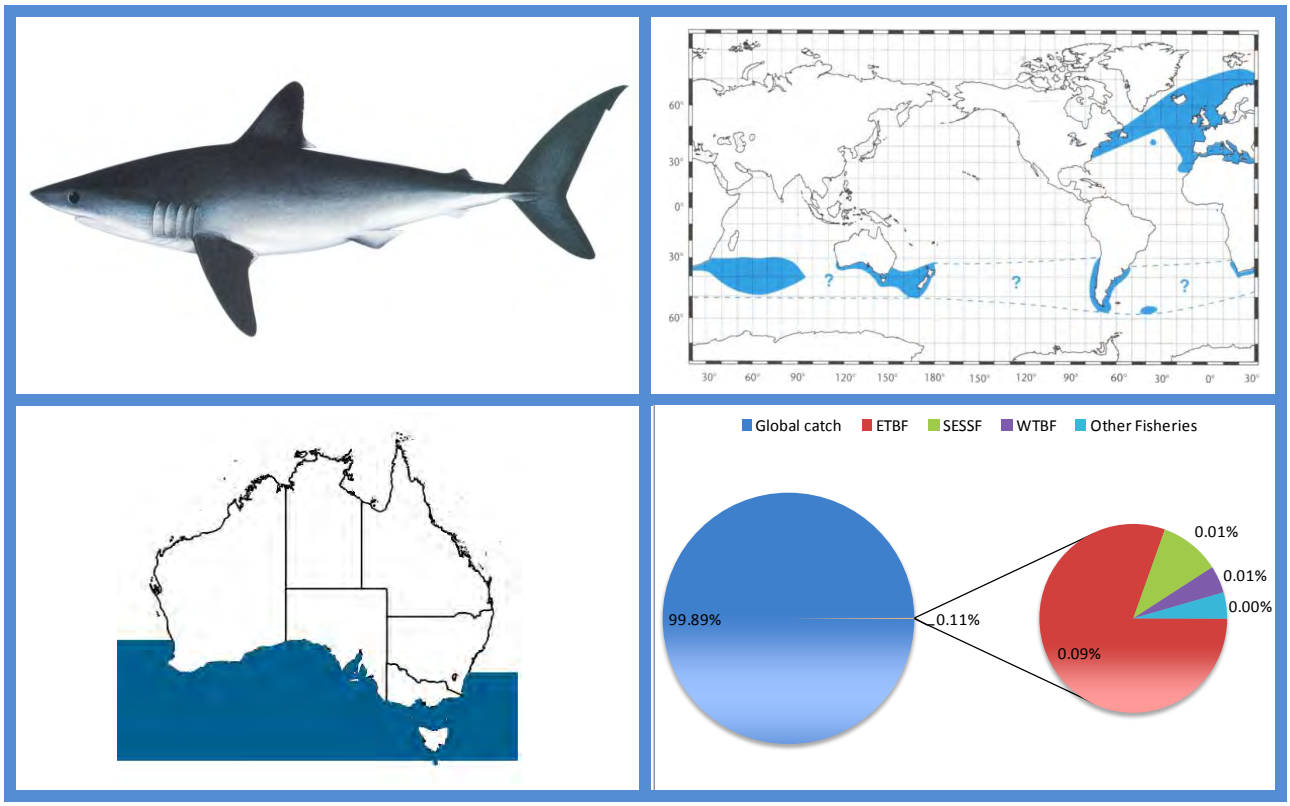
# Advice on CITES Appendix II Shark Listings




Matt Koopman and Ian Knuckey

2014

Report to Department of Sustainability, Environment, Water, Population and Communities

fishwell CONSULTING

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

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Matt Koopman and Ian Knuckey

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Cover shark illustrations from Last and Stephens (2009) and Atlas of Living Australia.

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# Background

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to ensure that international trade of wild animals and plants does not threaten their survival. Every two to three years, the member States — or Parties, of which Australia is one — meet to review the implementation of the Convention, including to consider (and where appropriate adopt) proposals to amend the lists of species in Appendices I and II. In Australia, the CITES Scientific Authority for Marine Species is the Marine Species Conservation Section of the Marine Biodiversity and Biosecurity Branch within the Department of Environment.

At the 16th meeting of the Conference of the Parties (CoP16) held in Bangkok, Thailand in March 2013, five shark species that inhabit Australian waters were listed on Annex II of CITES:

1. Oceanic Whitetip shark (*Carcharhinus longimanus*),
2. Smooth hammerhead (*Sphyrna zygaena*),
3. Great hammerhead (*Sphyrna mokorran*)
4. Scalloped hammerhead (*Sphyrna lewini*),
5. Porbeagle Shark (*Lamna nasus*),

Note, Manta spp (*Manta birostris* and *Manta alfredi*) were also listed on Annex II, however they are not targeted or kept as by-product in Australian fisheries, so were not required to be a focus of this assessment.

The CoP16 listings of these species will come into effect in September 2014. During the intervening period, the CITES Scientific Authority has requested expert advice on the Australian fisheries that catch these species in order to build a basis for better management and data collection over time so as to allow for the development of non-detriment findings (NDFs) for fisheries that wish to export CITES listed shark species.

# Objectives

The scope of this project was to conduct an assessment of all available datasets for Australian fisheries (both Commonwealth and state/territory) that harvest and/or interact with the above listed species to:

1. Provide a summary of the current/ historic harvest levels and arrangements in place for all fisheries that interact with these species with respect to adequacy of management arrangements, fishing methods / gear used, data collection methods and record keeping, shark processing arrangements, trends in the size- or sex-composition of the catch, and identify where gaps exist in terms of potentially meeting CITES NDF requirements into the future (e.g. catch recording mechanisms, onboard vs onshore processing, shark finning measures, trip limits, quotas etc);

2. Determine if any fisheries pose particular risks to species with respect to management arrangements or harvest levels or combinations of fisheries, whether able to be demonstrated through data or due to the lack of data available; and,

3. Recommend generalised, practical minimum management measures that could be implemented across all fisheries of particular fishing methods/gear types that would build a basis for better management and data collection over time to inform the Australian CITES Scientific Authority in the determination of non detriment findings.

# Materials and Methods

## Species and Fishery Distribution

There are many sources from which distributions of shark species can be obtained. These include the Atlas of Living Australia (ALA), Fishes of Australia, Fishbase, the Australian Faunal directory and the specific reference on Australian Sharks and Rays Last and Stevens (2009). For consistency, we take the distributions described by Last and Stevens (2009) and the Atlas of Living Australia to be the accepted range, but present additional distributions for comparison in Appendix 1.

The spatial distribution and gears used for all Australian (State and Commonwealth) marine fisheries was described. Comparisons of fishery and shark distributions were made to identify spatial and habitat overlaps, and judgements made on the likelihood that the fishing gear could actually capture the shark. This judgement was subjective, and was given one of three

categories, "none", "unlikely", or "possible". The category "none" denotes there is negligible chance of shark capture with that gear, and is used mainly for very selective fishing methods such as hand harvest, dip nets and octopus traps. The category "unlikely" denotes that there is only a small possibility of the gear catching a shark, and is usually used for pots and traps, where small sharks could get caught in the trap, and large sharks could become entangled in the ropes. The category "possible" refers to gear that have reasonable potential to capture sharks, and is applied to trawls, gillnets and line fishing methods. This table was discussed in relation to fisheries for which there were reported catches of the species of interest in logbook or observer data.

## Catch data

Commercial catches and observer data for the five species of interest were requested from each Australian State fisheries agency and from the Australian Fisheries Management Authority (AFMA). Requests were accompanied by confidentiality agreements, which restricted the use of any data supplied outside of the objectives of this project. Because catches and observer catches are not always recorded at species level, as well as requesting information for individual species, data requests included group codes for Whaler sharks (Codes for Australian Aquatic Biota, CAAB code 37018915 and 37018000), Genus Carcharhinus (37018904), Hammerhead Sharks (37019000), Genus Sphyrna (37019902), Mackerel sharks (37010903) and Genus Lamna (37010004). Raw data requested included fishery name and gear type, operational data such as date, position and effort, and catch data including common name and species name, retained and discarded catch and number. For observer data, length and sex information was also requested.

Data received from agencies varied greatly in quality, quantity and temporal resolution. Most agencies were able to distribute raw data as requested, but some aggregated data so as not to contravene their own data confidentiality policies.

Annual, Australia-wide catches by species were obtained by summing catches for all fisheries. While some hammerheads were separated to species in logbook data, there was significant catches of unspecified "Hammerheads". This was further complicated by not only comprising Great Hammerhead, Scalloped Hammerhead and Smooth Hammerhead, but also Winghead Shark (*Eusphyra blochii*) which was not of interest for this report. Where possible, catches of "Hammerheads" was disaggregated into component species based on available observer data. This was done for each fishery separately. Nearly 99% of "Hammerhead"

catch from 2001–2012 was disaggregated in this way, with most of the remaining "Hammerhead" catch being from NSW where the data could not be separated into species components because logbook data was aggregated across all fisheries, and very little observer data was available. Catches of "Hammerheads" from South Australia, Victoria and Tasmania were assumed to be 100% Smooth Hammerhead based on the geographical distribution of each species.

## Risk assessment

Once all of the data had been made available, a qualitative risk assessment based on expert judgment was made for each fishery that catches, or has large potential to catch any of the shark species. Determination of level of risk included: consideration of the spatial overlap of fishery and the distribution of the species; level of catch; any sustainability indicators available; and, the level of management arrangements implemented for each fishery. In many cases, ecological risk assessments (ERAs) have been completed, and these were used where possible. It must be kept in mind however, that ERAs are fisheries specific, and do not account for cumulative impacts of fishing mortality throughout the species' range which is an important consideration for conducting non detriment findings.

## Non-Detriment Finding requirements

From *the International Union for the Conservation of Nature and Natural Resources* (IUCN) workshops held in 1998 and 1999, a report was produced titled *CITES Scientific Authorities' Checklist to assist in making Non-detriment Findings for Appendix II Exports*. This has since been published by IUCN (Rosser and Haywood, 2002). Relevance of required information contained in that report was supported by a more recent meeting. The checklist describes 2 tables of information that should be followed for each species listed in Appendix II that is the subject of export as a result of removal of specimens from the wild, and is presented in Appendix 3 and Appendix 4 of this report. Explanations for each component of the NDF are also given to enable the evaluator to describe/score each component. This methodology was followed for the recent NDF for the Freshwater Sawfish (Anon 2011). Australia's CITES Scientific Authority has stated that it sees this as valuable in providing a qualitative assessment of the factors of relevance to a NDF, but notes its limitations in arriving at quantitative determinations of the level of harvest/trade that may be considered non-detrimental. At a more recent meeting, Anon (2008) described information required to complete NDFs for five different case study fish species as well as "sharks". These

requirements are listed in Annex 1 of Anon (2008), with minimum information considered essential to make a reliable NDF for each of the case studies highlighted. For sharks, none of the information requirements were highlighted, so we have assumed that each piece of information is equally important. These can be considered a summary of the information required to address the checklist of Rosser and Haywood (2002).

Additionally, at CITES CoP16, Resolution Conf 16.7 was adopted, which provides non-binding guiding principles to Parties for conducting robust, science-based assessments. This resolution goes some way towards articulating how Scientific Authorities may weigh-up known risks, uncertainties, and mitigation of risks, including through adaptive management, to determine whether a NDF can be made. The resolution provides the ability for adaptive management arrangements to be incorporated to ensure that unsustainable harvest regimes are detected and addressed accordingly.

The process followed by the Australian CITES Scientific Authority for making NDFs considers relevant information fields as per the IUCN guidelines, and follows the non-binding guiding principles in Resolution Conf 16.7. The process followed in assessing an Australian CITES export operation is explained in a Non-Detriment Finding Fact Sheet developed by the Australian Scientific Authority, which aims to help fisheries management agencies identify key uncertainties, focus information gathering, and develop appropriately precautionary and adaptive management arrangements where uncertainty or risks remain, to underpin NDFs. This factsheet has been provided to all relevant Australian and state and territory government agencies (found at Appendix 6) with responsibility for managing fisheries.

For each fishery that had reported catches/interactions with any of the five shark species, management arrangements are described in the context of the minimum requirements to make a reliable NDF for sharks as described in Anon (2008). This allowed gaps in management arrangements to be highlighted, and based on these gaps, recommendations were made to improve management and data collection so as to inform the CITES Scientific Authority in the determination of an NDF.

# Results and Discussion

## Species Distributions

There are many sources of distributions for marine species. The distributions for each of the five species obtained from a number of sources are presented in Appendix 1. For consistency,

we take the distributions described by Last and Stevens (2009) and the Atlas of Living Australia (ALA) to be the accepted range, but present additional distributions for comparison. Generally, there is sufficient information on the distribution of all of these listed shark species to support a NDF, however there remain knowledge gaps in relation to key habitat that present challenges in relation to the long-term sustainable management of these species throughout their ranges. Specifically, information on habitat use for the five species of interest in Australia is lacking, and habitat critical to particular life stages is yet to be identified throughout the species' ranges — such as juvenile or adult aggregation sites, mating and pupping areas and migration pathways.

There is evidence of habitat partitioning for some of these species. For instance there is fishing records and QLD and NSW beach netting programs indicate the Scalloped Hammerhead may exhibit habitat partitioning based on size and sex, with large mature females rarely found in Australian waters whilst being far more prevalent in Indonesian fisheries catch, however this anecdotal evidence is yet to be confirmed. Sexual segregation is commonly described in hammerhead species around the world, and studies in Australia and the Indo-Pacific have noted the absence of certain sex and size classes from catches in different areas (Stevens and Lyle 1989; Harry *et al*., 2011). However, the whereabouts of those missing sex and size classes has not yet been determined.

Studies considering the population genetics of Australian hammerheads have found little or no genetic subdivision between samples taken from the Indo-Pacific region, including east and west coasts of Australia and Indonesia (Ovenden *et al*. 2009; Ovenden *et al*. 2011). These results suggest that Australia and Indonesia are most likely sharing a fishery stock.

Table 6 provides information on the known (or inferred) stock status of the newly CITES Appendix II listed shark species in Australian and regional waters.

Oceanic Whitetip Shark

The Oceanic Whitetip Shark is described as "cosmopolitan in tropical and warm seas" (Last and Stevens 2009). It is found around the world at latitudes ranging approximately 40°S–40°N (Figure 1). In Australia, the distribution ranges across northern Australia (except for the Torres Strait, Gulf of Carpentaria and Arafura Sea) down to southern NSW in the east and Perth in the west. Despite this range, one specimen has been recorded off Port Lincoln, South Australia. These sharks are pelagic and oceanic, and are found at depths from the surface to at least 150 m. Little is known about their timing of reproduction in Australia.

a) b)

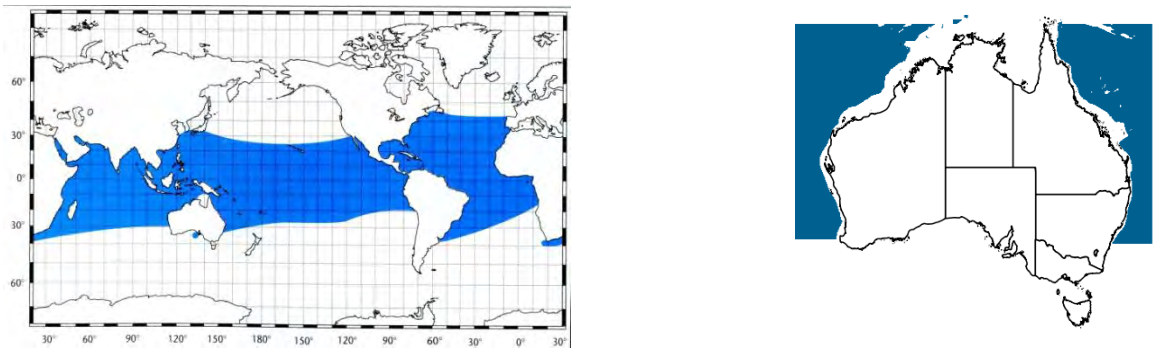

**Figure 1. Distribution of Oceanic Whitetip Shark from a) Last and Stevens (2009), and b) the Atlas of Living Australia.**

Smooth Hammerhead

The Smooth Hammerhead is found in tropical and temperate waters throughout the world between latitudes 55°S–55°N (Figure 2). According to Last and Stevens (2009), the Smooth Hammerhead occurs across all southern Australian states including Tasmania, reaching as far north as about latitude 30°S, or Coffs Harbour in the east and Jurien Bay in the west. ALA shows a more northerly extension to that range to approximately 18°S in the east and 20°S in the west. The ALA range is one used in this report. The Smooth Hammerhead inhabits continental and insular shelf waters, at depths from the surface to at least 20 m. Smooth Hammerhead are thought to pup during January to March in eastern Australia (Stevens, 1984).

a) b)

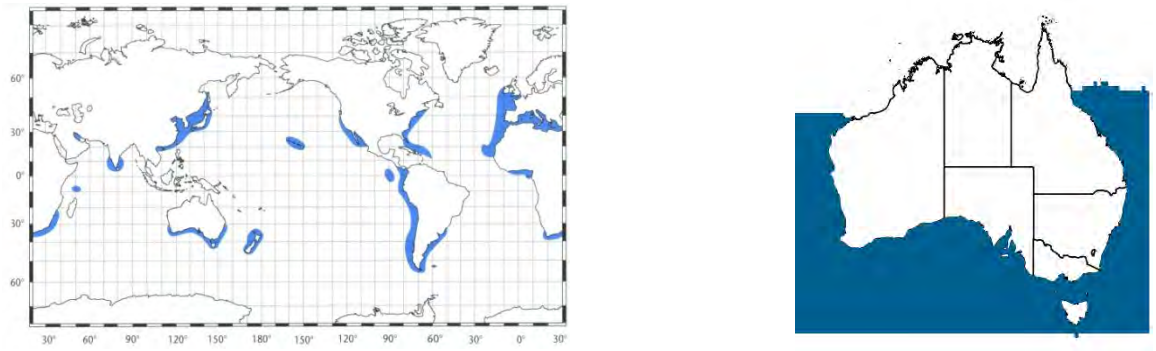

**Figure 2. Distribution of Smooth Hammerhead from a) Last and Stevens (2009), and b) the Atlas of Living Australia.**

Great Hammerhead

Great Hammerheads are distributed around the world in tropical and warm temperate seas between approximately latitudes 35°S–40°N (Figure 3). They have been recorded across

northern Australia from Sydney in the east to the Abrolhos Islands in the west (Last and Stevens 2009), however ALA shows the distribution in the west reaching as far south as Perth (~32°S). The ALA distribution will be the one accepted in this report. Great Hammerheads are found from the surface to at least 80 m deep, from shallow coastal waters and insular shelves to the continental shelf. Off Australia, Great Hammerhead pup between December and January (Last and Stevens, 2009).

a) b)

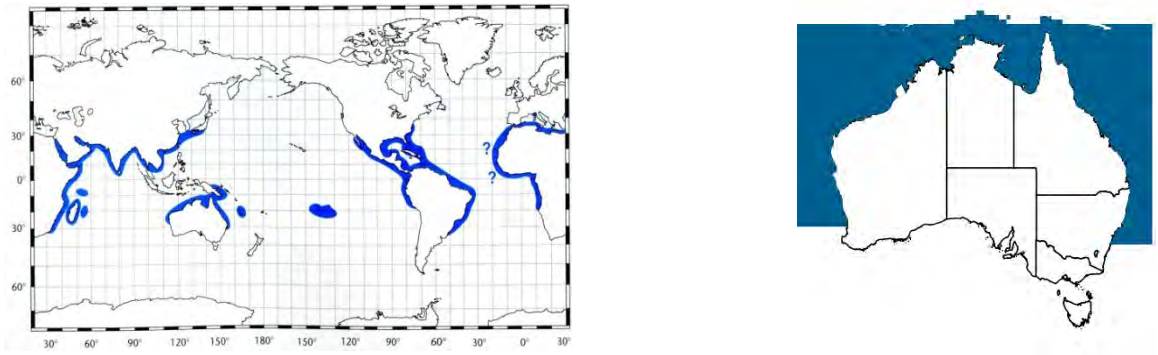

**Figure 3. Distribution of Great Hammerhead from a) Last and Stevens (2009), and b) the Atlas of Living Australia.**

Scalloped Hammerhead

Scalloped Hammerheads have a similar distribution to the Great Hammerhead. They are distributed around the world in tropical and warm temperate seas between approximately latitudes 34°S–45°N (Figure 4). In Australia, they are found in waters north of 34°S (Sydney in the east and Geographe Bay the west). Depth range from the surface to at least 275 m, and they can be found from close to shore to continental shelves and adjacent deeper water (Last and Stevens 2009). Pupping of Scalloped Hammerhead occurs during Spring and Summer in northern Australia (Stevens and Lyle, 1989; Harry *et al*. 2011).

a) b)

