access because it is known intimately
    - Make good money
    - Location is more protected from the weather and therefore safer
    - Home every night and it allows a good family life as against trawl fishing offshore in the Strait.
    - Being outdoors on the water – have always needed to be around water
    - Members of the family have always been in either farming or fishing
- Recreational Fishers
    - Provides an opportunity for social interaction across age ranges and abilities.
    - Often choose location because of proximity to home and ease of access.
    - Fishing is 'time out' and 'wind down' time on his own. It is relaxation time so not always a huge deal if they don't catch a fish.
    - Mental health and wellbeing benefits for those participating in fishing
    - Recreational fishing and clubs associated with it, provide a form of 'men's shed' well being benefit.
    - Provides a means to generate social interaction
    - Provides a means to connect people in clubs from different regions.
    - Recreational fishing organisations and the activity provide a means to develop the environmental stewardship of and educate, recreational fishers.
    - Favour marine parks and catch and release ethics of fishing
    - Feels good about being able to provide a feed of fish to the family – they like seeing where their food comes from.
    - Handicapped or people of all different ages are on the same level.
    - Organising community fishing events - "Its really rewarding".
    - Plenty of times when you come home with nothing it's still been a rewarding time out… "a great swim"
    - There is no by catch and you can specifically target the species you want.
    - Familiarity, proximity and access are the benefits of fishing in the Bay. The Bay is good for introducing kids to fishing because of the lack of swell and it's safer.
    - Being a member of a club is great as all members share the same passion.
    - Spear fishing is very rewarding in terms of it being a very specific activity that is quite technical in terms of all the factors that come into play. But it also doesn't have to be technical either – there are people who are more the 'summer fisher/diver'.
- Wholesale/Retail sector
    - Good lifestyle and income
    - Allow to work your own business
    - Like interacting with the customers
    - Able to provide fresh fish to people who can't fish for themselves, as well as being able to provide fish from other regions
    - Enjoy being able to provide information about the fish that customers are buying if they are interested

Issues:

- Community Groups:
    - Jet skiers are possibly the biggest issue for the sanctuary areas but doesn't happen often enough to do anything significant about it.
    - Land based run off of contaminants – e.g. the RAAF base had to remediate land due to contaminants.
    - Pollution and nutrient discharge are key issues
    - The destruction of green wedges causes more run off into the bay
    - 'Saltwater Coast' is a development right next door to Point Cooke Marine Sanctuary that could be a concern, but they may implement a central drainage wetland which would be positive.
    - Everyone talks about the effects of dredging and while there is a lot of silt – not sure.

  - Fresh water inflows and nutrient influxes increasing algae can be a problem – but not entirely sure of the causality: increased algae is being reported right across the bay.
  - Thinning of fish in non-sanctuary areas.
  - Detritus identified is generally recreational fishing gear – lures and bits of fishing line
  - Overfishing through illegal recreational fishing and poaching in sanctuary zones.
  - Urchins causing barren areas along with north pacific sea stars which appear to be increasing dramatically. Even in sanctuary zones where there are lots of snapper to eat the urchins.
  - Erosion of the Beaches
  - Storm water pollution and runoff from the catchments
  - Loss of wetlands that results from coastal developments
  - Effects of both commercial and recreational fishing
  - Pollution and negative benthic impacts of activities on and around boat ramps – mostly from recreational fishers
  - Pollution effects from recreational motor boats/clubs and moorings
  - Marine inference from the dredging for the deepening of the shipping channel.
- Commercial Fishers
  - There are lots of sea lice around the treatment plans on the edges of the Bay that just destroy the fish
  - Dredging has caused a whole lot of silt all over the bay that no one sees
  - Detergents in the water are affecting the sea grass and potentially causing the green slime which is the worst this year ever.
  - Pollution is the biggest problem - "Werribee – sometimes the water gets brown" thinks that this has to do with the detergents being discharged into the water.
  - Loss of seagrass habitat is concerning
  - Flushing from estuaries of pesticides etc with rain events.
  - Pollution is the biggest influencer of the health of the Bay and therefore the fish – general rubbish that comes down with rain and flushing events into the Bay.
  - Star Fish (northern Sea Star?) cover the bottom of the bay in areas and don't allow anything else to exist
  - There used to be mussels, oysters, bugs, sea snails but now you just don't get any of those in any numbers at all.
  - Oil and diesel being washed into the Bay from roads and drains about the edge.
  - Attempt to get involved in Committees and Government boards but often feel as if they are the unheard minority in the room, but their livelihood that is at stake.
- Recreational Fishers
  - There is competition for limited fishing space.
  - Certain spots there are not as many species around anymore – e.g. abalone.
  - There are more divers in the bay than ever now, usually concentrated at certain times (summer) and locations (tourist accommodation sites).
  - Overfishing is a major issue. There are more recreational fishers than ever fishing in the Bay, having an effect on the number of fish available.
  - Run off and the effect from pollutants and storm water from the streets – car oil, every day litter and chemicals must all have an effect.
  - Pollution in the bay with bottles and tackle discarded around piers and wharves.
  - Rec fishers are just seeking fair and equitable access to the resource
  - Corio Bay provides 70% of the Port Phillip Bay commercial catch when it is only 12.5% of the entire Bay.
  - Commercial fishers in the Bay are not subject to quota
  - Catch amounts of commercial fishers have been falsified
  - Conflict of the same areas in Corio Bay being used by both Commercial and recreational fishers
  - Economic cost of recreational fishing for no guarantee of a catch
  - Fish are not getting a chance to develop because they are caught by commercial fisherman
  - Kids are not adopting recreational fishing and enjoying the pastime as a past time, which was once on [the] doorstep because there are no fish to catch.
  - "It is only […] trailer boats haul seining and mesh netting that will [should?] be banned."

  - Fisheries Vic needs to look at bag and size limits in terms of decreasing bag and increasing size limits.
  - Issues with the Bay silting up which he suspects is from dust being blown into the Bay from agricultural activity in the hills and area around the bay.
  - The 'sediment at the bottom of the bay that is pulled up with the anchor is putrid'.
  - Commercial fishing in Port Phillip Bay is not of adequate value to justify the competition it poses with recreational fishing.
  - Commercial netting bans are a reallocation not a sustainability issue – which is not being clearly recognised.
  - Perception of areas being fished out by commercial fishers generates a gut reaction amongst recreational fishers of 'missing out' and their relaxation activity being taken away from them.
- Wholesale/Retail sector
  - Pressure on commercial fishers is also pressure on fresh seafood markets and retail stores
  - Concern for customers who don't recreationally fish
  - Lack of consideration by recreational fishers of the supply chain and consumer effects of shutting down commercial netting in the Port Philip Bay.
  - Loss of sardines would be a huge impact on many retailers whose customers regularly purchase product from them due to quality (2 x per week) [Quality of sardines is very dependent on being sold within 24 hours of being caught]
  - Pollution from river estuaries into the Bay

Interactions:

- Community Groups:
  - Co-operate with Parks Victoria
  - Marine Care groups collaborate
  - Public meetings and rallies
  - Family fishing days
  - Correspond with government departments and heads of departments.
  - Local restaurants don't use locally caught fish
  - Make recommendations to the government for the highest possible compensation to commercial fishers to buy out licences, aquaculture opportunities and for purse seining for sardines and pilchards to continue.
  - Seek interactions/collaborations with mutual benefit
  - Seek representation on appropriate boards and committees associated with management and development of the Bay and its environs
  - Seek to understand who they can work with and who they can't because of aspirations being too divergent.
- Commercial Fishers
  - Avoid boat ramps during day times as there is too much interaction with recreational fishers to make it worthwhile.
  - Mostly fish at night to avoid recreational fisher interaction.
  - Try to avoid interactions (people or TEPS) wherever possible to avoid the hassle and /or potential damage to nets
  - Have had very distressing interactions with vandals (recreational fishers?) who have smashed car windows and taken the wheel nuts off both car and trailer tyres while out fishing.
  - Have very little interaction with TEPs – most are sensible enough to get themselves out of the nets, or wait for assistance.
  - Generally sell to the same retailers, with very little sale of fish direct to the consumer/user (bait), so very focussed points of interaction with market and consumers.
  - Interact with and support VFARM (Victorian Fishery Association into Resource Management) and WINSC.
  - Try to communicate with recreational boaters/fishers to alert them to where nets are, but sometimes they still don't realise where they are and run through them.
- Recreational Fishers
  - Seek to work with government on issues for best all round outcomes

- Assist with extension of regulatory changes and responsible fishing practices relevant to recreational fishing.
- Jet skiers are the biggest interaction problem – “don’t obey the rules – basically [they’re] a pain in the bum”
- Boat traffic can cause problems for spear fishermen.
- Don’t have run-ins with commercial fishers as they mostly fish at night when he’s not diving.
- Interactions with commercial fishers does occur, though not a lot, mostly around the entrance to swan bay and Queenscliff (when targeting whiting).
- Commercial fishers around inner and outer Corio Bay which can cause some distress, has only occurred as a result of the closure of western port bay and the subsequent shifting of effort and displaced pressures.
- Commercial netters “make a mess of the grass beds”.
- ‘FOCBAG is working for the right cause but perhaps a more collaborative approach with a peak bodies and other stakeholders might have generated a better outcome’.

- Wholesale/Retail sector
    - Generally rely on the Melbourne Seafood Centre to represent their interests in any issues
    - Interact with the fishermen that they buy from and generally on the basis of best price.
    - Will buy fish from where ever it is available, though due to quality always attempt to get as much fish from as close to Melbourne as possible depending on the price and what their consumers are willing to pay.

11 Appendix 3 Level 1 Scale, Intensity and Consequence Analysis (SICA)

11.1 Commercial haul seine (including Garfish seine and beach seine): Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	3	3	1	Whiting are the primary target species and represent the highest catch by weight and value. All King George Whiting in Port Phillip Bay are juveniles => intensity Moderate, few boats in fishery but large nets at local scale => consequence Moderate because fishery appears sustainable, long-term trend in CPUE is increasing, catch fluctuations appear environmentally driven => confidence is low because total catch and effort (commercial and recreational) is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	3	2	2	Possible for fish to escape in the process of net retrieval, undersize whiting will generally escape through mesh, would usually be expected to survive => intensity Moderate, few boats in fishery but large nets at local scale => consequence Minor, any mortality is unlikely to be detectable at the level of the stock => confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	1	1	2	Would expect a very low rate of gear loss. Slight possibility Rock Flathead could be entangled in a lost net => intensity Negligible as nets are very rarely lost => consequence Negligible, increase in mortality would be extremely low and likely not detectable => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	2	1	Possible that anchor hitting bottom or dragging could influence whiting behaviour or movement but would be very localised => intensity Minor, few boats in fishery, anchoring occurs multiple times in process of net retrieval => consequence Minor, change in whiting behaviour/movement would be highly localised and short-term => confidence low, no data to support or refute

	Navigation/ steaming	1	3	5	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	1	1	2	Difficult to see any plausible hazard from navigation/steaming for the whiting population; possible that disturbance of the water column could influence the mortality of pelagic larvae entering bay => intensity Negligible, very few boats involved in fishery => consequence Negligible => confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the whiting population. => intensity Minor as infrequent event => consequence Major because could lead to population decline => confidence low, based on poor knowledge of potential for translocation
	On board processing	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract Snapper to waste but also predators such as sharks leading to higher localised mortality. => intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Negligible as increase in mortality would be very low relative to total mortality => confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Population size	Southern Garfish, *Hyporhamphus melanochir*	1.1	3	3	1	Small garfish that do not escape may be discarded once the net is retrieved. Fishing practices aim to release alive but some post-release mortality may occur. Incidence of meshing of undersize fish is low due to relatively large meh size in wings and relatively thick netting material => intensity Moderate, few boats in fishery but large nets at local scale => consequence Moderate as garfish are relatively fragile and susceptible to handling mortality => confidence low as there is little information on the prevalence and impact of discarding small garfish
	Stock enhancement	0									Does not occur
	Provisioning	0									Does not occur
	Organic waste disposal	1	3	3	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of whiting on a very localised scale => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change in behaviour/movement would be very small and likely not detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of whiting on a very localised scale => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change in behaviour/movement would be very small and likely not detectable => confidence low as there is no data to support or refute
	Chemical pollution	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae => intensity Minor, very few boats involved in fishery => consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae => intensity Minor, very few boats involved in fishery => consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	1	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	1	1	2	Would expect a very low rate of gear loss. Slight possibility Rock Flathead could be entangled in a lost net => intensity Negligible as nets are very rarely lost => consequence Negligible, increase in mortality would be extremely low and likely not detectable => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of whiting larvae entering bay => intensity Minor, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute

	Activity/ presence on water	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of whiting => intensity Minor, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	3	2	2	Sediments may be disturbed when net is hauled => intensity Moderate, few boats in fishery but large nets at local scale =>consequence Minor as change in behaviour/movement due to disturbance would be localised and short-lived => confidence low as there is no data on the amount of sediment disturbance from hauling seine
	Boat launching	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	3	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as change in behaviour/movement of whiting due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	2	2	Sediments may be disturbed in while anchoring or mooring; anchoring occurs in the process of net hauling =>intensity Minor, few boats in fishery, anchor set multiple times in process of retrieving net => consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect => confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	2	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, few boats in fishery but operate in shallow water =>consequence Negligible as effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	3	1	Whiting are a primary target species of the recreational hook and line fishery, all whiting in Port Phillip Bay are juveniles => intensity Major, high number of boats in fishery => consequence Moderate because catch is significantly higher than other fishery methods but is considered sustainable => confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on whiting habitat use (e.g. seagrass); mussels could attract whiting as a food source but could also increase catchability through aggregation => intensity Minor, farms occupy a relatively small area of the benthic habitat => consequence Minor, effect on whiting mortality would be small given relatively small area of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for whiting => intensity Major, very large human population and associated development =>consequence Major, juvenile whiting depend on shallow seagrass habitat and seagrass loss could lead to population decline => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat for whiting. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat for juvenile whiting (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Population size	King George Whiting,	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for larvae entering bay and benthic seagrass habitat for juveniles => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major,

						Sillaginodes punctatus					significant oil spill would have long term detrimental effect on whiting population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect light for seagrass habitat water (plume) and benthic habitat directly (spoil) => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. may affect whiting post-larvae and juveniles => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.2 Commercial haul seine (including Garfish seine and beach seine): Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	3	3	2	A preferred byproduct species, relatively low reproductive rate makes vulnerable to fishing pressure =>intensity Moderate, few boats in fishery but large netting area (i.e. locally intense) =>consequence Moderate because catch is relatively small and likely to be sustainable , especially compared to targeted fishery offshore => Confidence is high because total catch and effort data is well documented.
	Incidental behaviour	1	3	3	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	3	1	2	Possible for Gummy Shark to escape in the process of net retrieval, would usually be expected to survive =>intensity Moderate, few boats in fishery but large nets at local scale =>consequence Negligible, any mortality is unlikely to be detectable at the level of the stock =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	1	1	2	May occur, e.g. if Gummy Shark are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints

	Gear loss	1	3	5	Population size	Yank Flathead, *Platycephalus speculator*	1.1	1	1	2	Would expect a very low rate of gear loss. Slight possibility Yank flathead could be entangled in a lost net, =>intensity Negligible as nets are very rarely lost =>consequence Negligible, increase in mortality would be extremely low and likely not detectable => confidence high, based on fisher experience
	Anchoring/ Mooring	1	3	5	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	2	1	Possible that anchor hitting bottom or dragging could influence Gummy Shark behaviour or movement but would be very localised, =>intensity Minor, few boats in fishery, anchoring occurs multiple times in process of net retrieval =>consequence Minor, change in behaviour/movement would be highly localised and short-term =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	1	1	2	Possible that disturbance of the water column from navigation/steaming could influence the behaviour of pelagic schooling fish such as Australian Salmon =>intensity Negligible, , very few boats involved in fishery =>consequence Negligible, any affect would be localised and short-term =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the Gummy Shark population. =>intensity Minor as infrequent event =>consequence Major because could lead to population decline =>confidence low, based on poor knowledge of potential for translocation
	On board processing	1	3	3	Population size	Yank Flathead, *Platycephalus speculator*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract flathead to waste but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Negligible as increase in mortality would be very low => confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Population size	Spotted Stingaree, *Urolophus gigas*	1.1	3	3	1	Relatively low reproductive rate of Chondrichthyans makes them vulnerable to fishing pressure, fishing practices aim to release alive but some post-release mortality may occur => intensity Moderate, few boats in fishery but large nets at local scale => consequence Moderate as increase in mortality would be low relative to natural mortality and therefore sustainable => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									Does not occur
	Organic waste disposal	1	3	3	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Gummy Shark on a very localised scale, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Gummy Shark on a very localised scale, =>intensity minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	5	Population size	Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	5	Population size	Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute

	Gear loss	1	3	1	Population size	Yank Flathead, *Platycephalus speculator*	1.1	1	1	2	Would expect a very low rate of gear loss. Slight possibility Yank flathead could be entangled in a lost net, =>intensity Negligible as nets are very rarely lost =>consequence Negligible, increase in mortality would be extremely low and likely not detectable => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Australian Salmon, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Australian Salmon => intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	3	2	1	Sediments may be disturbed when net is hauled => intensity Moderate, few boats in fishery but large nets at local scale =>consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect => confidence low as there is no data on the amount of sediment disturbance from hauling seine
	Boat launching	1	3	5	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	3	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries =>consequence Minor as change in behaviour/movement of Gummy Sharks due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ Mooring	1	3	5	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	2	2	Sediments may be disturbed in while anchoring or mooring; anchoring occurs in the process of net hauling =>intensity Minor, few boats in fishery, anchor set multiple times in process of retrieving net =>consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	5	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	2	Sediments may be disturbed by propeller, wake in shallow water =>intensity Minor, few boats in fishery but operate in shallow water => Negligible as effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	4	3	1	Gummy Shark are a target of the recreational hook and line fishery, also caught in the commercial long-line and mesh net fisheries =>intensity Major, high number of boats in recreational fishery =>consequence Moderate because catch is considered sustainable, controlled by strict bag limit => Confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on Gummy Shark habitat use (e.g. seagrass). Food and structure may attract Gummy Shark but aggregation may increase vulnerability => intensity Minor, farms occupy a relatively small area of the benthic habitat =>consequence Minor, effect on Gummy Shark mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive Capacity	Gummy Shark, *Mustelus antarcticus*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for Gummy Shark, particularly in relation to pupping => intensity Major, very large human population and associated development =>consequence Major, Gummy Shark depend on shallow seagrass habitat for pupping=> confidence low as data on the relationship between Gummy Shark distribution/ reproduction and seagrass habitat is poorly understood in PPB

	Catchment inputs	1	3	6	Reproductive Capacity	Gummy Shark, *Mustelus antarcticus*	5.2	4	4	1	Nutrients, sediments and toxicants from catchment could affect seagrass habitat for Gummy Shark pupping. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence low as data on the relationship between Gummy Shark distribution/ reproduction and seagrass habitat is poorly understood in PPB
	Shipping activities	1	3	1	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	4	2	Primary concern is introduction of new marine pest affecting benthic productivity for flathead population => intensity Minor, Melbourne is a major shipping port but new pest introductions are rare events=> consequence Major, new marine pest introduction could have long term detrimental effect on Southern Sand Flathead population => confidence high based on evidence of marine pest introductions in Port Phillip Bay and other systems
	Port activities	1	2	3	Reproductive Capacity	Gummy Shark, *Mustelus antarcticus*	5.2	4	3	2	Dredging of shipping channels and dumping of spoil can affect light for seagrass habitat water (plume) and benthic habitat directly (spoil). => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.3 Commercial haul seine (including Garfish seine and beach seine): TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	2	Occasionally (rarely) caught, relatively low reproductive rate makes vulnerable to fishing pressure =>intensity Moderate, few boats in fishery but large netting area=>consequence Minor because catch is very small =>Confidence is high because total catch and effort data is well documented.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during “down time” =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact	Bait collection	0									No bait is used with this fishing method

without capture	Fishing	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	1	On rare occasions School Shark may escape from net while it is retrieved and would usually be expected to survive => intensity Moderate, few boats in fishery but large netting area =>consequence Minor, mortality would be very low relative to total fishing mortality =>confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	5	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Would expect a very low rate of gear loss. Slight possibility syngnathids could be entangled in a lost net, =>intensity Negligible as nets are very rarely lost =>consequence Negligible, increase in mortality would be extremely low and likely not detectable => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	5	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with Syngnathids causing mortality but would be extremely rare, => intensity Minor, few boats in fishery, anchoring occurs multiple times in process of net retrieval =>consequence Negligible, increase in mortality would not be detectable at population level =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Population of only 100 Burrunan dolphins in PPB; calves in particular are susceptible to boat strikes =>intensity Negligible as few boats in fishery, experienced skippers => consequence Minor because although one death would be significant at the population level, very unlikely given low intensity =>confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No or berley bait is used with this fishing method
	Organic waste disposal	1	3	3	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Moderate as even though small amount of debris from this fishery, even one death would be significant at the population level => confidence low as there is no data to support or refute for this fishery

	Chemical pollution	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of chemical pollution from this fishery would be unlikely to cause any mortalities in the population => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of chemical pollution from this fishery would be unlikely to cause any mortalities in the population => confidence low as there is no data to support or refute for this fishery
	Gear loss	1	3	1	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	2	Would expect a very low rate of gear loss. Slight possibility syngnathids could be entangled in a lost net =>intensity Negligible as nets are very rarely lost =>consequence Negligible increase in mortality would be extremely low and likely not detectable => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour, =>intensity Minor, very few boats involved in fishery and very small amount of noise introduced => consequence Minor as the small amount of noise introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
	Activity/ presence on water	1	3	5	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	3	2	1	Sediments may be disturbed when net is retrieved and when wading while fishing =>intensity Moderate, few boats in fishery but large netting area => consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Boat launching	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	3	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries =>consequence Minor as change in behaviour/movement of Pipefish and seahorses due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	1	Sediments may be disturbed in while anchoring in the process of fishing, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, few boats in fishery, anchoring occurs multiple times in process of net retrieval =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	1	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Minor, few boats in fishery, but fishing is in shallow water =>consequence Minor as effect would be small and difficult to detect => confidence low, no data to refute or confirm
External hazards (specify the particular example	Other capture fishery methods	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the bay poses a number of risks for the Burrunan Dolphin such as boat strikes and entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fishery => consequence Major as even one death would be significant at the population level for this species => Confidence is low because the population trajectory of the species in PPB is poorly understood

within each activity area)	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, mussel ropes may provide habitat for some species => intensity Minor, farms occupy a relatively small area of the benthic habitat =>consequence Minor, overall effect syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat for syngnathids => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in seagrass habitat and therefore abundance of syngnathid species => confidence low as data on the distribution and abundance of rarer species is limited
	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => Confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour=>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.4 Commercial haul seine (including Garfish seine and beach seine): Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Net strung loosely so lightly weighted on seagrass. Evidence from study in NSW suggest there can be a small effect on seagrass in certain seasons (i.e. winter) =>intensity Moderate, few boats in fishery but large swept area of net => consequence Moderate as no evidence of effects on seagrass from haul seining over many decades, seagrass changes are related to catchment inputs => Confidence low, no scientific studies on haul seine impacts on *Zostera* seagrass in Victorian bays
	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	As for capture, net strung loosely so lightly weighted on seagrass. Evidence from study in NSW suggest can be a small effect on seagrass in certain seasons (i.e. winter) =>intensity Moderate, few boats in fishery but large swept area of net => consequence Moderate as no evidence of effects on seagrass from haul seining over many decades, seagrass changes are related to catchment inputs => Confidence low, no scientific studies on haul seine impacts on *Zostera* seagrass in Victorian bays
	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	2	2	Would expect a very low rate of gear loss. In a rare circumstances a lost net could smother and shade seagrass =>intensity Negligible as nets are very rarely lost =>consequence Minor, effect on seagrass would be very localised => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchor usually set up to 6 times while fishing, may be on seagrass => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations => intensity Minor, few boats in fishery, although often in shallow water => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm

Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m) *Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests such as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs =>intensity Minor as rare event =>consequence Major because could lead to decline in native kelps and change in reef structure and function =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as localised change to habitat structure and function would be difficult to detect =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	1	Discarding of unwanted catch that has died may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area. => intensity Moderate as small number of boats involved in fishery but large swept area of net => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No or berley or bait is used with this fishing method
	Organic waste disposal	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	1.1	2	2	1	Organic waste such as food scraps or sewage may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area. => intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	1.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the seagrass reducing available light and affecting habitat structure and function, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on seagrass habitat => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	5	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae, =>intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on water quality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface =>intensity Minor, very few boats involved in fishery => consequence Negligible as change to water quality would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Gear loss	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	2	2	Would expect a very low rate of gear loss. In a rare circumstance, a lost net could smother and shade seagrass =>intensity Negligible as nets are very rarely lost =>consequence Minor, effect on seagrass would be very localised => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Activity/ presence on	1	3	5	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms

	water										=>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	2	Sediments may be disturbed when net is retrieved and when wading while fishing, associated turbidity could block light for seagrass => intensity Moderate, few boats in fishery but large netting area => consequence Minor as change in habitat structure and function from reduced light would be very small and difficult to detect =>confidence high, logical constraint on consequence
	Boat launching	1	3	5	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Moderate, few boats in fishery but dredging applies to all sub-fisheries => consequence Minor as disturbance would be small in area and have minimal impact on habitat structure and function => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchor usually set up to 6 times while fishing, may be on seagrass, associated turbidity could block light for seagrass => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Propeller turbulence could stir up sediment in shallow water, associated turbidity could block light for seagrass => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Seagrass can be impacted by anchors and chains in fishing using other methods => intensity Moderate, high number of boats in recreational fishery means incremental effects of anchoring could be significant => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => Confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Moderate, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can also occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and

						flat silt/sand sediment					dredge spoil => intensity Moderate, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.5 Commercial haul seine (including Garfish seine and beach seine): Communities component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Trophic/size structure	*Zostera* seagrass community	4.1	3	3	1	Removal of predatory fish may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Moderate, few boats in fishery but large swept area of net and range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => Confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Species composition	*Zostera* seagrass community	1.1	3	2	2	Possible for fish to escape in the process of net retrieval, undersize fish will generally escape through mesh, would usually be expected to survive =>intensity Moderate, few boats in fishery but large nets at local scale =>consequence Minor, any change to species composition is would be difficult to detect =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	5	Species composition	*Zostera* seagrass community	1.1	1	2	2	Would expect a very low rate of gear loss. In a rare circumstances a lost net could lead to altered species composition (invertebrates, fish) in the immediate area =>intensity Negligible as nets are very rarely lost =>consequence Minor, effect on species composition would be difficult to detect => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Anchor usually set up to 6 times while fishing, maybe on seagrass => intensity Minor, few boats in fishery => consequence Minor as localised effect on species composition would be difficult to detect => Confidence low, no data to refute or confirm

	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery but often in shallow water => consequence Minor as localised effect on species composition would be difficult to detect => Confidence low, no data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs =>intensity Minor as rare event =>consequence Major because could lead to complete loss or replacement of *Ecklonia* and consequent change to functional group composition =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the seagrass habitat affecting community distribution (i.e. invertebrates, small fish) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	3	2	1	Discarding catch of unwanted fish that have died may mean organic material and nutrients are introduced to the seagrass habitat affecting community distribution (i.e. invertebrates, small fish) in localised area => intensity Moderate small number of boats involved in fishery but large swept area of net => consequence Minor as effect on community distribution would be difficult to detect => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No or berley bait is used with this fishing method
	Organic waste disposal	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Organic waste such as food scraps or sewage may mean organic material and nutrients are introduced to the seagrass habitat affecting the distribution of the community (invertebrates, fish). => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the seagrass affecting the distribution of the community (may be indirect through lack of light affecting seagrass), =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on community distribution => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	5	Species composition	Pelagic (water column) community	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on species composition => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Minor, very few boats involved in fishery => consequence Negligible as change to species composition would be very small and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	1	Species composition	*Zostera* seagrass community	1.1	1	2	2	Would expect a very low rate of gear loss. In a rare circumstances a lost net could lead to altered species composition (invertebrates, fish) in the immediate area =>intensity Negligible as nets are very rarely lost => consequence Minor, effect on species composition would be difficult to detect => confidence high, based on fisher experience

	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery but often in shallow water => consequence Minor as localised effect on species composition would be minimal => Confidence low, no data to refute or confirm
	Activity/ presence on water	1	3	5	Distribution of the Community	Pelagic (water column) community	3.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter the distribution of the community by influencing the behaviour/movement of organisms =>intensity Minor, very few boats involved in fishery => consequence Negligible as the small amount of noise and visual stimuli introduced would only have a very localised effect on community distribution => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	3	2	1	Sediments may be disturbed when net is retrieved and when wading while fishing, associated turbidity could block light for seagrass with flow on effects on community distribution (invertebrates, small fish) => intensity Moderate, few boats in fishery but large netting area => consequence Minor as change in community distribution from reduced light would be minimal => Confidence low, no data to refute or confirm
	Boat launching	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	3	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps with flow on effects on community distribution (invertebrates, small fish) => intensity Moderate, few boats in fishery but dredging activities apply to all sub-fisheries => consequence Minor as disturbance would be small in area and have minimal impact on community distribution => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Anchor usually set up to 6 times while fishing, may be on seagrass, associated turbidity could block light for seagrass with flow on effects on community distribution (invertebrates, small fish) => intensity Minor, few boats in fishery => consequence Minor as localised effect on community distribution would be difficult to detect => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery but often in shallow water => consequence Minor as localised effect on species composition would be difficult to detect => Confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	Reef/*Ecklonia* community	4.1	3	3	1	Removal of larger fish by spearfishing on shallow reefs may alter food chain / trophic levels (i.e. less predatory fish leads to increased small fish with flow on effects to lower trophic levels) => intensity Moderate, spearfishing can be intensive on certain reefs, particularly over the summer period => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure at the broad scale => Confidence low, no scientific studies on spearfishing impacts on Victorian fish community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	3	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Moderate, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city =>

										consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
Port activities	2	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.6 Commercial Long-line: Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	2	3	Population size	Pale Octopus, *Octopus pallidus*	1.1	2	2	2	Fish for Pale Octopus with traps to use as bait, very small scale and low numbers taken => intensity Minor, few boats in fishery => consequence Minor as localised and change in population size would be difficult to detect=>confidence high, based on logic constraint
	Fishing	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	3	1	Snapper are primary target species, fishing occurs on the major spawning aggregation for the western Snapper stock => intensity Minor, few boats in fishery => consequence Moderate because fishery appears sustainable, long-term trend in CPUE is stable, catch fluctuations appear environmentally driven => Confidence is low because total catch and effort (commercial and recreational) is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	1	2	3	Behaviour/ movement	Pale Octopus, *Octopus pallidus*	6.1	2	1	1	Fish for Octopus with traps to use as bait, may escape in retrieval => intensity Minor, few boats in fishery =>consequence Negligible increase in mortality would be very low and likely not detectable => confidence low, no data to refute or confirm
	Fishing	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	2	On rare occasions Snapper may escape from hook while the long-line is retrieved and would usually be expected to survive, or may be pulled off the hook by seals or sharks =>intensity Minor, few boats in fishery =>consequence Minor, mortality would be very low relative to total fishing mortality=> confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	2	On rare occasions Snapper may escape with hook and broken line, later survival may depend on hook position etc. Also, seals or sharks may take hooked Snapper and break the snood or main line, => intensity Minor, few boats in fishery =>consequence Minor, mortality would be very low relative to total fishing mortality =>confidence high, based on fisher experience
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	1	Possible that anchor hitting bottom or dragging could influence Snapper behaviour or movement but would be very localised, =>intensity Negligible =>consequence Negligible =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Difficult to see any plausible hazard from navigation/steaming for the Snapper population; possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae, very few boats involved in fishery =>intensity Negligible =>consequence Negligible =>confidence high, based on logical constraints

Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the Snapper population. =>intensity Minor as infrequent event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential for translocation
	On board processing	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract Snapper to waste but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low =>confidence low as there is no data to support or refute
	Discarding catch	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract Snapper to area but also predators such as sharks leading to higher localised mortality. => intensity Minor as infrequent, localised event, small number of boats involved in fishery, => consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Introduction of bait to the environment may attract Snapper to area but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Organic waste disposal	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Snapper on a very localised scale, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change in behaviour/movement would be very small and likely not detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	3	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Snapper on a very localised scale, =>intensity Moderate as small number of boats involved in fishery, code of practice in place, but use of packaged bait means higher intensity than net sub-fisheries =>consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
	Chemical pollution	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Gear loss is rare, seals or sharks may take hooked Snapper and break the snood or main line, lost gear would only continue fishing for a matter of an hour or two while bait was still viable =>intensity Minor, gear loss rare, few boats in fishery =>consequence Minor, few Snapper would be expected to be hooked by ghost fishing gear=> confidence low as there is no data to support or refute
	Navigation/ steaming	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Snapper larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute

	Activity/ presence on water	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Snapper larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	1	2	3	Behaviour/ movement	Pale Octopus, *Octopus pallidus*	6.1	2	1	1	Fish for Pale Octopus with traps to use as bait, traps will disturb sediments when deployed and retrieved => intensity Minor, few boats in fishery => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence low, no data to refute or confirm
	Fishing	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	2	Sediments may be disturbed when weights at each end of the long-line are deployed and retrieved => intensity Minor, few boats in fishery => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Minor, few boats in fishery but dredging relates to all subfisheries =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring only occurs in rough weather/emergency situations =>intensity Negligible, few boats in fishery and most are moored =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	2	Sediments may be disturbed by propeller, wake in shallow water =>intensity Negligible, few boats in fishery and fishing is in deeper water =>consequence Negligible as generally in deeper water, effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Snapper are a primary target species of the recreational hook and line fishery, fishing occurs on the major spawning aggregation for the western Snapper stock =>intensity Major, high number of boats in fishery =>consequence Moderate because catch is significantly higher than other fishery methods but is considered sustainable =>Confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Primary aquaculture is mussel farming, snapper may be attracted to food/structure but aggregation may lead to increased catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant =>consequence Minor, effect on Snapper mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Coastal development can change coastal processes (currents, sediment transport) affecting benthic habitat for juveniles and adults and water column habitats for eggs and larvae => intensity Major, very large human population and associated development =>consequence Moderate, effect on Snapper will be by lessened by fact they occur in deeper water => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Reproductive capacity	Snapper, *Chrysophrys auratus*	5.2	4	4	1	Snapper population primarily determined by recruitment success that is related to plankton food for larvae that is in turn related to nutrients and flows from catchment => intensity major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Snapper recruitment (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => plankton => Snapper recruitment is still limited

	Shipping activities	1	3	1	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	2	Primary concern is introduction of a new marine pest affecting benthic productivity for juveniles, adults => intensity Minor, Melbourne is a major shipping port but new marine pest introductions are rare events => consequence Major, introduction of new marine pest could have long term detrimental effect on Snapper population => confidence high based on evidence of marine pest effects in Port Phillip Bay and other systems
	Port activities	1	2	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and benthic habitat (spoil). Dredge plume in Heads may affect Snapper migration => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. , =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.7 Commercial Long-line: Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	2	3	Population size	Pale Octopus, *Octopus pallidus*	1.1	2	2	2	Fish for Octopus with traps to use as bait, very small scale and low numbers taken=>intensity Minor, few boats in fishery=>consequence Minor as localised and change in population size would be difficult to detect=>confidence high, based on logic constraint
	Fishing	1	3	4	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	3	2	A preferred byproduct species, relatively low reproductive rate makes vulnerable to fishing pressure => intensity Minor, few boats in fishery => consequence Moderate because catch is small and likely to be sustainable, especially compared to targeted fishery offshore => Confidence is high because total catch and effort data is well documented.
	Incidental behaviour	1	3	3	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	1	2	3	Behaviour/ movement	Pale Octopus, *Octopus pallidus*	6.1	2	1	1	Fish for Octopus with traps to use as bait, may escape in retrieval, =>intensity minor, few boats in fishery =>consequence negligible increase in mortality would be very low and likely not detectable =>confidence low, no data to refute or confirm

	Fishing	1	3	4	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	2	2	On rare occasions Gummy Shark may escape from hook while the long-line is retrieved and would usually be expected to survive, or may be pulled off the hook by seals or sharks =>intensity Minor =>consequence Minor, increased mortality would be very low and difficult to detect =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	1	1	2	May occur, e.g. if Gummy Shark are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	4	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	2	2	On rare occasions Gummy Shark may escape with hook and broken line, later survival may depend on hook position etc. Also, seals or sharks may break main line, gear is lost with any hooked Gummy Shark still attached =>intensity Minor =>consequence Negligible, increased mortality would be very low and difficult to detect =>confidence high, based on fisher experience
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	1	1	1	Possible that anchor hitting bottom or dragging could influence Gummy Shark behaviour or movement but would be very localised, =>intensity Negligible =>consequence Negligible =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	1	1	2	Difficult to see any plausible hazard from navigation/steaming for the Gummy Shark population; very few boats involved in fishery =>intensity Negligible =>consequence Negligible =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could lead to decline in the Southern Sand Flathead population, most likely by affecting food chain (as may have already occurred with the Northern Pacific Seastar) =>intensity Minor as infrequent event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract Sand Flathead to waste but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low =>confidence low as there is no data to support or refute
	Discarding catch	1	3	4	Population size	Southern Fiddler Ray, *Trygonorrhina dumerilii*	1.1	2	2	1	Relatively low reproductive rate of Chondrichthyans makes them vulnerable to fishing pressure, fishing practices aim to release alive but some post-release mortality may occur => intensity Minor, few boats in fishery => consequence Minor as increase in mortality would be low relative to natural mortality => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	4	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Introduction of bait to the environment may attract Sand Flathead to area but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Organic waste disposal	1	3	3	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Gummy Shark on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	3	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Gummy Shark on a very localised scale, =>intensity Minor as small number of boats involved in fishery, code of practice in place, but use of packaged bait may mean higher intensity than net based sub-fisheries =>consequence Minor as change in

											behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
	Chemical pollution	1	3	4	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	4	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	2	1	Gear loss is rare, seals or sharks may take hooked fish and break the snood or main line, lost gear would only continue fishing for a matter of an hour or two while bait was still viable =>intensity Minor, gear loss rare, few boats in fishery =>consequence Minor, few Gummy Shark would be expected to be hooked by ghost fishing gear=> confidence low as there is no data to support or refute
	Navigation/ steaming	1	3	4	Behaviour/ movement	Southern Sand Flathead, *Platycephalus bassensis*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Southern Sand Flathead larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	4	Behaviour/ movement	Southern Sand Flathead, *Platycephalus bassensis*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Southern Sand Flathead larvae =>intensity Minor, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	1	2	3	Behaviour/ movement	Pale Octopus, *Octopus pallidus*	6.1	2	1	1	Fish for Octopus with traps to use as bait, traps will disturb sediments when deployed and retrieved, =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	2	Sediments may be disturbed when weights at each end of the long-line are deployed and retrieved =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	4	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Minor, few boats in fishery but dredging relates to all subfisheries =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	1	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring only occurs in rough weather/emergency situations =>intensity Negligible, few boats in fishery and most are moored =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Gummy Shark, *Mustelus antarcticus*	6.1	1	1	2	Sediments may be disturbed by propeller, wake in shallow water =>intensity Negligible, few boats in fishery and fishing is in deeper water =>consequence Negligible as generally in deeper water, effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example	Other capture fishery methods	1	3	6	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	4	3	1	Southern Sand Flathead are a widely caught target species of the recreational hook and line fishery =>intensity Major, high number of boats in fishery =>consequence Moderate because although there is a decline in CPUE in Port Phillip Bay this is thought to relate to the environment and recruitment =>Confidence is low because total catch and effort for the recreational fishery is poorly known / documented.

within each activity area)	Aquaculture	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm (e.g. seagrass) and consequent effect on Gummy Shark habitat use. Gummy Sharks may be attracted to food/structure but aggregation may increase catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant =>consequence Minor, effect on Gummy Shark mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	4	3	1	Coastal development can change coastal processes (currents, sediment transport) affecting benthic habitat for juveniles and adults and water column habitats for eggs and larvae => intensity Major, very large human population and associated development =>consequence Moderate, effect on Southern Sand Flathead will be by lessened by fact they occur in deeper water => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Reproductive capacity	Southern Sand Flathead, *Platycephalus bassensis*	5.2	4	4	1	Southern Sand Flathead population is likely to be determined by recruitment success that is related to plankton food for larvae that is in turn related to nutrients and flows from catchments => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Southern Sand Flathead recruitment (sewage treatment nutrient discharge is highly regulated), Southern Sand Flathead CPUE has been in decline related to recruitment => confidence low as understanding of the link between catchment inputs => plankton => Southern Sand Flathead recruitment is still limited
	Shipping activities	1	3	1	Population size	Southern Sand Flathead, *Platycephalus bassensis*	1.1	2	4	2	Primary concern is introduction of new marine pest affecting benthic productivity for flathead population => intensity Minor, Melbourne is a major shipping port but new pest introductions are rare events=> consequence Major, new marine pest introduction could have long term detrimental effect on Southern Sand Flathead population => confidence high based on evidence of marine pest introductions in Port Phillip Bay and other systems
	Port activities	1	2	3	Population size	Sand Flathead, *Platycephalus bassensis*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat for eggs and larvae (plume) and benthic habitat (spoil). => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.8 Commercial Long-line: TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Fish for Octopus with traps to use as bait, Syngnathids may enter traps resulting in accidental capture =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on population size would be difficult to detect => confidence low, no data to refute or confirm
	Fishing	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	2	Occasionally (rarely) caught, relatively low reproductive rate makes vulnerable to fishing pressure => intensity Minor, few boats in fishery =>consequence Minor because catch is very small => Confidence is high because total catch and effort data is well documented.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	1	2	3	Behaviour/ movement	Australian Fur-seal, *Arctocephalus pusillus*	6.1	2	1	1	Fish for Octopus with traps to use as bait, activity may attract seals, =>intensity Minor, few boats in fishery =>consequence Negligible because change in movement/behaviour would be very localised and likely not detectable => low, no data to refute or confirm
	Fishing	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	On rare occasions School Shark may escape from hook while the long-line is retrieved and would usually be expected to survive, or may be pulled off the hook by seals or sharks =>intensity Minor => intensity Minor => consequence Minor, increased mortality would be very low and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	On rare occasions School Shark may escape with hook and broken line, later survival may depend on hook position etc. Also, seals or sharks may break main line, gear is lost with any hooked School Shark still attached =>intensity Minor => consequence Minor, increased mortality would be very low and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	4	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with Syngnathids causing mortality but would be extremely rare =>intensity Negligible =>consequence Negligible => confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Population of only 100 Burrunan dolphins in PPB; calves in particular are susceptible to boat strikes =>intensity Negligible as few boats in fishery and not high speed => consequence Minor because although one death would be significant at the population level, very unlikely given low intensity => confidence low, limited data to refute or confirm

Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low =>confidence low as there is no data to support or refute
	Discarding catch	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Introduction of bait to the environment may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, => consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	3	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change in behaviour/movement would be very small and likely not detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves, =>intensity Minor as small number of boats involved in fishery, code of practice in place, but use of packaged bait may mean higher intensity than for net based sub-fisheries => consequence Moderate as even though small amount of debris from this fishery, even one death would be significant at the population level => confidence high as entanglements of dolphins with bait packaging have been recorded.
	Chemical pollution	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of chemical pollution from this fishery would be unlikely to cause any mortalities in the population => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, => intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of chemical pollution from this fishery would be unlikely to cause any mortalities in the population => confidence low as there is no data to support or refute for this fishery
	Gear loss	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Gear loss is rare, seals or sharks may take hooked fish and break the snood or main line, dolphins may entangle in lost line =>intensity Minor, very few boats involved in fishery and gear loss is rare => consequence Moderate as even one death would be significant at the population level => confidence low as there is no data to support or refute for this fishery
	Navigation/ steaming	1	3	4	Behaviour/ movement	Burrunan Dolphin,	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour, =>intensity Minor, very few boats involved in fishery and very

						Tursiops australis					small amount of noise introduced => consequence Minor as the small amount of noise introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
	Activity/ presence on water	1	3	4	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	1	2	3	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	1	Fish for Octopus with traps to use as bait, traps will disturb sediments when deployed and retrieved, may affect syngnathid habitat if deployed on seagrass =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed when weights at each end of the long-line are deployed and retrieved, may affect syngnathid habitat if deployed on seagrass (usually not the case) =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps, may affect syngnathid habitat if disturbs seagrass habitat =>intensity minor, few boats in fishery, although dredging applies to all sub-fisheries =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring only occurs in rough weather/emergency situations, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Minor, few boats in fishery and most are moored =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Negligible, few boats in fishery and fishing is in deeper water => consequence Negligible as generally in deeper water, effect would be very small and likely not detectable => confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the bay poses a number of risks for the Burrunan Dolphin such as boat strikes and entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fisheries =>consequence Major as even one death would be significant at the population level for this species => Confidence is low because the population trajectory of the species in PPB is poorly understood
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for Syngnathids. Conversely, some species may use the artificial structures as habitat => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant =>consequence Minor, overall effect syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat for syngnathids => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in habitat and therefore abundance of syngnathid species => confidence low as data on the distribution and abundance of rarer species is limited

	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for Syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.9 Commercial Long-line: Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	2	3	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	1	1	Octopus are collected for bait. Pots and lines and any associated dragging or movement could impact on seagrass if deployed on that habitat => intensity Minor, few boats in fishery =>consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	Weights on longline in contact with bottom and possible dragging =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence

	Incidental behaviour	1	3	3	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	1	2	3	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	1	1	As for capture, pots and lines and any associated dragging or movement could impact on seagrass if deployed on that habitat =>intensity Minor, few boats in fishery =>consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	As for capture, weights on longline in contact with bottom and possible dragging =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Incidental behaviour	1	3	3	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	Gear loss is rare, seals or sharks may take hooked Snapper and break the snood or main line including weights =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchoring only occur in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m) *Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs =>intensity Minor as rare event =>consequence Major because could lead to decline in native kelps and change in reef structure and function =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the benthic habitat =>intensity Minor as infrequent, localised event, small number of boats involved in fishery =>consequence Negligible as localised change to habitat structure and function would not be detectable =>confidence low as there is no data to support or refute
	Discarding catch	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	1	Discarding of unwanted catch that has died may mean organic material and nutrients are introduced to the benthic habitat =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as localised change to habitat structure and function would not be detectable =>confidence low as there is no data to support or refute
	Stock Enhancement	0									Does not occur
	Provisioning	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	1	Introduction of bait to the environment may mean organic material and nutrients are introduced to the benthic habitat. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as localised change to habitat structure and function would not be detectable =>confidence low as there is no data to support or refute