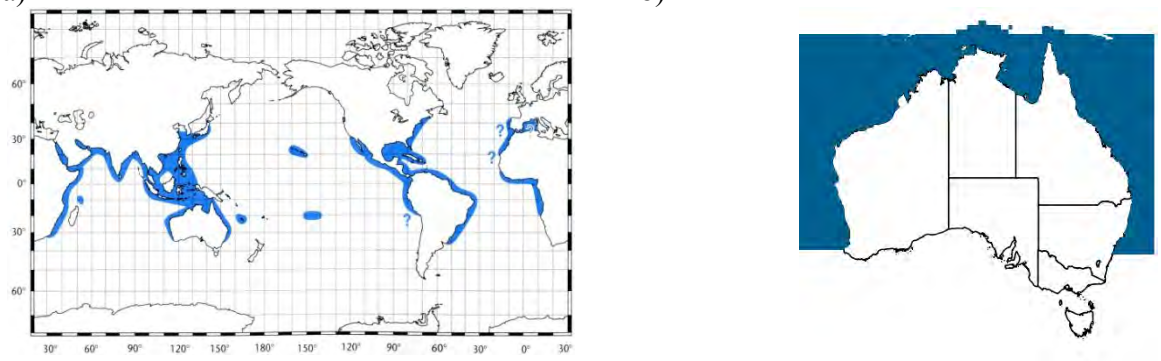

**Figure 4. Distribution of Scalloped Hammerhead from a) Last and Stevens (2009), and b) the Atlas of Living Australia.**

Porbeagle Shark

Porbeagle Sharks inhabit temperate waters in both hemispheres (Figure 5). In the southern hemisphere they can be found between 30°S–58°S. There have been few Australian records, but they range across southern Australia from southern NSW in the east to southern Western Australia (Last and Stevens 2009). They occur from surface waters to at least 370 m on the continental shelf and oceanic waters. Information on the timing Australia was not found.

a) b)

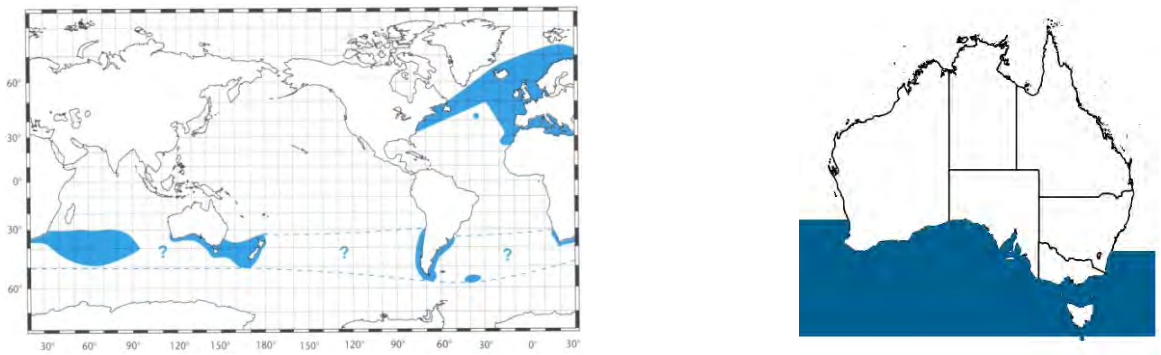

**Figure 5. Distribution of Porbeagle Shark from a) Last and Stevens (2009), and b) the Atlas of Living Australia.**

**Table 1. Summary of distributions and habitats for each listed shark species. Extent of latitudinal range is given for both east and west coasts of Australia.**

| Shark species | Eastern limit | Western limit | Habitat | Notes |
|---|---|---|---|---|
| Oceanic Whitetip Shark | <34°S | <34°S | Oceanic | Except for the Torres Strait, Gulf of Carpentaria and Arafura Sea |
| Smooth Hammerhead | >18°S | >34°S | Insular shelf<br>Continental shelf | |
| Great Hammerhead | <34°S | <32°S | Coastal<br>Insular shelf<br>Continental shelf | |
| Scalloped Hammerhead | <34°S | <34°S | Coastal<br>Insular shelf<br>Continental shelf<br>Oceanic | Description of "adjacent deeper water " interpreted as oceanic |
| Porbeagle Shark | >34°S | >32°S | Continental shelf<br>Oceanic | |

## Species Biology

There is considerable biological information available on all of these shark species from both a global perspective and in Australia. Information is available on longevity, size/age at maturity, fecundity, gestation period, reproductive mode and their preferred habitat and diet of each of the listed shark species (Table 2). Generally, there is sufficient information on the biology of all of these listed shark species so support a NDF, noting there are considerably fewer sources of information in relation to the Great and Smooth Hammerhead sharks than for the Scalloped Hammerhead.

**Table 2. Biological characteristics for each sharks required to make a reliable NDF. Fec: fecundity, $T_m$: age at maturity (years), Gest: gestation period (months), CSh: Continental Shelf, Oc: Oceanic, ISh: Insular Shelf, VIV: Viviparous, OPH: Oviphagous, FISH: Teleost fishes, CEPH: Cephalopods, MOL: Molluscs, CR: Decapod crustaceans, INV: Other invertebrates, BIR: Seabirds, MAM: Marine mammals, CHON: Chondrichthyan fishes, PL: Plants.**

| Biological characteristic | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| Reproductive rate | Fec 1–14 [1]<br>$T_m$ 4–5 [1]<br>Gest 12 [3] | Fec 20–50 [3]<br>$L_m$ 265 cm [3]<br>Gest 10–11 [3]<br>Likely a 2-year breeding cycle [9] | Fec 6–33 [3]<br>$T_m$ 7–10 [4]<br>Gest 11 [3] | Fec 13–23 [3]<br>$T_m$ 15 [1]<br>Gest 9–10 [3] | Fec 1–5 [3]<br>$T_m$ 13 [6] (in the North Atlantic Ocean)<br>Gest 8–9 [8]<br>Annual [8] |
| Longevity (years) | 22 [1] | $L_{max}$ 350 cm [3] | 44 [5] | 35 [1] | >26 [6] (in the North Atlantic Ocean) |
| Habitat | Pelagic, CSh & Oc [3] | Pelagic, CSh, ISh [3] | Demersal, CSh, ISh [3] | Pelagic, CSh, ISh [3] | Pelagic, CSh & Oc [3] |
| Diet (%) | FISH (43.1)<br>CEPH (43.9)<br>MOL (1.0)<br>CR (1.0)<br>BIR (1.0)<br>MAM (4.0)<br>CHON (2.0)<br>PL (4.0) [2] | FISH (29.8)<br>CEPH (68.9)<br>CR (0.4)<br>CHON (0.9) [2] | FISH (43.5)<br>CEPH (3.3)<br>CR (11.2)<br>CHON (41.7)<br>PL (0.2) [2] | FISH (61.9)<br>CEPH (15.5)<br>MOL (0.1)<br>CR (22.0)<br>CHON (0.5) [2] | FISH (74.7)<br>CEPH (22.7)<br>INV (1.3)<br>BIR (0.7)<br>PL (0.7) [2] |
| Dispersal mechanism / reproduction mode | VIV [3] | VIV [3] | VIV [3] | VIV [3] | OPH [3] |
| Tolerance to human activity other than harvest | No specific information. Possibly some recreation catch. Recreational shark catch discussed in [3] | No specific information. Some recreation catch. Recreational shark catch discussed in [3]. Total annual recreational catch of hammerheads in NSW likely to be 10–50 t [7] Following the listing of scalloped and great hammerhead as threatened in NSW, these species are no-longer allowed to be taken. | | | No specific information. Possibly some recreation catch. Recreational shark catch discussed in [3] |

References:

[1] Smith et al (1998);
[2] Corte s(1999);
[3] DAFF (2001);
[4] Harry et al (2011);
[5] Piercy et al (2010);
[6] Francis et al (2008);
[7] Rowling et al (2010);
[8] IUCN Redlist Porbeagle;
[9] Scandol et al (2008).

## Fishery Information

***Australian fisheries that interact with the listed shark species***

A summary of catches/interactions between 124 commercial fisheries in Australia with any of the five listed shark species is shown in Table 4. Of the 33 commercial fisheries in Western Australia, there were four with confirmed catches or interactions: Temperate demersal gillnet and demersal longline; Kimberley gillnet and Barramundi; Pilbara fish trawl; and, the Northern shark (WA North Coast Shark Fishery and Joint Authority Northern Shark Fishery). Of the 11 commercial fisheries in the Northern Territory, there were six with confirmed catches or interactions: Barramundi Fishery; Coastal Line Fishery; Demersal Fishery; Development Fishery; Offshore Net and Line Fishery; and, the Spanish Mackerel Fishery. Queensland has 21 commercial fisheries, of which eight had confirmed catches or interactions: Coral Reef Fin Fish Fishery; East Coast Inshore Fin Fish Fishery; East Coast Otter Trawl Fishery; East Coast Spanish Mackerel Fishery; Fin Fish (Stout Whiting) Trawl Fishery; Gulf of Carpentaria Developmental Fin Fish Trawl Fishery; Gulf of Carpentaria Inshore Fin Fish Fishery; and, the River and Inshore Beam Trawl Fishery. New South Wales has eight commercial fisheries, of which five with confirmed catches or interactions: Estuary General Fishery; Estuary Prawn Trawl Fishery; Ocean Hauling Fishery; Ocean Trawl Fishery; and, Ocean Trap & Line Fishery. Of the 10 commercial fisheries in Victoria, only the Victorian Ocean Fishery had confirmed catches or interactions. Of the nine commercial fisheries in Tasmania, only the Scalefish Fishery had confirmed catches or interactions. Of the nine commercial fisheries in South Australia, only the Marine Scalefish Fishery had confirmed catches or interactions. Finally, of the 23 Commonwealth fisheries, there were eleven with confirmed catches or interactions: Australian High Seas Fisheries; Coral Sea Fishery (multi sector); Eastern Tuna and Billfish Fishery; Heard Island and McDonald Islands Fishery; Macquarie Island Toothfish Fishery; Northern Prawn Fishery; Southern and Eastern Scalefish and Shark Fishery (multi sector); Torres Strait Prawn Fishery; North West Slope Trawl Fishery; Western Deepwater Trawl Fishery; and the Western Tuna and Billfish Fishery.

A comparison of distributions of each species of interest with areas of each fishery and subjective assessment of the potential for each gear type to catch each species, revealed 34 fisheries with no confirmed catches or interaction, but has the potential for that to occur (Table 7). Nineteen of those are from Western Australia. Brief examination of management arrangement was made for those fisheries to describe likely reasons for their absence from the fisheries data (Table 7). The most common likely cause was lack of information on bycatch

from observer data (either because no observer program has been conducted, or because such information is not readily available). Other main potential reasons include fisheries that are highly targeted (eg South Australia's Sardine Fishery), there are management arrangements to reduce bycatch (WA's Onslow Prawn Fishery) or the fishery operates very close to shore or in bays, inlets or estuaries (eg South Australia's Lakes and Coorong Fishery).

***Catch statistics***

A ten year time series of the total global retained catches of the five listed shark species was obtained from the Food and Agriculture Organisation (FAO) FishStat website and compared to the catches taken in Australian fisheries (Table 5). However it should be noted that there are considerable problems with these data (Lack and Sant, 2011), including suspected significant underreporting by some of the largest fishing States, some of which fish in the Oceania region for stocks shared with Australian fisheries. This may mean Australian catch is proportionally over represented in the FAO data set.

On a global scale, most of the hammerhead species are reported generically as "Hammerheads", not as the individual species (there were no records of catch of Great Hammerhead in global catches). This meant that comparison to global catches for hammerheads could only be made at the generic level, not at the species level. Total global catches of hammerheads over the last decade has ranged between about 2000 and 6000 t and is generally increasing, whilst in Australia, catches have ranged between 200 and 600 t and have been declining since 2004 (Figure 6). Most of the hammerhead catches in Australia are taken by the Northern Territory's Offshore Net and Line Fishery (ONLF), Queensland's East Coast, Inshore Finfish Fishery (ECIFFF) and Western Australia's Northern Shark Fishery (NSF) and Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF) (Figure 7). The first three of those (ONLF, ECIFFF and NSF) have also show the greatest decline in catches. Declines in Hammerhead catches in the ONLF (~40% between 2003–2012) are commensurate with the decrease in effort (~56% or from ~1,800 boat days in 2003 to ~800 boat days in 2011) (Northern Territory Government, 2012). Further, management arrangements have been introduced in recent years to reduce catches of sharks including fin ratios, and capping longline effort, and ONLF fishers have shifted away from targeting sharks to targeting Grey Mackerel (Northern Territory Government, 2012). While there has also been a decrease in effort in the ECIFFF, the large decrease in overall shark catch (including Hammerheads) during 2009–10 was attributed to changed management arrangements including implementation of a total allowable commercial catch (TACC) on sharks (Anon,

2011d). There has been no reported effort in the NSF since 2008–09 (Fletcher and Santoro, 2012).

In Australia, there is improvement of the recording of hammerheads to species level in commercial logbook data, and there has been ancillary data (eg. observer data) which has allowed disaggregation of unspecified hammerhead catch to the species level. The sum of disaggregated hammerheads does not equal the value for "HH" in any year, because Winghead Sharks were also reported as "Hammerheads" in some logbooks, and they were accounted for in the disaggregation, but not reported here. The breakdown of catches of Scalloped Hammerheads, Great Hammerheads and Smooth Hammerheads is shown in Figure 8, Figure 9, and Figure 10 respectively.

Across the globe, catches of Porbeagle Shark have declined from about 1200 t to 200 t over the last decade (Figure 11). Australian annual catches have been less than 2.5 t since at least 2001, representing <1% of the global catch, most (>75%) being taken in the Commonwealth's Eastern Tuna and Billfish Fishery (ETBF) (Figure 12).

Global catches of Ocean Whitetip Shark have been variable between 200 and 1800 t but have declined from 25 t to 3 t in Australia over the last decade (Figure 13). Most of these are taken in the ETBF and the Western Tuna and Billfish Fishery (WTBF) (Figure 14)[1], and catches in both fisheries have declined significantly since 2002. The decrease in catches by these fisheries coincides with decreases in total effort, and implementation measures to reduce catches of sharks including the banning of wire trace, trip/trigger limits, ban on shark finning and carriage of line cutters and de-hookers (Woodhams *et al.* 2012). Both these fisheries are part of Regional Fisheries Management Organisations (RFMOs) that have recently banned the retention of this species.

[1] Annually aggregated NSW catches from 2009/10–2011/12 for Oceanic Whitetip Shark and Porbeagle Shark were split evenly over those three years (2009-2012). Where catches were obtained for financial year (NSW data), the most recent calendar year was assigned to those data (for example 2009/10 became 2010).

## Recommended improvements to Australian fisheries management and data

The relevant management arrangements and information available for each Australian fishery that had catches/interactions with any of the five listed shark species is provided in Appendix 5.

Table 7 assesses the potential for fisheries to interact with the different CITES listed shark species based on gear type and best known information on species range/habitat preferences. This method highlights a large number of fisheries that could potentially interact with species, however, only a small proportion of these fisheries have reported and confirmed interactions. For the purposes of this report, only those fisheries that have confirmed interactions will be considered.

Gaps in management vary across fisheries, but some of the most common include a lack of species identification in fishery logbooks, breakdown of estimates of illegal, unreported and unregulated (IUU) fishing into jurisdiction, observer programs or availability of observer data, restriction in potential catch of sharks (eg no trip limits or quotas) and facility to report discards in commercial logbooks (Appendix 5).

Gaps in management arrangements and data are highlighted in the context of the minimum requirements considered to support a NDF for sharks as described in Anon (2008). Based on these gaps, recommendations were made to strengthen management and data collection over time to better inform the assessment process for future NDFs. Measures such as those presented below, in combination with pre-determined decision rules and an adaptive management framework, would over time improve the information available to the Australian CITES Scientific Authority in determining NDFs for trade of these species. The recommendations for strengthened management and data collection are summarised below.

**Table 3. Summary of recommended improvements to the management and data requirements of each Australian fishery that has confirmed catches or interactions with any of the five listed shark species.**

| **WA – Kimberley gillnet and barramundi fishery (KGBF)** | |
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| **Recommendations** | 2.10 An estimate of the annual IUU catch of Great Hammerhead, Scalloped Hammerhead and Ocean Whitetip Shark within the boundary of this fishery is required.<br>2.14 Implement trip limits for the five shark species of interest.<br>2.19 Provide facility to report discards in commercial logbook data.<br>2.20 Collect more recent observer data to describe species composition of the catch and discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the five shark species of interest, as well as maximum size limits. |
| **WA – Northern shark fishery (NSF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trigger limits for the five shark species of interest.<br>2.19 Remove generic shark references in logbooks and improve species identification in logbook data. |

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| | 2.20 Collect more recent observer data to describe species composition.. |
| **WA – Pilbara fish trawl fishery (PFTF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.19 Allow for reporting of discarded shark in the logbooks and/or use observer program to estimate total annual discard of sharks of interest. |
| **WA – Temperate demersal gillnet and demersal longline fisheries (TDGDLF)** | |
| **Recommendations** | 2.14 Implement trip limits for the five listed shark species.<br>2.19 Remove generic shark references in logbooks and provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the five listed shark species, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **NSW – Ocean Trawl Fishery (OTF)** | |
| **Recommendations** | 2.14 Implement trip limits for the listed shark species other than Scalloped and Great Hammerhead<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the listed shark species other Scalloped and Great Hammerhead, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **NSW – Ocean Hauling Fishery (OHF)** | |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers could be implemented for the listed shark species other Scalloped and Great Hammerhead.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the listed shark species other Scalloped and Great Hammerhead, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **NSW – Ocean Trap & Line Fishery (OTLF)** | |
| **Recommendations** | 2.14 There are reasonably strong controls on shark captures in this fishery. If they were to be strengthened at all, separate trip limits and maximum size limits for the listed shark species other Scalloped and Great Hammerhead could be introduced.<br>2.19 Provide facility to report discards in commercial logbooks. |
| **Queensland – River and Inshore Beam Trawl Fishery (RIBTF)** | |
| **Recommendations** | 2.10 Estimate IUU catch<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve species identification of observers. Required estimation of weight in observer records. |
| **Queensland – Gulf of Carpentaria Inshore Fin Fish Fishery (GOCIFFF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records. |
| **Queensland – Gulf of Carpentaria Developmental Fin Fish Trawl Fishery (GCDFFTF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.20 Improve reporting of shark weight in observer records. |
| **Queensland – Fin Fish (Stout Whiting) Trawl Fishery (FFTF) Gulf of Carpentaria Developmental Fin Fish Trawl Fishery** | |
| **Recommendations** | 2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records. |
| **Queensland – East Coast Spanish Mackerel Fishery (ECSMF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Provide facility to report shark species and discards in commercial logbooks. |

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| **Queensland – East Coast Otter Trawl Fishery (ECOTF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records |
| **Queensland – East Coast Inshore Fin Fish Fishery (ECIFFF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trip limits for the listed shark species by licence with an S symbol.<br>2.19 Improve reporting to species level and provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records |
| **Queensland – Coral Reef Fin Fish Fishery (CRFFF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Improve reporting to species level and provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Implement trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **Northern Territory – Barramundi Fishery (BF)** | |
| **Recommendations** | 2.19 Improve reporting to species level in commercial logbooks and include discard weights.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Potentially implement maximum size limit for Smooth Hammerhead, Oceanic Whitetip Shark or Porbeagle Shark.<br>Required estimation of weight in observer records. |
| **Northern Territory – Demersal Fishery (DF) – multi sector that now includes the original Finfish Trawl and Demersal Fisheries** | |
| **Recommendations** | 2.10 Estimate IUU catch<br>2.20 Improve reporting to species level in both logbooks and by observers. |
| **Northern Territory – Offshore Net and Line Fishery (ONLF)** | |
| **Recommendations** | Develop performance measures for Hammerheads.<br><br>2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 and 2.18 Implement trip limits for the listed shark species<br>2.18 Require landing with of sharks with fins naturally attached<br>2.19 Remove generic group reference and improve reporting to species level in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Implement trip limits for the listed shark species. and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **Commonwealth – Western Tuna and Billfish Fishery (WTBF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.19 Only slight improve needed in reporting to species level in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records. |
| **Commonwealth – Western Deepwater Trawl Fishery (WDTF)** | |
| **Recommendations** | 2.14 Implement trigger limits for the five shark species of interest.<br>2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **Commonwealth – North West Slope Trawl Fishery (NWSTF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trigger limits for the five shark species of interest.<br>2.20 Improve reporting of shark to species level in observer records.<br>2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **Commonwealth – Torres Strait Prawn Fishery (TSPF)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery |

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| | level.<br>2.20 Improve reporting of shark to species level in observer records, and require reporting of discards of sharks in commercial logbooks. |
| **Commonwealth – Southern and Eastern Scalefish and Shark Fishery (multiple sectors)** | |
| **Recommendations** | 2.14 Implement catch or trip limits for the five shark species of interest.<br>2.20 Improve reporting of shark to species level in observer records. Check on the correct identification of shark species in commercial logbook data<br>2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. |
| **Commonwealth – Northern Prawn Fishery** | |
| **Recommendations** | 2.10 An estimate of the annual IUU catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but may require a specific project to identify species (mostly by fins) on seized vessels.<br>2.20 Improve reporting of shark to species level in observer records, and require reporting of discards of sharks in commercial logbooks. |
| **Commonwealth – Eastern Tuna and Billfish Fishery** | |
| **Recommendations** | 2.20 Improve reporting of hammerhead shark to species level in observer records. |
| **Commonwealth – Coral Sea (multi-sector)** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.20 Observer data on retained and discarded shark species should be identified down the species level. Commercial logbook data is generally identified to species level for hammerheads but whalers and weasel sharks are often grouped but any Oceanic Whitetip Sharks should be specifically identified (there was none apparent in the observer data).<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature population. |
| **Commonwealth – Australian High Seas Fisheries** | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.26 A maximum size limit could be implemented for the non-trawl sector to ensure stricter protection of a portion of the mature population. |
| **South Australia – Marine Scalefish Fishery (MSF)** | |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for Smooth Hammerhead and Porbeagle Shark could be implemented.<br>2.19 Improve reporting of sharks to species level in commercial logbooks and record any discards.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature population. |
| **Victorian – Ocean Access Fishery (OAF)** | |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for Smooth Hammerhead and Porbeagle Shark could be implemented.<br>2.19 Improve identification of shark catches in commercial logbooks.<br>2.20 An observer program should be implemented and data on retained and discarded shark species should be identified down the species level.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature shark population. |
| **Tasmanian – Scalefish Fishery (SF)** | |
| **Recommendations** | 2.19 Improve identification of shark catches in commercial logbooks.<br>2.20 An observer program should be implemented and data on retained and discarded shark species should be identified down the species level.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature shark population. |

# Determination of Risk

All of the five listed shark species have a widespread contiguous distribution on a global scale (Table 6). Their respective distributions in Australia represent only a small proportion of their global distribution and this is reflected in the catch data (based on FAO, Commonwealth and

State catch data). The Australian catch represents just 0.11% of the global Porbeagle Shark catch and only 1.1% of the global Oceanic Whitetip Shark catch (based on the 2001-2011 average catches). On this basis, if considered in isolation, it is extremely unlikely that any of the Australian fisheries would represent a risk to either of these pelagic shark species. However CITES NDFs are to consider all sources of mortality impacting a population, and all of these shark species taken in Australian fisheries are shared stocks with international fisheries where significantly more harvest takes place. The effect of this cumulative mortality needs to be considered. A summary of the national status and major threats are shown in Table 6.

The Australian fishery that takes the large majority of both of these species is the Commonwealth's Eastern Tuna and Billfish Fishery. This fishery currently allows no take of Oceanic Whitetip Sharks, and a combined total of 20 sharks of other species per trip. A compliance risk assessment has been undertaken and there is high confidence in the effective implementation of permit conditions. To reduce risks on these sharks: shark fins must remain naturally attached to the carcass; it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed; the use of wire trace is prohibited to reduce shark bycatch; and, Porbeagle Sharks cannot be targeted, and can only be retained if they are dead at retrieval. Catch is monitored through fishing logbooks, and catch disposal records and fishers are required to report number and estimated weight of fish caught, and estimated number of fish discarded. There is high confidence in monitoring of retained catches through an established observer program which aims to cover 8.5% of the effort. Catch verification is also facilitated using a system of AFMA authorised fish receivers and catch disposal records (CDRs). Integrated Computer Vessel Monitoring System (ICVMS) is required on all vessels. In their level 2 ecological risk assessment, Webb *et al.* (2007) assigned a medium category to Scalloped Hammerhead, Smooth Hammerhead and Oceanic Whitetip Shark. A high risk was assigned to Porbeagle Shark (Webb *et al.*, 2007), but this was lowered to medium in the residual risk assessment because of reduced shark bycatch through the ban on use of wire trace (Anon, 2009). The only main area for improvement recommended for this fishery is to improve reporting of hammerhead shark to species level in observer records.

In contrast to the extremely low relative catches of Oceanic Whitetip Shark and Porbeagle Shark on a global scale, Australian fisheries account for 8.5% of the global hammerhead catch (based on the 2001-2011 average catches). This figure represents the unspecified

hammerhead catch, because this is how most of the catch was reported in the FAO FishStat database. Four Australian fisheries account for about 90% of the Australian hammerhead catch: the Northern Territory's Ocean Net and Line Fishery, Queensland's East Coast Inshore Finfish Fishery, and Western Australia's Temperate demersal Gillnet and Demersal Longline Fishery and Northern Shark Fishery. These fisheries are managed through a variety of measures including limited entry, catch or effort limits, gear restrictions, logbooks and observer programs (see Appendix 5), however, for the purpose of meeting the requirements for the development of NDFs for the listed shark species, there are a number of areas for improvement that they share in common, albeit to differing degrees. There has been an effort to estimate the IUU catch weight and catch composition of sharks down to species level (Marshall, 2011) but this has been estimated across all of northern Australia and is not currently able to be associated with any particular fishery. This disaggregation of IUU shark catches by fishery may be possible with further analysis of current data, but it would now be almost a decade out of date. We believe this is one of the major gaps in the data required to support a NDF. Another major area for data improvement is the recording of these shark species down to species level in both the commercial logbooks and observer data. In some fisheries, this goal is hindered by having grouped or generic "hammerhead" or "shark" headings hard-coded into the paper logsheets. Industry is generally able to identify these species, so if capacity to record individual species is promoted, the generic reference should be removed from logbooks to encourage this. Space on logbooks is usually at a premium, so hard-coding very rarely caught individual species into the logsheet may be difficult to justify for some fisheries, but this does not prevent fishermen writing this information in. In concert with species-level reporting in log books, the requirement to land these sharks with fins naturally or otherwise attached in a tamper-proof manner would also improve the capacity to verify species-level reporting of harvest, which would improve the level of confidence in catch data that may form the basis for future NDFs. Fisheries that target any of these shark fisheries could also consider implementing adaptive management arrangements that collect length frequency and sex frequency data at appropriate trigger points.

Another issue is that some of the commercial logbooks do not cater for recording of discards. Given that many fisheries have "no take" or trip limits on byproduct/bycatch shark species, and that limiting or reducing the total level of mortality including post-release may be an important factor in arriving at NDFs, it is important that the capacity to record discards of these shark species is incorporated into the logbooks. Finally, although many of these

fisheries may have catch triggers or trip limits for byproduct species, these are more often associated with groups "baskets" of shark species - rarely individual species. In fisheries that have the potential ability to target or increased catch level (even if not realised) of any of the listed shark species, limits should be placed on each of the listed species. A limit on the maximum size of sharks that can be retained could also be implemented to ensure stricter protection of a portion of the mature shark population. Obviously, this is of limited value if there is likely to be low survival of released sharks. As such, in fisheries where incidental catch is likely to exceed trip limits, measures to reduce shark catch (such as by banning wire traces), in concert with measures to improve survivability of captured sharks, (such as provision of release handling guidelines or carriage of dehookers and line cutters), may be of value in improving the sustainable management of the recently CITES listed Hammerhead species which will provide a better basis for determining NDFs.

In summary, the minimum management measures that would improve the information basis and enhance the sustainable management of these species, both of which may be required in determining a NDF if implemented in a consistent manner for all fisheries that interact or are likely to interact with these species are:

- An improved understanding and management focus on particular fisheries where IUU may be a problem
- Species level reporting in log books
- Landing of sharks with fins naturally attached
- Mandatory discard reporting to species level
- Maximum size limits
- Trip limits
- Further measures to reduce incidental capture and post release mortality as practically appropriate to specific fisheries and gear types

One final comment is that any management change or data improvements implemented to meet the requirements for NDF should be practical, effective and efficient. Overly complex or onerous management changes in fisheries where catch is low and incidental could well meet with resistance and ultimately undermine the quality of the commercial logbook data, which is currently improving markedly. As such, in the bulk of the fisheries that have negligible interactions, simple changes that ensure species level reporting of all retained and discarded catches would go a long way to meeting the NDF requirement to consider

cumulative mortality. It may be appropriate to institute additional practical management measures in fisheries with more significant impact on these species to improve sustainability.

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**Table 4. Checklist of fisheries with confirmed catches or interactions with each of the five shark species. Cells shaded grey indicate that the shark was not identified to species and reported as group code.**

**Where "Hammerhead" was reported in catches from South Australia, Victoria and Tasmania it was assumed that is was Smooth Hammerhead. Average annual retained commercial catches calculated over 2007–2012 (or less if data from all of the years was not available) are labelled.**

| **Jurisdiction/Fishery** | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| **Western Australia** | | | | | |
| West coast rock lobster | × | × | × | × | × |
| Roe's abalone | × | × | × | × | × |
| Octopus | × | × | × | × | × |
| Abrolhos Islands and Mid West, South West Trawl Managed Fisheries and South Coast Trawl Fishery | × | × | × | × | × |
| Cockburn Sound crab | × | × | × | × | × |
| Deep sea crab | × | × | × | × | × |
| West Coast Nearshore and Estuarine Finfish | × | × | × | × | × |
| West coast purse seine | × | × | × | × | × |
| West coast demersal Scalefish | × | × | × | × | × |
| South Coast Demersal Scalefish | × | × | × | × | × |
| South coast crustacean | × | × | × | × | × |
| Abalone (greenlip/brownlip) | × | × | × | × | × |
| South Coast Nearshore and Estuarine Finfish (including WA salmon and Estuarine Fishfish (south coast) and Australian Herring | × | × | × | × | × |
| Albany/King George Sound purse seine, Bremer Bay purse seine, Esperance purse seine | × | × | × | × | × |
| **Temperate demersal gillnet and demersal longline** | <1 t | 50 - 100 t | | <1 t | × |
| Shark bay prawn | × | × | × | × | × |
| Exmouth Gulf prawn | × | × | × | × | × |
| Shark Bay scallop | × | × | × | × | × |
| Shark Bay crabs | × | × | × | × | × |
| Shark Bay beach seine and mesh net | × | × | × | × | × |
| Shark Bay snapper (Gascoyne Demersal Scalefish Fishery) | × | × | × | × | × |
| Onslow prawn | × | × | × | × | × |
| Nickol Bay prawn | × | × | × | × | × |
| Broome prawn | × | × | × | × | × |
| Kimberley prawn | × | × | × | × | × |
| **Kimberley gillnet and barramundi** | × | × | × | ✓ | × |
| Northern demersal scalefish | × | × | × | × | × |
| **Pilbara fish trawl**[2] | × | ✓ | ✓ | ✓ | × |
| Pilbara demersal trap and line | × | × | × | × | × |
| Mackerel | × | × | × | × | × |
| **Northern shark (WA North Coast Shark Fishery and Joint Authority Northern Shark Fishery )** | <1 t | | 1-10 t | 1-10 t | × |
| Pearl oyster | × | × | × | × | × |
| Beche-de-mer | × | × | × | × | × |

[2] Not present in data request. See DOF (2010). The Bycatch Action Plan for the Pilbara Fish Trawl Interim Managed Fishery. Fisheries Management Paper No. 244. Department of Fisheries, WA.

**Table 4 contd. Checklist of fisheries with confirmed catches or interactions with each of the five shark species. Cells shaded grey indicate that the shark was not identified to species and reported as group code.**

| **Jurisdiction/Fishery** | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| **Northern Territory** | | | | | |
| Aquarium Fishery | × | × | × | × | × |
| **Barramundi Fishery**[3] | × | × | | | × |
| **Coastal Line Fishery**[4] | × | × | | | × |
| Coastal Net Fishery | × | × | × | × | × |
| **Demersal Fishery** | × | × | | | × |
| **Development Fishery**4 | × | × | | | × |
| Mud Crab Fishery | × | × | × | × | × |
| **Offshore Net and Line Fishery** | × | × | 50-100 t | 50-100 t | × |
| **Spanish Mackerel Fishery**4 | × | × | | | × |
| Timor Reef Fishery | × | × | × | × | × |
| Trepang Fishery | × | × | × | × | × |
| **Queensland** | | | | | |
| Blue Swimmer Crab Fishery | × | × | × | × | × |
| Coral Fishery | × | × | × | × | × |
| **Coral Reef Fin Fish Fishery** | | × | ✓ | × | × |
| Crayfish and Rocklobster Fishery (formerly Tropical Rock Lobster Fishery) | × | × | × | × | × |
| Deep Water Fin Fish Fishery | | | | | × |
| East Coast Bêche-de-mer Fishery | × | × | × | × | × |
| **East Coast Inshore Fin Fish Fishery** | <1 t | <1 t | <1 t | 50-100 t | × |
| **East Coast Otter Trawl Fishery** | | | | ✓ | × |
| East Coast Pearl Fishery | × | × | × | × | × |
| **East Coast Spanish Mackerel Fishery** | | | | <1 t | |
| East Coast Trochus Fishery | × | × | × | × | × |
| **Fin Fish (Stout Whiting) Trawl Fishery** | | × | × | ✓ | × |
| **Gulf of Carpentaria Developmental Fin Fish Trawl Fishery** | × | × | × | ✓ | × |
| **Gulf of Carpentaria Inshore Fin Fish Fishery** | | | 1-10 t | 1-10 t | × |
| Gulf of Carpentaria Spanish Mackerel Fishery | | | | | × |
| Marine Aquarium Fish Fishery | × | × | × | × | × |
| Marine Specimen Shell Collection Fishery | × | × | × | × | × |
| Mud Crab Fishery | × | × | × | × | × |
| **River and Inshore Beam Trawl Fishery** | | | | ✓ | × |
| Rocky Reef Fin Fish Fishery | | × | × | × | × |
| Spanner Crab Fishery | × | × | × | × | × |

[3] Despite catch information not reported to species level, indications from NT DPIF scientists indicates that either GH and/or ScH have been caught in small numbers in these fisheries, and management arrangements for these fisheries are reviewed.

[4] Small numbers of "Hammerhead Shark" are reported from either commercial catch or logbooks, however these records may refer to any of Great Hammerhead, Scalloped Hammerhead and Winghead Shark and a combination of those species. Management arrangements for these fisheries were not reviewed.

**Table 4 contd. Checklist of fisheries with confirmed catches or interactions with each of the five shark species. Cells shaded grey indicate that the shark was not identified to species and reported as group code.**

| **Jurisdiction/Fishery** | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| **NSW** | | | | | |
| Abalone Fishery | × | × | × | × | × |
| **Estuary General Fishery** [5] | | | × | | |
| **Estuary Prawn Trawl Fishery** 5 | × | | | | × |
| Lobster Fishery | × | × | × | × | × |
| **Ocean Hauling Fishery** | ✓ | ✓ | × | × | × |
| **Ocean Trawl Fishery** | ✓ | <1 t | <1 t | <1 t | ✓ |
| **Ocean Trap & Line Fishery** | ✓ | <1 t | 1-10 t | 1-10 t | ✓ |
| Sea Urchin and Turban Shell Restricted Fishery | × | × | × | × | × |
| **Victoria** | | | | | |
| Abalone Fishery | × | × | × | × | × |
| Giant Crab Fishery | × | × | × | × | × |
| PQ Aquatics | × | × | × | × | × |
| Rock Lobster Fishery | × | × | × | × | × |
| Scallop Fishery | × | × | × | × | × |
| Sea Urchin Fishery | × | × | × | × | × |
| Commercial Bay and Inlet Fisheries | × | × | × | × | × |
| **Victorian Ocean Fishery** | × | <1 t | × | × | × |
| Victorian Inshore Trawl Fishery | × | × | × | × | × |
| Ocean Purse Seine Fishery | × | × | × | × | × |
| **Tasmania** | | | | | |
| Abalone Fishery | × | × | × | × | × |
| Rock Lobster Fishery | × | × | × | × | × |
| **Scalefish Fishery** | × | <1 t | × | × | × |
| Giant Crab Fishery | × | × | × | × | × |
| Scallop Fishery | × | × | × | × | × |
| Commercial Dive Fishery | × | × | × | × | × |
| Shellfish Fishery | × | × | × | × | × |
| Marine Aquarium Fish Fishery | × | × | × | × | × |
| Octopus Fishery | × | × | × | × | × |

[5] None of the five shark species of interest can be legally retained in this fishery, however very small numbers have been reported as being landed. Advice from NSW DPI suggests that those records are either reporting errors, data entry errors or reporting of illegal fishing. This fishery is not considered further in this report.

**Table 4 contd. Checklist of fisheries with confirmed catches or interactions with each of the five shark species. Cells shaded grey indicate that the shark was not identified to species and reported as group code.**

| **Jurisdiction/Fishery** | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| | | | | | |
| **South Australia** | | | | | |
| Abalone Fishery | × | × | × | × | × |
| Blue Crab Fishery | × | × | × | × | × |
| Giant Crab Fishery | × | × | × | × | × |
| Lakes and Coorong Fishery | × | × | × | × | × |
| **Marine Scalefish Fishery** | × | ✓ | × | × | × |
| Scallop and Turbo Fisheries | × | × | × | × | × |
| Sea Urchin Fishery | × | × | × | × | × |
| Prawn (Gulf St Vincent, Spencer Gulf and West Coast) Fishery | × | × | × | × | × |
| Rock Lobster Fishery | × | × | × | × | × |
| **Commonwealth** | | | | | |
| **Australian High Seas Fisheries** | <1 t | × | × | × | <1 t |
| Bass Strait Scallop Central Zone Fishery | × | × | × | × | × |
| **Coral Sea Fishery (multi sector)** | | <1 t | | <1 t | × |
| **Eastern Tuna and Billfish Fishery** | 1-10 t | <1 t | | <1 t | <1 t |
| Heard Island and McDonald Islands Fishery | × | × | × | × | ✓ |
| Macquarie Island Toothfish Fishery | × | × | × | × | ✓ |
| **Northern Prawn Fishery** | | ✓ | ✓ | ✓ | × |
| Skipjack Tuna Fishery | × | × | × | × | × |
| Small Pelagics Fishery | × | × | × | × | × |
| **Southern and Eastern Scalefish and Shark Fishery (multi sector)** | | 1-10 t | | <1 t | <1 t |
| Southern Bluefin Tuna Fishery | × | × | × | × | × |
| Southern Squid Jig Fishery | × | × | × | × | × |
| Torres Strait Beche-de-mer Fishery | × | × | × | × | × |
| Torres Strait Crab Fishery | × | × | × | × | × |
| Torres Strait Finfish Fishery | × | × | × | × | × |
| Torres Strait Pearl Shell Fishery | × | × | × | × | × |
| **Torres Strait Prawn Fishery** | × | × | × | ✓[6] | ×[7] |
| Torres Strait Trochus Fishery | × | × | × | × | × |
| Torres Strait Tropical Rock Lobster Fishery | × | × | × | × | × |
| Torres Strait Turtle and Dugong Fishery | × | × | × | × | × |
| **North West Slope Trawl Fishery** | | × | × | ✓ | × |
| **Western Deepwater Trawl Fishery** | <1 t | × | × | × | × |
| **Western Tuna and Billfish Fishery** | <1 t | | | <1 t | <1 t |

[6] Fishery was reported as Torres Strait and gear reported as Bottom otter trawl. We assume Torres Strait Prawn Fishery because it is the only fishery in the Torres Strait that allows the use of trawl gear.