	Organic waste disposal	1	3	3	Water quality	Pelagic habitat	1.1	2	1	1	Organic waste such as food scraps or sewage could affect the surrounding water quality on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change to water quality would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Substrate quality	Sparse patchy macroalgae on flat silt/sand sediment	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the substrate quality of the habitat =>intensity Minor as small number of boats involved in fishery, code of practice in place, but where packaged bait is used intensity may be higher than for net based sub fisheries => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on substrate quality => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	4	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae =>intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on water quality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface =>intensity Minor, very few boats involved in fishery => consequence Negligible as change to water quality would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Gear loss	1	3	3	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	Gear loss is rare, seals or sharks may take bait or hooked fish and break the snood or main line including weights =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Activity/ presence on water	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms =>intensity Minor, very few boats involved in fishery => consequence Negligible as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	1	2	3	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	1	1	Octopus are collected for bait. Pots and lines and any associated dragging or movement could impact on seagrass if deployed on that habitat =>intensity Minor, few boats in fishery =>consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	Weights on longline in contact with bottom and possible dragging =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Boat launching	1	3	4	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps =>intensity minor, few boats in fishery, most are moored (dredging applies to all sub-fisheries) =>consequence Minor as disturbance would be small in area and have minimal impact on habitat structure and function => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchoring only occur in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery, anchoring is rare (but seagrass could occur in mooring area) => consequence Minor as localised effect on habitat structure and function would be minimal => confidence low, no data to refute or confirm

	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Seagrass can be impacted by anchors and chains in fishing operations, and also by the hauling of seines. => intensity Moderate, high number of boats in recreational fishery means incremental effects of anchoring => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.10 Commercial Long-line: Community component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	2	3	Species composition	*Zostera* seagrass community	1.1	2	1	1	Octopus are collected for bait. Pots and lines and any associated dragging or movement could impact on seagrass community if deployed on that habitat =>intensity Minor, few boats in fishery =>consequence Negligible as localised effect on species composition would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Trophic/size structure	Central muds community	4.1	2	3	1	Removal of Snapper and other predatory fish may alter food chain / trophic levels => intensity Minor, few boats in fishery => consequence Moderate as effects on Trophic / size structure are likely to be ecologically sustainable => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Incidental behaviour	1	3	3	Species composition	Central muds community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	1	2	3	Species composition	*Zostera* seagrass community	1.1	2	1	1	As for capture, pots and lines and any associated dragging or movement could impact on seagrass community if deployed on that habitat =>intensity Minor, few boats in fishery =>consequence Negligible as localised effect on species composition would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Trophic/size structure	Central muds community	4.1	2	2	1	On rare occasions fish may escape from hook while the long-line is retrieved, or may be pulled off the hook by seals or sharks Some Snapper and other predatory fish may die and this may alter food chain / trophic levels => intensity Minor, few boats in fishery => consequence Minor as effects on Trophic / size structure would be minimal given few fish would escape and then die => Confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Incidental behaviour	1	3	3	Species composition	Central muds community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	4	Trophic/size structure	Central muds community	4.1	2	2	1	On rare occasions Snapper and other predatory fish may escape with hook and broken line, later survival may depend on hook position etc. Also, seals or sharks may take hooked fish and break the snood or main line, => intensity Minor, few boats in fishery => consequence Minor as effects on Trophic / size structure would be minimal given few fish would escape and then die => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Anchoring/ mooring	1	3	4	Distribution of the Community	Central muds community	3.1	1	1	1	Anchoring only occurs in rough weather/emergency, possible that anchor hitting bottom or dragging could influence community distribution but would be very localised => intensity Negligible => consequence Negligible => confidence low, no data to support or refute

	Navigation/ steaming	1	3	4	Distribution of the Community	Pelagic (water column) community	3.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting community distribution of planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on community distribution would be unlikely to be detectable => Confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs =>intensity Minor as rare event =>consequence Major because could lead to complete loss or replacement of *Ecklonia* and consequent change to functional group composition =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Distribution of the Community	Central muds community	3.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Discarding catch	1	3	4	Distribution of the Community	Central muds community	3.1	2	2	1	Discarding catch of unwanted fish that have died may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	4	Distribution of the Community	Central muds community	3.1	2	2	1	Introduction of bait to the environment may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Organic waste disposal	1	3	3	Distribution of the Community	Central muds community	3.1	2	1	1	Organic waste such as food scraps or sewage could affect the distribution of planktonic organisms on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change to community distribution would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Distribution of the Community	Central muds community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the distribution of the benthic community => intensity Minor as small number of boats involved in fishery, code of practice in place, but where packaged bait is used intensity may be higher than for net based sub fisheries => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on community distribution => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the species composition of plankton in the pelagic community, =>intensity Minor, very few boats involved in fishery => consequence Negligible as would only be a small amount of chemical pollution from this fishery, thus effect on species composition would likely not be detectable => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community =>intensity Minor, very few boats involved in fishery => consequence Negligible as change to species composition would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Gear loss	1	3	3	Distribution of the Community	Central muds community	3.1	2	2	2	Gear loss is rare, seals or sharks may take hooked Snapper and break the snood or main line including weights, lost gear may settle on bottom =>intensity Minor, few boats in

											fishery => consequence Minor as localised effect on benthic community distribution would be difficult to detect => Confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting species composition of planktonic organisms in the pelagic community =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on distribution of community would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Activity/ presence on water	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter the species composition of the pelagic community by influencing the behaviour/movement of organisms => intensity Minor, very few boats involved in fishery => consequence Negligible as the small amount of noise and visual stimuli introduced would only have a very localised effect on species composition => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	1	2	3	Species composition	*Zostera* seagrass community	1.1	2	1	1	Octopus are collected for bait. Pots and lines and any associated dragging or movement could disturb sediment with consequent impact on seagrass community if deployed on that habitat => intensity Minor, few boats in fishery =>consequence Negligible as localised effect on seagrass community would be unlikely to be detectable =>confidence low, no data to refute or confirm
	Fishing	1	3	4	Distribution of the Community	Central muds community	3.1	2	1	2	Weights on longline in contact with bottom and possible dragging disturbing sediment and affecting the distribution of the benthic community =>intensity Minor, few boats in fishery => consequence Negligible as localised effect on community distribution would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Boat launching	1	3	4	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps with flow on effects on community distribution (invertebrates, small fish) =>intensity Minor, few boats in fishery, most boats are moored => consequence Minor as disturbance would be small in area and have minimal impact on community distribution => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	4	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Anchoring only occurs in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery, anchoring is rare (but seagrass could occur in mooring area) => consequence Minor as localised effect on seagrass community would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting species composition of planktonic organisms in the pelagic community =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on distribution of community would be unlikely to be detectable => Confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	*Zostera* seagrass community	4.1	4	3	1	Removal of predatory fish by methods such as haul seine, mesh net and recreational rod and line near seagrass beds may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Major, i.e. large number of boats in recreational fishery, large swept area of haul seine, and a range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => Confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known

Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments.
Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.11 Commercial mesh net: Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	3	3	1	Rock Flathead are a primary target species, adults occur primarily in seagrass habitat =>intensity Moderate, few boats in fishery but length of netting is potentially significant =>consequence Moderate because fishery appears sustainable, long-term trend in CPUE is stable but variable => Confidence is low because total catch and effort (commercial and recreational) is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	3	2	1	Possible for entangled fish to escape, undersize Rock Flathead will generally escape through mesh, would usually be expected to survive => intensity Moderate, few boats in fishery but length of netting is potentially significant =>consequence Minor, any mortality would be difficult to detect at the level of the stock => confidence low, no data to support or refute
	Incidental behaviour	1	3	3	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	2	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	2	2	Would expect a very low rate of gear loss. Slight possibility Rock Flathead could be entangled in a lost net =>intensity Minor as nets are rarely lost =>consequence Minor, any mortality would be difficult to detect at the level of the stock => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	2	1	1	Possible that anchor hitting bottom or dragging could influence Rock Flathead behaviour or movement but would be very localised, =>intensity Minor, few boats in fishery =>consequence Negligible =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	1	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Rock Flathead =>intensity Negligible, , very few boats involved in fishery =>consequence Negligible =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced (e.g., invasive *Caulerpa* from Interstate replacing seagrass) could lead to decline in the Rock Flathead. =>intensity Minor as infrequent event

											=>consequence Major because could lead to population decline =>confidence low, based on poor knowledge of potential for translocation
	On board processing	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract Snapper to waste but also predators such as sharks leading to higher localised mortality. => intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Negligible as increase in mortality would be very low relative to total mortality => confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract Snapper to area but also predators such as sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event, small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									Does not occur
	Organic waste disposal	1	3	3	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Rock Flathead on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Rock Flathead on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	2	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	2	2	Would expect a very low rate of gear loss. Slight possibility Rock Flathead could be entangled in a lost net =>intensity Minor as nets are rarely lost =>consequence Minor, any mortality would be difficult to detect at the level of the stock => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	1	1	Introduction of turbulence to the water column while underway could influence the mortality of Rock Flathead eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in mortality would be very localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	5	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Rock Flathead, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	2	2	2	Sediments may be disturbed when net is set and retrieved => intensity Minor, few boats in fishery =>consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect => confidence low as there is no data on the amount of sediment disturbance from hauling seine

	Boat launching	1	3	5	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps affecting juvenile whiting in shallow water =>intensity Minor, few boats in fishery, although dredging applies to all sub-fisheries =>consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	1	1	2	Sediments may be disturbed while anchoring or mooring =>intensity Negligible, few boats in fishery, generally underway when fishing =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	5	Behaviour/ movement	Rock Flathead, *Platycephalus laevigatus*	6.1	1	1	2	Sediments may be disturbed by propeller, wake in shallow water =>intensity Negligible, few boats in fishery, although may work in shallow water =>consequence Negligible as effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	3	1	Whiting are a primary target species of the recreational hook and line fishery; fishing occurs on juvenile fish =>intensity Major, high number of boats in fishery =>consequence Moderate because catch is significantly higher than other fishery methods but is considered sustainable, catch variations primarily driven by environmental variation => Confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm (e.g. seagrass) and consequent effect on Rock Flathead habitat use => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant =>consequence Minor, effect on Rock Flathead mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for Rock Flathead => intensity Major, very large human population and associated development =>consequence Major, Rock Flathead depend on seagrass habitat and seagrass decline could lead to population decline => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat for Rock Flathead. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat for Rock Flathead (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for eggs and larvae and benthic seagrass habitat for adults => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events=> consequence Major, significant oil spill would have long term detrimental effect on Rock Flathead population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect light for seagrass habitat for Rock Flathead through increased turbidity (plume) and benthic habitat directly (spoil). => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur

	Other anthropogenic activities	1	3	6	Population size	Rock Flathead, *Platycephalus laevigatus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. that could affect Rock Flathead eggs and larvae in the water column =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.12Commercial mesh net: Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Elephant Fish, *Callorhinchus milii*	1.1	3	3	2	Relatively low reproductive rate makes vulnerable to fishing pressure => intensity Moderate, few boats in fishery but length of netting is potentially significant => consequence Moderate because catch is relatively small and likely to be sustainable => Confidence is high because total catch and effort data is well documented.
	Incidental behaviour	1	3	3	Population size	Western Australian Salmon *Arripis truttaceus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Elephant Fish, *Callorhinchus milii*	1.1	3	2	2	Possible for Elephant Fish to escape after entanglement in net, would usually be expected to survive =>intensity Moderate, few boats in fishery but length of netting is potentially significant =>consequence Minor, any mortality would be difficult to detect at the level of the stock =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Western Australian Salmon *Arripis truttaceus*	1.1	1	1	2	May occur, e.g. if Western Australian Salmon is hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	2	Population size	Elephant Fish, *Callorhinchus milii*	1.1	1	2	2	Would expect a very low rate of gear loss, could occur through poaching or sharks biting through. Slight possibility Elephant Fish could be entangled in a lost net =>intensity Negligible as nets are rarely lost =>consequence Minor, nets may keep fishing after lost but because rare event increase in mortality would minimal => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Elephant Fish, *Callorhinchus milii*	6.1	1	1	1	Possible that anchor hitting bottom or dragging could influence Elephant Fish behaviour or movement but would be very localised, =>intensity Negligible =>consequence Negligible =>confidence low, no data to support or refute

	Navigation/ steaming	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	1	1	2	Possible that disturbance of the water column from navigation/steaming could influence the behaviour of pelagic schooling fish such as Western Australian Salmon =>intensity Negligible, , very few boats involved in fishery =>consequence Negligible =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	West Australian Salmon, *Arripis truttaceus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the Australian Salmon population. =>intensity Minor as infrequent event =>consequence Major because could lead to population decline =>confidence low, based on poor knowledge of potential for translocation.
	On board processing	1	3	5	Behaviour/ movement	Elephant Fish, *Callorhinchus milii*	6.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may attract Elephant Fish to area =>intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Minor as change in behaviour/movement would be temporary and localised =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Behaviour/ movement	Elephant Fish, *Callorhinchus milii*	6.1	2	2	1	Discarding of unwanted catch that has died may attract may attract Elephant Fish to area =>intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Minor as change in behaviour/movement would be temporary and localised =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									Does not occur
	Organic waste disposal	1	3	3	Behaviour/ movement	Elephant Fish, *Callorhinchus milii*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Elephant Fish on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Pale Octopus, *Octopus pallidus*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Pale Octopus on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	5	Population size	Longfin Pike, *Dinolestes lewini*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	5	Population size	Longfin Pike, *Dinolestes lewini*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	2	Population size	Elephant Fish, *Callorhinchus milii*	1.1	2	2	2	Would expect a very low rate of gear loss, could occur through poaching or sharks biting through. Slight possibility Elephant Fish could be entangled in a lost net =>intensity Minor as nets are rarely lost =>consequence Minor, nets may keep fishing after lost but because rare event increase in mortality would minimal => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Australian Salmon =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute

	Activity/ presence on water	1	3	5	Behaviour/ movement	West Australian Salmon, *Arripis truttaceus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Australian Salmon => intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	2	2	2	Sediments may be disturbed when net is set and retrieved, attracting mullet to the area but also potential predators such as sharks => intensity Minor, few boats in fishery but potentially significant length of netting =>consequence Minor as change in behaviour/movement due to disturbance would be small and difficult to detect => confidence low as there is no data on the amount of sediment disturbance from mesh netting
	Boat launching	1	3	5	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	2	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps attracting mullet to area but also potential predators such as sharks =>intensity Minor, few boats in fishery => consequence Minor as change in behaviour/movement due to disturbance would be very small and difficult to detect =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	1	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring attracting mullet to area but also potential predators such as sharks =>intensity Negligible, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	5	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	2	1	2	Sediments may be disturbed by propeller, wake in shallow water attracting mullet to area but also potential predators such as sharks =>intensity Minor, few boats in fishery =>consequence Negligible as effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Elephant Fish, *Callorhinchus milii*	1.1	4	3	1	Elephant Fish are a target of the recreational hook and line fishery =>intensity Major, high number of boats in fishery =>consequence Moderate because catch is considered sustainable, controlled by strict bag limit => Confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Reproductive Capacity	Southern Calamari, *Sepioteuthis australis*	5.2	2	2	1	Primary aquaculture is mussel farming, can lead to change in seagrass habitat under farm and consequent effect on Southern Calamari spawning => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant =>consequence Minor, effect on Calamari mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive Capacity	Southern Calamari, *Sepioteuthis australis*	5.2	4	4	2	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for Southern Calamari spawning => intensity Major, very large human population and associated development =>consequence Major, Calamari depend on seagrass habitat for spawning => confidence high based on research on Calamari in PPB
	Catchment inputs	1	3	6	Reproductive Capacity	Southern Calamari, *Sepioteuthis australis*	5.2	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat for Southern Calamari spawning. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) with consequent effects on Southern Calamari spawning => confidence high based on research on Southern Calamari in PPB
	Shipping activities	1	3	1	Reproductive Capacity	Southern Calamari, *Sepioteuthis australis*	5.2	2	4	2	Primary concern is oil spill from ship collision affecting shallow seagrass habitat utilised by Southern Calamari for spawning => intensity minor, Melbourne is a Major shipping port but major oil spills are rare events=> consequence Major, oil spill could have long

											term detrimental effect on Southern Calamari population in PPB => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Reproductive Capacity	Southern Calamari, *Sepioteuthis australis*	5.2	4	3	2	Dredging of shipping channels and dumping of spoil can affect light for seagrass habitat through turbidity (plume) and benthic habitat directly (spoil), with consequent reduction in Southern Calamari spawning => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	West Australian Salmon, *Arripis truttaceus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.13 Commercial mesh net: TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Little Penguin, *Eudyptula minor*	1.1	3	3	2	Capture of penguins is extremely rare but has occurred in unusual conditions, birds from St Kilda colony would be more vulnerable due to small colony size =>intensity Moderate, few boats in fishery but potentially significant length of netting => consequence Moderate because very small number of penguins would be captured => confidence High because mortality of penguins by capture in mesh nets has been recorded.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Population size	Little Penguin, *Eudyptula minor*	1.1	3	2	1	On rare occasions may contact net and then escape, would usually be expected to survive => intensity Moderate, but potentially significant length of netting =>consequence Minor, penguins would be expected to survive most interactions =>confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints

	Gear loss	1	3	2	Population size	Little Penguin, *Eudyptula minor*	1.1	1	3	2	Gear loss is very rare but may happen through shark bites or poaching. Slight possibility penguins could be entangled in a lost net =>intensity Negligible as nets are very rarely lost => consequence Moderate, very few if any penguins would be expected to be captured by lost nets=> confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with Syngnathids causing mortality but would be extremely rare =>intensity Negligible, few boats and fishing usually conducted underway =>consequence Negligible =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Population of only 100 Burrunan dolphins in PPB; calves in particular are susceptible to boat strikes =>intensity Negligible as few boats in fishery and not high speed => consequence Minor because although one death would be significant at the population level, very unlikely given low intensity => confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Onboard processing such as head and gutting Gummy Sharks may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality. =>intensity Minor as infrequent, localised event , small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality =>intensity Minor as infrequent, localised event, small number of boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No or berley bait is used with this fishing method
	Organic waste disposal	1	3	3	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves, =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Moderate as even though small amount of debris from this fishery, even one death would be significant at the population level => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of chemical pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity minor, very few boats involved in fishery => consequence Minor as the very small amount of exhaust pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery

	Gear loss	1	3	2	Population size	Little Penguin, *Eudyptula minor*	1.1	1	3	2	Gear loss is very rare but may happen through shark bites or poaching. Slight possibility penguins could be entangled in a lost net =>intensity Negligible as nets are very rarely lost => consequence Moderate, very few if any penguins would be expected to be captured by lost nets=> confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour =>intensity Minor, very few boats involved in fishery and very small amount of noise introduced => consequence Minor as the small amount of noise introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
	Activity/ presence on water	1	3	5	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed when net is set and retrieved =>intensity Minor, few boats in fishery but potentially significant length of netting =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed in while anchoring, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Minor, few boats in fishery, fishing occurs while underway =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	5	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat =>intensity Minor, few boats in fishery =>consequence Negligible as effect would be very small and likely not detectable =>confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the Bay poses a number of risks for the Burrunan Dolphin such as boat strikes and entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fishery => consequence Major as even one death would be significant at the population level for this species => Confidence is low because the population trajectory of the species in PPB is poorly understood
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, some species may use the artificial habitat => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant =>consequence Minor, overall effect syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat for syngnathids => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in habitat and therefore abundance of syngnathid species => confidence low as data on the distribution and abundance of rarer species is limited

	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => Confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour=>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.14 Commercial mesh net: Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Possible dragging of leadline on seagrass as net is retrieved =>intensity Minor, few boats in fishery => consequence Minor as retrieval of net and leadline would result in limited dragging over seagrass => confidence low, no data to refute or confirm

	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	As for capture, possible dragging of leadline on seagrass as net is retrieved =>intensity Minor, few boats in fishery => consequence Minor as retrieval of net and leadline would result in limited dragging over seagrass => Confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	2	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	2	2	Would expect a very low rate of gear loss (most likely stolen). In a rare circumstances a lost net could smother and shade seagrass =>intensity Negligible as nets are very rarely lost =>consequence Minor, effect on seagrass would be very localised => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	2	2	Anchoring does not usually occur while fishing, only in rough weather, emergency, may be on seagrass => intensity Minor, few boats in fishery, usually not anchored => consequence Minor as localised effect on habitat structure and function would be minimal => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m) *Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs =>intensity Minor as few boats in fishery, rare event =>consequence Major because could lead to decline in native kelps and change in reef structure and function =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as localised change to habitat structure and function would be difficult to detect =>confidence low as there is no data to support or refute

	Discarding catch	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Discarding of unwanted catch that has died may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area => intensity Minor as infrequent, localised event, small number of boats involved in fishery => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No or berley bait is used with this fishing method
	Organic waste disposal	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	1.1	2	2	1	Organic waste such as food scraps or sewage may mean organic material and nutrients are introduced to the seagrass habitat affecting structure and function in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery, code of practice in place => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	1.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the seagrass reducing available light and affecting habitat structure and function =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on seagrass habitat => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	5	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae =>intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on water quality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface =>intensity Minor, very few boats involved in fishery => consequence Negligible as change to water quality would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Gear loss	1	3	2	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	2	2	Would expect a very low rate of gear loss (if occurs usually when stolen). In a rare circumstances a lost net could smother and shade seagrass =>intensity Negligible as nets are very rarely lost =>consequence Minor, effect on seagrass would be very localised => confidence high, based on fisher experience
	Navigation/ steaming	1	3	5	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence

	Activity/ presence on water	1	3	5	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms =>intensity Minor, very few boats involved in fishery => consequence Negligible as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	1	1	Sediments may be disturbed when weights/anchors holding net in place are deployed and retrieved, associated turbidity could block light for seagrass => intensity Minor, few boats in fishery => consequence Negligible as change in habitat structure and function from reduced light would be very small and likely not detectable => Confidence low, no data to refute or confirm
	Boat launching	1	3	5	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Minor, few boats in fishery but dredging activities apply to all boats => consequence Minor as disturbance would be small in area and have minimal impact on habitat structure and function => Confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	1	1	Anchoring does not usually occur while fishing, only in rough weather, emergency, may be on seagrass, associated turbidity could block light for seagrass => intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would likely not be detectable => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Propeller turbulence could stir up sediment in shallow water, associated turbidity could block light for seagrass => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Seagrass can be impacted by anchors and chains in fishing using other methods => intensity Moderate, high number of boats in recreational fishery means incremental effects of anchoring could be significant => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => Confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small area of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known

Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can also occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.15 Commercial mesh net: Communities component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Trophic/size structure	*Zostera* seagrass community	4.1	3	3	1	Removal of predatory fish may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Moderate, few boats in fishery but significant lengths of netting, multiple species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Species composition	*Zostera* seagrass community	1.1	3	1	2	Possible for fish to escape after initial entanglement, undersize fish will generally escape through mesh, would usually be expected to survive =>intensity moderate, few boats in fishery but significant catch at local scale =>consequence negligible, any change to species composition is unlikely to be detectable =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" and fish could escape before capture =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	2	Species composition	*Zostera* seagrass community	1.1	1	2	2	Would expect a very low rate of gear loss. In a rare circumstances a lost net could lead to altered species composition (invertebrates, fish) in the immediate area =>intensity Negligible as nets are very rarely lost => consequence Minor, nets may keep fishing after lost but because rare event effect on species composition would be difficult to detect => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	1	1	Anchoring does not usually occur while fishing, only in rough weather, emergency, may be on seagrass => intensity Minor, few boats in fishery => consequence Negligible as localised effect on species composition would be unlikely to be detectable => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery, but can work in shallow water => consequence Minor as localised effect on species composition would be minimal => Confidence low, no data to refute or confirm
Addition/ movement of	Translocation of	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain

biological material	Species (boat launching, re-ballasting)										(Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs =>intensity Minor as rare event =>consequence Major because could lead to complete loss or replacement of *Ecklonia* and consequent change to functional group composition =>confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the seagrass habitat affecting community distribution (i.e. invertebrates, small fish) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Discarding catch	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Discarding catch of unwanted fish that have died may mean organic material and nutrients are introduced to the seagrass habitat affecting community distribution (i.e. invertebrates, small fish) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Stock enhancement	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Onboard processing such as head and gutting Gummy Sharks may mean organic material and nutrients are introduced to the seagrass habitat affecting community distribution (i.e. invertebrates, small fish) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Provisioning	0									No or berley bait is used with this fishing method
	Organic waste disposal	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Organic waste such as food scraps or sewage may mean organic material and nutrients are introduced to the seagrass habitat affecting the distribution of the community (invertebrates, fish) => intensity Minor as infrequent, localised event , small number of boats involved in fishery, code of practice in place => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the seagrass affecting the distribution of the community (may be indirect through lack of light affecting seagrass), =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on community distribution => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	5	Species composition	Pelagic (water column) community	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence species composition of plankton, fish larvae, in the pelagic community =>intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on species composition => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	5	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community =>intensity minor, very few boats involved in fishery => consequence negligible as change to species composition would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Gear loss	1	3	2	Species composition	*Zostera* seagrass community	1.1	2	2	2	Would expect a very low rate of gear loss (usually only occurs when net is stolen). In a rare circumstances a lost net could lead to ghost fishing resulting in altered species composition of fish in the immediate area =>intensity minor as nets are very rarely lost but localised effect could be significant =>consequence minor, effect on species composition would be difficult to detect => confidence high, based on fisher experience

	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery but often work in shallow water => consequence Minor as localised effect on species composition would be minimal => Confidence low, no data to refute or confirm
	Activity/ presence on water	1	3	5	Distribution of the Community	Pelagic (water column) community	3.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter the distribution of the community by influencing the behaviour/movement of organisms =>intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on community distribution => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Sediments may be disturbed by leadline, weights/anchors when net is set and retrieved, associated turbidity could block light for seagrass with flow on effects on community distribution (invertebrates, small fish) => intensity Minor, few boats in fishery but significant length of netting => consequence Minor as change in community distribution from reduced light would be minimal => confidence low, no data to refute or confirm
	Boat launching	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps with flow on effects on community distribution (invertebrates, small fish) =>intensity Minor, few boats in fishery, although dredging activities relate to all boating => consequence Minor as disturbance would be small in area and have minimal impact on community distribution => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	5	Distribution of the Community	*Zostera* seagrass community	3.1	2	1	1	Anchoring does not usually occur while fishing, only in rough weather, emergency, may be on seagrass, associated turbidity could block light for seagrass with flow on effects on community distribution (invertebrates, small fish) => intensity Minor, few boats in fishery => consequence Negligible as localised effect on community distribution would likely not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	5	Species composition	*Zostera* seagrass community	1.1	2	2	1	Possible to get propeller scarring of seagrass when travelling between fishing locations leading to change in species composition (invertebrates, fish) => intensity Minor, few boats in fishery, but can work in shallow water => consequence Minor as localised effect on species composition would be minimal => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	Reef/*Ecklonia* community	4.1	3	3	1	Removal of larger fish by spearfishing on shallow reefs may alter food chain / trophic levels (i.e. less predatory fish leads to increased small fish with flow on effects to lower trophic levels) => intensity Moderate, spearfishing can be intensive on certain reefs, particularly over the summer period => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure at the broad scale => confidence low, no scientific studies on spearfishing impacts on Victorian fish community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Moderate, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city =>

										consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments.
Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	1	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.16 Commercial Purse-seine: Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									Does not occur
	Fishing	1	3	4	Population size	Australian Sardine, *Sardinops sagax*	1.1	2	2	2	Main target species are small pelagic schooling fish, primarily the Australian Sardine =>intensity Minor, very few boats in fishery => consequence Minor because low level effort relative to population size of target species, catch rate increasing in recent years =>confidence is high because catch and effort is well known/documented.
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, very few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									Does not occur
	Fishing	1	3	4	Population size	Australian Sardine, *Sardinops sagax*	1.1	2	1	2	On rare occasions Australian Sardine may escape through a hole in the net and would usually be expected to survive =>intensity Minor, very few boats in fishery =>consequence Negligible =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, very few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	1	Population size	Australian Sardine, *Sardinops sagax*	1.1	1	1	2	Very rare to lose net, could occur due to snagging, Net needs to be actively pursed to catch fish so ghost fishing not an issue =>intensity Negligible because very rare event =>consequence Negligible, no ghost fishing =>confidence high, based on fisher experience
	Anchoring/ mooring	1	3	3	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	1	1	1	Possible that anchor hitting bottom or dragging could influence sardine behaviour or movement but would be very localised =>intensity Negligible, very few boats in fishery, anchoring only occurs in rough weather =>consequence Negligible =>confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Australian anchovy, *Engraulis australis*	1.1	1	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of anchovy, very few boats involved in fishery =>intensity Negligible =>consequence Negligible =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Australian sardine, *Sardinops sagax*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the sardine population (as has happened previously with the pilchard virus that decimated the population in Port Phillip) =>intensity Minor as infrequent event =>consequence Major because could lead to

											population decline =>confidence low, based on no knowledge of potential for translocation
	On board processing	0									No processing occurs at sea (only salting)
	Discarding catch	1	3	4	Population size	Australian Sardine, *Sardinops sagax*	1.1	2	1	1	Discarding of unwanted catch that has died may attract Australian Sardine to area but also predators such as Australian Salmon leading to higher localised mortality =>intensity Minor as infrequent, localised event, very small number of boats involved in fishery, =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait/berley is used to attract the target species
	Organic waste disposal	1	3	3	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of sardines on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of sardines on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	4	Population size	Australian Anchovy, *Engraulis australis*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Australian Anchovy that spawn in the north of the bay =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	4	Population size	Australian Anchovy, *Engraulis australis*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae of Australian Anchovy that spawn in the north of the bay => intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	1	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	1	1	2	Very rare to lose net, could occur due to snagging, net needs to be actively pursed to catch fish so ghost fishing not an issue => intensity negligible because very rare event => consequence negligible, no ghost fishing, influence on movement and behaviour would be difficult to detect =>confidence high, based on fisher experience
	Navigation/ steaming	1	3	4	Behaviour/ movement	Australian Anchovy, *Engraulis australis*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Australian Anchovy larvae, =>intensity Minor, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	4	Behaviour/ movement	Australian Anchovy, *Engraulis australis*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of anchovy larvae, => intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									Does not occur
	Fishing	1	3	4	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	2	1	2	Sediments and water column currents may be disturbed when the purse-seine is deployed and retrieved =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence

	Boat launching	1	3	4	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps =>intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	3	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	1	1	2	Sediments may be disturbed while anchoring or mooring; anchoring only occurs in rough weather/emergency situations =>intensity Negligible, few boats in fishery, anchoring is rare =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Australian Anchovy, *Engraulis australis*	6.1	2	1	1	Turbulence from the propeller or boat wake disturbing the water column while underway could influence the behaviour/movement of Australian Anchovy larvae => intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Australian Sardine, *Sardinops sagax*	1.1	2	2	2	Other fishery capture methods, such as haul seining and mesh-netting, would only take very low quantities of purse seine target species such as sardines =>intensity Minor, small number of boats in haul-seine, mesh net fisheries, not targeting sardines =>consequence Minor because only small incidental catch of sardines by other fishery methods =>Confidence high because catch of other commercial methods is well documented.
	Aquaculture	1	3	6	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	2	2	1	Primary aquaculture is mussel farming, associated structures in water column could affect sardine behaviour and movement => intensity Minor, farms occupy a relatively small area of the bay =>consequence Minor, effect on sardine movement and behaviour would be small and difficult to detect => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Australian Anchovy, *Engraulis australis*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting water column habitats for eggs and larvae of Australian Anchovy that spawn in the north of the bay => intensity Major, very large human population and associated development =>consequence Major, change in coastal processes from coastal development could lead to long term decline in Australian Anchovy population => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Reproductive capacity	Australian Anchovy, *Engraulis australis*	5.2	4	4	1	Australian Anchovy population is likely to be determined by levels of plankton food for larvae, juveniles and adults that is in turn related to nutrients and flows from the catchment => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Australian Anchovy population (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => plankton => anchovy population is limited
	Shipping activities	1	3	1	Population size	Australian Anchovy, *Engraulis australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for eggs, larvae, juvenile and adult Australian Anchovy => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events=> consequence Major, significant oil spill would have long term detrimental effect on anchovy population, => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Behaviour/ movement	Australian Sardine, *Sardinops sagax*	6.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and affect Australian Sardine feeding behaviour and movement => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Australian Sardine, *Sardinops sagax*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality

											from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.17 Commercial Purse-seine: Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	2	Snapper are minor byproduct species, fishing occurs on the major spawning aggregation for the western Snapper stock =>intensity Minor, few boats in fishery, not targeting Snapper =>consequence Minor because only small incidental catch taken by purse-seining =>confidence is high because catch of Snapper by purse seine is well documented.
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" =>intensity Negligible, very few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	On rare occasions Snapper may escape through hole in the net and would usually be expected to survive =>intensity Negligible, rare event, few boats in fishery, not targeting Snapper => consequence Negligible, effect on Snapper population would not be detectable =>confidence high, based on fisher experience
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time", Snapper may escape before capture and subsequent mortality could occur =>intensity Negligible, very few boats in fishery and would only happen occasionally =>consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
	Gear loss	1	3	1	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Very rare to lose net, could occur due to snagging, net needs to be actively pursed to catch fish so ghost fishing not an issue => intensity Negligible because very rare event => consequence Negligible, no ghost fishing => confidence high, based on fisher experience
	Anchoring/ mooring	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	1	Possible that anchor hitting bottom or dragging could influence Snapper behaviour or movement but would be very localised, intensity Negligible, very few boats in fishery, anchoring only occurs in rough weather => consequence Negligible => confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	1	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Snapper =>intensity negligible, very few boats involved in fishery => consequence negligible =>confidence high, based on logical constraints
Addition/ movement of biological	Translocation of	1	3	2	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a

material	Species (boat launching, re-ballasting)										new species is introduced, could lead to decline in the Snapper population. =>intensity Minor as infrequent event =>consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential for translocation
	On board processing	0									No processing occurs at sea (only salting)
	Discarding catch	1	3	4	Population size	Melbourne Skate, *Spiniraja whitleyi*	1.1	2	2	1	Relatively low reproductive rate of Chondrichthyans makes them vulnerable to fishing pressure, fishing practices aim to release alive but some post-release mortality may occur => intensity Minor, few boats in fishery => consequence Minor as increase in mortality would be low relative to natural mortality => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait/berley is used to attract the target species
	Organic waste disposal	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Snapper on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Snapper on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place =>consequence Negligible as change in behaviour/movement would be very small and likely not detectable =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery => consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Exhaust	1	3	4	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Minor, very few boats involved in fishery =>consequence Negligible as increase in mortality would be very low and likely not detectable => confidence low as there is no data to support or refute
	Gear loss	1	3	1	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	2	Very rare to lose net, could occur due to snagging, Net needs to be actively pursed to catch fish so ghost fishing not an issue =>intensity Negligible because very rare event =>consequence Negligible, no ghost fishing, influence on movement and behaviour would be difficult to detect =>confidence high, based on fisher experience
	Navigation/ steaming	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Snapper larvae =>intensity Minor, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Snapper larvae, =>intensity Minor, very few boats involved in fishery =>consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									Does not occur
	Fishing	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	2	Sediments may be disturbed when the purse-seine is deployed and retrieved => intensity Minor, few boats in fishery =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence

	Boat launching	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Minor, few boats in fishery => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring only occurs in rough weather/emergency situations =>intensity Negligible, few boats in fishery and most are moored =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	1	1	2	Turbulence from the propeller or boat wake disturbing the water column while underway could influence the behaviour/movement of Snapper larvae =>intensity Negligible, very few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Snapper are a primary target species of the recreational hook and line fishery; fishing occurs on the major spawning aggregation for the western Snapper stock => intensity Major, high number of boats in fishery => consequence Moderate because catch is significantly higher than other fishery methods but is considered sustainable => confidence is low because total catch and effort for the recreational fishery is poorly known / documented.
	Aquaculture	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on Snapper habitat use. Snapper may be attracted to food/structure but aggregation may lead to higher catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Minor, effect on Snapper mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Coastal development can change coastal processes (currents, sediment transport) affecting benthic habitat for juveniles and adults and water column habitats for eggs and larvae => intensity Major, very large human population and associated development => consequence Moderate, effect on Snapper will be by lessened by fact they occur in deeper water => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Reproductive capacity	Snapper, *Chrysophrys auratus*	5.2	4	4	1	Snapper population primarily determined by recruitment success that is related to plankton food for larvae that is in turn related to nutrients and flows from catchment => intensity major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Snapper recruitment (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => plankton => Snapper recruitment is still limited
	Shipping activities	1	3	1	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	2	Primary concern is introduction of a new marine pest affecting benthic productivity for juveniles, adults => intensity Minor, Melbourne is a major shipping port but new marine pest introductions are rare events => consequence Major, introduction of new marine pest could have long term detrimental effect on Snapper population => confidence high based on evidence of marine pest effects in Port Phillip Bay and other systems
	Port activities	1	2	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and benthic habitat (spoil). Dredge plume in Heads may affect Snapper migration => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
	Other anthropogenic activities	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay =>consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.18 Commercial Purse-seine: TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	3	2	Very rarely caught in purse seine, released alive => intensity Negligible, few boats in fishery, very rare event => consequence Moderate because animals are released alive and survival should be high; however, even one death would be significant at the population level => confidence high based on fisher experience
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible, increase in mortality would be very low and likely not detectable => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	3	2	Very rarely caught in purse seine, may escape net before capture => intensity Negligible, few boats in fishery, very rare event => consequence Moderate because animals escape alive and survival should be high; however, even one death would be significant at the population level => confidence high based on fisher experience
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	1	2	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time", hooked School Shark may escape during retrieval =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Minor, increase in mortality would be low => confidence high, based on logical constraints
	Gear loss	1	3	1	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Very rare to lose net, could occur due to snagging, net needs to be actively pursed to catch fish so ghost fishing not an issue, lost net could affect benthic habitat for syngnathids =>intensity Negligible because very rare event =>consequence Negligible, no ghost fishing =>confidence low, no information to support or refute
	Anchoring/ mooring	1	3	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with syngnathids causing mortality but would be extremely rare => intensity Negligible, few boats in fishery, anchoring only in rough weather, emergency => consequence Negligible, increased mortality would not be detectable => confidence low, no data to support or refute
	Navigation/ steaming	1	3	4	Population size	Burrunan Dolphin,	1.1	1	2	1	Population of only 100 Burrunan Dolphins in PPB; calves in particular are susceptible to boat strikes => intensity Negligible as few boats in fishery and not high speed =>

						Tursiops australis					consequence Minor because although one death would be significant at the population level, very unlikely given low intensity => confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	0									No processing occurs at sea (only salting)
	Discarding catch	1	3	4	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Discarding of unwanted catch that has died may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Minor as infrequent, localised event, small number of boats involved in fishery, =>consequence Negligible as increase in mortality would be very low and likely not detectable =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait/berley is used to attract the target species
	Organic waste disposal	1	3	3	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change in behaviour/movement would be very small and likely not detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Moderate as even though small amount of debris from this fishery, even one death would be significant at the population level => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of chemical pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of exhaust pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Gear loss	1	3	1	Population size	Syngnathidae, Pipefish and seahorses	1.1	1	1	1	Very rare to lose net, could occur due to snagging; lost net could affect benthic habitat for syngnathids =>intensity Negligible because very rare event => consequence Negligible, no ghost fishing =>confidence low, no information to support or refute
	Navigation/ steaming	1	3	4	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour => intensity Minor, very few boats involved in fishery and very small amount of noise introduced => consequence Minor as the small amount of noise introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
	Activity/ presence on water	1	3	4	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin => intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on

											behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed when lead-core rope drags on bottom as net is pursed and retrieved, may affect syngnathid habitat if deployed on seagrass (usually not the case) => intensity Minor, few boats in fishery => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	4	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, few boats in fishery, but dredging applies to all sub-fisheries => consequence Minor as change in behaviour/movement due to disturbance would be very small and difficult to detect => confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	3	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	1	2	Sediments may be disturbed in while anchoring or mooring; anchoring only occurs in rough weather/emergency situations, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, few boats in fishery and most are moored =>consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	4	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of turbulence to the water column from propeller or boat wake could influence the behaviour/movement of Burrunan Dolphin, => intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the bay poses a number of risks for the Burrunan Dolphin such as boat strikes and entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fishery => consequence Major as even one death would be significant at the population level for this species => confidence is low because the population trajectory of the species in PPB is poorly understood
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, some species may use artificial habitat provided by aquaculture => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Minor, overall effect syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat for syngnathids => intensity Major, very large human population and associated development => consequence Major, continued coastal developed likely to lead a reduction in habitat and therefore abundance of syngnathid species => confidence low as data on the distribution and abundance of rarer species is limited
	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems

	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.19 Commercial Purse-seine: Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	2	2	Lead-core rope in contact with dense *Pyura* and possible dragging => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be difficult to detect => Confidence high, logical constraint on consequence
	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	2	2	As for capture, lead-core rope in contact with dense *Pyura* and possible dragging => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be difficult to detect => Confidence high, logical constraint on consequence
	Incidental behaviour	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible => confidence high, based on logical constraints
	Gear loss	1	3	1	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	2	2	Very rare to lose net, could occur due to snagging, lost net could smother dense *Pyura* => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat

											structure and function would be difficult to detect => Confidence high, logical constraint on consequence
	Anchoring/ mooring	1	3	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchoring only occur in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms => intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m) *Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs => intensity Minor as rare event => consequence Major because could lead to decline in native kelps and change in reef structure and function => confidence high, based on knowledge of the effects of existing species.
	On board processing	0									No processing occurs at sea (only salting)
	Discarding catch	1	3	4	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	1	1	Discarding of unwanted catch that has died may mean organic material and nutrients are introduced to the benthic habitat =>intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Negligible as localised change to habitat structure and function would not be detectable =>confidence low as there is no data to support or refute.
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait/berley is used to attract the target species
	Organic waste disposal	1	3	3	Water quality	Pelagic habitat	1.1	2	1	1	Organic waste such as food scraps or sewage could affect the surrounding water quality on a very localised scale =>intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change to water quality would be very small and likely not detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Substrate quality	Dense *Pyura* sp. sea squirt on flat sand sediment	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the substrate quality of the habitat => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on substrate quality => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	4	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae => intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect would be minimal on water quality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface => intensity Minor, very few boats involved in fishery => consequence Negligible as change to water quality would be very small and likely not detectable => confidence low as there is no data to support or refute.
	Gear loss	1	3	1	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	1	2	Very rare to lose net, could occur due to snagging, lost net could smother dense *Pyura* => intensity Minor, few boats in fishery => consequence Minor as localised effect on habitat structure and function would be difficult to detect => Confidence high, logical constraint on consequence

	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
	Activity/ presence on water	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms => intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Habitat structure and function	Dense *Pyura* sp. sea squirt on flat sand sediment	5.1	2	1	2	Lead-core rope could create sediment plume affecting feeding by *Pyura* => intensity Minor, few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence.
	Boat launching	1	3	4	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	2	Sediment may be disturbed in boat launching, or dredging activities around launching ramps creating plume blocking light for seagrass => intensity Minor, few boats in fishery, most are moored => consequence Minor as disturbance would be small in area and have minimal impact on habitat structure and function => confidence high, logical constraint on consequence.
	Anchoring/ mooring	1	3	3	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Anchoring only occurs in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery, anchoring is rare (but seagrass could occur in mooring area) => consequence Minor as localised effect on habitat structure and function would be minimal => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	4	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms => intensity Minor as few boats in fishery => consequence Negligible as localised effect on habitat structure and function would be unlikely to be detectable => Confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Seagrass can be impacted by anchors and chains in fishing operations, and also by the hauling of seines => intensity Moderate, high number of boats in recreational fishery means incremental effects of anchoring => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => Confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments

	Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.20 Commercial Purse-seine: Community component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Trophic/size structure	Pelagic (water column) community	4.1	2	3	1	Removal of small pelagic fish may alter pelagic food chain / trophic levels => intensity Minor, few boats in fishery => consequence Moderate as effects on trophic / size structure are likely to be ecologically sustainable => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	Possible that other methods (i.e. line fishing) could be used incidentally during "down time" => intensity Negligible, few boats in fishery and would only happen occasionally => consequence Negligible => confidence high, based on logical constraints
Direct impact without capture	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Trophic/size structure	Pelagic (water column) community	4.1	2	2	2	Removal of small pelagic fish may alter pelagic food chain / trophic levels. On rare occasions small pelagic fish may escape through a hole in the net and would usually be expected to survive => intensity Minor, few boats in fishery => consequence Minor as effects on trophic / size structure are likely to be small given most escaped fish will survive => Confidence high, based on logical constraints
	Incidental behaviour	1	3	3	Species composition	*Zostera* seagrass community	1.1	1	1	2	May occur, e.g. if fish are hooked but not captured when undertaking incidental hook and line fishing =>intensity Negligible, few boats in fishery and would only happen occasionally =>consequence Negligible => confidence high, based on logical constraints

	Gear loss	1	3	1	Trophic/size structure	High Diversity Sands Community	4.1	2	1	2	Very rare to lose net, could occur due to snagging, lost net could smother high diversity epifaunal community => intensity Minor, few boats in fishery => consequence Minor as localised effect on trophic / size structure would be difficult to detect => confidence high, logical constraint on consequence
	Anchoring/ Mooring	1	3	3	Distribution of the Community	High Diversity Sands Community	3.1	1	1	1	Anchoring only occur in rough weather/emergency, possible that anchor hitting bottom or dragging could influence community distribution but would be very localised =>intensity Negligible => consequence Negligible =>confidence low, no data to support or refute
	Navigation/ Steaming	1	3	4	Distribution of the Community	Pelagic (water column) community	3.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting community distribution of planktonic organisms => intensity Minor as few boats in fishery => consequence Negligible as localised effect on community distribution would be unlikely to be detectable => Confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs => intensity Minor as rare event => consequence Major because could lead to complete loss or replacement of *Ecklonia* and consequent change to functional group composition => confidence high, based on knowledge of the effects of existing species
	On board processing	0									No processing occurs at sea (only salting)
	Discarding catch	1	3	4	Distribution of the Community	High Diversity Sands Community	3.1	2	2	1	Discarding catch of unwanted fish that have died may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor as infrequent, localised event , small number of boats involved in fishery => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait/berley is used to attract the target species
	Organic waste disposal	1	3	3	Distribution of the Community	Pelagic (water column) community	3.1	2	1	1	Organic waste such as food scraps or sewage could affect the distribution of planktonic organisms on a very localised scale => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Negligible as change to community distribution would be very small and likely not detectable =>confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	3	Distribution of the Community	High Diversity Sands Community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the distribution of the benthic community => intensity Minor as infrequent, localised event, small number of boats involved in fishery, code of practice in place => consequence Minor as would only be a small amount of debris from this fishery, thus effect would be minimal on community distribution => confidence low as there is no data to support or refute for this fishery
	Chemical Pollution	1	3	4	Species composition	Pelagic (water column) community	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the species composition of plankton in the pelagic community => intensity Minor, very few boats involved in fishery => consequence Minor as would only be a small amount of chemical pollution from this fishery, thus effect on species composition would be small and difficult to detect => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Minor, very few boats involved in fishery => consequence negligible as change to species composition would be very small and likely not detectable => confidence low as there is no data to support or refute