[7] Observer data reported catch of a Porbeagle Shark in this fishery that was discarded. The area of the Torres Strait Prawn Fishery is well out of the accepted distribution of the Porbeagle Shark, and we assume this was a misidentification or keypunching error (it is possible however that it was a legitimate interaction).

a) b)

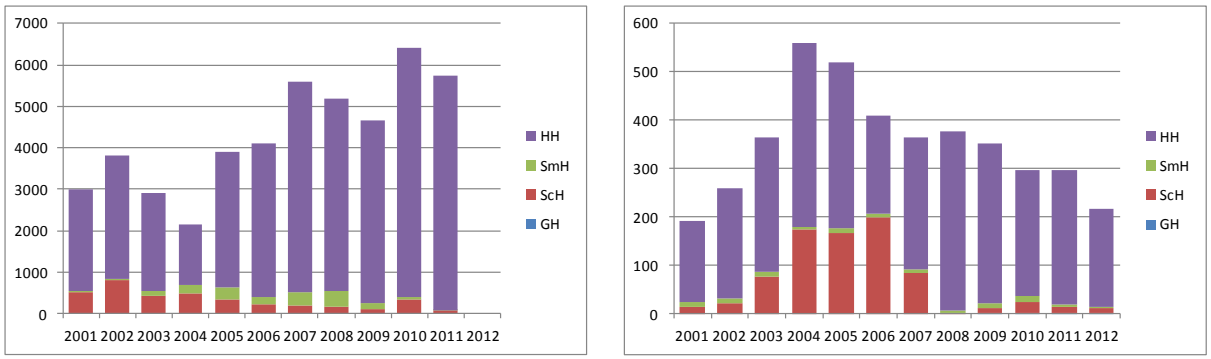



**Figure 6 Annual catches (t) of hammerheads a) globally and b) Australian. Scalloped Hammerhead (ScH), Smooth Hammerhead (SmH), Great Hammerhead (GH) and unspecified hammerhead (HH). Source: FAO FishStat and Australian fishery logbook data.**

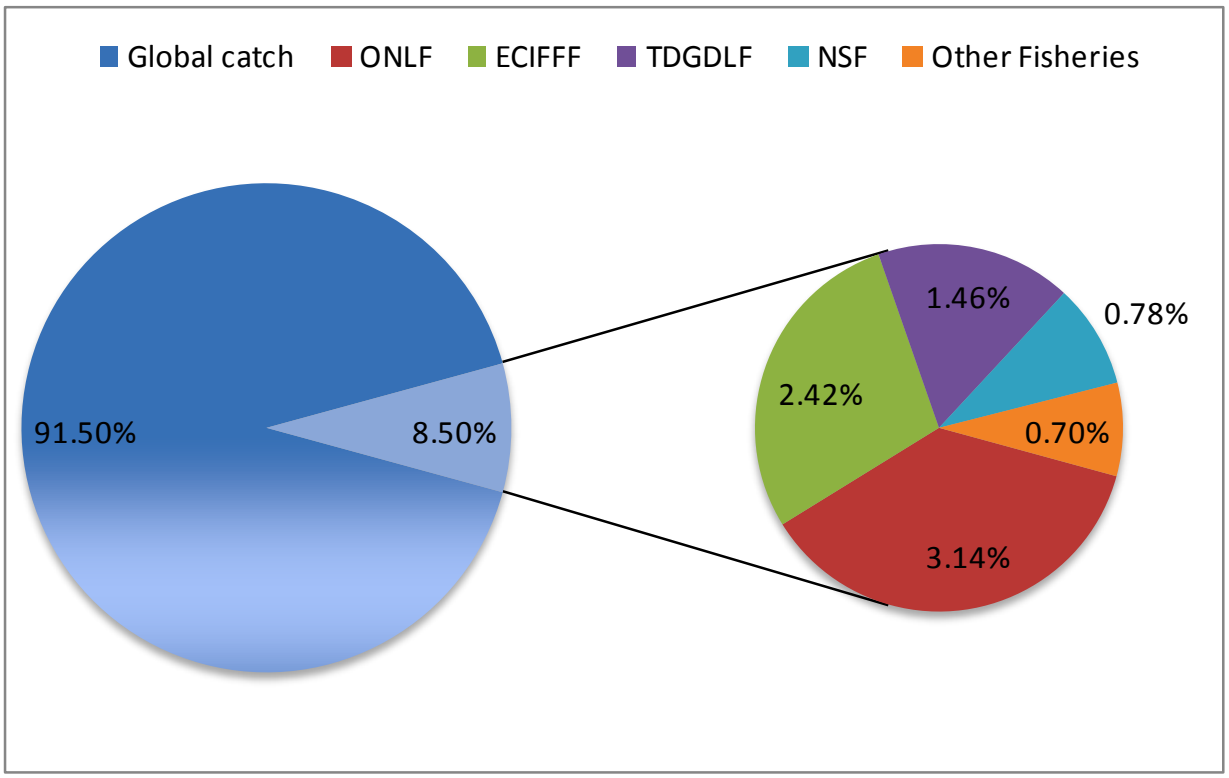



**Figure 7. Percent of the global (FAO, 2013) of all Hammerheads (Scalloped Hammerhead, Smooth Hammerhead and "Hammerhead") coming from Australian Fisheries (2001–2011). ONLF= Northern Territory's Ocean Net and Line Fishery, ECIFFF = Queensland's East Coast Inshore Finfish Fishery, TDGDLF = Western Australia's Temperate Demersal Gillnet and Demersal Longline Fishery, NSF = Western Australia's Northern Shark Fishery, Other fisheries = all other Australian Fisheries.**

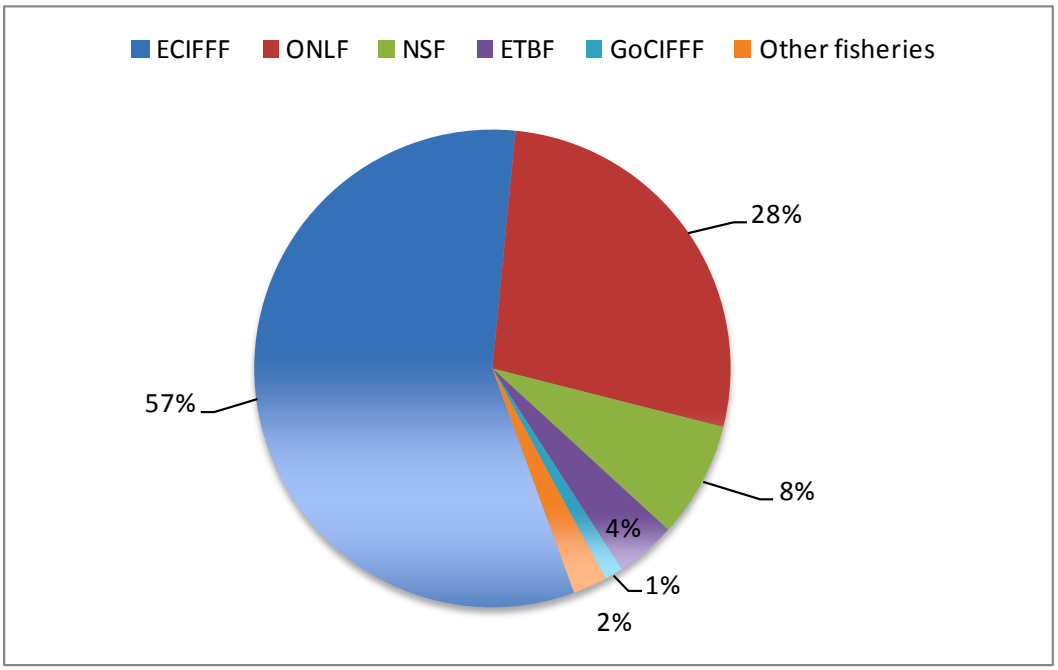



**Figure 8. Australian catches by Scalloped Hammerhead by fishery (2001–2011). ECIFFF = Queensland's East Coast Inshore Finfish Fishery, ONLF= Northern Territory's Offshore Net and Line Fishery, NSF = Western Australia's Northern Shark Fishery, GoCIFFF = Queensland's Gulf of Carpentaria Inshore Finfish Fishery, Other fisheries = all other Australian Fisheries.**

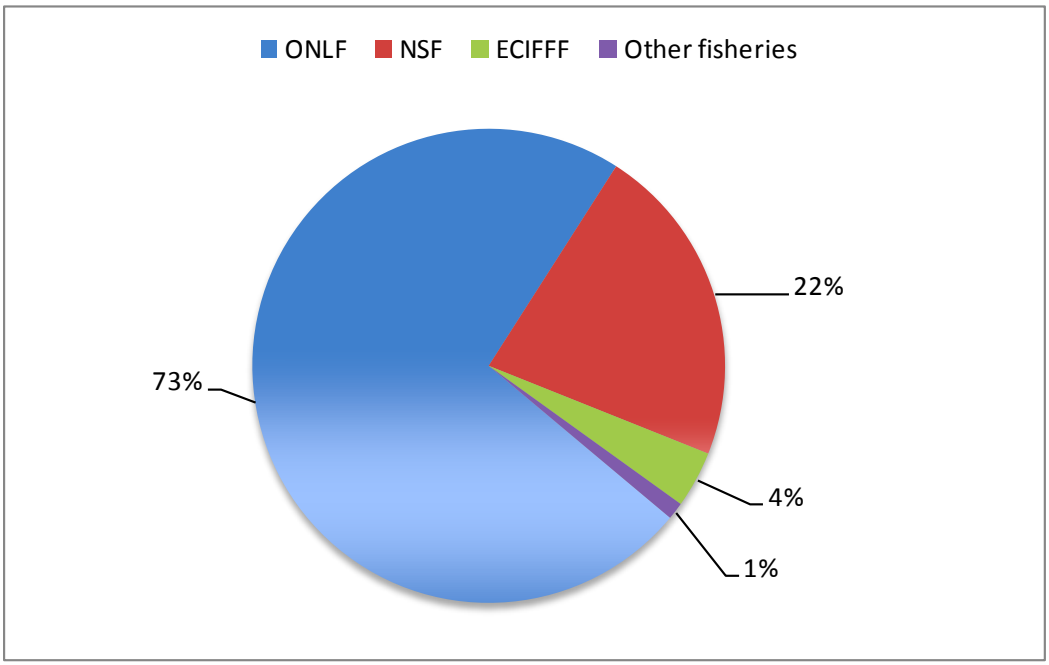



**Figure 9. Australian catches by Great Hammerhead by fishery (2001–2011). ONLF= Northern Territory's Offshore Net and Line Fishery, NSF = Western Australia's Northern Shark Fishery, ECIFFF = Queensland's East Coast Inshore Finfish Fishery, Other fisheries = all other Australian Fisheries.**

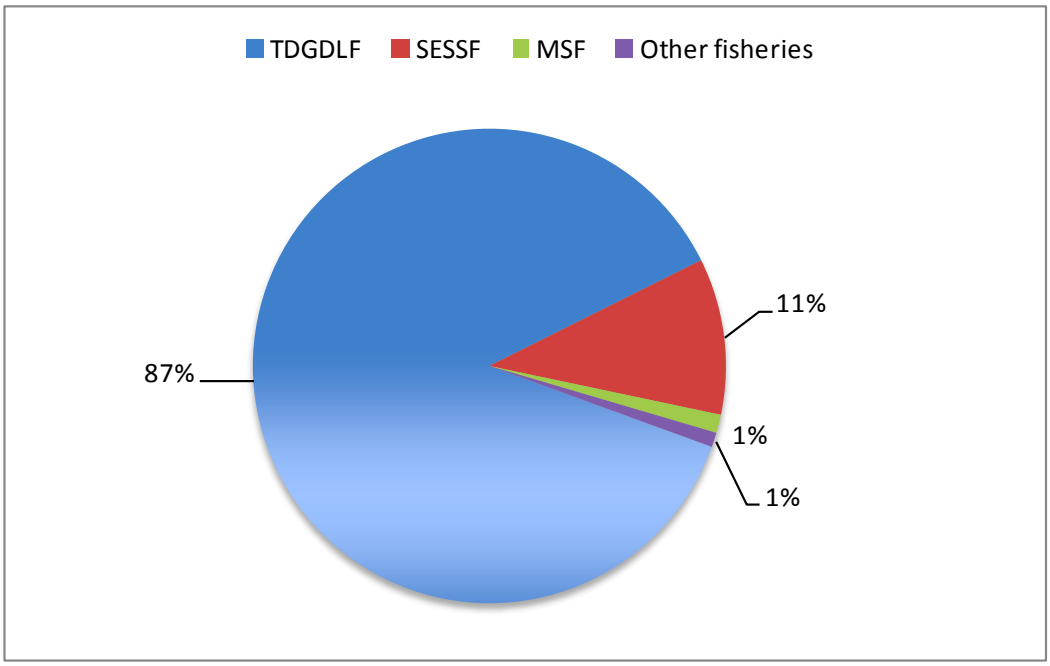



**Figure 10. Australian catches by Smooth Hammerhead by fishery (2001–2011). TDGDLF = Western Australia's Temperate Demersal Gillnet and Demersal Longline Fishery, SESSF = the Commonwealth managed Southern and Eastern Scalefish and Shark Fishery, MSF = South Australia's Marine Scalefish Fishery, Other fisheries = all other Australian Fisheries.**

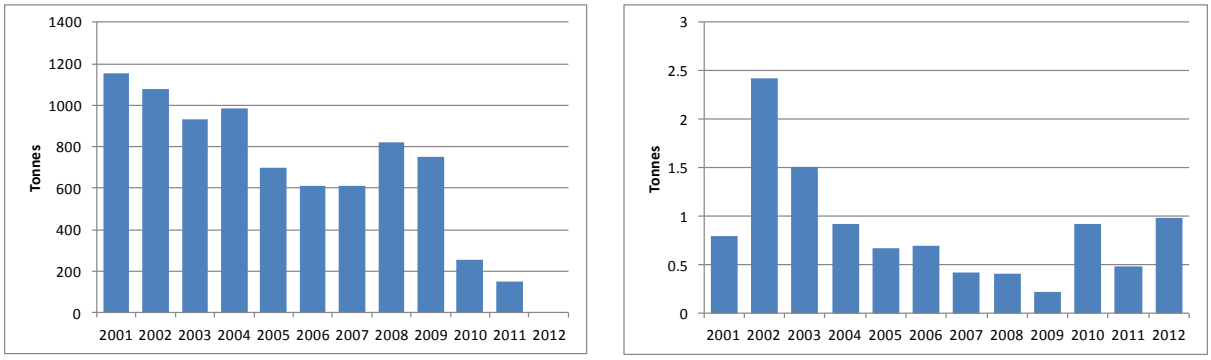



**Figure 11 Annual catches (t) of Porbeagle Shark a) globally and b) Australian. Source FAO FishStat and Australian fishery logbook data.**

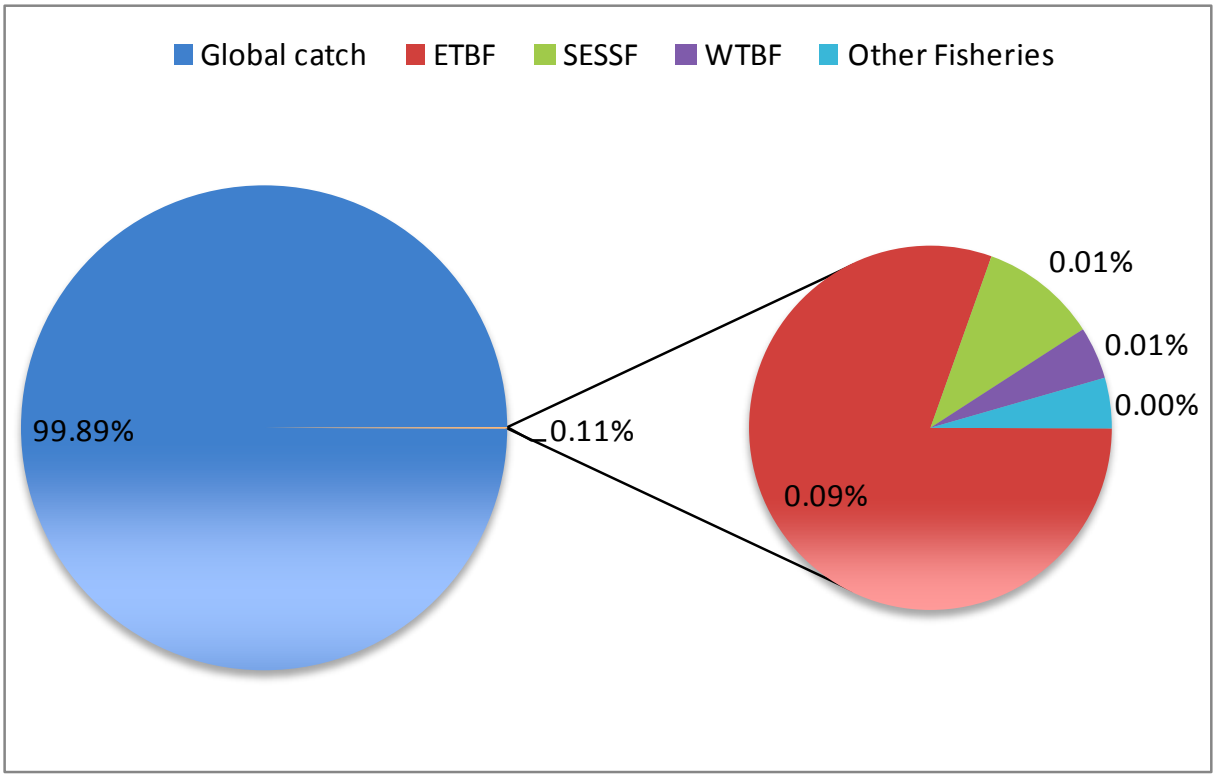



**Figure 12. Percent of the global (FAO, 2013) of Porbeagle Shark coming from Australian Fisheries (2001–2011). ETBF = the Commonwealth managed Eastern Tuna and Billfish Fishery, SESSF = the Commonwealth managed Southern and Eastern Scalefish and Shark Fishery, WTBF = the Commonwealth managed Western Tuna and Billfish Fishery, Other fisheries = all other Australian Fisheries.**

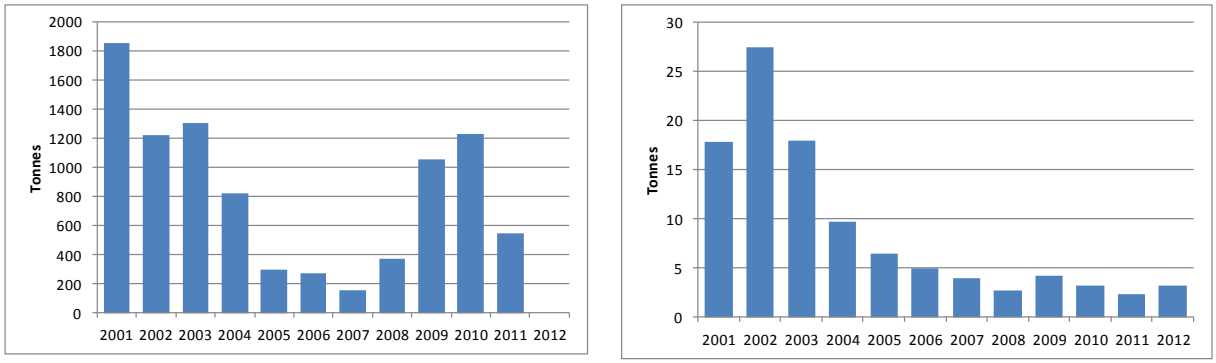



**Figure 13 Annual catches (t) of Ocean Whitetip Shark a) globally and b) Australian. Source FAO FishStat and Australian fishery logbook data.**

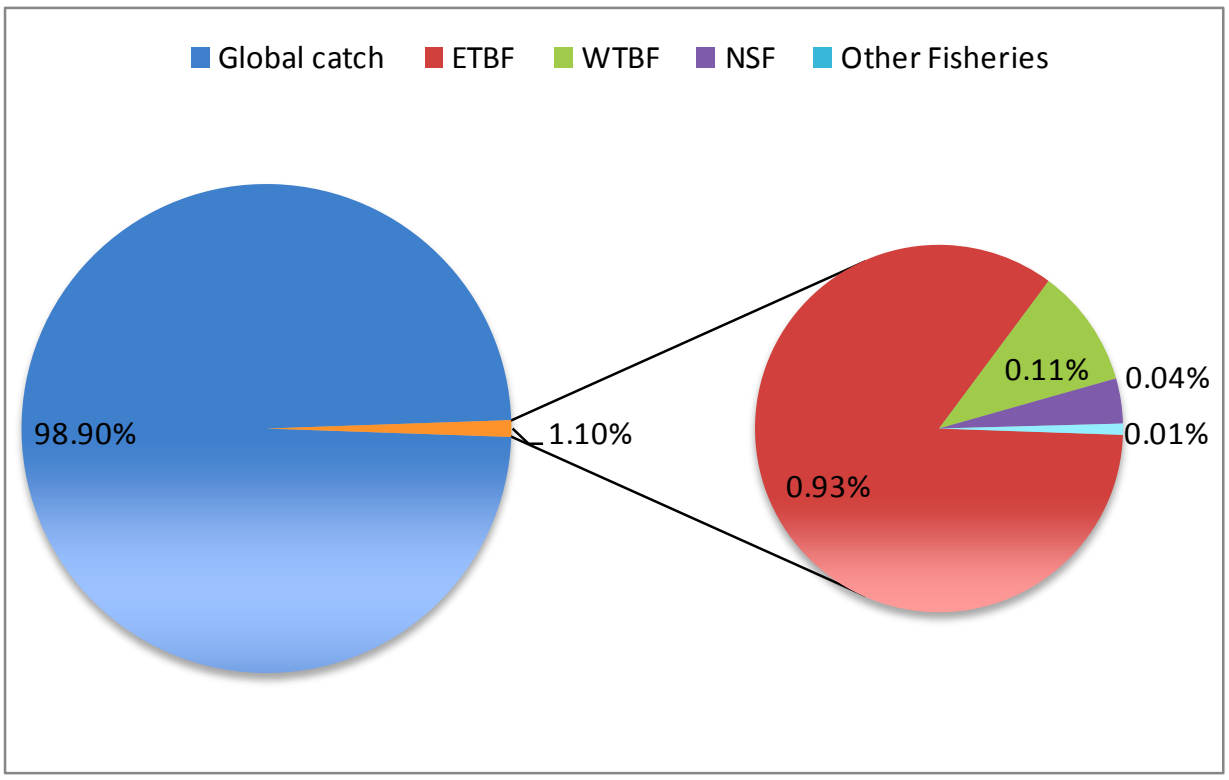



**Figure 14. Percent of the global (FAO, 2013) of Oceanic Whitetip Shark coming from Australian Fisheries (2001–2011). ETBF = the Commonwealth managed Eastern Tuna and Billfish Fishery, WTBF = the Commonwealth managed Western Tuna and Billfish Fishery, NSF = Western Australia's Northern Shark Fishery, Other fisheries = all other Australian Fisheries.**

**Table 5. Total global and Australian commercial retained catches (t) of Porbeagle Shark (PS), Oceanic Whitetip Shark (OWT), Scalloped Hammerhead (ScH), Smooth Hammerhead (SmH), Great Hammerhead (GH) and unspecified hammerhead (HH).**

**Disaggregation of unspecified hammerhead catch is also shown, including the small amount that was unable to be disaggregated. The sum of disaggregated hammerheads does not equal the value for "HH" in any year, because there Winghead Sharks were also reported as "Hammerheads" in some logbooks, and they were accounted for in the disaggregation, but not reported here. Note, there were no records of catch of Great Hammerhead in global catches. Annually aggregated NSW catches from 2009/10–2011/12 for Oceanic Whitetip Shark and Porbeagle Shark were split evenly over those three years (2009-2012). Where catches were obtained for financial year (NSW data), the most recent calendar year was assigned to those data (for example 2009/10 became 2010).**

| | Catch (t) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total global[8] | | | | | Australian logbook | | | | | | Disaggregation of unspecified Hammerheads | | | |
| | PS | OWT | ScH | SmH | HH | PS | OWT | GH | ScH | SmH | HH | GH | ScH | SmH | HH |
| 2001 | 1155 | 1857 | 515 | 27 | 2459 | 0.80 | 17.82 | | 14.42 | 8.44 | 168.61 | 46.41 | 34.73 | 41.31 | 11.74 |
| 2002 | 1076 | 1224 | 798 | 40 | 2978 | 2.42 | 27.42 | | 21.57 | 8.81 | 229.62 | 64.96 | 49.08 | 62.15 | 7.73 |
| 2003 | 931 | 1308 | 425 | 119 | 2361 | 1.51 | 17.91 | | 76.41 | 9.38 | 279.55 | 82.99 | 62.33 | 60.87 | 4.18 |
| 2004 | 985 | 826 | 492 | 205 | 1465 | 0.92 | 9.66 | | 173.25 | 4.90 | 382.24 | 110.80 | 83.02 | 64.64 | 2.83 |
| 2005 | 696 | 297 | 328 | 294 | 3269 | 0.67 | 6.51 | | 167.63 | 10.15 | 341.48 | 118.01 | 90.11 | 67.08 | 2.16 |
| 2006 | 613 | 273 | 224 | 176 | 3696 | 0.69 | 4.96 | | 198.94 | 8.72 | 200.65 | 64.76 | 69.85 | 64.29 | 2.66 |
| 2007 | 608 | 154 | 202 | 321 | 5056 | 0.42 | 3.97 | | 84.69 | 7.77 | 270.79 | 63.05 | 137.40 | 63.82 | 4.32 |
| 2008 | 819 | 375 | 158 | 380 | 4645 | 0.41 | 2.75 | | 1.67 | 4.03 | 371.46 | 79.77 | 214.51 | 62.94 | 6.83 |
| 2009 | 749 | 1058 | 109 | 134 | 4419 | 0.22 | 4.23 | 0.52 | 10.37 | 10.48 | 329.52 | 85.07 | 159.45 | 68.17 | 2.28 |
| 2010 | 254 | 1232 | 336 | 65 | 5995 | 0.92 | 3.24 | 2.18 | 22.94 | 11.55 | 259.76 | 59.00 | 112.42 | 75.83 | 0.01 |
| 2011 | 152 | 544 | 65 | 14 | 5673 | 0.48 | 2.27 | 1.31 | 11.55 | 5.94 | 278.27 | 77.02 | 124.86 | 68.62 | 1.29 |
| 2012 | | | | | | 0.98 | 3.14 | 0.69 | 10.05 | 2.30 | 204.42 | 53.05 | 88.26 | 60.57 | 0.00 |

[8] FAO FishStat (http://www.fao.org/fishery/statistics/global-capture-production/query/en) Accessed August 2013

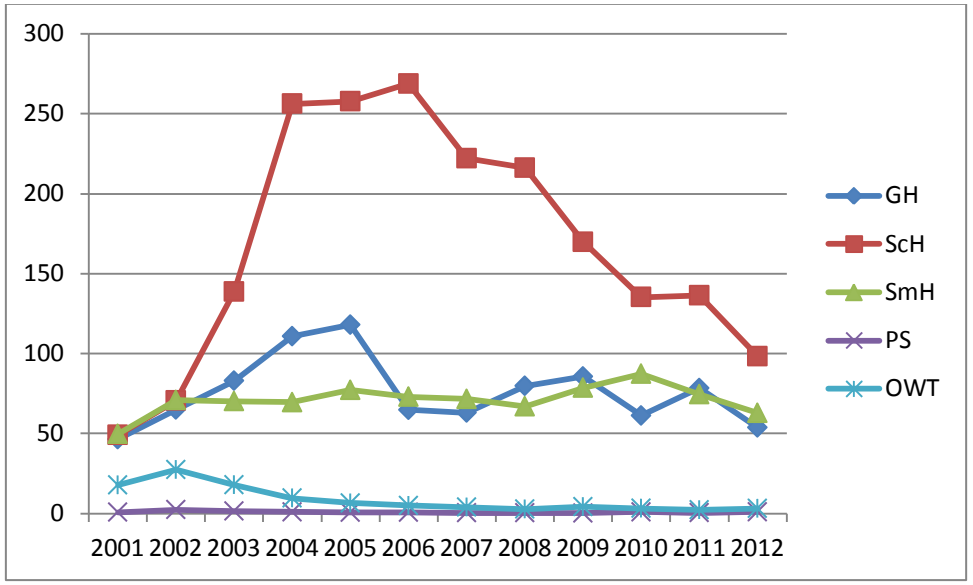



**Figure 15 - Total Shark Catch by Species in Australian Fisheries .**

**Table 6. National status for each sharks required to make a reliable NDF.**

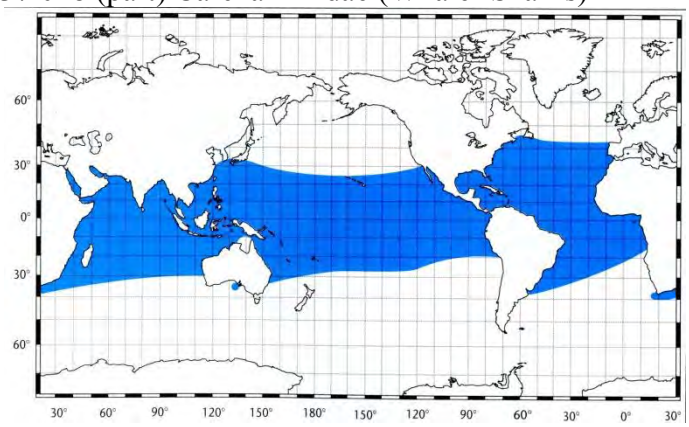
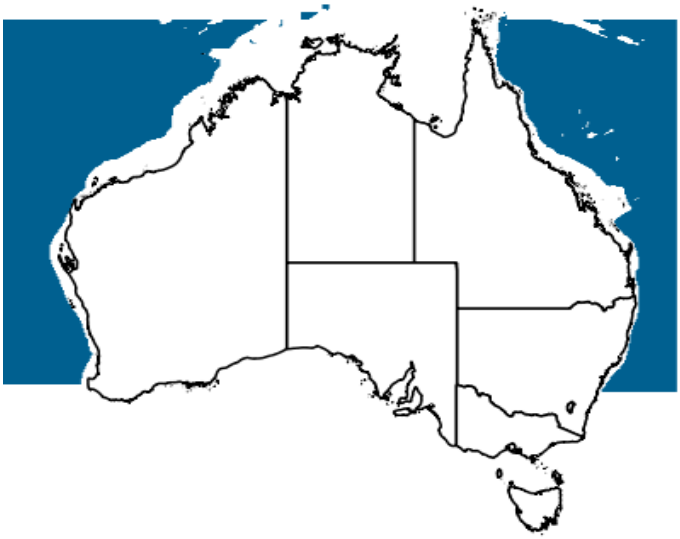
| National status | OWT | SmH | GH | ScH | PS |
|---|---|---|---|---|---|
| National distribution | Widespread, contiguous [1] | Widespread, contiguous [1] | Widespread, contiguous [1] | Widespread, contiguous [1] | Widespread, contiguous [1] |
| National abundance | Unquantified | Unquantified | Unquantified | Unquantified | Unquantified, but "probably not uncommon" [1] |
| National population trend | Unknown | Catch-per-unit-effort (CPUE) data from the NSW Shark Meshing Program collected between 1950 and 2007/08 indicate that hammerhead sharks (SmH, GH and ScH) have declined substantially in NSW. [5] The decline in CPUE is about 85% over the past 35 years. [2]<br>Catch of Scalloped Hammerhead decreased by 73% during 2002/03–2012/13. Catch of Great Hammerhead increased by 333% over the same period, while total catch of shark increased by 12%. [8] | | | Unknown |
| Quality of abundance and trend information | WCPFC has assessed this species for the Western and Central Pacific, which is on the East Coast of Australia, as Overfished and subject to Overfishing. | Species composition of NSW Shark Meshing Program catch is uncertain, but it can be assumed that the majority of the hammerhead catch was likely to be SmH. [5]<br>It is uncertain how effort or level and accuracy of species identification changed over time in the Qld Shark control program. | | | Not Applicable |
| Major threats | Commercial Fishing | NSW - The threatening processes for this species are continued harvest in recreational, commercial and bather protection fisheries. [5]<br>Commercial Fishing | NSW - The threatening processes for this species are continued harvest in recreational, commercial and bather protection fisheries. [6]<br>IUU fishing [3]<br>Commercial Fishing | NSW - The threatening processes for this species are continued harvest in recreational, commercial and bather protection fisheries. [7]<br>IUU fishing [4]<br>Commercial Fishing | Commercial and recreational/gamefishing |
| Level of major threats | See Table 5 for commercial catches | 3270 hammerheads caught in NSW beach protection program during 1972–2010, of which 1.34% were released alive [2]<br>See Table 5 for commercial catches | | | See Table 5 for commercial catches |

References:

[1] Last and Stevens (2009);
[2] Reid et al (2011);
[3] Denham et al (2007);
[4] Baum et al (2007);
[5] Anon (2012);
[6] Anon (2011b);

[7] Anon (2011c);
[8] QDAF (2013).

# Appendix 1: Known distributions of the five shark species

| | |
|---|---|
| Scientific name | *Carcharhinus longimanus* |
| Australian standard common name | Oceanic Whitetip Shark |
| Alternative common names | Oceanic White Tip Shark, Oceanic White-tipped Whaler, White-tipped Whaler, Whitetip Whaler |
| CAAB code | 37 018032 |
| Group CAAB code - name | 37 018915 Carcharhinidae undifferentiated<br>37 018904 Carcharhinus spp. |
| Family (from CAAB) | 37 018 (part) Carcharhinidae (Whaler Sharks) |
| Last and Stevens (2009) |  |
| Last and Stevens (2009) | Cosmopolitan in tropical and warm temperate seas. Northern Australia (except for the Torres Strait, Gulf of Carpentaria and Arafura Sea) south to southern NSW. The southern limit off Western Australia is uncertain, but it would be expected at least as far south as Perth. One specimen was recorded off Port Lincoln, South Australia. Oceanic and pelagic from the surface to a depth of at least 150 m. May occur close to inshore where there is a narrow continental shelf. |
| Atlas of Living Australia website at http://bie.ala.org.au/species/Carcharhinus+longimanus. Accessed 20 May 2013 |  |

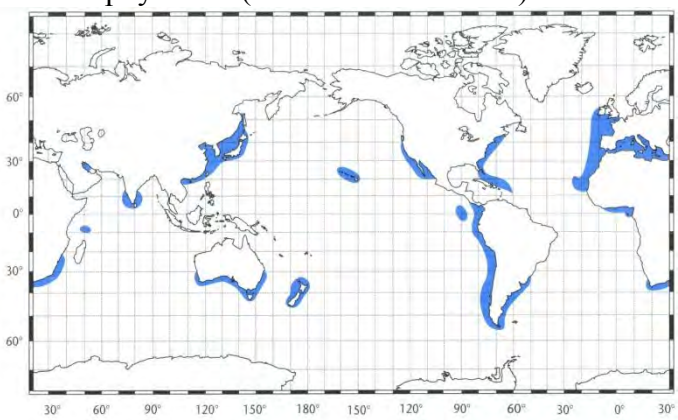
Will White, 2011, Oceanic Whitetip Shark, *Carcharhinus longimanus*, in Fishes of Australia, accessed 13 May 2013, http://www.fishesofaustralia.net.au/Home/species/1950

Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

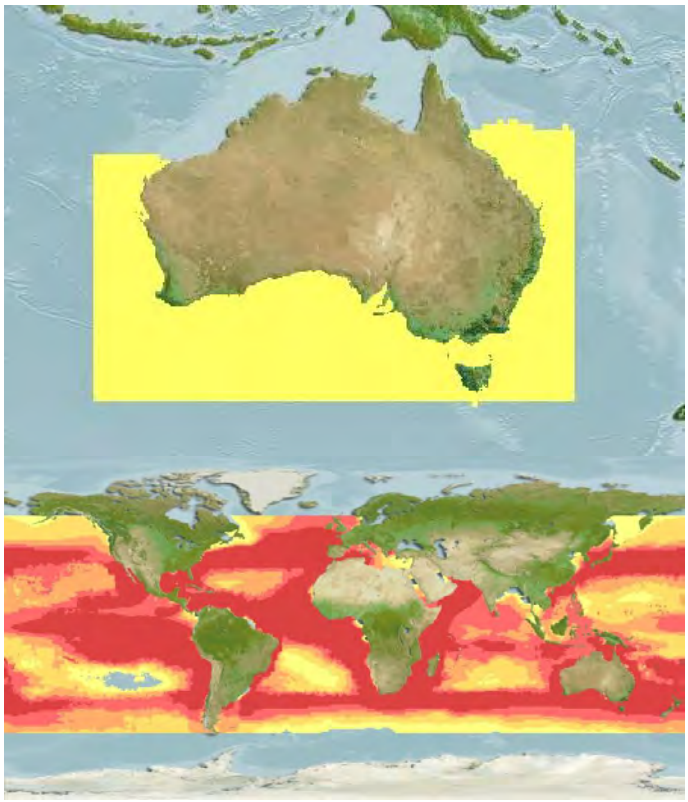
Fishbase range
Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Marine; pelagic-oceanic; oceanodromous (Ref. 51243); depth range 0 - 230 m (Ref. 58302), usually 0 - 152 m (Ref. 55185). Subtropical; 18°C - 28°C (Ref. 244); 46°N - 43°S, 180°W - 180°E (Ref. 6871)

Australian Faunal Directory
http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Carcharhinus_longimanus

| | |
|---|---|
| Scientific name | *Sphyrna zygaena* |
| Australian standard common name | Smooth hammerhead |
| Alternative common names | Common Hammerhead Shark, Hammerhead Shark, Hammerheaded Shark, Smooth Hammerhead Shark |
| CAAB code | 37 019004 |
| Group CAAB code - name | 37_019000 Sphyrnidae - undifferentiated hammerhead sharks<br>37 019902 Sphyrna spp. |
| Family (from CAAB) | 37 019 Sphyrnidae (Hammerhead Sharks) |
| Last and Stevens (2009) |  |
| Last and Stevens (2009) | Widespread, temperate in both Hemispheres (also tropical in some regions). Southern Australia north to about 30ºS between Coffs Harbour (NSW) and Jurien Bay (WA). Occurs over the continental and insular shelves from the surface to at least 20 m depth. |
| Atlas of Living Australia website at http://bie.ala.org.au/species/Sphyrna+zygaena. Accessed 20 May 2013 |  |

Dianne J. Bray, 2011, Smooth Hammerhead, *Sphyrna zygaena*, in Fishes of Australia, accessed 13 May 2013, http://www.fishesofaustralia.net.au/home/species/1970



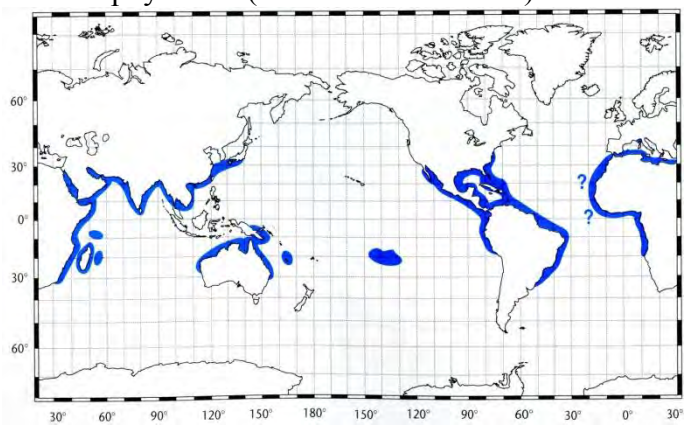
Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Fishbase environment/climate/range

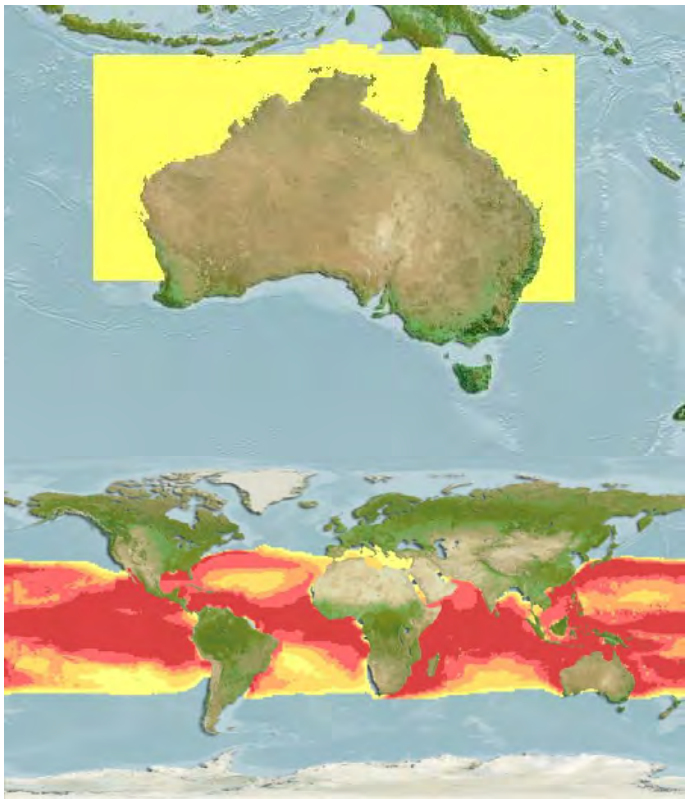
Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Marine; brackish; pelagic-oceanic; oceanodromous (Ref. 13562); depth range 0 - 200 m (Ref. 5578), usually 0 - 20 m (Ref. 55303). Subtropical; 59°N - 55°S, 180°W - 180°E

Australian Faunal Directory http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Carcharhinus_longimanus

| | |
|---|---|
| Scientific name | *Sphyrna mokarran* |
| Australian standard common name | Great hammerhead |
| Alternative common names | Hoe-head Shark |
| CAAB code | 37 019002 |
| Group CAAB code - name | 37 019000 Sphyrnidae - undifferentiated hammerhead sharks<br>37 019902 Sphyrna spp. |
| Family (from CAAB) | 37 019 Sphyrnidae (Hammerhead Sharks) |
| Last and Stevens (2009) |  |
| Last and Stevens (2009) | Circumglobal in tropical and warm temperate seas. Recorded throughout northern Australia, south to Sydney (NSW) and the Abrolhos Islands (WA). Continental and insular shelves, from the surface (and in very shallow water) to at least 80 m depth. |
| Atlas of Living Australia website at http://bie.ala.org.au/species/Sphyrna+mokarran. Accessed 20 May 2013 |  |

Dianne J. Bray, 2011, Great Hammerhead, *Sphyrna mokarran*, in Fishes of Australia, accessed 13 May 2013, http://www.fishesofaustralia.net.au/home/species/1969



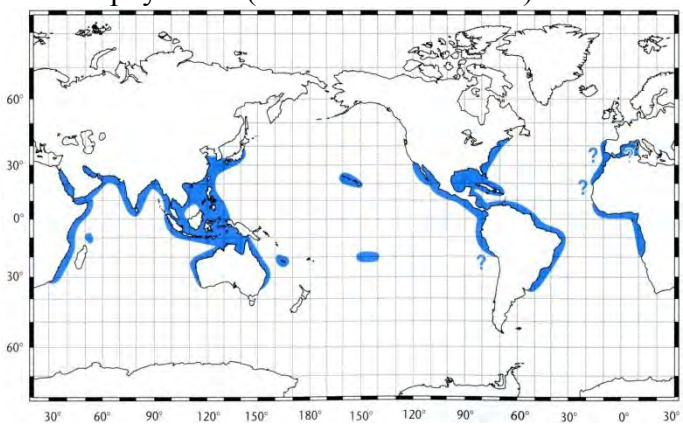
Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Fishbase environment/climate/range