	Gear loss	1	3	1	Trophic/size structure	High Diversity Sands Community	4.1	1	2	2	could occur due to snagging, lost net could smother high diversity epifaunal community => intensity Negligible, few boats in fishery, very rare to lose net => consequence Minor as localised effect on trophic / size structure would be difficult to detect => Confidence high, logical constraint on consequence
	Navigation/ Steaming	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting species composition planktonic organisms in the pelagic community => intensity Minor as few boats in fishery => consequence Negligible as localised effect on distribution of community would be unlikely to be detectable => confidence high, logical constraint on consequence
	Activity/ presence on water	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter the species composition of the pelagic community by influencing the behaviour/movement of organisms => intensity Minor, very few boats involved in fishery => consequence Minor as the small amount of noise and visual stimuli introduced would only have a very localised effect on species composition => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									Does not occur in this fishery
	Fishing	1	3	4	Distribution of the Community	High Diversity Sands Community	3.1	2	2	2	Sediments may be disturbed when lead-core rope drags on bottom as net is pursed and retrieved, may affect epifaunal community on high diversity sands =>intensity Minor, few boats in fishery =>consequence Minor as change in distribution of the community due to disturbance would be small and detect =>confidence high, logical constraint on consequence
	Boat launching	1	3	4	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	2	Seagrass may be disturbed in boat launching, or dredging activities around launching ramps with flow on effects on community distribution (invertebrates, small fish) => intensity Minor, few boats in fishery, most boats are moored => consequence Minor as disturbance would be small in area and have minimal impact on community distribution => confidence high, logical constraint on consequence
	Anchoring/ Mooring	1	3	3	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Anchoring only occurs in rough weather/emergency; seagrass could occur in area of mooring or anchoring => intensity Minor, few boats in fishery, anchoring is rare (but seagrass could occur in mooring area) => consequence Minor as localised effect on seagrass community would be minimal => Confidence low, no data to refute or confirm
	Navigation/ Steaming	1	3	4	Species composition	Pelagic (water column) community	1.1	2	1	2	Navigation and steaming would cause turbulence possibly affecting species composition of planktonic organisms in the pelagic community =>intensity Minor as few boats in fishery => consequence Negligible as localised effect on distribution of community would be unlikely to be detectable => confidence high, logical constraint on consequence
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	*Zostera* seagrass community	4.1	4	3	1	Removal of predatory fish by methods such as haul seine, mesh net and rod and line near seagrass beds may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Major, i.e. large number of boats in recreational fishery, large swept area of haul seine, and a range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known

Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.21 Recreational hook and line: Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	3	5	Population size	Southern Calamari, *Sepioteuthis australis*	1.1	3	2	1	Fish for Southern Calamari with jigs to use as bait, although species is increasingly targeted for eating => intensity Moderate, large number of boats in fishery but smaller proportion would target Southern Calamari for bait => consequence Minor as catch for bait forms small part of a larger recreational/commercial catch that is currently considered sustainable => Confidence is low because total catch and effort in recreational fishery is poorly known / documented.
	Fishing	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Snapper are a primary target species of the recreational hook and line fishery, fishing occurs on the major spawning aggregation for the western Snapper stock => intensity Major, high number of boats in fishery => consequence Moderate because catch is significantly higher than other fishery methods but is considered sustainable => Confidence is low because total catch and effort for the recreational fishery is poorly known / documented, stock assessment tools are limited (currently being addressed in modelling project), and management controls are also limited in a recreational dominated fishery (i.e. limited options to control fishing effort).
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => Consequence Minor because take of Snapper by incidental spearfishing would be very small => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	1	3	5	Population size	Southern Calamari, *Sepioteuthis australis*	1.1	3	2	1	Fish for Southern Calamari with jigs to use as bait, although species is increasingly targeted for eating, some may escape during retrieval=> intensity Moderate, large number of boats in fishery but smaller proportion would target Southern Calamari for bait => consequence Minor as mortality after escape would occur but would be relatively low compared to the direct impact of fishing => confidence low, no data to refute or confirm
	Fishing	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Snapper may be hooked but then break free during retrieval, fish may later die depending on depth of hooking etc =>intensity Major, large number of boats targeting Snapper => consequence Minor, mortality is likely to be much lower than from direct capture => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing, Snapper could escape from spear before capture and later die => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => Consequence Negligible because mortality of Snapper occurring in this way would not be detectable => confidence low, no data to refute or confirm

	Gear loss	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Snapper may escape with hook and broken line still attached, later survival may depend on hook position etc. => intensity Major, large number of boats in fishery, => consequence Minor, mortality from attached hook and broken line would be considerably lower than by direct capture => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	3	2	1	Possible that anchor hitting bottom or dragging could influence Snapper behaviour or movement but would be very localised, =>intensity moderate, large number of boats in fishery, fishing usually occurs while anchored => consequence Minor, effect on behaviour/movement would be difficult to detect => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Snapper => intensity Moderate, large number of boats in fishery => consequence Minor, mortality from this source would be very low compared with total egg and larval mortality =>confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the Snapper population. => intensity Minor as infrequent event =>consequence Major because could lead to population decline => confidence low, based on no knowledge of potential for translocation
	On board processing	1	3	5	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	1	Onboard processing such as gutting and filleting fish and discarding frames may attract Snapper to waste but also predators such as sharks leading to higher localised mortality. => intensity Moderate, large number of boats involved in fishery but lower proportion would process onboard => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Discarding catch	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Large numbers of undersize Snapper are released in the fishery, as well as legal size Snapper where the bag limit has been reached. High grading can occur where legal size Snapper are discarded in favour of larger fish within the bag limit => intensity Major, large number of boats in fishery and catch rate of undersize fish can be high => consequence Moderate, mortality of released undersize fish can be in the order of 20% but overall the fishery is considered to be sustainable => confidence low as data on total release and discard numbers is lacking
	Stock enhancement	0									Does not occur
	Provisioning	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Introduction of bait and berley to the environment may attract Snapper to area but also predators such as sharks leading to higher localised mortality. => intensity Major, large number of boats involved in fishery, majority use bait and many use berley => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	3	2	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Snapper on a very localised scale => intensity moderate as large number of boats in fishery, so incremental effect of organic waste would be significant => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	3	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Snapper on a very localised scale => intensity Moderate as large number of boats in fishery, incremental effect of discarded plastic bags etc would be significant => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
	Chemical pollution	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Snapper, =>intensity Major, large number of boats in fishery at the time Snapper are spawning =>consequence Minor as increase in

											mortality would be low relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Major, large number of boats in fishery at the time Snapper are spawning => consequence Minor as increase in mortality would be low relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Gear loss	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	2	1	Hooks and line are commonly lost on reefs due to snagging, Snapper may take baited hooks or be hooked incidentally, or become tangled in discarded line => intensity Major, large number of boats in fishery, considerable amount of snagging and gear loss => consequence Minor, mortality from hooking and entanglement of Snapper would be low => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Snapper larvae => intensity Major, large number of boats involved in fishery at the time Snapper are spawning => consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Snapper larvae => intensity Major, large number of involved in fishery at the time Snapper are spawning => consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	1	2	4	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	1	1	Pumping Bass Yabbies for bait disturbs sediments and creates sediment plumes that may affect King George Whiting behaviour/movement => intensity Minor, small number of rec fishers pump Bass Yabbies for bait in localised areas => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence low, no data to refute or confirm
	Fishing	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	3	1	2	Sediments will be disturbed when sinkers hit the bottom and are dragged along the bottom during retrieval =>intensity Moderate, large number of boats in fishery but very small disturbance => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	4	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Major, large numbers of boats launched and retrieved in this fishery => consequence Minor as change in behaviour/movement of whiting due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	2	1	Sediments may be disturbed in while anchoring or mooring => intensity Major, large number of boats in fishery and Snapper fishing usually occurs while anchored => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, large number of boats fishery but most in deeper water => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	3	2	Snapper are also the primary target species of the commercial long-line fishery (and is also important in the haul seine and mesh net fisheries), fishing occurs on the major spawning aggregation for the western Snapper stock => intensity Moderate, few boats in fishery => consequence Moderate because fishery appears sustainable, long-term trend in CPUE is stable, catch fluctuations appear environmentally driven =>Confidence is high because catch and effort is well documented.
	Aquaculture	1	3	6	Population size	King George Whiting,	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on whiting habitat use. King George Whiting may be attracted to

					Sillaginodes punctatus					food/structure provided by mussel farm but aggregation may increase catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Minor, effect on King George Whiting mortality would be small given relatively small area of impact => confidence low as there is no data to support or refute
Coastal development	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for whiting => intensity Major, very large human population and associated development =>consequence Major, juvenile whiting depend on shallow seagrass habitat => confidence low as data on the effect of coastal processes is limited
Catchment inputs	1	3	6	Reproductive capacity	Snapper, *Chrysophrys auratus*	5.2	4	4	1	Snapper population primarily determined by recruitment success that is related to plankton food for larvae that is in turn related to nutrients and flows from catchment => intensity major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Snapper recruitment (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => plankton => Snapper recruitment is still limited
Shipping activities	1	3	1	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	2	Primary concern is introduction of a new marine pest affecting benthic productivity for juveniles, adults => intensity Minor, Melbourne is a major shipping port but new marine pest introductions are rare events => consequence Major, introduction of new marine pest could have long term detrimental effect on Snapper population => confidence high based on evidence of marine pest effects in Port Phillip Bay and other systems
Port activities	1	2	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and benthic habitat (spoil). Dredge plume in the Heads may affect Snapper migration => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.22 Recreational hook and line: Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	3	5	Population size	Barracouta, *Thyrsites atun*	1.1	3	2	1	Barracouta are targeted to use as bait for Snapper and other species => intensity Moderate, large number of boats in fishery but smaller proportion would target Barracouta for bait => consequence Minor as catch for bait would be expected to be relatively low and have minimal impact on stock => Confidence is low because total catch and effort in recreational fishery is poorly known / documented.
	Fishing	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	3	1	Not usually targeted but a preferred byproduct species in Port Phillip Bay, low population levels and reproductive rate makes vulnerable to fishing pressure =>intensity Major, high number of boats in fishery, vulnerable to Gummy Shark methods => consequence Moderate because although vulnerable the catch is small => confidence low, total catch and effort for the recreational fishery is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing =>intensity Minor because relatively few recreational fishers would also undertake incidental fishing => consequence Negligible because take of School Shark by incidental spearfishing would be very small => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	1	3	5	Population size	Barracouta, *Thyrsites atun*	1.1	3	2	1	Barracouta are targeted to use as bait for Snapper and other species, some may escape during retrieval=> intensity Moderate, large number of boats in fishery but smaller proportion would target Barracouta for bait => consequence Minor as mortality after escape would occur but would be relatively low compared to the direct impact of fishing => confidence low, no data to refute or confirm
	Fishing	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	School Shark may be hooked but then escape during retrieval, fish may later die depending on depth of hooking etc => intensity Major, high number of boats in fishery, vulnerable to Gummy Shark methods => consequence Minor, mortality is likely to be much lower than from direct capture => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing. School Shark may escape after spearing and survival will depend on severity of wound => intensity Minor because relatively few recreational fishers would also undertake incidental spearfishing => consequence Negligible because take of School Shark by incidental spearfishing would be very small and incidence of escape after spearing would be even smaller => confidence low, no data to refute or confirm
	Gear loss	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	School Shark may escape with hook and broken line still attached, later survival may depend on hook position etc. =>intensity Major, large number of boats in fishery, => consequence Minor, mortality from attached hook and broken line would be considerably lower than by direct capture => confidence low, no data to refute or confirm

	Anchoring/ mooring	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	2	1	Possible that anchor hitting bottom or dragging could influence School Shark behaviour or movement but would be very localised => intensity Moderate, large number of boats in fishery, fishing usually occurs while anchored => consequence Minor, effect on behaviour/movement would be difficult to detect => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Sixspine Leatherjacket, *Meuschenia freycineti*	1.1	3	2	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Sixspine Leatherjacket => intensity Moderate, large number of boats in fishery => consequence Minor, mortality from this source would be very low compared with total egg and larval mortality => confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the Bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	1	Onboard processing such as gutting and filleting fish and discarding frames may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality => intensity Moderate, large number of boats involved in fishery but lower proportion would process onboard => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Discarding catch	1	3	6	Population size	Smooth Stingray, *Dasyatis brevicaudata*	1.1	4	3	1	Discarding of unwanted catch such as rays can lead to post-release mortality depending on handling => intensity Major, large number of boats involved in fishery => consequence Moderate as although overall mortality would be low, ray species have low reproductive rates => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	Introduction of bait and berley to the environment may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Major, large number of boats involved in fishery, majority use bait and many use berley => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	2	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale => intensity Moderate as large number of boats in fishery, so incremental effect of organic waste would be significant => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of School Shark on a very localised scale => intensity Moderate as large number of boats in fishery, incremental effect of discarded plastic bags etc would be significant => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
	Chemical pollution	1	3	6	Population size	Sixspine Leatherjacket, *Meuschenia freycineti*	1.1	4	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Sixspine Leatherjacket => intensity major, large number of boats in fishery => consequence Minor as increase in mortality would be low relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Population size	Sixspine Leatherjacket, *Meuschenia freycineti*	1.1	4	2	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae =>intensity Major, large number of boats in fishery => consequence Minor as increase in mortality would be low relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute

	Gear loss	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	Hooks and line are commonly lost on reefs due to snagging, School Shark may take baited hooks or be hooked incidentally, or become tangled in discarded line => intensity Major, large number of boats in fishery, considerable amount of snagging and gear loss => consequence Minor, mortality from hooking and entanglement of lost gear would be very low => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Sixspine Leatherjacket, *Meuschenia freycineti*	6.1	4	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Sixspine Leatherjacket larvae =>intensity Major, large number of boats involved in fishery => consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	4	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of School Shark in shallow water => intensity Major, large number of involved in fishery but most in deeper water => consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	1	2	4	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	2	1	1	Pumping Bass Yabbies for bait disturbs sediments and creates sediment plumes that may affect Yelloweye Mullet behaviour/movement in shallow water => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence low, no data to refute or confirm
	Fishing	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	1	2	Sediments will be disturbed when sinkers hit the bottom and are dragged along the bottom during retrieval => intensity Moderate, large number of boats in fishery but very small disturbance => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	4	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Major, large numbers of boats launched and retrieved in this fishery => consequence minor as change in behaviour/movement of Yelloweye Mullet due to disturbance would be small and localised => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	4	2	1	Sediments may be disturbed in while anchoring or mooring => intensity Major, large number of boats in in fishery and fishing usually occurs while anchored => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Yelloweye Mullet, *Aldrichetta forsteri*	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, large number of boats fishery but most in deeper water => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	3	2	School Shark are also caught as byproduct species in the haul seine, long-line and mesh net fisheries => intensity Moderate, small number of boats in fishery but swept area of net (i.e. haul-seining) can be large =>consequence Moderate because even though catch is relatively small, species has low population size and reproductive rate => confidence is high because total catch and effort is well documented.
	Aquaculture	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm (e.g. seagrass) and consequent effect on School Shark habitat use. School Shark may be attracted to food/structure but aggregation may increase catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Minor, effect on School Shark mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive capacity	School Shark, *Galeorhinus galeus*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat that is used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Major, very large human population and associated development => consequence Major, continued coastal developed likely to lead a

											reduction in habitat and potential effects on School Shark reproduction => confidence low as data on the habitat use of the species in Port Phillip is limited
	Catchment inputs	1	3	6	Reproductive capacity	School Shark, *Galeorhinus galeus*	5.2	4	4	1	Nutrients and sediments from catchment could affect quality and extent of seagrass habitat used by School Sharks for pupping and juvenile nursery areas in Port Phillip => highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs of nutrients or sediments could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence low as data on the habitat use of the species in Port Phillip is limited.
	Shipping activities	1	3	1	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting seagrass habitat used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Moderate, Melbourne is a major shipping port but oil spills are rare events => consequence Major, significant oil spill would have long term effect on School Shark population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	School Shark, *Galeorhinus galeus*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect benthic (seagrass) habitat used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.23 Recreational hook and line: TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	3	5	Population size	Western Port Ghost Shrimp, *Calliax tooradin*	1.1	2	2	1	Very rare species of Ghost Shrimp (Bass Yabby) that could be incidentally taken while pumping Bass Yabbies for bait => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Minor as, given the intensity, the mortality of this shrimp from bait collection would be very low => confidence low, no data to refute or confirm
	Fishing	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	3	1	Not usually targeted but a preferred byproduct species in Port Phillip Bay, low population levels and reproductive rate makes vulnerable to fishing pressure => intensity Major, high number of boats in fishery, vulnerable to Gummy Shark / Snapper methods => consequence Moderate because although vulnerable, the catch is small and management

											restrictions are in place => confidence low: total catch and effort for the recreational fishery is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing, including the spearing of school shark => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => Consequence Negligible because catch would be very small from this activity=> confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	1	3	5	Behaviour/ movement	Australian Fur-seal, *Arctocephalus pusillus*	6.1	3	2	1	Activity associated with catching fish or Southern Calamari for bait may attract seals, particularly occurs near entrance area => intensity Moderate, large number of boats in fishery but much smaller proportion fish for bait => consequence Minor because change in movement/behaviour would be localised and short-term => confidence low, no data to refute or confirm
	Fishing	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	School Shark may escape from hook while being retrieved and may subsequently die, low population levels and reproductive rate makes vulnerable to fishing pressure => intensity Major, high number of boats in fishery, vulnerable to Gummy Shark methods => consequence Minor because although vulnerable, the total mortality of escaped fish would be low => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing, including the spearing of school shark; shark may escape from spear while being retrieved and later die => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => consequence Negligible because rate of escaped catch from this activity would be very low => confidence low, no data to refute or confirm
	Gear loss	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	School Shark may escape with hook and broken line, later survival may depend on hook position, low population levels and reproductive rate makes vulnerable to fishing pressure => intensity Major, high number of boats in fishery, vulnerable to Gummy Shark / Snapper methods => consequence Minor because although vulnerable, the total mortality of escaped fish would be low => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	3	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with syngnathids in seagrass beds causing mortality => intensity Moderate, large number of boats in fishery, anchoring occurs around seagrass beds (i.e. whiting fishing) => consequence Negligible, mortality rate would be very low relative to population sizes => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	3	1	Population of only 100 Burrunan Dolphins in PPB; calves in particular are susceptible to boat strikes => intensity Major as large number of boats in fishery and many are high speed => consequence Moderate because even one death would be significant at the population level => confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	1	Onboard processing such as gutting and filleting fish and discarding frames may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality =>intensity Moderate, large number of boats involved in fishery but lower proportion would process onboard => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Discarding catch	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	1	1	Discarding of unwanted catch may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Major as large number of number of boats involved in fishery => consequence Minor as increase in mortality would be low and difficult to detect => confidence low as there is no data to support or refute

	Stock enhancement	0									Does not occur
	Provisioning	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	2	1	Introduction of bait and berley to the environment may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Major, large number of boats involved in fishery, majority use bait and many use berley => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	2	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale =>intensity Moderate as large number of boats in fishery, so incremental effect of organic waste would be significant => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves => intensity Major as large number of boats involved in fishery with significant incremental debris => consequence Major as even though mortality would be rare, even one death would be significant at the population level => confidence is low because the population trajectory of the species in PPB is poorly understood
	Chemical pollution	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin => intensity Major as large number of boats involved in fishery with significant incremental chemical pollution => consequence Minor as levels of chemical pollution would be much lower than from catchment, industry and shipping; mortality would be very rare if at all => Confidence is low because the population trajectory of the species in PPB is poorly understood
	Exhaust	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, intensity Moderate as large number of boats involved in fishery with incremental exhaust pollution => consequence Minor as mortality would be very unlikely from this source => confidence is low because the population trajectory of the species in PPB is poorly understood
	Gear loss	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Significant amount of line and terminal tackle is lost in recreational fishery, dolphins may entangle in lost line => intensity Major, large number of boats involved in fishery and gear loss is common => consequence Major as even though mortality would be rare, even one death would be significant at the population level => Confidence is low because the population trajectory of the species in PPB is poorly understood
	Navigation/ steaming	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	4	3	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour => intensity Major, large number of boats involved in fishery and significant amount of noise introduced => consequence Moderate as the significant amount of noise introduced has the potential to regularly effect behaviour/movement => confidence is low because the effect of boat noise on dolphin behaviour/movement is poorly understood
	Activity/ presence on water	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	4	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin, => intensity Major, large number of boats involved in fishery => consequence Minor as the activity on the water may have s small and localised effect behaviour/movement => Confidence is low because the effect of activity on the water on dolphin behaviour/movement is poorly understood
Disturb physical processes	Bait collection	1	2	4	Population size	Western Port Ghost Shrimp, *Calliax tooradin*	1.1	2	2	1	Very rare species of Ghost Shrimp (Bass Yabby) that could be affected by disturbance of sediments while pumping Bass Yabbies for bait => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Minor as, given the intensity, the mortality of this shrimp from bait collection would be very low => confidence low, no data to refute or confirm

	Fishing	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	1	2	Sediments will be disturbed when sinkers hit the bottom and are dragged along the bottom during retrieval => intensity Moderate, large number of boats in fishery but very small disturbance => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	4	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity major, large numbers of boats launched and retrieved in this fishery => consequence Minor as change in behaviour/movement of syngnathids due to disturbance would be small and localised => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	4	2	2	Sediments may be disturbed in while anchoring or mooring, may affect syngnathid habitat if disturbs seagrass habitat => intensity Major, large number of boats in fishery and fishing usually occurs while anchored => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, large number of boats fishery but most in deeper water => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	4	3	2	School Shark are also caught as byproduct species in the haul seine, long-line and mesh net fisheries => intensity Moderate, small number of boats in fishery but swept area of net (i.e. haul-seining) can be large => consequence Moderate because even though catch is relatively small, species has low population size and reproductive rate => confidence is high because total catch and effort is well documented.
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, some species may use mussel farm structure as habitat => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Minor, overall effect on syngnathid mortality would be small given relatively small area of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive capacity	School Shark, *Galeorhinus galeus*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat that is used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Major, very large human population and associated development => consequence Major, continued coastal developed likely to lead a reduction in habitat and potential effects on School Shark reproduction => confidence low as data on the habitat use of the species in Port Phillip is limited
	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project