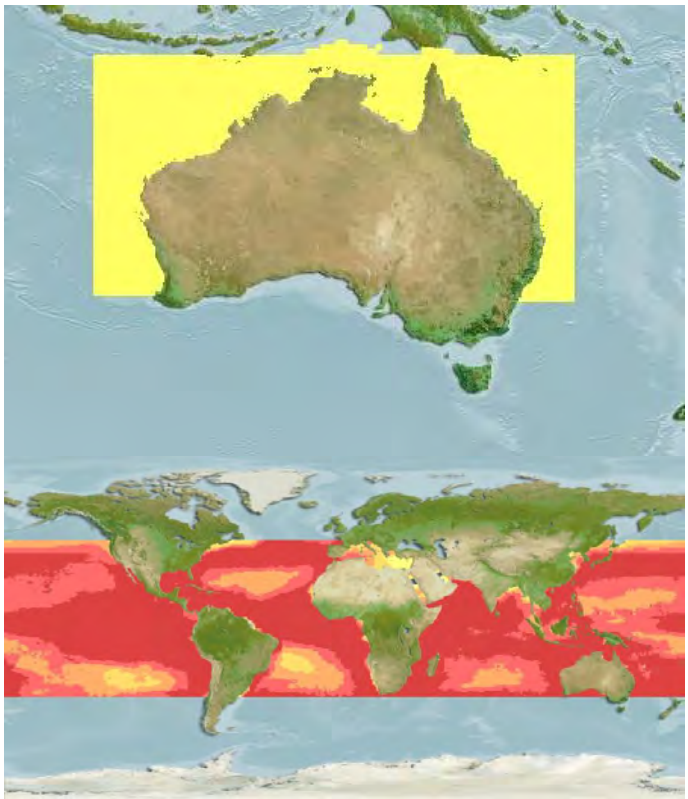
Marine; brackish; pelagic-oceanic; oceanodromous (Ref. 51243); depth range 1 - 300 m (Ref. 37816). Subtropical; 45°N - 37°S, 180°W - 180°E

Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Australian Faunal Directory http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Sphyrna_mokarran

| | |
|---|---|
| Scientific name | *Sphyrna lewini* |
| Australian standard common name | Scalloped hammerhead |
| Alternative common names | Hammer-head Shark, Hammerhead Shark, Kidney-headed Shark, Scalloped Hammerhead Shark |
| CAAB code | 37 019001 |
| Group CAAB code - name | 37 019000 Sphyrnidae - undifferentiated hammerhead sharks<br>37 019902 Sphyrna spp. |
| Family (from CAAB) | 37 019 Sphyrnidae (Hammerhead Sharks) |
| Last and Stevens (2009) |  |
| Last and Stevens (2009) | Cosmopolitan in tropical and warm temperate seas. In Australia, recorded throughout the north to about 34ºS on both coasts (Sydney to Geographe Bay). Occurs over the continental and insular shelves and adjacent deep water, from the surface to at least 275 m. Juveniles often occur close to shore. |
| Atlas of Living Australia website at http://bie.ala.org.au/species/Sphyrna+lewini. Accessed 20 May 2013 |  |

Dianne J. Bray, 2011, Scalloped Hammerhead, *Sphyrna lewini*, in Fishes of Australia, accessed 13 May 2013, http://www.fishesofaustralia.net.au/home/species/1968



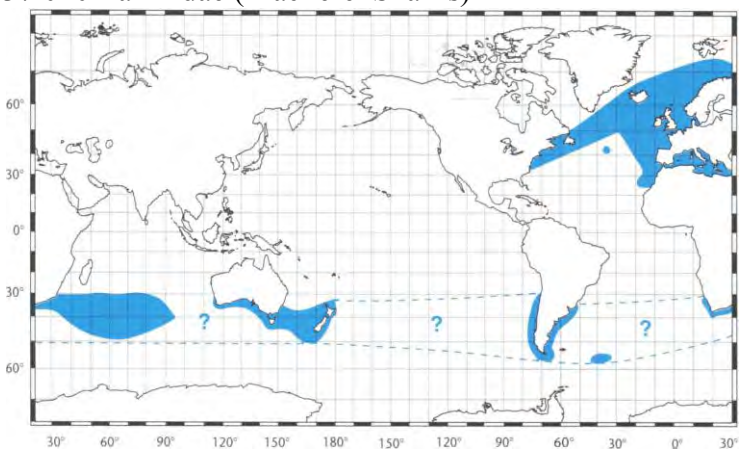
Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Fishbase environment/climate/range

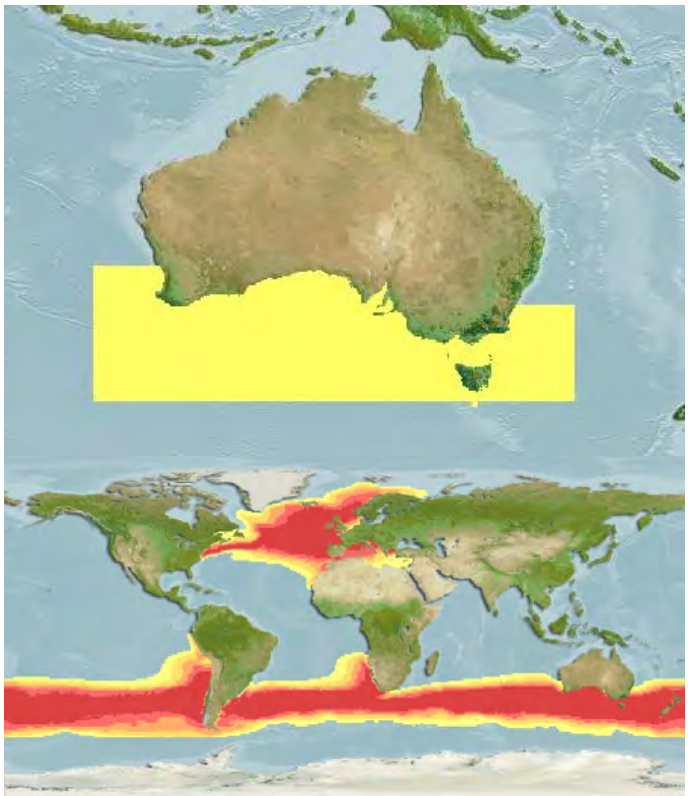
Marine; brackish; pelagic-oceanic; oceanodromous (Ref. 51243); depth range 0 - 512 m, usually 0 - 25 m (Ref. 26999). Tropical; 46°N - 36°S, 180°W - 180°

Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Australian Faunal Directory http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Sphyrna_lewini

| | |
|---|---|
| Scientific name | *Lamna nasus* |
| Australian standard common name | Porbeagle Shark |
| Alternative common names | Mackerel Shark |
| CAAB code | 37 010004 |
| Group CAAB code - name | 37 010000 Lamnidae - undifferentiated mackerel sharks<br>37 010903 Lamna spp. |
| Family (from CAAB) | 37 010 Lamnidae (Mackerel Sharks) |
| Last and Stevens (2009) |  |
| Last and Stevens (2009) | Anti-tropical in the North and South Atlantic, South Pacific and southern Indian Oceans. Few Australian records but probably not uncommon; southern Australia from southern NSW to southern Western Australia. Mainly on the continental shelf but also oceanic; occurs from the surface down to 370 m. |
| Atlas of Living Australia website at http://bie.ala.org.au/species/Lamna+nasus. Accessed 20 May 2013 |  |

Dianne J. Bray, 2011, Porbeagle, *Lamna nasus*, in Fishes of Australia, accessed 13 May 2013, http://www.fishesofaustralia.net.au/home/species/1848



Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Fishbase environment/climate/range

Marine; pelagic-oceanic; oceanodromous (Ref. 51243); depth range 0 - 715 m (Ref. 26346). Temperate; 2°C - 18°C (Ref. 6871); 76°N - 59°S, 180°W - 180°E (Ref. 247)

Froese, R. and D. Pauly. Editors. 2011.FishBase. World Wide Web electronic publication. www.fishbase.org, version 04/2013

Australian Faunal Directory http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Lamna_nasus

# Appendix 2: Fishery / species distribution overlap for the five shark species

**Table 7. Fishing gear and area of State and Commonwealth fisheries showing which of the five sharks species they spatially overlap with, and subjective assessment of potential for capture by geartype (described in methods). OWT = Oceanic Whitetip Shark, SmH = Smooth Hammerhead, GH = Great Hammerhead, ScH = Scalloped Hammerhead, PS = Porbeagle Shark. Potential for capture by gear type was subjectively assigned one of three levels; none, unlikely, possible. Where potential for capture was assessed as possible, but was not confirmed by presence in fisheries logbook or observer data, potential reasons their absence in the data are described**

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| **Western Australia** | | | | | |
| West coast rock lobster | Baited traps. [2] | The fishery is situated along the west coast of Australia between Latitudes 21 and 2 S. The fishery is managed in 3 zones: south of latitude 30° S (Zone C), north of latitude 30° S (Zone B) and the Abrolhos Islands Area (also generally referred to as Zone A). [2] | SmH<br>GH<br>ScH<br>PS | Unlikely | |
| Roe's abalone | Diver hand collection. [2] | Commercial fishing for oe ‘s abalone is managed in 6 separate regions from the South Australian border to Busselton Jetty (~30.65° S). [2] | ScH | None | |
| Octopus | Unbaited or passive (shelter) octopus pots; the fishery uses both passive shelter pots and active (trigger pots) traps to selectively harvest octopus. [2] | Octopus caught in the DOF are limited to the boundaries of the developmental fishery, which is an area bounded by Coral Bay (~21.34° S) in the north and Esperance in the south. [2] | SmH<br>GH<br>ScH<br>PS | None | |
| Abrolhos Islands and Mid West, South West Trawl Managed Fisheries and South Coast Trawl Fishery | Each of these fisheries operates using low opening otter trawl systems. [2] | AIMWTMF: all the waters of the Indian Ocean adjacent to Western Australia between 27 51 south latitude and 29 0 south latitude on the landward side of the 200 m isobath“.<br>SWTMF: all the waters of the Indian Ocean adjacent to Western Australia between 1 . 27 south latitude and 115 0 .0 east longitude where it intersects the high water mark at Cape Leeuwin, and on the landward | SmH<br>GH<br>ScH<br>PS | Possible | Low otter trawl net. [2]<br>Very low bycatch [2]<br>No information on observer programs was found. |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | side of the 200 m isobath". SCTF: Condition 73 provides for the use of demersal otter trawl nets off the south coast of Western Australia in state waters east of 115° E longitude. Condition 79 provides for the use of demersal otter trawl nets for taking scallops within the Recherche Archipelago. Four fishing boat licences have both conditions. [2] | | | |
| Cockburn Sound crab | Originally, commercial crab fishers in WA used set (gill) nets or drop nets, but most have now converted to purpose- designed crab traps. [2] | The Cockburn Sound (Crab) Managed Fishery encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle (~32.06° S) to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island, and back to John Point on the mainland (~32.27° S). [2] | None | Unlikely | |
| Deep sea crab | Baited pots operated in a long-line formation. [2] | all the waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone. [2] | OWT<br>SmH<br>GH<br>ScH<br>PS | Unlikely | |
| West Coast Nearshore and Estuarine Finfish (a number of different minor fisheries) | Gill nets and beach seine nets. [2] | The management plan encompasses all estuaries in the West Coast Bioregion between 27° S and 33°11 S. Complex closures exist for both the Swan/Canning and Peel/Harvey commercial fisheries (refer to management plans, related legislation and regulations). Cockburn Sound (Fish Net) Managed Fishery and Cockburn Sound (Line & Pot) Managed Fishery operates within Cockburn Sound. West Coast Beach Bait Managed Fishery covers WA waters from Moore River (north of Perth) to Tim's Thicket (south of Mandurah). South West Beach Seine Fishery covers WA waters from Tim's Thicket south to Port | GH<br>ScH | Possible | Small scale [2]<br>Close to shore/estuarine [2]<br>Low bycatch [2]<br>No information on observer programs was found. |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | Geographe Marina.<br>South-West Coast Salmon Managed Fishery includes all WA waters north of Cape Beaufort except Geographe Bay. [2] | | | |
| West coast purse seine | Purse seine. [2] | The Perth metropolitan fishery operates between 33° S and 31° S latitude, and out to the 200 nm EEZ. The Southern Development Zone covers waters between 33° S and Cape Leeuwin. The Northern Development Zone covers waters between 31° S and 22° S. [2] | OWT<br>SmH<br>GH<br>ScH<br>PS | Possible | Targeted.<br>Low bycatch.<br>Some observer work has been conducted [81], but no records of the species of interested in observer data was received, and summaries of observed catches could not be found (apart from interactions with protected species [82]). |
| West coast demersal Scalefish | Handline and drop line. [2] | The WCDSIMF encompasses the waters of the Indian Ocean just south of Shark Bay (at 26° 0‘S ) to just east of Augusta (at 115° 0‘E ) and extends seaward to the 200 nm boundary of the Australian Fishing Zone (AFZ). [2] | OWT<br>SmH<br>GH<br>ScH<br>PS | Possible | No information on observer programs was found. |
| South Coast Demersal Scalefish | Primarily using wetline methods such as droplines, handlines and trolling. Haul nets and set nets are also used. [2] | The fishery operates in the South Coast Bioregion, from 115° 0‘ to the WA/SA border. It extends out to the 200 nm EEZ. [2] | SmH<br>PS | Possible | No information on observer programs was found. |
| South coast crustacean | Lobster and cray pots. [2] | From 34°24‘S to the WA/SA border. The boundaries of the deep sea crab component of the fishery (Condition 105) include all the waters of these fisheries deeper than 200 metres, excluding those of the ERLF, where crabs may only be taken by the holders of an Esperance Rock Lobster Managed Fishery Licence. [2] | SmH<br>PS | Unlikely | |
| Abalone (greenlip/brownlip) | Abalone ‘iron‘ to prise the shellfish off rocks [2] | Abalone Management Plan covers all Western Australian coastal waters. [2] | SmH<br>GH<br>ScH | None | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| South Coast Nearshore and Estuarine Finfish (including WA salmon and Estuarine Fishfish (south coast) and Australian Herring | Mainly using trap nets (herring only), beach seines, haul nets and gill nets. [2] | Spatial management of these fisheries is detailed, involving coastal waters, individual beaches and estuaries. However they are restricted to within the Southern Bioregion 115° 0‘ to the WA/SA border. [2] | SmH | Possible | Targeted [2]<br>Near shore [2]<br>No information on observer programs was found. |
| Albany/King George Sound purse seine, Bremer Bay purse seine, Esperance purse seine | Purse seine nets. [2] | Waters between Cape Leeuwin and the Western Australia/South Australia border, extending out to the 200 nm EEZ. [2] | SmH<br>PS | Possible | Targeted.<br>Very low bycatch. [81] |
| Temperate demersal gillnet and demersal longline | Majority of operators use demersal gillnets and power-hauled reels to target sharks. [2] | The Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery spans the waters from 33° S latitude to the WA/SA, and out to the 200 nm EEZ. [2] | OWT<br>SmH<br>ScH<br>PS | Confirmed (OWT, SmH, ScH) | |
| Shark bay prawn | Low opening, otter trawls. [2] | The waters of the Indian Ocean between latitudes 2 S and 2 0 S and adjacent to Western Australia on the landward side of the 200 m isobath, together with those waters of Shark Bay south of 2 0 south latitude. [2] | GH<br>ScH | Possible | Bycatch reduction devices (‘grids’) are mandatory. [2]<br>Information on bycatch composition was not found. |
| Exmouth Gulf prawn | Otter trawls. [2] | Areas within Exmouth Gulf (approximately 22.2° –21.6°S). [2] | GH<br>ScH | Possible | Low otter trawl net. [2]<br>Use of grids avoid capture of most large sharks and rays. [83] |
| Shark Bay scallop | Low opening, otter trawls. [2] | The waters of the Indian Ocean between latitudes 2 S and 2 0 S and adjacent to Western Australia on the landward side of the 200 m isobath, together with those waters of Shark Bay south of 2 0 south latitude. [2] | GH<br>ScH | Possible | Low otter trawl net. [2]<br>The total bycatch of fish and other fauna is minimal. [2]<br>No information on observer programs was found. |
| Shark Bay crabs | Hourglass traps. [2] | Waters of Shark Bay (approximately 24.5° – 25.5°S) north of Cape Inscription, to Bernier and Dorre Islands and Quobba Point. In addition, two fishers with long- standing histories of trapping crabs in Shark Bay are | GH<br>ScH | Unlikely | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | permitted to fish in the waters of Shark Bay south of Cape Inscription. [2] | | | |
| Shark Bay beach seine and mesh net | Beach seine and haul net [2] | Within shark bay, south of approximately 25.48°S [2] | GH<br>ScH | Possible | Close to shore.<br>Bycatch is minimal in the SBBSMNF because netting operations selectively target specific schools of fish. [2]<br>No information on observer programs was found. |
| Shark Bay snapper (Gascoyne Demersal Scalefish Fishery) | Mechanised handlines with an average of 15 hooks.[1] | Waters of the Indian Ocean and Shark Bay between latitudes 23°07‘30ǁS and 2 0‘S out to the 200 nm EEZ [2]. | OWT<br>GH<br>ScH | Possible | There are few species captured by the fishery that are not retained. [2]<br><br>Commercial operators must return any sharks caught and are not permitted to use wire trace, in order to minimise interactions with sharks. [2]<br>Some observer work has been conducted [84], but no records of the species of interested in observer data was received, and summaries of observed catches could not be found. |
| Onslow prawn | Otter trawls. [2] | All the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery east of 114°39.9' on the landward side of the 200 m depth isobath [2] | OWT<br>GH<br>ScH | Possible | Fish Escape Devices are mandatory in all trawl nets. [2]<br>Sharks cannot be retained. Full implementation of grids has also greatly reduced any likelihood of capture. No information on observer programs was |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
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| | | | | | found. [85] |
| Nickol Bay prawn | Otter trawls. [2] | All the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath [2] | OWT<br>GH<br>ScH | Possible | As for Onslow Prawn. |
| Broome prawn | Otter trawls. [2] | All Western Australian waters of the Indian Ocean lying east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath [2] | OWT<br>GH<br>ScH | Possible | As for Onslow Prawn. |
| Kimberley prawn | Otter trawls. [2] | All Western Australian waters of the Indian Ocean lying east of 12 5 east longitude and west of 12 5 east longitude [2] | OWT<br>GH<br>ScH | Possible | As for Onslow Prawn. |
| Kimberley gillnet and barramundi | Gillnet in inshore waters and the taking of barramundi (*Lates calcarifer*) by any means. [2] | All Western Australian waters lying north of 19°S latitude and west of 129°E and within three nautical miles seaward of the low water mark of the mainland of Western Australia and the waters of ing Sound of 1 21. 7 S and Jacks Creek, Yardogarra Creek and in the Fit roy iver north of 17 27‘S [2] | GH<br>ScH | Confirmed (ScH) | |
| Northern demersal scalefish | Handline, dropline and fish traps. [2] | All Western Australian waters off the north coast of Western Australia east of longitude 120°E. These waters extend out to the edge of the Australian Fishing Zone (200 nm) [2] | OWT<br>GH<br>ScH | Possible | Mainly fish trap. [2]<br>No information on observer programs was found. |
| Pilbara fish trawl | Otter trawl. [2] | Waters north of 21 5‘S and between 11 9‘ ‘‘E and 120 E. The fishery is seaward of the 50 m isobath and landward of the 200 m isobath [2]. | OWT<br>GH<br>ScH | Confirmed (SmH, GH, ScH) | |
| Pilbara demersal trap and line | Fish traps and lines [2] | Trap - 11 9. ‘E and 120 00‘E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath<br>Line - all waters bounded by a line commencing at the intersection of 21 5 ‘S and the high water mark on the western side of the North West Cape on the mainland of Western | OWT<br>GH<br>ScH | Possible | No information on observer programs was found. |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | Australia; thence west along the parallel to the intersection of 21 5 'S and the boundary of the Australian Fishing Zone and north to 120E [2]. | | | |
| Mackerel | Near-surface trolling gear, jig fishing [2] | The Fishery extends from the Cape Leeuwin ( 22.51'S) to the WA/NT border and out to the 200 nm EEZ [2]. | OWT SmH GH ScH PS | Possible | No information on observer programs was found. |
| Northern shark (WA North Coast Shark Fishery and Joint Authority Northern Shark Fishery ) | Demersal longline with a relatively small amount of pelagic gillnetting [2] | The WANCSF extends from longitude 11 0 ' E (North West Cape) to 12 5' E ( oolan Island), and the JANSF from longitude 12 5' E to the WA/NT border and out to the 200 nm EEZ [2]. | OWT GH ScH | Confirmed (OWT, ScH) | |
| Pearl oyster | Harvest method is drift diving, in which six to eight divers are attached to large outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting legal- sized oysters by hand as they are seen. [2] | 11 10' E (Exmouth) to WA/NT border and out to the 200 nm EEZ. [2] | GH ScH | None | |
| Beche-de-mer | Hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading. [2] | Throughout Western Australian waters with the exception of a number of specific closures and out to the 200 nm EEZ. [2] | GH ScH | None | |
| **Northern Territory** | | | | | |
| Aquarium Fishery | Barrier, cast, scoop, drag and skimmer nets, hand pumps, freshwater pots and hand-held instruments to collect aquarium species [4]. | Most inland, estuarine and marine waters provided they have permission to access land or sea country to the outer boundary of the AFZ [4]. | GH ScH | Unlikely | |
| Barramundi Fishery | Monofilament gillnets [4]. | From the high water mark to 3 nm seaward from the low water mark and is restricted to waters seaward from the coast, river mouths and legislated closure lines. [4] | GH ScH | Confirmed (ScH) | |
| Coastal Line Fishery | Vertical lines, cast nets (for bait | From the high water mark to 15 nm from the | GH | Confirmed | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | only), scoop nets or gaffs can be used from the high water mark out to 2 nm from the low water mark. Drop lines and a maximum of five fish traps per licence may also be used from 2 nm out to the 15 nm limit. [4] | low water mark along the NT coast. [4] | ScH | | |
| Coastal Net Fishery | Coastal net, gillnet. [4] | Extends from the high water mark to 3 nm from the low water mark. [4] | GH<br>ScH | Possible | Minor fishery.<br>No information on observer programs was found. |
| Demersal Fishery (including original Finfish Trawl and Demersal Fisheries) | Baited traps and vertical lines, including hand lines and drop lines. [4]<br>Semi-pelagic demersal trawl. [4] | Waters from 15 nm from the coastal baseline to the outer limit of the AFZ, excluding the area of the Timor Reef Fishery. [4] | GH<br>ScH | Confirmed (ScH) | |
| Development Fishery | Lift net, drop net, purse seine [4] | Not described, minor fishery [4] | GH<br>ScH | Confirmed | |
| Mud Crab Fishery | Crab pots are baited with fresh meat or fish. [4] | Tidal waters between the Queensland and Western Australian borders [4] | GH<br>ScH | Unlikely | |
| Offshore Net and Line Fishery | Demersal or pelagic long lines or pelagic nets. [4] | NT waters from the high water mark to the boundary of the AFZ. [4] | GH<br>ScH | Confirmed (GH, ScH) | |
| Spanish Mackerel Fishery | Troll lines, floating hand lines and rods. [4] | NT waters seaward off the coast and river mouths, to the outer limit of the AFZ. [4] | GH<br>ScH | Confirmed | |
| Timor Reef Fishery | Baited traps and lines, including hand lines, drop lines and finfish long lines. [4] | The fishery operates well offshore in the Timor Sea, in a remote region extending north-west of Darwin to the Western Australia/NT border and to the outer limit of the AFZ. [4] | GH<br>ScH | Possible | This fishery can not retain sharks or shark products.<br>Hammerhead sharks were captured in low numbers during a trial of longline fishing in 2011. Longlines have not been used commercially since the trial.<br>Some observer work, but no reports of species of interest apart from during the trial. |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
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| Trepang Fishery | Hand harvest. [4] | Waters to 3 nm seaward of baselines (i.e. the NT coastline and surrounding islands). [4] | GH<br>ScH | None | |
| **Queensland** | | | | | |
| Blue Swimmer Crab Fishery | Crab pots. [5] | The fishing area covers the majority of Queensland tidal waters, except closed waters. [5] | OWT<br>GH<br>ScH | Unlikely | |
| Coral Fishery | Hand or by using hand-held non-mechanical implements, such as a hammer and chisel. [6] | The Queensland east coast between 10 1' S and 2 0' S (not including areas closed through general fisheries closures or marine parks zoning under the Commonwealth Great Barrier Reef Marine Park Act 1975 and the Queensland Marine Parks Act 1982). There are two small collection areas south of 2 0' S however access to these is restricted through licence conditions. [6] | OWT<br>GH<br>ScH | None | |
| Coral Reef Fin Fish Fishery | Up to three lines, with no more than six hooks (total), using either a rod and reel or a handline. [7] | East coast Queensland waters. [7] | OWT<br>GH<br>ScH | Confirmed (GH) | |
| Crayfish and Rocklobster Fishery (formerly Tropical Rock Lobster Fishery) | Commercial divers use hookah to collect live lobsters by hand or using nooses. Spear guns and hand spearing are also permitted for both commercial and recreational fishers. [8] | East coast of Queensland comprises all tidal waters east of longitude 142° 31□ 49□ E, south of latitude 10° 41□ south and north of latitude 14° south. The fishery also extends out to the 25 nm seabed line along the Gulf of Carpentaria coast, south of latitude 10 ' S. [8] | OWT<br>GH<br>ScH | None | |
| Deep Water Fin Fish Fishery | Multi-hook apparatus on trotline or dropline. [9] | Queensland east coast waters east of the 200 m bathometric line. [9] | OWT<br>GH<br>ScH | Confirmed | |
| East Coast Bêche-de-mer Fishery | Harvest by hand. [10] | Tin Can Bay (2 S) to Cape York (10 1′ S) [10] | OWT<br>GH<br>ScH | None | |
| East Coast Inshore Fin Fish Fishery | Mesh, haul (seine), tunnel and cast nets as well as hook and line. [11] | All Queensland tidal waters east of longitude 142°31'49" east, other than tidal waters of waterways that flow to the sea west of | OWT<br>GH<br>ScH | Confirmed (OWT, SmH, GH, | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | longitude 142°31'49" east. [11] | | ScH) | |
| East Coast Otter Trawl Fishery | Otter trawl. [12] | All tidal waters (excluding estuaries) east of longitude 1 2 1 . 9'E out to the East Coast Offshore Constitutional Settlement (OCS) Boundary5 between Cape York and the Queensland/New South Wales (NSW) border [12] | OWT GH ScH | Confirmed (ScH) | |
| East Coast Pearl Fishery | Harvest live pearl oysters by hand. [13] | All tidal waters south of 10 1′ S and east of 1 2 1′ 9′′ E. [13] | OWT GH ScH | None | |
| East Coast Spanish Mackerel Fishery | Line-only fishery permitted to use a maximum of three lines and up to six hooks. [14] | East Coast Spanish Mackerel Fishery includes Queensland and Commonwealth waters adjacent to the Queensland east coast, to the outer edge of the Australian Exclusive Economic Zone. [15] | OWT GH ScH | Confirmed (ScH) | |
| East Coast Trochus Fishery | Hand-held non-mechanical implements. [16] | State and Commonwealth waters off the east coast of Queensland [16] | OWT GH ScH | None | |
| Fin Fish (Stout Whiting) Trawl Fishery | Otter trawling and Danish seine. [17] | Queensland and Commonwealth waters between the 20 fathom and 50 fathom depth contours from Sandy Cape to NSW border. [17] | GH ScH | Confirmed (ScH) | |
| Gulf of Carpentaria Developmental Fin Fish Trawl Fishery | Semi-demersal fish otter trawl. [18] | Gulf of Carpentaria (GOC) waters beyond 25 nm from the Queensland coast to the boundary of the Australian Fishing Zone in the north. The western boundary of the fishery is the Queensland – Northern Territory border and the southern boundary is 15° S. [18] | GH ScH | Confirmed (ScH) | |
| Gulf of Carpentaria Inshore Fin Fish Fishery | Set mesh nets. [19] | Slade Point near the tip of Cape York Peninsula westward to the Queensland–Northern Territory border and operates in all tidal waterways out to the 25 nm line. [19] | GH ScH | Confirmed (GH, ScH) | |
| Gulf of Carpentaria Spanish Mackerel Fishery | Either troll lines (hauled, by hand or hand/electric/hydraulic winches) or heavy rod and reel lines. [20] | All tidal waters in the Queensland Gulf of Carpentaria from Slade Point near the tip of Cape York Peninsula to the Queensland–Northern Territory border. [20] | GH ScH | Confirmed | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| Marine Aquarium Fish Fishery | Fishing lines, cast scoop and seine nets with the assistance of SCUBA or hookah equipment. [21] | East coast of Queensland within the bounds of the Offshore Constitutional Settlement. [21] | OWT<br>GH<br>ScH | None | |
| Marine Specimen Shell Collection Fishery | Hand or hand- operated shell dredges. [22] | All Queensland waters within the boundary of the Offshore Constitutional Settlement. [22] | OWT<br>GH<br>ScH | None | |
| Mud Crab Fishery | Traps and crab pots. [23] | Majority of Queensland tidal waters, except closed waters. [23] | OWT<br>GH<br>ScH | Unlikely | |
| River and Inshore Beam Trawl Fishery | Beam trawl. [25] | Between Cape York and the Queensland/New South Wales (NSW) border. [25] | OWT<br>GH<br>ScH | Confirmed (ScH) | |
| Rocky Reef Fin Fish Fishery | Hook and line. [26] | The area includes the Great Barrier Reef Marine Park (GBRMP), however, fishers are permitted to harvest rocky reef fin fish species throughout QLD waters provided they have the appropriate line endorsement. [27] | OWT<br>GH<br>ScH | Possible | Targets finfish, and only small amount of bycatch. [27] No species of interest in observer data. |
| Spanner Crab Fishery | Dillies. [28] | All Queensland coastal waters, from the New South Wales (NSW) border to the Northern Territory border. [28] | OWT<br>GH<br>ScH | Unlikely | |
| **NSW** | | | | | |
| Abalone Fishery | Hand collection methods. [29] | NSW and Commonwealth waters off the NSW coast [29] | SmH<br>GH<br>ScH<br>PS | None | |
| Estuary General Fishery | Traps (fish, crab and eel), Meshing nets<br>Fish hauling nets, Prawn nets (hauling, seine, running, set pocket, hand hauled and push or scissor), Handgathering Handlining [30] | Specific estuaries throughout NSW (estuaries are also subject to closures to certain methods at some or all times). Also includes the ocean beach for the pipi fishery. [30] | GH<br>ScH | Possible | Present in logbook data, but records are either reporting errors, data entry errors or reporting of illegal fishing |
| Estuary Prawn Trawl Fishery | Otter trawl net (prawns) [31] | The NSW Estuary Prawn Trawl Fishery area is limited to three NSW estuaries being the estuaries of Clarence (~29.4° S), Hunter (~32.9° S) and Hawkesbury Rivers (~33.6° S). | GH<br>ScH | Possible | Present in logbook data, but records are either reporting errors, data entry errors or reporting of illegal fishing |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
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| | | [31] | | | (NSW DPI, pers. Comm.) |
| Lobster Fishery | Inshore and offshore lobster traps [32] | NSW and Commonwealth waters off the NSW coast from the Queensland border to the Victorian border [32] | OWT<br>SmH<br>GH<br>ScH<br>PS | Unlikely | |
| Ocean Hauling Fishery | Hauling net (general purpose), garfish net (hauling), pilchard, anchovy and bait net, purse seine net, lift net. [33] | Ocean waters within three nautical miles of the natural coastline. [33] | SmH<br>GH<br>ScH | Confirmed (OWT, ScH) | |
| Ocean Trawl Fishery | Otter trawl net (prawns), otter trawl net (fish), Danish seine net (fish). [34] | Ocean waters within NSW [34] | OWT<br>SmH<br>GH<br>ScH<br>PS | Confirmed (OWT, SmH, GH, ScH, PS) | |
| Ocean Trap & Line Fishery | Fishtrap (bottom/demersal), Spanner crab net, line methods (set lines/trotlines, driftlines, handlines, droplines, trolling, jigging and polling. [35] | NSW and adjacent Commonwealth waters out to the 4000 metre isobath (approximately 60 to 80 nm offshore) [35] | OWT<br>SmH<br>GH<br>ScH<br>PS | Confirmed (OWT, SmH, GH, ScH, PS) | |
| Sea Urchin and Turban Shell Restricted Fishery | Diving. [36] | NSW waters. [36] | SmH<br>GH<br>ScH | None | |
| **Victoria** | | | | | |
| Abalone Fishery | Hand collection using commercial diving equipment is permitted for commercial divers. [37] | Victorian State waters, extending into Commonwealth waters of the northern Bass Strait region. [37] | SmH | None | |
| Giant Crab Fishery | Baited pots. [38] | The VGCF occurs in the Western Rock Lobster Fishery zone, which operates between Apollo Bay and the South Australian border. The fishery operates in Commonwealth and State waters on the continental shelf and slope off Victoria. [38] | SmH<br>PS | Unlikely | |
| PQ Aquatics | Hand collection by scuba diving | Victorian state waters (near shore) in Port | SmH | None | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
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| | from a boat. [39] | Phillip Bay and South Australian state waters (near shore). [39] | | | |
| Rock Lobster Fishery | Baited commercial rock lobster pots. [40] | The commercial fishery is divided into eastern and western ones at longitude 1 0' E, near Apollo Bay. The eastern zone (EZ) extends east to the NSW border and south to 9 12'S. The western zone (WZ) extends west to the South Australian border and south to 40°S. [40] | SmH PS | Unlikely | |
| Scallop Fishery | Vessels tow a single dredge which is dragged along the seabed. [40] | Runs 20 nm out from the Victorian coast line [40] | SmH PS | Unlikely | |
| Sea Urchin Fishery | Fishers use long metal tongs or gloved hands to remove urchins from the reef. [40] | The fishery is divided into two zones. The eastern zone includes the coastal waters east of Lakes Entrance to the NSW boarder (primarily Mallacoota); the other zone is in PPB. [40] | SmH | None | |
| Commercial Bay and Inlet Fisheries | Haul seine nets and mesh nets, hand lines. Incidental catches are taken using squid jigs, long lines, purse seine nets, ring seine. [40] | Main commercial fishing locations are PPB, Corner Inlet/ Nooramunga, Gippsland Lakes. [40] | SmH | Possible | Inshore, often light gear. Limited observer. |
| Victorian Ocean Fishery | A drop line, longline, handline or fishing line including hooks and snoods, a dip net; a bait trap; an octopus trap; a landing net a gaff; a seine net; a mesh net; a bait pump. [41] | Marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea [41] | SmH | Confirmed (SmH) | |
| Victorian Inshore Trawl Fishery | Trawl net. [41] | Marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes or any inlet of the sea. [41] | SmH | Possible | Limited observer coverage. |
| Ocean Purse Seine Fishery | Purse seine net and a lampara net. [41] | Marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes or any inlet of the sea. [41] | SmH | Possible | Targeted. No information on observer programs was found. |
| **Tasmania** | | | | | |
| Abalone Fishery | Dive fishery (hand collection) using hookah gear. [42] | Commonwealth and State waters. [42] | SmH | None | |
| Rock Lobster Fishery | Lobster pots. [49] | Commonwealth and State waters. [49] | SmH | Unlikely | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
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| | | | PS | | |
| Scalefish Fishery | Multi-gear, including gillnets, hook and line, long lines, squid jigs and different types of seine nets. [51] | State waters. [51] | SmH<br>PS | Confirmed (SmH) | |
| Giant Crab Fishery | Initially harvested giant crabs with modified rock lobster pots, however larger, heavier steel pots are now being used to target the species. 44 | The area of the fishery includes waters surrounding the state of Tasmania generally south of 39°12′ and out to the outer edge of the Australian Exclusive Economic Zone. Part of the TCGF is in Commonwealth waters; however the entire fishery is managed by Tasmania under an Offshore Constitutional Settlement (OCS) between the Australian Government and the Government of Tasmania. [44] | SmH<br>PS | Unlikely | |
| Scallop Fishery | Scallop dredge. [50] | From the high water mark to 20 nm into Bass Strait and from the high water mark out to 200 nm off the rest of the State of Tasmania [50] | SmH<br>PS | Unlikely | |
| Commercial Dive Fishery | Non-mechanical fishing methods such as tongs, a single prolonged hook or a gloved hand. [43] | The area of the Tasmanian Commercial Dive Fishery encompasses all Tasmanian state waters, excluding protected and research areas. [43] | SmH | None | |
| Shellfish Fishery | Hand collection only. [47] | Georges Bay, north east Tasmania, within Tasmanian state waters. [47] | SmH | None | |
| Marine Aquarium Fish Fishery | Non-mechanical fishing methods, such as hand nets, slurp guns, bait traps and barrier nets. This is achieved through diving, wading or by hand. [46] | All State waters, excluding protected areas and research areas. [46] | SmH | None | |
| Octopus Fishery | Unbaited pots grouped into lots of 500 and attached along the bottom by longlines, hand collection from small vessels with the aid of lights and gaff hooks. One permit currently for the use of 400 m of gillnet. [48] | Waters adjacent to the State of Tasmania out to 200 nm. [48] | SmH<br>PS | None | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| **Commonwealth** | | | | | |
| Australian High Seas Fisheries | Trawl, dropline, autoline, trotline, gillnet and fish trapping. [53] | High seas southern Pacific and southern Indian Oceans [53] | OWT SmH GH ScH PS | Confirmed (OWT, PS) | |
| Bass Strait Scallop Central Zone Fishery | Scallop dredge. [52] | The central area of Bass Strait between the Victorian and Tasmanian scallop fisheries. [52] | SmH PS | Unlikely | |
| Coral Sea Fishery (multi sector) | Demersal longline, setline, dropline and trotline.<br>Demersal and midwater otter board trawl, Fish traps, hand harvest, barbless hook and line, cast nets and seine nets and/or scoop nets [54] | East of the Great Barrier Reef Marine Park (GBRMP) and extends to the edge of the Australian Fishing Zone; it extends north from Sandy Cape, Fraser Island, to Cape York but excludes the area of the Coringa-Herald and Lihou Reef National Nature Reserves. [54] | OWT GH ScH | Confirmed (OWT, SmH, ScH) | |
| Eastern Tuna and Billfish Fishery | Pelagic longline and minor lines (handline, troll, rod and reel). [55] | The Eastern Tuna and Billfish Fishery extends south from Cape York, Queensland, to the South Australian/Victorian border. Fishing occurs in both the Australian Fishing Zone and adjacent high seas. [55] | OWT SmH GH ScH PS | Confirmed (OWT, SmH, ScH, PS) | |
| Heard Island and McDonald Islands Fishery | Demersal otter board trawling, midwater trawling and demersal longlining. [56] | The Heard Island and McDonald Islands (HIMI) Fishery lies in waters adjacent to the Islands of the same name. The Islands are Australia's most remote sovereign territory and are located on the Kerguelen Plateau in the south Indian Ocean, about 4,000 km south-west of Perth. The HIMI Fishery extends from 12 nm offshore to the edge of the Australian Exclusive Economic Zone (EEZ), which extends to 200 nautical miles, or to the maritime boundary with Iles Kerguelen. [56] | None (However www.fishbase.org describe their range as extending to 59°S which overlaps with the HIMI) | Confirmed (PS) | |
| Macquarie Island Toothfish Fishery | Demersal otter board trawl and demersal longlining. [57] | The Macquarie Island Toothfish Fishery operates in Commonwealth waters surrounding Macquarie Island; i.e. from three nautical miles to 200 nautical miles offshore. [57] | None (However www.fishbase.org describe their range as | Confirmed (PS) | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | | extending to 59°S which overlaps with the Macquarie Island) | | |
| Northern Prawn Fishery | Twin gear otter trawl. [58] | Northern Australia – Cape York in Queensland to Cape Londonderry in Western Australia (coastal waters out to 200 nautical miles). [58] | GH<br>ScH | Confirmed (SmH, GH, ScH) | |
| Skipjack Tuna Fishery | Purse seine, pole and line fishing [59] | The Skipjack Tuna Fishery comprises two sub-fisheries, the Western and Eastern Skipjack Tuna Fisheries. The fishery as a whole extends throughout the Australian Fishing Zone, including waters surrounding Norfolk, Christmas and Cocos (Keeling) Islands. The fishery encompasses areas of the Western Tuna and Billfish Fishery (WTBF) and the Eastern Tuna and Billfish Fishery (ETBF), with an exception of an area of the ETBF off northern Queensland [59] | OWT<br>SmH<br>GH<br>ScH<br>PS | Possible | Targeted. Low bycatch. [87] |
| Small Pelagics Fishery | Purse seine and mid-water trawl (single and pair). [60] | From Queensland/New South Wales (NSW) border, around southern Australia to a line at latitude $31^0$ south (near Lancelin north of Perth). [60] | OWT<br>SmH<br>GH<br>ScH<br>PS | Possible | Targeted. Low bycatch. [88] |
| Southern and Eastern Scalefish and Shark Fishery (multi sector) | Demersal otter trawl, pair trawl, midwater trawl, Danish seine, demersal longline, demersal gillnet, dropline trotline, handline, fish traps. [61] | The area of the fishery extends south from Fraser Island in southern Queensland, around New South Wales, Victoria, Tasmania and South Australia, to Cape Leeuwin in southern Western Australia. The fishery operates in both Commonwealth and state waters, under Offshore Constitutional Settlement arrangements with the different state | OWT<br>SmH<br>GH<br>ScH<br>PS | Confirmed (SmH, ScH, PS) | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | governments. [61] | | | |
| Southern Bluefin Tuna Fishery | Purse seining, longline. [62] | The Australian Southern Bluefin Tuna (SBT) Fishery encompasses fishing operations for SBT inside the Australian Fishing Zone and on the high seas. [62] | OWT<br>SmH<br>GH<br>ScH<br>PS | Possible | Targeted. Low bycatch. [89] |
| Southern Squid Jig Fishery | Squid jigging. A device with barbless lures attached to 1 or more jig lines that are rotated by elliptical spools. [63] | Commonwealth waters from Fraser Island to the South Australian / Western Australian border, including waters around Tasmania. [63] | OWT<br>SmH<br>GH<br>ScH<br>PS | Unlikely | |
| Torres Strait Beche-de-mer Fishery | Hand collection from vessels less than seven metres in length. Hand held non-mechanical devices may be used. [64] | The tip of Cape York to the northern border of Australian jurisdiction in the Torres Strait Protected Zone and includes islands and their territorial waters recognised within the Torres Strait Treaty as being Sovereign Islands of Australia. [64] | GH<br>ScH | None | |
| Torres Strait Crab Fishery | Hand harvest or using scoop nets. | As for Torres Strait Finfish Fishery | GH<br>ScH | None | |
| Torres Strait Finfish Fishery | Troll lines, hand lines with single hooks, fishing rods or mechanically operated reels. [65] | Tidal waters within the Torres Strait Protected Zone (TSPZ) and the area declared under the *Torres Strait Fisheries Act 1984* (the Act) to be 'outside *but near'* the TSPZ for commercial fishing for finfish [65] | GH<br>ScH | Possible | Small scale. Hammerheads can not be landed. Some observer work, but no species of interest reported. [90] |
| Torres Strait Pearl Shell Fishery | Hand harvest. | As for Torres Strait Finfish Fishery, but extending to 141°01'E in the west and 11°10'S in the south. | GH<br>ScH | None | |
| Torres Strait Prawn Fishery | Otter trawl (quad gear). [66] | The eastern part of the Torres Strait. Most of the trawling activity in the fishery occurs on the continental shelf within 20 to 90 nm of the coastline, in depths of between 18 and 40 m. [66] | GH<br>ScH | Confirmed (ScH) | |
| Torres Strait Trochus Fishery | Hand or hand held non-mechanical implements. [67] | The Torres Strait Trochus Fishery operates in tidal waters within the Torres Strait Protected Zone (TSPZ) and the area declared under the *Torres Strait Fisheries Act 1984* to be 'outside | GH<br>ScH | None | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | but near' the TSPZ. [67] | | | |
| Torres Strait Tropical Rock Lobster Fishery | Hand collection, some with small hand-held spears and some with hookah dive gear. [68] | Torres Strait. [68] | GH<br>ScH | None | |
| Torres Strait Turtle and Dugong Fishery | Spear. | As for Torres Strait Pearl Shell Fishery. | GH<br>ScH | None | |
| North West Slope Trawl Fishery | Demersal crustacean trawls and fish trawls. [69] | The North West Slope Trawl Fishery operates in Commonwealth waters off the north-west coast of Western Australia, roughly between the<br>200 m isobath and the outer boundary of the Australian Fishing Zone. The western boundary of the fishing area aligns with longitude 114°E and continues north-east parallel to the Western Australian coastline to longitude 125°E. The operation of the fishery occurs within the North-west Marine Region. [69] | OWT<br>GH<br>ScH | Confirmed (ScH) | |
| Western Deepwater Trawl Fishery | Demersal crustacean trawls and fish trawls. [69] | The Western Deepwater Trawl Fishery operates in Commonwealth waters off the western coastline of Western Australia, in waters extending from the 200 m isobath to the outer boundary of the Australian Fishing Zone. The fishery extends from the western boundary of the Great Australian Bight Trawl Sector in the south (115 0 'E ) to the western boundary on the North West Slope Trawl Fishery (114°E) in the north [69] | OWT<br>SmH<br>GH<br>ScH<br>PS | Confirmed (OWT) | |
| Western Tuna and Billfish Fishery | Pelagic longline, minorline or purse seine equipment. [70] | The WTBF operates in Commonwealth waters. It extends from Queensland's Cape York Peninsula west to the South Australia-Victoria border. It also includes waters around Christmas Island and the Cocos (Keeling) Islands and a high seas fishing zone. [70] | OWT<br>SmH<br>GH<br>ScH<br>PS | Confirmed (OWT, ScH, PS) | |
| **South Australia** | | | | | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| Abalone Fishery | Diver hand collection. [71] | Target species harvested from reefs and rock shelves within South Australian and adjacent Commonwealth waters. [71] | SmH<br>PS | None | |
| Blue Crab Fishery | Crab pots. [72] | The Gulf St Vincent Blue Crab Fishing Zone, which includes all waters of Gulf St Vincent north of latitude 35°03. 2'S, and the Spencer Gulf Blue Crab Fishing Zone which includes all waters of Spencer Gulf north of latitude 34°26. 75'S. [72] | PS | Unlikely | |
| Giant Crab Fishery | Beehive pot. [73] | State and Commonwealth waters adjacent to South Australia. [73] | SmH<br>PS | Unlikely | |
| Lakes and Coorong Fishery | Multi-gear fishery including mesh nets, swinger nets, hauling nets, bait net, drop/hook nets, dab net, drum net, cockle rake, cockle net, crab rake, yabbie trap, shrimp trap, set line, razor fish tongs, fish spear and electro-fishing gear. [74] | The lower River Murray lakes (Lake Alexandrina and Lake Albert), the Coorong lagoons, and coastal marine waters adjacent to the Sir Richard and Younghusband Peninsulas (out to three nautical miles from the low water mark) [74] | SmH | Possible | Mostly operates inside the Lakes. Some observer work, but no species of interest reported. [91] |
| Marine Scalefish Fishery | Principle gear types include hand line, haul net, gill net and long line. Secondary gear types include rod and line, dab net, drop line, pilchard net, purse seine, hoop net, crab rake, cockle net, cockle rake, scallop dredge, fork, trap, hand spear, razorfish tongs, bait net, bait pump, bait spade, brailing net, drop net, crab pot, large mesh net and jigging machine. [75] | Waters adjacent to the State of South Australia (Commonwealth and State waters). [75] | SmH<br>PS | Confirmed (SmH) | |
| Scallop and Turbo Fisheries | Dive-only Fisheries. Taken by hand using hookah or Self Contained Underwater Breathing Apparatus (SCUBA). [79] | All coastal waters of South Australia (State waters only) including gulfs, bays and estuaries (excluding the Coorong Estuary and Coffin Bay [for scallops only]), from the Western Australian border (129°E) to the | SmH | None | |