	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.24 Recreational hook and line: Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	3	5	Habitat structure and function	Sparse *Zostera* sp. seagrass on intertidal sand-mud flat	5.1	2	2	1	Pumping Bass Yabbies for bait results in disturbance of intertidal mudflats with sparse *Zostera* seagrass => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Minor as the disturbance would be very localised and short-lived => confidence low, no data to refute or confirm
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	4	2	1	Sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Major, large number of boats in fishery => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	2	2	1	Possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing, possible that reef could be disturbed by fins etc when spearfishing => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	1	3	5	Habitat structure and function	Sparse *Zostera* sp. seagrass on intertidal sand-mud flat	5.1	2	2	1	As for capture, pumping Bass Yabbies for bait results in disturbance of intertidal mudflats with sparse *Zostera* seagrass => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Minor as the disturbance would be very localised and short-lived => confidence low, no data to refute or confirm
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	4	2	1	As for capture, sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Major, large number of boats in fishery => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/	5.1	2	2	1	As for capture, possible that other recreational methods (spearfishing, hand collection) could be used incidentally when primary purpose is hook and line fishing, possible that reef could be disturbed by fins etc when spearfishing => intensity Minor because relatively

						Ecklonia					few recreational fishers would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Gear loss	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	4	2	1	Gear can be lost through sinkers and hooks snagging on algae and sessile invertebrates, berley bags and weights can also be lost => intensity Major, large number of boats in fishery, snagging is common on reefs => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	1	Anchoring is common and anchor and chain can affect seagrass (i.e. whiting fishing); mooring also often occurs in sheltered areas with seagrass where chain causes "blowout" => intensity Moderate, large number of boats in fishery, most fishing is at anchor, but a lower proportion fishing near seagrass => consequence Minor as effect on habitat structure and function would be minimal given growth characteristics of *Zostera* => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	4	2	2	Navigation and steaming would cause turbulence possibly affecting habitat quality for planktonic organisms => intensity Major as large number of high-speed boats in fishery => Consequence Minor as localised effect on habitat structure and function would be difficult to detect => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs => intensity Minor as rare event => consequence Major because could lead to decline in native kelps and change in reef structure and function => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	5	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	3	2	1	Onboard processing such as gutting and filleting fish and discarding frames may mean organic material and nutrients are introduced to the benthic habitat. => intensity Moderate as large number of boats involved in fishery but smaller proportion would process fish on board => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Discarding catch	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	3	2	1	Discarding of unwanted catch that has died may mean organic material and nutrients are introduced to the benthic habitat. => intensity Moderate as large number of boats involved in fishery but smaller proportion would discard dead catch => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	4	2	1	Introduction of bait and berley to the environment means organic material and nutrients are introduced to the benthic habitat => intensity Major as large number of boats involved in fishery, most using bait and many using berley => consequence Minor as localised change to habitat structure and function be difficult to detect => confidence low as there is no data to support or refute.
	Organic waste disposal	1	3	6	Water quality	Pelagic habitat	1.1	4	2	1	Organic waste such as food scraps or sewage could affect the surrounding water quality on a localised scale => intensity Major as large number of boats involved in fishery => consequence Minor as change to water quality would be small and localised => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	6	Substrate quality	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	3.1	3	3	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the substrate quality of the habitat, buoyant material can also impact intertidal areas => intensity Moderate as large number of boats in fishery, incremental effect of discarded plastic bags etc would be significant => consequence Moderate as the amount of debris would be approaching the level where substrate quality is compromised in some areas => confidence low as there is no data to support or refute for this fishery

	Chemical pollution	1	3	6	Water quality	Pelagic habitat	1.1	4	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae => intensity Major, large number of boats in fishery => consequence Minor as level of chemical pollution would be much lower than that associated with industry, catchment inputs and shipping (although water quality may be compromised in localised areas e.g. marinas) => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Air quality	Pelagic habitat	2.1	4	2	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface => intensity Major, large number of boats in fishery => consequence Minor as influence on air quality would be low relative to other sources of air pollution => confidence low as there is no data to support or refute
	Gear loss	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	4	2	1	Gear can be lost through sinkers and hooks snagging on algae and sessile invertebrates, berley bags and weights can also be lost => intensity Major, large number of boats in fishery, snagging is common on reefs => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	4	2	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms => intensity Major, large number of boats involved in fishery => consequence Minor as change in pelagic habitat structure and function would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Habitat structure and function	Pelagic habitat	5.1	4	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms => intensity Major, large number of boats involved in fishery => consequence Minor as the noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	1	2	4	Habitat structure and function	Sparse *Zostera* sp. seagrass on intertidal sand-mud flat	5.1	2	2	1	Pumping Bass Yabbies for bait results in movement of sediments (including sediment plumes) on intertidal mudflats with sparse *Zostera* seagrass => intensity Minor, small number of rec fishers pump yabbies for bait in localised areas => consequence Minor as the disturbance would be very localised and short-lived => confidence low, no data to refute or confirm
	Fishing	1	3	6	Habitat structure and function	Sparse patchy macroalgae on flat silt/sand sediment	5.1	2	1	2	Sediments will be disturbed when sinkers hit the bottom and are dragged along the bottom during retrieval =>intensity Minor, large number of boats in fishery but very small disturbance to physical processes => consequence Negligible as change in habitat structure and function due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	2	2	Seagrass may be disturbed in boat launching (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps => intensity Major, large numbers of boats launched and retrieved in this fishery => consequence Minor as disturbance would be small in area and have localised impact on habitat structure and function only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	2	1	Anchoring is common and anchor and chain can affect seagrass (i.e. King George whiting fishing); mooring also often occurs in sheltered areas with seagrass – can remove seagrass and alter sediment movement/plumes => intensity Major, large number of boats in fishery, most fishing is at anchor => consequence Minor as effect on habitat structure and function would be minimal given strong re-growth characteristics of *Zostera* => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, shifting sediment and creating sediment plumes affecting seagrass => intensity Minor, large number of boats fishery but most in deeper water => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm

External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	1	Seagrass can be impacted by anchors and chains, and also by the hauling of seines, in commercial fishing operations => intensity Moderate, small number of boats in commercial fishery but some methods have nets with large area swept (i.e. haul seine) => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can also occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.25 Recreational hook and line: Community component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	1	3	5	Trophic/size structure	Pelagic (water column) community	1.1	3	2	1	Pelagic species such as Barracouta, Jack Mackerel, Yellowtail Scad and Blue Mackerel are targeted to use as bait for Snapper and other species. Removal of pelagic fish may alter food chain / trophic levels in pelagic community => intensity Moderate, large number of boats in fishery but smaller proportion would target pelagic fish for bait => consequence Minor as catch for bait would be expected to be relatively low and therefore effect on Trophic/size structure would be minimal => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Fishing	1	3	6	Trophic/size structure	Reef/*Ecklonia* community	4.1	4	3	1	Removal of Snapper and other predatory fish may alter food chain / trophic levels => intensity Major, large number of boats in fishery => consequence Moderate as effects on Trophic / size structure are likely to be significant but should be ecologically sustainable => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Incidental behaviour	1	3	3	Species composition	Reef/*Ecklonia* community	1.1	2	2	1	Possible that other recreational methods (e.g. spearfishing) could be used incidentally when primary purpose is hook and line fishing => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => Consequence Minor because take of fish by incidental spearfishing would be very small => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	1	3	5	Trophic/size structure	Pelagic (water column) community	1.1	3	1	1	Pelagic species such as Barracouta, Jack Mackerel, Yellowtail Scad and Blue Mackerel are targeted to use as bait for Snapper and other species, may escape from hook before capture and later die. Removal of pelagic fish may alter food chain / trophic levels in pelagic community=> intensity Moderate, large number of boats in fishery but smaller proportion would target pelagic fish for bait => consequence Negligible as total mortality from escape after hooking would very low and therefore effect on Trophic/size structure would be likely not detectable => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Fishing	1	3	6	Trophic/size structure	Reef/*Ecklonia* community	4.1	4	2	1	Fish may escape while being retrieved and later die. Removal of Snapper and other predatory fish may alter food chain / trophic levels => intensity Major, large number of boats in fishery => consequence Minor as total mortality would be much lower than from direct capture , effects on Trophic / size structure are likely to be difficult to detect => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Incidental behaviour	1	3	3	Species composition	Reef/*Ecklonia* community	1.1	2	1	1	Possible that other recreational methods (e.g. spearfishing) could be used incidentally when primary purpose is hook and line fishing, fish may escape from spear while being retrieved and later die => intensity Minor because relatively few recreational fishers would also undertake incidental fishing => consequence negligible because total mortality of escaped fish from incidental spearfishing would be very small => confidence low, no data to refute or confirm

	Gear loss	1	3	6	Trophic/size structure	Reef/*Ecklonia* community	4.1	4	2	1	Fish may break off and escape with hook and broken line, later survival may depend on hook position etc. => intensity Major, large number of boats in fishery => consequence Minor as total mortality would be much lower than from direct capture , effects on Trophic / size structure are likely to be difficult to detect => confidence low, no scientific studies on fishing impacts on trophic / size structure in PPB
	Anchoring/ mooring	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	3	2	1	Anchoring is common and anchor and chain can affect seagrass (i.e. whiting fishing); mooring also often occurs in sheltered areas with seagrass where chain causes "blowout" => intensity Moderate, large number of boats in fishery, most fishing is at anchor, but a lower proportion fishing near seagrass => consequence Minor as effect on *Zostera* community would be minimal given the strong re-growth potential of *Zostera* => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	4	2	2	Navigation and steaming would cause turbulence possibly affecting community distribution of planktonic organisms =>intensity Major as large number of high-speed boats in fishery => consequence Minor as localised effect on the distribution of the community would be difficult to detect => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs => intensity Minor as rare event => consequence Major because could lead to complete loss or replacement of *Ecklonia* and consequent change to functional group composition => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	5	Distribution of the Community	Reef/*Ecklonia* community	3.1	3	2	1	Onboard processing such as gutting and filleting fish and discarding frames may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Moderate as large number of boats involved in fishery but smaller proportion would process fish on board => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
	Discarding catch	1	3	6	Distribution of the Community	Reef/*Ecklonia* community	3.1	3	2	1	Discarding catch of unwanted fish that have died may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Moderate as large number of boats involved in fishery but smaller proportion would discard dead catch => consequence Minor as would have a minimal effect on community distribution =>confidence low as there is no data to support or refute
	Stock enhancement	0									Does not occur
	Provisioning	1	3	6	Distribution of the Community	Dense *Pyura* sp. sea squirt on flat sand sediment	3.1	4	3	1	Introduction of bait and berley to the environment means organic material and nutrients are introduced to the benthic habitat, can lead to change in distribution of community, i.e. attraction of scavengers such as Northern Pacific Seastar => intensity Major as large number of boats involved in fishery, most using bait and many using berley => consequence Moderate as could have a significant effect on community distribution => confidence low as there are no scientific studies to support or refute
	Organic waste disposal	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	4	2	1	Organic waste such as food scraps or sewage could affect the distribution of plankton in the pelagic community on a localised scale => intensity Major as large number of boats involved in fishery and incremental addition of organic waste likely to be significant => consequence Minor as change to distribution of the plankton community would be small and localised => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	6	Distribution of the Community	Reef/*Ecklonia* community	3.1	3	3	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the distribution of the benthic community => intensity Moderate as large number of boats in fishery, incremental effect of discarded plastic bags etc would be significant =>

										consequence Moderate as the amount of debris would be approaching the level where the distribution of the community is significantly affected in some areas => confidence low as there is little data to support or refute for this fishery
	Chemical pollution	1	3	6	Species composition	Pelagic (water column) community	1.1	4	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the species composition of plankton in the pelagic community => intensity Major, large number of boats in fishery => consequence Minor as level of chemical pollution would be much lower than that associated with industry, catchment inputs and shipping (although species composition may be affected in localised areas e.g. marinas) => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Species composition	Pelagic (water column) community	1.1	4	2	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Major, large number of boats in fishery => consequence Minor as effect on distribution of the pelagic community would be difficult to detect => confidence low as there is no data to support or refute
	Gear loss	1	3	6	Distribution of the Community	Reef/*Ecklonia* community	3.1	4	2	1	Gear can be lost through sinkers and hooks snagging on algae and sessile invertebrates, berley bags and weights can also be lost => intensity Major, large number of boats in fishery, snagging is common on reefs => consequence Minor as localised effect on the distribution of the community would be small and difficult to detect => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Species composition	Pelagic (water column) community	1.1	4	2	1	Navigation and steaming would cause turbulence possibly affecting species composition of planktonic organisms in the pelagic community => intensity Major, large number of boats involved in fishery =>consequence Minor as change in species composition of planktonic organisms would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	4	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could affect the distribution of the pelagic community by influencing the behaviour/movement of organisms => intensity Major, large number of boats involved in fishery => consequence Minor as the noise and visual stimuli introduced would only have a very localised effect on behaviour/movement => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	1	2	4	Distribution of the Community	Intertidal mudflat community	3.1	2	2	1	Pumping Bass Yabbies for bait results in movement of sediments (including sediment plumes) on intertidal mudflats affecting the invertebrate community => intensity Minor, small number of rec fishers pump Bass Yabbies for bait in localised areas => consequence Minor as the disturbance would be very localised and short-lived => confidence low, no data to refute or confirm
	Fishing	1	3	6	Distribution of the Community	High Diversity Sands community	3.1	2	1	2	Sediments will be disturbed when sinkers hit the bottom and are dragged along the bottom during retrieval => intensity Minor, large number of boats in fishery but very small disturbance to physical processes => consequence Negligible as change in the distribution of the benthic community due to disturbance would be very small and likely not detectable =>confidence high, logical constraint on consequence
	Boat launching	1	3	6	Species composition	*Zostera* seagrass community	1.1	4	2	2	Sediment plumes may be created by launching related activities (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps, could affect light for seagrass with flow on to community => intensity Major, large numbers of boats launched and retrieved in this fishery => consequence Minor as disturbance would be small in area and have localised impact on species composition only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Species composition	*Zostera* seagrass community	1.1	3	2	1	Anchoring is common and anchor and chain can affect seagrass (i.e. King George Whiting fishing); mooring also often occurs in sheltered areas with seagrass – can remove seagrass and alter sediment movement/plumes => intensity Moderate, large number of boats in fishery, most fishing is at anchor, but a lower proportion fishing near seagrass => consequence Minor as effect on species composition would be localised and short-lived

											given strong re-growth characteristics of *Zostera* => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Species composition	*Zostera* seagrass community	1.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, shifting sediment and creating sediment plumes affecting seagrass community => intensity Minor, large number of boats fishery but most in deeper water => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	*Zostera* seagrass community	4.1	3	3	1	Removal of fish by methods such as haul seine and mesh net near seagrass beds may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Moderate, small number of boats in fishery but large swept area of haul seine, and a range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development =>consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
	Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.26 Recreational Spearfishing: Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Magpie Perch, *Cheilodactylus nigripes*	1.1	3	3	1	Magpie Perch are a long-lived species that are a preferred target of spearfishers on reefs => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Moderate because of low population numbers and vulnerability to spearfishing on nearshore reefs => confidence is low because both participation and catch is poorly known / documented.
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Possible that other recreational (methods recreational hook and line, hand collection) could be used incidentally when primary purpose is spearfishing => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of Snapper by incidental fishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Magpie Perch, *Cheilodactylus nigripes*	1.1	2	2	1	Magpie Perch may be speared but then break free during retrieval, fish may later die depending on severity of wound => intensity Minor, relatively small number of participants in fishery, with a low proportion of speared Magpie Perch escaping => consequence Minor, mortality will be lower than from direct capture => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Possible that other recreational methods (recreational hook and line, hand collection) could be used incidentally when primary purpose is spearfishing, Snapper could escape before capture by rod and line and later die => intensity Minor because relatively few spearfishers would also undertake incidental fishing => consequence Minor because total mortality of Snapper that escape while incidental fishing would be very small relative to overall mortality related to other sub-fisheries=> confidence low, no data to refute or confirm
	Gear loss	1	3	3	Population size	Magpie Perch, *Cheilodactylus nigripes*	1.1	2	1	1	Magpie Perch may escape with spear still attached, unlikely to survive => intensity Minor, relatively small number of participants in fishery; Magpie Perch escaping with gear still attached would be very rare => consequence Negligible, mortality after escape with

											attached spearfishing gear would be extremely low => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	2	1	Possible that anchor hitting bottom or dragging could influence Snapper behaviour or movement but would be very localised => intensity Minor, relatively small number of boats in fishery, fishing usually occurs while anchored => consequence Minor, effect on behaviour/movement would be difficult to detect => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Snapper => intensity Minor, relatively small number of boats in fishery => consequence Negligible, mortality from this source would not be detectable compared with total egg and larval mortality => confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of pest species, particularly if a new species is introduced, could lead to decline in the Snapper population. => intensity Minor as infrequent event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential for translocation
	On board processing	1	3	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Onboard processing such as gutting and filleting fish and discarding frames may attract Snapper to waste but also predators such as sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Negligible as increase in mortality would not be detectable => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	1	3	5	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Berley is occasionally used (e.g. Australian Pilchards). Introduction of berley to the environment may attract Snapper to area but also predators such as sharks leading to higher localised mortality =>intensity Minor, relatively small number of boats involved in fishery, lower proportion would use berley => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	5	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Snapper on a very localised scale => intensity Minor as relatively small number of boats in fishery => consequence Negligible as change in behaviour/movement would not be detectable => confidence low as there is no data to support or refute

Addition of non-biological material	Debris	1	3	5	Behaviour/ movement	Magpie Perch, *Cheilodactylus nigripes*	6.1	2	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Magpie Perch on a very localised scale => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based spearfishers => consequence Minor as change in behaviour/movement would be small and difficult to detect =>confidence low as there is no data to support or refute
	Chemical pollution	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Snapper =>intensity Minor, relatively few boats in the fishery => consequence Minor as increase in mortality would be difficult to detect relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae => intensity Minor relatively few boats in the fishery => consequence Negligible as increase in mortality would likely not be detectable relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	1	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect Snapper behaviour and movement => intensity Minor, loss of gear would be rare => consequence negligible, effect of gear loss on Snapper behaviour/movement would not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Snapper larvae => intensity Minor relatively few boats in the fishery =>consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Snapper larvae => intensity Minor, relatively few boats in the fishery => consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Behaviour/ movement	Magpie Perch, *Cheilodactylus nigripes*	6.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, significant participation in spearfishing but most time is spent at the surface => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	3	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as change in behaviour/movement of whiting due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm

	Anchoring/ mooring	1	3	6	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	2	2	1	Sediments may be disturbed in while anchoring or mooring => intensity Minor, relatively few boats in in fishery, boat would be anchored while spear fishing => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	King George Whiting, *Sillaginodes punctatus*	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	4	3	1	Snapper are a primary target species of the recreational rod and line and commercial long-line fisheries (and are also important in the haul seine and mesh net fisheries), fishing occurs on the major spawning aggregation for the western Snapper stock => intensity Major, particularly for the recreational rod and line fishery where large numbers of anglers target the species => consequence Moderate because fishery appears sustainable, commercial long-term trend in CPUE is stable, catch fluctuations appear environmentally driven => confidence is low because total catch and effort for the recreational rod and line fishery is poorly known/documented.
	Aquaculture	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on whiting habitat use. Whiting may be attracted to mussels for food but aggregation could lead to increased catchability => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Minor, effect on whiting mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	King George Whiting, *Sillaginodes punctatus*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting seagrass habitat for whiting => intensity Major, very large human population and associated development => consequence Major, juvenile whiting depend on shallow seagrass habitat => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Reproductive capacity	Snapper, *Chrysophrys auratus*	5.2	4	4	1	Snapper population primarily determined by recruitment success that is related to plankton food for larvae that is in turn related to nutrients and flows from catchment => intensity major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to decline in Snapper recruitment (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => plankton => Snapper recruitment is still limited
	Shipping activities	1	3	1	Population size	Snapper, *Chrysophrys auratus*	1.1	2	4	2	Primary concern is introduction of a new marine pest affecting benthic productivity for juveniles, adults => intensity Minor, Melbourne is a major shipping port but new marine pest introductions are rare events => consequence Major, introduction of new marine pest could have long term detrimental effect on Snapper population => confidence high based on evidence of marine pest effects in Port Phillip Bay and other systems
	Port activities	1	2	3	Behaviour/ movement	Snapper, *Chrysophrys auratus*	6.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and benthic habitat (spoil). Dredge plume in Heads may affect Snapper migration => intensity Major; Melbourne is a major shipping port => consequence Moderate,

											dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Snapper, *Chrysophrys auratus*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.27 Recreational spearfishing: Byproduct and bycatch

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	3	3	1	Large size and slow movement makes this species vulnerable to spearfishing => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Moderate because total catch would likely be sustainable => confidence is low because both participation and catch is not known.
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other recreational (methods recreational hook and line, hand collection) could be used incidentally when primary purpose is spearfishing => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of School Shark by incidental fishing would be very small relative to other sub-fisheries=> confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	2	1	Large size and slow movement makes this species vulnerable to spearfishing. Fish may be speared but then break free during retrieval, fish may later die depending on severity of wound => intensity Minor, relatively small number of participants in fishery, with a low proportion of speared fish escaping =>consequence Minor, mortality will be lower than from direct capture => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other recreational methods (recreational hook and line, hand collection) could be used incidentally when primary purpose is spearfishing, School Shark could escape before capture by rod and line and later die => intensity Minor because relatively

											few spearfishers would also undertake incidental fishing => consequence Minor because total mortality of School Shark that escape while incidental fishing would be very small relative to overall mortality related to other sub fisheries => confidence low, no data to refute or confirm
	Gear loss	1	3	3	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	1	1	Dusky Morwong may escape with spear still attached, unlikely to survive => intensity Minor, relatively small number of participants in fishery; Dusky Morwong escaping with gear still attached would be very rare => consequence Negligible, mortality after escape with attached spearfishing gear would be extremely low relative to total mortality => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	2	1	Possible that anchor hitting bottom or dragging could influence Dusky Morwong behaviour or movement but would be very localised => intensity Minor, relatively small number of boats in fishery; fishing usually occurs while anchored => consequence Minor, effect on behaviour/movement would be difficult to detect => confidence low, no data to support or refute.
	Navigation/ steaming	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Dusky Morwong => intensity Minor, relatively small number of boats in fishery => consequence Negligible, mortality from this source would be not be detectable compared with total egg and larval mortality => confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the Dusky Morwong population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Onboard processing such as gutting and filleting fish and discarding frames may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as increase in mortality would not be difficult to detect => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Berley is occasionally used (e.g. pilchards). Introduction of berley to the environment may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery, lower proportion would use berley => consequence Minor as increase in mortality would be low relative to direct capture => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	5	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Dusky Morwong on a very localised scale => intensity Minor as relatively small number of boats in fishery, waste may also be introduced by shore-based spearfishers => consequence Negligible as change in behaviour/movement would not be detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	5	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of Dusky Morwong on a very localised scale => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based spearfishers => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute

	Chemical pollution	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Dusky Morwong => intensity Minor, relatively few boats in the fishery => consequence Minor as increase in mortality would be difficult to detect relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae => intensity Minor, relatively few boats in the fishery => consequence Minor as increase in mortality would be difficult to detect relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute.
	Gear loss	1	3	3	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	1	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect Dusky Morwong behaviour and movement => intensity Minor, loss of gear would be rare => consequence Negligible, effect of gear loss on Dusky Morwong behaviour/movement would not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Dusky Morwong larvae => intensity Minor, relatively few boats in the fishery =>consequence Minor as change in behaviour/movement would be localised and difficult to detect => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Dusky Morwong larvae => intensity Minor, relatively few boats in the fishery => consequence Negligible as change in behaviour/movement would be localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, significant participation in spearfishing but most time is spent at the surface => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	3	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps, potentially affecting nearshore seagrass habitat for juveniles => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as change in behaviour/movement of Dusky Morwong due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	2	1	Sediments may be disturbed while anchoring or mooring, potentially affecting nearshore seagrass habitat for juveniles => intensity Minor, relatively few boats in in fishery, boat would be anchored while spear fishing => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Dusky Morwong, *Dactylophora nigricans*	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, potentially affecting nearshore seagrass habitat for juveniles => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Gummy Shark, *Mustelus antarcticus*	1.1	4	3	1	Gummy Shark are a target species of the recreational rod and line and commercial long-line fisheries => intensity Major, significant fishing effort in the recreational hook and line and commercial long-line fisheries => consequence Moderate because fishery appears sustainable => Confidence is low because total catch and effort for the recreational rod and line fishery is poorly known/documented.
	Aquaculture	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm (e.g. seagrass) and consequent effect on juvenile Dusky Morwong seagrass habitat use => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Minor, effect on Dusky Morwong mortality would be

										small given relatively small are of impact => confidence low as there is no data to support or refute
Coastal development	1	3	6	Reproductive capacity	Dusky Morwong, *Dactylophora nigricans*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat that is used by juvenile Dusky Morwong => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in habitat and potential effects on Dusky Morwong reproduction => confidence low as data on the habitat use of the species in Port Phillip is limited
Catchment inputs	1	3	6	Reproductive capacity	Dusky Morwong, *Dactylophora nigricans*	5.2	4	4	1	Nutrients, sediments and toxicants from catchment could affect seagrass habitat used by juvenile Dusky Morwong => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat for juvenile Dusky Morwong (sewage treatment nutrient discharge is highly regulated) => confidence low as data on the habitat use of the species in Port Phillip is limited.
Shipping activities	1	3	1	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting seagrass habitat used by juvenile Dusky Morwong => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term effect on Dusky Morwong population => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	3	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect benthic (seagrass) habitat used by juvenile Dusky Morwong => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Population size	Dusky Morwong, *Dactylophora nigricans*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.28 Recreational spearfishing: TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	3	2	1	Very occasionally may be captured by spearfishing, low population levels and reproductive rate makes vulnerable to fishing pressure => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor because take of School Shark by spearfishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other recreational methods (recreational hook and line, hand collection) could be used incidentally when primary purpose is spearfishing => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of School Shark by incidental fishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	School Shark may be speared but then break free during retrieval, fish may later die depending on severity of wound => intensity Minor, relatively small number of participants in fishery, with a low proportion of speared fish escaping => consequence Minor, mortality will be lower than from direct capture and total mortality much lower than other fishery methods => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other recreational fishing (e.g. recreational hook and line) could be used incidentally when primary purpose is spearfishing. Hooked School Shark may escape during retrieval and later die => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental hook and line fishing => consequence Minor because take of School Shark by incidental fishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
	Gear loss	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	1	1	School Shark may escape with spear still attached, unlikely to survive => intensity minor, relatively small number of participants in fishery; School Shark escaping with gear still attached would be very rare => consequence Negligible, mortality after escape with

											attached spearfishing gear would be extremely low relative to overall mortality related to other sub-fisheries => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with syngnathids in seagrass beds causing mortality => intensity Minor, relatively small number of boats in fishery, fishing usually occurs while anchored => consequence Negligible, mortality rate would be very low relative to population sizes => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Population of only 100 Burrunan dolphins in PPB; calves in particular are susceptible to boat strikes => intensity Minor as relatively small number of boats in fishery => consequence Minor because although one death would be significant at the population level, very unlikely given low intensity =>confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Onboard processing such as gutting and filleting fish and discarding frames may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as increase in mortality would be difficult to detect => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	1	3	5	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Berley is occasionally used (e.g. Australian Pilchards). Introduction of berley to the environment may attract School Shark to area but also predators such as larger sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery, lower proportion would use berley => consequence Minor as increase in mortality would be low relative to direct capture = confidence low as there is no data to support or refute
	Organic waste disposal	1	3	5	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale => intensity Minor as relatively small number of boats in fishery, waste may also be introduced by shore-based spearfishers => consequence Negligible as change in behaviour/movement would not be detectable => confidence low as there is no data to support or refute

Addition of non-biological material	Debris	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based spearfishers => consequence Moderate as even though mortality would be rare, even one death would be significant at the population level => Confidence is low because the population trajectory of the species in PPB is poorly understood
	Chemical pollution	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin =>intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of chemical pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin, =>intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of exhaust pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Gear loss	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost. Possible dolphin could become entangled in rope etc. => intensity Negligible, relatively small number of participants in fishery; loss of gear would be rare => consequence Minor because although one death would be significant at the population level, very low intensity means highly unlikely =>confidence low, limited data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour =>intensity Minor, relatively small number of boats involved in fishery => consequence Minor as the amount of noise introduced in consideration of intensity has the potential to only occasionally effect behaviour/movement => confidence is low because the effect of boat noise on dolphin behaviour/movement is poorly understood
	Activity/ presence on water	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin => intensity Minor, relatively small number of boats involved in fishery => consequence Minor as the noise and visual stimuli introduced in consideration of intensity has the potential to only occasionally affect behaviour/movement => confidence is low because the effect of boat noise on dolphin behaviour/movement is poorly understood
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	3	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Moderate, significant participation in spearfishing but most time is spent at the surface => consequence Negligible as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Behaviour/	Syngnathidae, Pipefish and seahorses	6.1	3	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as change in

					movement						behaviour/movement of syngnathids due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	2	Sediments may be disturbed in while anchoring or mooring; may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, relatively few boats in in fishery, boat would be anchored while spear fishing => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence high, logical constraint on consequence
	Navigation/ steaming	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the bay poses a number of risks for the Burrunan Dolphin such as entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fishery => consequence Major as even one death would be significant at the population level for this species => confidence is low because the population trajectory of the species in PPB is poorly understood
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, mussel farm infrastructure may provide habitat for some species => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect may be significant => consequence Minor, overall effect on syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive capacity	School Shark, *Galeorhinus galeus*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat that is used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Major, very large human population and associated development => consequence Major, continued coastal developed likely to lead to a reduction in habitat and potential effects on School Shark reproduction => confidence low as data on the habitat use of the species in Port Phillip is limited
	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => Confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems

	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis may result in collisions with dolphins or affect dolphin behaviour => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.29 Recreational Spearfishing: Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	3	2	1	Reef biota can be damaged in the process of spearfishing though contact with fins or standing/walking on reef in shallow water => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is spearfishing; sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	3	2	1	As for capture, reef biota can be damaged in the process of spearfishing though contact with fins or standing/walking on reef in shallow water => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm

	Incidental behaviour	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is spearfishing; sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Gear loss	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	1	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare => consequence Negligible as localised effect on habitat structure and function would not be detectable => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Anchoring is common and anchor and chain can affect algae and sessile invertebrates => => intensity Minor, relatively small number of boats in fishery, although fishing usually occurs while anchored => consequence Minor as effect on habitat structure and function would be localised and difficult to detect => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence, possibly affect habitat quality for planktonic organisms => intensity Minor, relatively small number of boats in fishery => consequence Negligible as localised effect on pelagic habitat structure and function would not be detectable => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests such as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs => intensity Minor as rare event => consequence Major because could lead to decline in native kelps and change in reef structure and function => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Onboard processing such as gutting and filleting fish and discarding frames may mean organic material and nutrients are introduced to the benthic habitat => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	1	3	5	Habitat structure and function	Low profile reef/platform (<1 m)/Ascidians/ *Ecklonia*	5.1	2	2	1	Berley is occasionally used (e.g. Australian Pilchard). Introduction of berley to the environment means organic material and nutrients are introduced to the benthic habitat => intensity Minor, relatively small number of boats involved in fishery and lower proportion would use berley => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute.
	Organic waste disposal	1	3	5	Water quality	Pelagic habitat	1.1	2	1	1	Organic waste such as food scraps or sewage could affect the surrounding water quality on a localised scale => intensity Minor as small number of boats involved in fishery => consequence Negligible as change to water quality would not be detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	5	Substrate quality	Low profile reef/platform (<1 m)/*Ecklonia*	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the substrate quality of the habitat, buoyant material can also impact intertidal areas => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based spearfishers => consequence Minor as, considering the intensity, change in substrate quality would be small and difficult to detect => confidence low as there is no data to support or refute for this fishery

	Chemical pollution	1	3	6	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae => intensity Minor, relatively few boats in the fishery => consequence Minor as effect on water quality would be small and difficult to detect => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface => intensity Minor, relatively few boats in the fishery =>consequence Negligible as influence on air quality would not be detectable relative to other sources of air pollution => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	1	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare => consequence negligible as localised effect on habitat structure and function would not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Navigation and steaming would cause turbulence possibly affecting habitat quality for planktonic organisms => intensity Minor, relatively few boats in the fishery => consequence Negligible as, considering the intensity, change in habitat structure and function would not be detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms => intensity Minor, relatively few boats in the fishery; could also be effects of noise and visual stimuli from shore-based spearfishers => consequence Negligible as, considering the intensity, the change in habitat structure and function would not be detectable => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, significant participation in spearfishing but most time is spent at the surface => consequence negligible as change in habitat structure and function due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	1	Sediment plumes may be created by launching related activities (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps, could affect light for seagrass => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries =>consequence Minor as disturbance would be small in area and have localised impact on habitat structure and function only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Sediments may be disturbed while anchoring or mooring; possible shading effect on seagrass => intensity Minor, relatively few boats in in fishery, boat would be anchored while spearfishing => consequence Minor as effect on habitat structure and function would be minimal in consideration of the intensity => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	3	1	Seagrass can be impacted by anchors and chains in the recreational hook and line fishery, and also by the hauling of seines in commercial fishing operations => intensity Major, large number of boats in the recreational fishery so important incremental effect of anchoring; small number of boats in commercial fishery but some methods have nets with large area swept (i.e. haul seine) => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => confidence is low because the there is no data on these impacts in Port Phillip Bay.

Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can also occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.30 Recreational spearfishing: Community component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Species composition	Reef/*Ecklonia* community	1.1	3	4	1	Removal of reef fish species by spearfishing can alter fish species composition => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Major as effects on species composition are likely to be significant in localised areas where reefs are easily accessible to shore-based spearfishers => confidence low, little data available on spearfishing impacts on species composition in PPB.
	Incidental behaviour	1	3	3	Trophic/size structure	Reef/*Ecklonia* community	4.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is spearfishing; removal of larger, predatory fish could affect trophic/size structure => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of fish by incidental rod and line would be very small => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Species composition	Reef/*Ecklonia* community	1.1	3	2	1	Removal of reef fish species by spearfishing can alter fish species composition; fish may be speared but then break free during retrieval, fish may later die depending on severity of wound => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as total mortality would be much lower than from direct capture => confidence low, little data available on spearfishing impacts on species composition in PPB.
	Incidental behaviour	1	3	3	Trophic/size structure	Reef/*Ecklonia* community	4.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is spearfishing; hooked fish may escape during retrieval and later die; removal of larger, predatory fish could affect trophic/size structure => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because indirect mortality of fish by incidental rod and line fishing would be very small => confidence low, no data to refute or confirm
	Gear loss	1	3	3	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	2	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect the distribution of the reef community => intensity Minor, loss of gear would be rare =>

											consequence Negligible as localised effect on the distribution of the community would be difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	2	1	Anchoring is common and anchor and chain can affect the distribution of organisms in the community => intensity Minor, relatively small number of boats in fishery, although fishing usually occurs while anchored => consequence Minor as the effect on the distribution of the community would be localised and difficult to detect => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	2	2	2	Navigation and steaming would cause turbulence possibly affecting the community distribution of planktonic organisms => intensity Minor, relatively small number of boats in fishery => consequence Minor as localised effect on the pelagic community would be difficult to detect => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests such as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs => intensity Minor as rare event => consequence Major because could lead to complete loss or replacement of *Ecklonia* kelp and consequent change to functional group composition => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	2	1	Onboard processing such as gutting and filleting fish and discarding frames may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	1	3	5	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	2	1	Berley is occasionally used (e.g. Australian Pilchard). Introduction of berley to the environment means organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor, relatively small number of boats involved in fishery and lower proportion would use berley => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
	Organic waste disposal	1	3	5	Distribution of the Community	Pelagic (water column) community	3.1	2	2	1	Organic waste such as food scraps or sewage could affect the distribution of plankton in the pelagic community on a localised scale => intensity Minor, relatively small number of boats involved in fishery => consequence Minor as change to distribution of the

											plankton community would be small and localised => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	5	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the distribution of the benthic community => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based spearfishers => consequence Minor as, considering the intensity, change in substrate quality would be small and difficult to detect => confidence low as there is no data to support or refute for fishery
	Chemical pollution	1	3	6	Species composition	Pelagic (water column) community	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the species composition of plankton in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Minor as effect on species composition would be small and difficult to detect => confidence low as there is no data to support or refute.
	Exhaust	1	3	6	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Negligible as effect on species composition of the pelagic community would be difficult to detect => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Habitat structure and function	Reef/*Ecklonia* community	5.1	2	1	1	Gear (spears, fins, buoys, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare => consequence Negligible as localised effect on habitat structure and function would not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Species composition	Pelagic (water column) community	1.1	2	2	1	Navigation and steaming would cause turbulence possibly affecting species composition planktonic organisms in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Negligible as, considering the intensity, change in species composition would not be detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could affect the distribution of the pelagic community by influencing the behaviour/movement of organisms => intensity Minor, relatively few boats in the fishery; could also be effects of noise and visual stimuli from shore-based spearfishers => consequence Negligible as, considering the intensity, the change in the distribution of the community would not be detectable => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Distribution of the Community	Reef/*Ecklonia* community	3.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, significant participation in spearfishing but most time is spent at the surface => consequence Negligible as change in the distribution of the community due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence

	Boat launching	1	3	6	Species composition	*Zostera* seagrass community	1.1	2	2	1	Sediment plumes may be created by launching related activities (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps, could affect the species composition of the seagrass community => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as disturbance would be small in area and have localised impact on species composition only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Sediments may be disturbed while anchoring or mooring; possible shading effect on seagrass affecting the distribution of the community => intensity Minor, relatively few boats in in fishery; boat would be anchored while spearfishing => consequence Minor as effect on habitat structure and function would be minimal in consideration of the intensity => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, shifting sediment and creating sediment plumes affecting seagrass and associated community => intensity Minor, relatively few boats in in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	6	Trophic/size structure	*Zostera* seagrass community	4.1	4	3	1	Removal of fish by other fishery methods near seagrass beds may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Major, large number of boats in the recreational fishery; small number of boats in commercial fishery but some methods have nets with large area swept (i.e. haul seine); range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small area of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in the area of seagrass community => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments

	Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long-term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition

11.31 Hand collection (commercial and recreational): Target species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	3	3	1	Blacklip Abalone are a primary target species of recreational and commercial hand collection. Commercial catch from Port Phillip Bay has declined in recent years, forms part of the Central Zone Quota => intensity Moderate, relatively small number of participants in fishery, but can be concentrated in localised areas => consequence Moderate because the abalone fishery is tightly controlled and considered to be sustainable => Confidence is low because the recreational take (and also illegal take) is poorly known.
	Incidental behaviour	1	2	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Possible that other recreational methods (e.g. recreational line, spearfishing) could be used incidentally when primary purpose is hand collection => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of Snapper by incidental

											fishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	2	1	Undersize abalone may be handled for measurement and then released, some may later die => intensity Minor, relatively small number of participants in fishery => consequence Minor, mortality would be low and have minimal impact on the stock => confidence low, no data to refute or confirm
	Incidental behaviour	1	2	3	Population size	Snapper, *Chrysophrys auratus*	1.1	2	2	1	Possible that other recreational methods (e.g. recreational line, spearfishing) could be used incidentally when primary purpose is hand collection; Snapper could escape from line or spear before capture and later die => intensity Minor because relatively few hand collectors, and fewer would also undertake incidental line or spearfishing => consequence Minor because total mortality of Snapper that escape while incidental fishing would be very small relative to overall mortality related to other fisheries => confidence low, no data to refute or confirm
	Gear loss	1	3	3	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	1	1	Possible in this fishery, for example loss of catch bag and subsequent mortality of catch => intensity Minor, relatively small number of participants in fishery; loss of catch bag would be rare => consequence Negligible, mortality associated with gear loss would be extremely low relative to overall mortality related to fishing => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Commercial Scallop, *Pecten fumatus*	6.1	2	2	1	Possible that anchor and chain hitting bottom or dragging could cause change in behaviour/movement of scallops but would be very localised => intensity Minor, relatively small number of boats in fishery; fishing usually occurs while anchored => consequence Minor, effect on behaviour/movement would be difficult to detect => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	1	2	Possible that disturbance of the water column could influence the mortality of pelagic eggs and larvae of Blacklip Abalone => intensity Minor, relatively small number of boats in fishery => consequence Negligible, mortality from this source would be not be detectable compared with total egg and larval mortality => confidence high, based on logical constraints
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Also includes translocation of native species such as urchins that can compete with Blacklip Abalone. Translocation around the bay of species, leading to competitive interactions with Blacklip Abalone, could lead to decline in the population. => intensity Minor as infrequent event => consequence Major because could lead to population decline => confidence low, based on no knowledge of potential for translocation
	On board processing	1	3	3	Population size	Commercial Scallop, *Pecten fumatus*	1.1	2	1	1	Material from onboard processing such as shucking and discarding shells (recreational fishery) may attract Commercial Scallop predators leading to increased mortality => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Negligible as increase in mortality would likely not be detectable => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait or berley used in fishery
	Organic waste disposal	1	3	5	Behaviour/ movement	Commercial Scallop, *Pecten fumatus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of Commercial Scallop on a very localised scale =>intensity Minor as relatively small number of boats in fishery => consequence Negligible as change in behaviour/movement would not be detectable => confidence low as there is no data to support or refute

Addition of non-biological material	Debris	1	3	5	Behaviour/ movement	Blacklip Abalone, *Haliotis rubra*	6.1	2	2	1	Debris such as plastic bags or other rubbish could affect the behaviour/movement of abalone on reefs on a very localised scale => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based hand-collectors => consequence Minor as change in behaviour/movement would be small and difficult to detect => confidence low as there is no data to support or refute
	Chemical pollution	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the mortality of pelagic eggs and larvae of Blacklip Abalone => intensity Minor, relatively few boats in the fishery => consequence Minor as increase in mortality would be difficult to detect relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the mortality of pelagic eggs and larvae of Blacklip Abalone => intensity Minor as relatively few boats in the fishery => consequence Minor as increase in mortality would be difficult to detect relative to total mortality of eggs and larvae => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Behaviour/ movement	Blacklip Abalone, *Haliotis rubra*	6.1	2	2	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and subsequently affect Blacklip Abalone behaviour and movement => intensity Minor, loss of gear would be rare => consequence Minor; effect of gear loss on abalone behaviour/movement would be difficult to detect => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Blacklip Abalone, *Haliotis rubra*	6.1	2	1	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Blacklip Abalone larvae => intensity Minor, relatively few boats in the fishery => consequence Negligible as change in behaviour/movement would be localised and likely not detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Behaviour/ movement	Blacklip Abalone, *Haliotis rubra*	6.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Blacklip Abalone larvae => intensity Minor; relatively few boats in the fishery => consequence Negligible as change in behaviour/movement would be highly localised and likely not detectable => confidence low as there is no data to support or refute
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Behaviour/ movement	Commercial Scallop, *Pecten fumatus*	6.1	2	2	1	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, relatively small number of participants in fishery => consequence Minor as change in behaviour/movement due to disturbance would be very localised and short-lived => confidence low, no data to refute or confirm
	Boat launching	1	3	6	Behaviour/ movement	Commercial Scallop, *Pecten fumatus*	6.1	2	2	1	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Minor, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries (most scallops in deeper water) => consequence Minor as change in behaviour/movement of scallops due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Commercial Scallop, *Pecten fumatus*	6.1	2	2	1	Sediments may be disturbed while anchoring or mooring => intensity Minor, relatively few boats in fishery, boat would be anchored while hand collecting => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Blacklip Abalone, *Haliotis rubra*	6.1	2	1	1	Turbulence from the propeller or boat wake disturbing the water column while underway could influence the behaviour/movement of Blacklip Abalone larvae => intensity Minor, few boats involved in fishery => consequence Negligible as change in behaviour/movement would be very localised and likely not detectable => confidence low as there is no data to support or refute
External hazards (specify the particular	Other capture fishery methods	1	3	4	Population size	Southern Rock Lobster, *Jasus edwardsii*	1.1	2	3	2	The commercial Southern Rock Lobster fishery includes some fishing inside Port Phillip Heads => intensity Minor, low level of commercial effort in PPB => consequence Moderate because commercial fishery is tightly managed and appears sustainable => Confidence is high because commercial catch and effort is well documented.

example within each activity area)	Aquaculture	1	3	6	Population size	Commercial Scallop, *Pecten fumatus*	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and consequent effect on scallop habitat use => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Minor, effect on Commercial Scallop mortality would be small given relatively small area of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the suitability of nearshore reefs for Blacklip Abalone (i.e. sedimentation) => intensity Major, very large human population and associated development => consequence Major, much of the abalone reef habitat in Port Phillip Bay is in shallow, near shore locations => confidence low as data on the effect of coastal processes is limited
	Catchment inputs	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	4	4	1	Abalone reefs exposed to nutrients, sediments and toxicants from catchment, (particularly in northern PPB); these can change reef ecology (e.g. shift from kelp to turf or urchin barren dominated) affecting suitability for Blacklip Abalone => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long term changes to catchment inputs, especially nutrients, could lead to change in reef habitat suitability for Blacklip Abalone (sewage treatment nutrient discharge is highly regulated) => confidence low as understanding of the link between catchment inputs => reef ecology => Blacklip Abalone is still limited
	Shipping activities	1	3	1	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for eggs and larvae and benthic habitat for juveniles, adults => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the Blacklip Abalone population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Commercial Scallop, *Pecten fumatus*	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect water column habitat (plume) and benthic habitat (sedimentation and spoil). Dredge plume may affect larvae in water column, sedimentation and spoil could affect benthic habitat for Commercial Scallop => intensity Major, Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur
	Other anthropogenic activities	1	3	6	Population size	Blacklip Abalone, *Haliotis rubra*	1.1	3	2	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. affecting eggs and larvae of Blacklip Abalone in the water column => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Minor as increase in mortality from these activities would be low and difficult to detect => confidence low as there is no data to support or refute

11.32 Hand collection (commercial and recreational): TEP species

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Syngnathids may be captured incidentally while hand collecting around reefs => intensity Minor, relatively small number of participants in fishery => consequence Minor because the incidental take of syngnathids would be very small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	2	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other recreational (recreational hook and line) could be used incidentally when primary purpose is hand collection => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because take of School Shark by incidental fishing would be very small relative to other sub-fisheries => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Syngnathids may be captured incidentally while hand collecting around reefs, may escape in the process of capture and later die => Intensity Minor, relatively small number of participants in fishery => consequence Negligible because the mortality of syngnathids would be very small and likely not detectable => confidence low, no data to refute or confirm
	Incidental behaviour	1	2	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Possible that other methods (e.g. recreational hook and line) could be used incidentally when primary purpose is hand collection. Hooked School Shark may escape during retrieval and later die => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because mortality of School Shark by escaping in the process of capture by incidental fishing would be very small relative to other fishing mortality => confidence low, no data to refute or confirm.
	Gear loss	1	3	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and could impact on syngnathids on reefs or in seagrass beds causing possible mortality => intensity Minor, relatively small number of participants in fishery; loss of gear would be rare => consequence Negligible, mortality would be very low relative to population sizes => confidence low, limited data to refute or confirm

	Anchoring/ mooring	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	1	1	Possible that anchor or chain hitting bottom or dragging could come into contact with syngnathids on reefs or in seagrass beds causing mortality => intensity Minor, relatively small number of boats in fishery; fishing usually occurs while anchored => consequence Negligible, mortality rate would be very low relative to population sizes => confidence low, no data to support or refute
	Navigation/ steaming	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Population of only 100 Burrunan dolphins in PPB; calves in particular are susceptible to boat strikes => intensity Negligible as relatively small number of boats in fishery => consequence Minor because although one death would be significant at the population level, very unlikely given low intensity => confidence low, limited data to refute or confirm
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Population size	School Shark, *Galeorhinus galeus*	1.1	2	4	1	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation around the bay of a new introduced pest could affect the School Shark population through the food chain => intensity Minor as rare event => consequence Major because could lead to population decline =>confidence low, based on no knowledge of potential new pest species
	On board processing	1	3	3	Population size	School Shark, *Galeorhinus galeus*	1.1	2	2	1	Material from onboard processing such as shucking and discarding shells (recreational fishery) may attract School Shark to waste but also predators such as larger sharks leading to higher localised mortality => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as increase in mortality would be difficult to detect =>confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait or berley used in fishery
	Organic waste disposal	1	3	5	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	1	1	Organic waste such as food scraps or sewage could affect the behaviour/movement of School Shark on a very localised scale => intensity Minor as relatively small number of boats in fishery, waste may also be introduced by shore-based hand-collectors => consequence Negligible as change in behaviour/movement would likely not be detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	5	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	3	1	Debris such as plastic bags or other rubbish can entangle Burrunan Dolphin adults and calves => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based hand-collectors => consequence Moderate as even though mortality would be rare, even one death would be significant at the population level => confidence is low because the population trajectory of the species in PPB is poorly understood
	Chemical	1	3	6	Population size	Burrunan Dolphin,	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin => intensity Minor,

	pollution					*Tursiops australis*					very few boats involved in fishery => consequence Minor as the very small amount of chemical pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Exhaust	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	2	1	Chemical pollution from boat exhaust entering water column could influence the health and potentially cause mortality of the Burrunan Dolphin => intensity Minor, very few boats involved in fishery => consequence Minor as the very small amount of exhaust pollution would be unlikely to lead to mortality => confidence low as there is no data to support or refute for this fishery
	Gear loss	1	3	3	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	1	2	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost. Possible dolphin could become entangled in rope etc. => intensity Negligible, relatively small number of participants in fishery; loss of gear would be rare => consequence Minor because although one death would be significant at the population level, very low intensity means highly unlikely => confidence low, limited data to refute or confirm
	Navigation/ steaming	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise to the water column while underway could influence the behaviour/movement of Burrunan Dolphins in relation to echolocation of prey and reproductive behaviour => intensity Minor, relatively small number of boats involved in fishery => consequence Minor as the amount of noise introduced in consideration of intensity has the potential to only occasionally effect behaviour/movement => confidence is low because the effect of boat noise on dolphin behaviour/movement is poorly understood
	Activity/ presence on water	1	3	6	Behaviour/ movement	Burrunan Dolphin, *Tursiops australis*	6.1	2	2	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could influence the behaviour/movement of Burrunan Dolphin => intensity Minor, relatively small number of boats involved in fishery => consequence Minor as the noise and visual stimuli introduced in consideration of intensity has the potential to only occasionally effect behaviour/movement => Confidence is low because the effect of boat noise on dolphin behaviour/movement is poorly understood
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Behaviour/ movement	School Shark, *Galeorhinus galeus*	6.1	2	2	1	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, relatively small number of participants in the fishery => consequence Minor as change in behaviour/movement due to disturbance would be very small and likely not detectable => confidence low, no data to refute or confirm
	Boat launching	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	3	2	2	Sediments may be disturbed in boat launching, or dredging activities around launching ramps => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as change in behaviour/movement of syngnathids due to disturbance would be small and difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	2	Sediments may be disturbed while anchoring or mooring; may affect syngnathid habitat if disturbs seagrass or reef/algae habitat => intensity Minor, relatively few boats in fishery, boat would be anchored while hand collecting => consequence Minor as change in behaviour/movement due to disturbance would be relatively small and localised => confidence high, logical constraint on consequence

	Navigation/ steaming	1	3	6	Behaviour/ movement	Syngnathidae, Pipefish and seahorses	6.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, may affect syngnathid habitat if disturbs seagrass habitat => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	4	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	The presence of the 6 other sub-fisheries in the bay poses a number of risks for the Burrunan Dolphin such as entanglement in discarded fishing line, nets and waste => intensity Major, high number of boats in fishery => consequence Major as even one death would be significant at the population level for this species => confidence is low because the population trajectory of the species in PPB is poorly understood
	Aquaculture	1	3	6	Population size	Syngnathidae, Pipefish and seahorses	1.1	2	2	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present, with consequences for syngnathids. Conversely, mussel farm structures may provide habitat for some species => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant =>consequence Minor, overall effect on syngnathid mortality would be small given relatively small are of impact => confidence low as there is no data to support or refute
	Coastal development	1	3	6	Reproductive capacity	School Shark, *Galeorhinus galeus*	5.2	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat that is used by School Sharks for pupping and juvenile nursery areas in Port Phillip => intensity Major, very large human population and associated development => consequence Major, continued coastal developed likely to lead a reduction in habitat and potential effects on School Shark reproduction => confidence low as data on the habitat use of the species in Port Phillip is limited
	Catchment inputs	1	3	6	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	4	4	1	Contaminants from catchment can enter the food chain and concentrate in tissues of apex predators such as dolphins => intensity Major, highly developed catchment influenced by major industrial city => consequence Major as even one death would be significant at the population level for this species => confidence is low because contaminant inputs and amplification in the food chain is poorly understood, as is the population trajectory for dolphins
	Shipping activities	1	3	1	Population size	Burrunan Dolphin, *Tursiops australis*	1.1	2	4	2	Primary concern is oil spill from ship collision affecting water column habitat for dolphins and their prey, as well as introducing toxicants to the food chain => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on the very small population => confidence high based on evidence of oil spill effects in other systems
	Port activities	1	2	3	Population size	Syngnathidae, Pipefish and seahorses	1.1	4	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat for syngnathids through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Major; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
	Other extractive activities	0									Does not occur
	Other	1	3	6	Population size	Burrunan Dolphin,	1.1	3	4	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. In particular, high speed recreational craft such as jet skis

	anthropogenic activities					*Tursiops australis*					may result in collisions with Burrunan Dolphin s or affect Burrunan Dolphin behaviour => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Major as even one death would be significant at the population level for this species => confidence low as there is limited data on the impacts of recreational activities on dolphins

11.33 Hand collection (commercial and recreational): Habitat component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	3	2	1	Reef biota can be damaged in the process of hand collection though contact with fins or standing/walking on reef in shallow water, as well as turning over rocks etc => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	2	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is hand-collecting; sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	3	2	1	As for capture, reef biota can be damaged in the process of hand collection though contact with fins or standing/walking on reef in shallow water, as well as turning over rocks etc => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm
	Incidental behaviour	1	2	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is hand collection; sinkers and hooks can snag on algae and sessile invertebrates, berley bags and weights in contact with bottom and possible dragging => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor as localised effect on habitat structure and function would be small and difficult to detect => confidence low, no data to refute or confirm

	Gear loss	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	1	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare => consequence Negligible as localised effect on habitat structure and function would most likely not be detectable => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	2	1	Anchoring is common and anchor and chain can affect algae and sessile invertebrates => intensity minor, relatively small number of boats in fishery, although fishing usually occurs while anchored => consequence Minor as effect on habitat structure and function would be localised and difficult to detect => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	2	Navigation and steaming would cause turbulence possibly affect habitat quality for planktonic organisms => intensity Minor, relatively small number of boats in fishery => consequence Negligible as localised effect on pelagic habitat structure and function would not be detectable => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests such as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on native kelps on reefs => intensity Minor as rare event => consequence Major because could lead to decline in native kelps and change in reef structure and function => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	2	1	Material from onboard processing such as shucking and discarding shells (recreational fishery) may mean organic material and nutrients are introduced to the benthic habitat. => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as localised change to habitat structure and function would be difficult to detect => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	0									No bait or berley used in fishery
	Organic waste disposal	1	3	5	Water quality	Pelagic habitat	1.1	2	1	1	Organic waste such as food scraps or sewage could affect the surrounding water quality on a localised scale => intensity minor as small number of boats involved in fishery, => consequence negligible as change to water quality would not be detectable => confidence low as there is no data to support or refute
Addition of non-biological material	Debris	1	3	5	Substrate quality	Low profile reef/platform (<1 m)/*Ecklonia*	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the substrate quality of the habitat, buoyant material can also impact intertidal areas => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based hand collectors => consequence Minor as, considering the intensity, change in substrate quality would be small and difficult to detect => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	6	Water quality	Pelagic habitat	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence water quality in the pelagic habitat for plankton, fish larvae => intensity Minor, relatively few boats in the fishery => consequence Minor as effect on water quality would be small and difficult to detect => confidence low as there is no data to support or refute
	Exhaust	1	3	6	Air quality	Pelagic habitat	2.1	2	1	1	Chemical pollution from boat exhaust could potentially degrade air quality for species such as seabirds occupying the habitat associated with the water surface => intensity Minor, relatively few boats in the fishery => consequence Negligible as influence on air quality would likely not be detectable relative to other sources of air pollution => confidence low as there is no data to support or refute
	Gear loss	1	3	3	Habitat structure and function	Low profile reef/platform (<1 m)/ *Ecklonia*	5.1	2	1	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare =>

											consequence Negligible as localised effect on habitat structure and function would most likely not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Navigation and steaming would cause turbulence possibly affecting habitat quality for planktonic organisms => intensity Minor, relatively few boats in the fishery => consequence Negligible as, considering the intensity, change in habitat structure and function would likely not be detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Habitat structure and function	Pelagic habitat	5.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could alter habitat quality by influencing the behaviour/movement of organisms => intensity Minor, relatively few boats in the fishery; could also be effects of noise and visual stimuli from shore-based hand collectors => consequence Negligible as, considering the intensity, the change in habitat structure and function would not be detectable => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Habitat structure and function	Low profile reef/platform (<1 m)/*Ecklonia*	5.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, relatively small participation in hand collection fishery => consequence Negligible as change in habitat structure and function due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	2	1	Sediment plumes may be created by launching related activities (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps, could affect light for seagrass => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-fisheries => consequence Minor as disturbance would be small in area and have localised impact on habitat structure and function only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Sediments may be disturbed in while anchoring or mooring; possible shading effect on seagrass => intensity Minor, relatively few boats in in fishery, boat would be anchored while hand collecting => consequence Minor as effect on habitat structure and function would be minimal in consideration of the intensity => Confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water => intensity Minor, relatively few boats in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	4	Habitat structure and function	*Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	3	1	Seagrass can be impacted by anchors and chains in the recreational hook and line fishery, and also by the hauling of seines in commercial fishing operations => intensity Major, large number of boats in the recreational fishery so important incremental effect of anchoring; small number of boats in commercial fishery but some methods have nets with large area swept (i.e. haul seine) => consequence Moderate as effect on seagrass is likely to be sustainable given that *Zostera* has good re-growth potential => confidence is low because the there is no data on these impacts in Port Phillip Bay.
	Aquaculture	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass habitat where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting nearshore seagrass habitat => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in seagrass habitat => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Habitat structure and function	Dense *Zostera* sp. seagrass on	5.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect seagrass habitat. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth).

					flat silt/sand sediment					Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment encompassing major city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in seagrass habitat (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments
Shipping activities	1	3	1	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass (e.g. Swan Bay) => intensity Minor, Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil spill would have long term detrimental effect on seagrass habitat => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	3	Habitat structure and function	Dense *Zostera* sp. seagrass on flat silt/sand sediment	5.1	3	3	2	Dredging of shipping channels and dumping of spoil can affect seagrass habitat through reduced light penetration from sediment plumes and direct burial by settled sediments and dredge spoil => intensity Moderate; Melbourne is a major shipping port => consequence Moderate, dredging and spoil operations are highly regulated => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Habitat structure and function	Pelagic habitat	5.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. => intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on water quality could be significant => confidence low as there is limited data on the impacts of recreational activities on water quality

11.34Hand collection (commercial and recreational): Community component

Direct impact	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (from S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence score (1-2)	Rationale
Direct impact of capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Species composition	Reef/*Ecklonia* Community	1.1	3	3	1	Removal of species by hand collection (e.g. Blacklip Abalone, White Urchins) can alter competitive interactions amongst species affecting species composition => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Moderate as effects on species composition are likely to be significant but not of sufficient magnitude to cause major changes to species composition (possible beneficial effect of urchin removal) => confidence low, little data available on hand collection impacts on species composition in PPB.
	Incidental behaviour	1	2	3	Trophic/size structure	Reef/*Ecklonia* Community	4.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is hand collection; removal of larger, predatory fish could affect trophic/size structure => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => Consequence Minor because take of fish by incidental rod and line would be very small => confidence low, no data to refute or confirm
Direct impact without capture	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Species composition	Reef/*Ecklonia* Community	1.1	3	2	1	Removal of species by hand collection (e.g. Blacklip Abalone, White Urchins) can alter competitive interactions amongst species affecting species composition; organisms may be damaged in the process but not captured and later die => intensity Moderate, relatively small number of participants in fishery, can be concentrated in localised areas => consequence Minor as total mortality, and consequent effect on specie composition, would be lower than from direct capture => confidence low, little data available on spearfishing impacts on species composition in PPB.
	Incidental behaviour	1	2	3	Trophic/size structure	Reef/*Ecklonia* Community	4.1	2	2	1	Possible that other recreational methods (e.g. rod and line fishing) could be used incidentally when primary purpose is hand collection; hooked fish may escape during retrieval and later die; removal of larger, predatory fish could affect trophic/size structure => intensity Minor because relatively small number of participants in fishery and a lower proportion would also undertake incidental fishing => consequence Minor because indirect mortality of fish by incidental rod and line fishing would be very small => confidence low, no data to refute or confirm

	Gear loss	1	3	3	Distribution of the Community	Reef/*Ecklonia* Community	3.1	2	2	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and subsequently affect the distribution of the reef community => intensity Minor, loss of gear would be rare => consequence Negligible as localised effect on the distribution of the community would be difficult to detect => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Distribution of the Community	Reef/*Ecklonia* Community	3.1	2	2	1	Anchoring is common and anchor and chain can affect the distribution of organisms in the community => intensity Minor, relatively small number of boats in fishery, although fishing usually occurs while anchored => consequence Minor as the effect on the distribution of the community would be localised and difficult to detect => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	2	2	2	Navigation and steaming would cause turbulence possibly affecting the community distribution of planktonic organisms => intensity Minor, relatively small number of boats in fishery => Consequence Minor as localised effect on the pelagic community would be difficult to detect => confidence high, logical constraint on consequence
Addition/ movement of biological material	Translocation of Species (boat launching, re-ballasting)	1	3	2	Functional group composition	Reef/*Ecklonia* Community	2.1	2	4	2	Port Phillip Bay is one of the most highly affected water bodies in terms of introduced pests. These can affect habitat characteristics (e.g. *Undaria* kelp) and the food chain (Northern Pacific Seastar). Translocation of existing pests such as *Undaria*, native species such as urchins *Heliocidaris* and species that may be introduced in the future can have dramatic effects on functional group composition on reefs =>intensity Minor as rare event => consequence Major because could lead to complete loss or replacement of *Ecklonia* kelp and consequent change to functional group composition => confidence high, based on knowledge of the effects of existing species
	On board processing	1	3	3	Distribution of the Community	Reef/*Ecklonia* Community	3.1	2	2	1	Material from onboard processing such as shucking and discarding shells (recreational fishery) may mean organic material and nutrients are introduced to the benthic habitat affecting community distribution (e.g. scavengers) in localised area => intensity Minor, relatively small number of boats involved in fishery and lower proportion would process onboard => consequence Minor as would have a minimal effect on community distribution => confidence low as there is no data to support or refute
	Discarding catch	0									Does not occur
	Stock enhancement	0									Does not occur
	Provisioning	0									Does not occur
	Organic waste disposal	1	3	5	Distribution of the Community	Pelagic (water column) community	3.1	2	2	1	Organic waste such as food scraps or sewage could affect the distribution of plankton in the pelagic community on a localised scale => intensity Minor, relatively small number of boats involved in fishery => consequence Minor as change to distribution of the plankton community would be small and localised => confidence low as there is no data to support or refute

Addition of non-biological material	Debris	1	3	5	Distribution of the Community	Reef/*Ecklonia* Community	3.1	2	2	1	Debris such as plastic bags or other rubbish can settle on the bottom affecting the distribution of the benthic community => intensity Minor as relatively few boats in fishery, some debris may also come from shore-based hand collection => consequence Minor as, considering the intensity, change in substrate quality would be small and difficult to detect => confidence low as there is no data to support or refute for this fishery
	Chemical pollution	1	3	6	Species composition	Pelagic (water column) community	1.1	2	2	1	Chemical pollution from boat (oil/petrol/diesel) entering water column could influence the species composition of plankton in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Minor as effect on species composition would be small and difficult to detect => confidence low as there is no data to support or refute.
	Exhaust	1	3	6	Species composition	Pelagic (water column) community	1.1	2	1	1	Chemical pollution from boat exhaust entering water column could influence species composition of plankton, fish larvae, in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Negligible as influence on air quality would not be detectable relative to other sources of air pollution => confidence low as there is no data to support or refute.
	Gear loss	1	3	3	Habitat structure and function	Reef/*Ecklonia* Community	5.1	2	1	1	Gear (catch bags, abalone tools, fins, ropes etc) may occasionally be lost and subsequently affect algae and sessile invertebrates => intensity Minor, loss of gear would be rare => consequence Negligible as localised effect on habitat structure and function would not be detectable => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Species composition	Pelagic (water column) community	1.1	2	2	1	Navigation and steaming would cause turbulence possibly affecting species composition of planktonic organisms in the pelagic community => intensity Minor, relatively few boats in the fishery => consequence Negligible as, considering the intensity, change in species composition would not be detectable => confidence low as there is no data to support or refute
	Activity/ presence on water	1	3	6	Distribution of the Community	Pelagic (water column) community	3.1	2	1	1	Introduction of noise and visual stimuli to the water column while undertaking fishing activities could affect the distribution of the pelagic community by influencing the behaviour/movement of organisms => intensity Minor, relatively few boats in the fishery; could also be effects of noise and visual stimuli from shore-based hand collection => consequence Negligible as considering the intensity, the change in the distribution of the community would not be detectable => confidence low as there is no data to support or refute for this fishery
Disturb physical processes	Bait collection	0									No bait is used with this fishing method
	Fishing	1	3	6	Distribution of the Community	Reef/*Ecklonia* Community	3.1	2	1	2	Sediments may be disturbed by fins when divers swim near the bottom => intensity Minor, relatively small participation in hand collection fishery => consequence Negligible as change in the distribution of the community due to disturbance would be very small and likely not detectable => confidence high, logical constraint on consequence
	Boat launching	1	3	6	Species composition	*Zostera* seagrass community	1.1	2	2	1	Sediment plumes may be created by launching related activities (i.e. propeller scars travelling to and from ramp), or dredging activities around launching ramps, could affect the species composition of the seagrass community => intensity Moderate, few boats launched and retrieved relative to hook and line fishery, but dredging applies to all sub-

											fisheries => consequence minor as disturbance would be small in area and have localised impact on species composition only => confidence low, no data to refute or confirm
	Anchoring/ mooring	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Sediments may be disturbed while anchoring or mooring; possible shading effect on seagrass affecting the distribution of the community => intensity Minor, relatively few boats in in fishery, boat would be anchored while hand collecting => consequence Minor as the effect on the distribution of the community would be minimal in consideration of the intensity => confidence low, no data to refute or confirm
	Navigation/ steaming	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	2	1	Sediments may be disturbed by propeller, wake in shallow water, shifting sediment and creating sediment plumes affecting seagrass and associated community => intensity Minor, relatively few boats in in fishery => consequence Minor as effect would be small and localised => confidence low, no data to refute or confirm
External hazards (specify the particular example within each activity area)	Other capture fishery methods	1	3	4	Trophic/size structure	*Zostera* seagrass community	4.1	4	3	1	Removal of fish by other fishery methods near seagrass beds may alter food chain / trophic levels (i.e. less predatory fish leads to increased small invertebrate feeding fish with flow on effects to lower trophic levels) => intensity Major, large number of boats in the recreational fishery; small number of boats in commercial fishery but some methods have nets with large area swept (i.e. haul seine); range of species caught => consequence Moderate as significant fish removal in localised areas but no evidence for effects on Trophic / size structure => confidence low, no scientific studies on fishing impacts on Victorian *Zostera* community trophic / size structure
	Aquaculture	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	2	3	1	Primary aquaculture is mussel farming, can lead to change in benthic habitat under farm and would affect seagrass community where present => intensity Minor, farms occupy a relatively small area of the benthic habitat but local effect could be significant => consequence Moderate, overall effect on seagrass community would be sustainable given relatively small are of impact => Confidence low due to lack of studies on impacts
	Coastal development	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	1	Coastal development can change coastal processes (currents, sediment transport) affecting the distribution of the nearshore seagrass community => intensity Major, very large human population and associated development => consequence Major, continued coastal development likely to lead a reduction in the area of the seagrass community => confidence low as the details of future coastal development are not known
	Catchment inputs	1	3	6	Distribution of the Community	*Zostera* seagrass community	3.1	4	4	2	Nutrients, sediments and toxicants from catchment could affect the seagrass community through change in seagrass distribution. Seagrass loss can occur if nutrients are too low (i.e. drought) or too high (causing epiphyte growth). Sediments can increase turbidity blocking light for seagrass. Toxicants such as herbicides could affect seagrass growth => intensity Major, highly developed catchment influenced by major industrial city => consequence Major, long-term changes to catchment inputs of nutrients, sediments or toxicants could lead to decline in the area of seagrass community (sewage treatment nutrient discharge is highly regulated) => confidence high based on research in Port Phillip Bay and elsewhere on seagrass links to nutrients/sediments.
	Shipping activities	1	3	1	Distribution of the Community	*Zostera* seagrass community	3.1	2	4	2	Primary concern is oil spill from ship collision affecting intertidal and shallow subtidal areas of seagrass community (e.g. Swan Bay) => intensity Minor; Melbourne is a major shipping port but major oil spills are rare events => consequence Major, significant oil

										spill would have long term detrimental effect on seagrass community => confidence high based on evidence of oil spill effects in other systems
Port activities	1	2	1	Species composition	Port Phillip Bay entrance deep reef community	1.1	5	4	2	Accommodating increasing ship size can mean deepening / widening of the PPB entrance area with consequent impacts on the listed PPB entrance deep reef community => intensity Severe, occasional but very severe and localised => consequence Major, dredging operations are highly regulated but there are long term impacts and recovery is slow => confidence high based on evidence from Port Phillip Bay Channel Deepening Project
Other extractive activities	0									Does not occur
Other anthropogenic activities	1	3	6	Species composition	Pelagic (water column) community	1.1	3	3	1	Human recreational activities may introduce noise and visual stimuli as well as materials such as debris, oil, petrol etc. =>intensity Moderate, large numbers of non-fishing recreational craft/activities using the bay => consequence Moderate as incremental effects on plankton species composition could be significant => confidence low as there is limited data on the impacts of recreational activities on pelagic species composition