| Fishery | Gear | Lat/long/Area | Area/habitat overlap with shark species | Potential of capture by gear | Potential reason for no record of capture |
|---|---|---|---|---|---|
| | | Victorian border (141°E). [79] | | | |
| Sea Urchin Fishery | Only non-mechanical fishing methods such as tongs, a single prolonged hook or a gloved hand may be used to collect sea urchins. Divers may free dive or use a hookah line (a long compressed air hose) operating out of small boats. [80] | The area of the fishery includes all state waters along the South Australian coastline. [80] | SmH | None | |
| Prawn (Gulf St Vincent, Spencer Gulf and West Coast) Fishery | Demersal otter trawl. [78] | 1) Spencer Gulf, South Australia, in water depth greater than 10 m<br>2) Gulf St Vincent, South Australia, in water depth greater than 10 m<br>3) West Coast – Oceanic waters around Nuyts Archipelago, Anxious Bay and Coffin Bay, South Australia. [78] | SmH<br>PS | Possible | Some observer work, but no species of interest reported. [86] |
| Rock Lobster Fishery | Beehive pot. [77] | Marine waters adjacent to South Australia. [77] | SmH<br>PS | Unlikely | |
| Sardine (Pilchard) Fishery | Purse seine net. [76] | The area of jurisdiction includes all the waters adjacent to the State of SA out to the 200 nm Australian Fishing Zone. [76] | SmH<br>PS | Possible | Targeted, low bycatch. Some observer work, but information on bycatch composition was not found. |


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# Appendix 3: Summary of harvest regime required for NDF (Rosser and Haywood, 2002).

**Is the species endemic, found in a few countries only, or widespread?**

**Conservation status of the species (if known):**

| Type of Harvest | Main product | Degree of control | Demographic segment of population harvested | | | | | Relative level of harvest (include no. or quantity if known) | | | | Reason for harvest and percentage (if known) | | | Commercial destination of harvest, and percentage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eggs | Juveniles | Adult male | Adult female | Non selective | Low | Med | High | Un-known | Subsistence | Commercial | Others | Local | National | Inter-national |
| 1.5 Live capture | | a) Regulated | | | | | | | | | | | | | | | |
| | | b) Illegal or Unregulated | | | | | | | | | | | | | | | |
| 1.6 Killing of individuals | | a) Regulated | | | | | | | | | | | | | | | |
| | | b) Illegal or Unregulated | | | | | | | | | | | | | | | |

# Appendix 4: Checklist for analysis of factors affecting the management regime required for NDF (Rosser and Haywood, 2002).

| | | |
|---|---|---|
| **Biological characteristics** | | |
| 2.1 Life history:<br>What is the species' life history? | High reproductive rate, long-lived | |
| | High reproductive rate, short-lived | |
| | Low reproductive rate, long-lived | |
| | Low reproductive rate, short-lived | |
| | Uncertain | |
| | | |
| 2.2 Ecological adaptability:<br>To what extent is the species adaptable (habitat, diet, environmental tolerance etc.)? | Extreme generalist | |
| | Generalist | |
| | Specialist | |
| | Extreme specialist | |
| | Uncertain | |
| | | |
| 2.3 Dispersal efficiency:<br>How efficient is the species' dispersal mechanism at key life stages? | Very good | |
| | Good | |
| | Medium | |
| | Poor | |
| | Uncertain | |
| | | |
| 2.4 Interaction with humans:<br>Is the species tolerant to human activity? other than harvest? | No interaction | |
| | Pest/Commensal | |
| | Tolerant | |
| | Sensitive | |
| | Uncertain | |
| | | |
| **National status** | | |
| 2.5 National distribution:<br>How is the species distributed nationally? | Widespread, contiguous in country | |
| | Widespread, fragmented in country | |
| | Restricted and fragmented | |
| | Localized | |
| | Uncertain | |
| | | |
| 2.6 National abundance:<br>What is the abundance nationally? | Very abundant | |
| | Common | |
| | Uncommon | |
| | Rare | |
| | Uncertain | |
| | | |
| 2.7 National population trend:<br>What is the recent national population trend? | Increasing | |
| | Stable | |
| | Reduced, but stable | |

| | | |
|---|---|---|
| | Reduced and still decreasing | |
| | Uncertain | |
| | | |
| 2.8 Quality of information:<br>What type of information is available to describe abundance and trend in the national population? | Quantitative data, recent | |
| | Good local knowledge | |
| | Quantitative data, outdated | |
| | Anecdotal information | |
| | None | |
| | | |
| 2.9 Major threats:<br>What major threat is the species facing (underline following: overuse/habitat loss and alteration/invasive species/other) and how severe is it? | None | |
| | Limited/Reversible | |
| | Substantial | |
| | Severe/Irreversible | |
| | Uncertain | |
| | | |
| **Harvest management** | | |
| 2.10 Illegal harvest or trade:<br>How significant is the national problem of illegal or unmanaged harvest or trade? | None | |
| | Small | |
| | Medium | |
| | Large | |
| | Uncertain | |
| | | |
| 2.11 Management history:<br>What is the history of harvest? | Managed harvest: ongoing with adaptive framework | |
| | Managed harvest: ongoing but informal | |
| | Managed harvest: new | |
| | Unmanaged harvest: ongoing or new | |
| | Uncertain | |
| | | |
| 2.12 Management plan or equivalent:<br>Is there a management plan related to the harvest of the species? | Approved and co-ordinated local and national management plans | |
| | Approved national/state/provincial management plan(s) | |
| | Approved local management plan | |
| | No approved plan: informal unplanned management | |
| | Uncertain | |
| | | |
| 2.13 Aim of harvest regime in management planning:<br>What is harvest aiming to achieve? | Generate conservation benefit | |
| | Population management/control | |
| | Maximize economic yield | |
| | Opportunistic, unselective harvest, or none | |
| | Uncertain | |
| | | |

| | | |
|---|---|---|
| 2.14 Quotas:<br>Is the harvest based on a system of quotas? | Ongoing national quota:<br>based on biologically derived local quotas | |
| | Ongoing quotas: "cautious" national or local | |
| | Untried quota: recent and based on biologically derived local quotas | |
| | Market-driven quota(s), arbitrary quota(s), or no quotas | |
| | Uncertain | |
| | | |
| **Control of harvest** | | |
| 2.15 Harvesting in Protected Areas:<br>What percentage of the legal national harvest occurs in State-controlled Protected Areas? | High | |
| | Medium | |
| | Low | |
| | None | |
| | Uncertain | |
| | | |
| 2.16 Harvesting in areas with strong resource tenure or ownership:<br>What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use? | High | |
| | Medium | |
| | Low | |
| | None | |
| | Uncertain | |
| | | |
| 2.17 Harvesting in areas with open access:<br>What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access? | None | |
| | Low | |
| | Medium | |
| | High | |
| | Uncertain | |
| | | |
| 2.18 Confidence in harvest management:<br>Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls? | High confidence | |
| | Medium confidence | |
| | Low confidence | |
| | No confidence | |
| | Uncertain | |
| | | |
| **Monitoring of harvest** | | |
| 2.19 Methods used to monitor the harvest:<br>What is the principal method used to monitor the effects of the harvest? | Direct population estimates | |
| | Quantitative indices | |
| | Qualitative indices | |
| | National monitoring of exports | |
| | No monitoring or uncertain | |
| | | |
| 2.20 Confidence in harvest monitoring:<br>Do budgetary and other factors allow effective harvest monitoring? | High confidence | |
| | Medium confidence | |
| | Low confidence | |

| | | |
|---|---|---|
| | No confidence | |
| | Uncertain | |
| | | |
| **Incentives and benefits from harvesting:** | | |
| 2.21 Utilization compared to other threats:<br>What is the effect of the harvest when taken together with the major threat that has been identified for this species? | Beneficial | |
| | Neutral | |
| | Harmful | |
| | Highly negative | |
| | Uncertain | |
| | | |
| 2.22 Incentives for species conservation:<br>At the national level, how much conservation benefit to this species accrues from harvesting? | High | |
| | Medium | |
| | Low | |
| | None | |
| | Uncertain | |
| | | |
| 2.23 Incentives for habitat conservation:<br>At the national level, how much habitat conservation benefit is derived from harvesting? | High | |
| | Medium | |
| | Low | 3 |
| | None | |
| | Uncertain | |
| | | |
| **Protection from harvest:** | | |
| 2.24 Proportion strictly protected:<br>What percentage of the species' natural range or population is legally excluded from harvest? | >15% | |
| | 5-15% | |
| | <5% | |
| | None | |
| | Uncertain | |
| | | |
| 2.25 Effectiveness of strict protection measures:<br>Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection? | High confidence | |
| | Medium confidence | |
| | Low confidence | |
| | No confidence | |
| | Uncertain | |
| | | |
| 2.26 Regulation of harvest effort:<br>How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse? | Very effective | |
| | Effective | |
| | Ineffective | |
| | None | |
| | Uncertain | |
| | | |

# Appendix 5: Management arrangements and data available to inform NDF for fisheries with confirmed catches of any of the five shark species, summary of risk assessments and recommendations.

| **WA – Kimberley gillnet and barramundi fishery (KGBF)** | | |
|---|---|---|
| **Harvest management** | 2.10 Illegal harvest or trade: | The KGBF is in the North Coast Bioregion. The North Coast bioregions fisheries officers use a risk assessment based approach to fisheries compliance to ensure areas and activities of a high risk of non-compliance are targeted. A range of compliance duties are carried out in the bioregion including investigations, catch, licence, gear, processor, retail and transport inspections. These are carried out through roadside checks, land & sea patrols and aerial surveillance. [1]<br>During 2010/11, there were 154 compliance contacts made with the commercial fishing industry in the North Coast Bioregion, resulting in 9 infringement warnings, 13 infringement notices and 7 prosecutions. [1] Information on specific fisheries involved or infringement type was not reported. [1]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the KGBF area. [2] Estimates are not available specifically for the KGBF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] |
| | 2.11 Management history: | The KGBF is management under the Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989 and the Western Australian Fish Resources Management Regulations 1995 (FRMR) in force under the Western Australian Fish Resources Management Act 1994. [1]<br>The Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989 has undergone amendment, the last of which were published on 3 July 2012. [3]<br>Main management tools are limited entry, seasonal and spatial area closures and gear restrictions. Access to the KGBF is limited to seven licences. [1] |
| | 2.12 Management plan or equivalent: | The KGBF is managed under the Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989. [1] |
| | 2.13 Aim of harvest regime in management planning: | There are no stated objectives in the Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989. [3] The objectives of the WA Fish Resources Management Act 1994 are (a) to develop and manage fisheries and aquaculture in a sustainable way; and (b) to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations. [4]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | There are no restrictions on the catch of any of the five listed shark species in the KGBF. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | **Uncertain.** There are State MPAs that overlap with the area of the KGBF. Many of those MPAs contain multiple |

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| | | use areas, and some fishing methods used by the NSF are permitted in some zones. [5,6]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | The KGBF is managed mainly through input controls such as limited entry, seasonal and spatial area closures and gear restrictions. [1]<br>Shark finning is prohibited in WA. [4]<br>A compliance program is in place, however compliance rates specific to the KGBF are not reported. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | KGBF operators are required to complete monthly catch and effort logbooks. [1] Fishers are required to report processed weight of fish caught by species per month. They are instructed to "enter the common name of the species you have caught using the 'Australian Seafood Handbook' as a reference or call the catch and effort returns officer for assistance. There is no capacity to report discards.<br>Observer data is restricted to one research study, which identified catch of hammerheads to species during the early 2000s. [7]<br>Population estimates are not available for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Catch and effort data were validated during the research project. [7]<br>Observer data is restricted to one research study during the early 2000s. [7] In that report, Scalloped Hammerhead were identified to species.<br>There was no commercial logbook data for the five listed shark species.<br>Medium confidence was assigned to this factor because there has been validation of the logbook system, and there has been some observer work as part of a research program, however that program operated a decade ago. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Only 1 Scalloped Hammerhead weighing 109.1 kg was observed during the research project, and from that, an estimated 1.2–4.7 t was caught each year by the KGBF during 2000–2004. [7] |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the KGBF with zones that are strictly protected, and there are also other areas that are closed to the KGBF. [1] Determination of the proportion of the strictly protected area in the area of the KGBF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and compliance activities are reported for each Bioregion [1], however details of the compliance breaches are not available. It is unknown if any of the reported breaches were by KGBF fishers, or if they related to breaches of regulated waters conditions. [1] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through input controls limited entry, seasonal and spatial area closures and gear restrictions[1]. There is no regulation of the harvest of these shark species. |
| **Risk assessment** | An ERA has been conducted for the ecosystems of the Kimberly, and while they included hammerhead catches in the analyses, they did not explicitly assess the risk to hammerheads. [8] That ERA demonstrated that there has been no reduction in either mean trophic level or mean maximum length in the finfish catches recorded within the Kimberly (i.e. no fishing down of the food web) over the past 30 years. | |

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| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required.<br>2.14 Implement trip limits for the five shark species of interest.<br>2.19 Provide facility to report discards in commercial logbook data.<br>2.20 Collect more recent observer data to describe species composition of the catch and discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the five shark species of interest, as well as maximum size limits. | |
| **References** | 1. Fletcher, W.J. and Santoro, K. (eds). 2012. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2011/12: The State of the Fisheries. Department of Fisheries, Western Australia.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989 (Doc. No. 10-07)<br>4. Fish Resources Management Act 1994. (Incorporating the amendments proposed by the Fish Resources Management Amendment Bill 2011 (Bill No. 204 — 1B))<br>5. http://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Marine-Protected-Areas/Pages/Marine-Reserves.aspx (Accessed August 2013)<br>6. DEC. (2010). Proposed Camden Sound Marine Park indicative management plan. Department of Environment and Conservation, Western Australia.<br>7. McAuley, R., Lenanton, R., Chidlow, J., Allison, R. and Heist, E. 2005. Biology and stock assessment of the thickskin (sandbar) shark, Carcharhinus plumbeus, in Western Australia and further refinement of the dusky shark, Carcharhinus obscurus, stock assessment, Final FRDC Report – Project 2000/134, Fisheries Research Report No. 151, Department of Fisheries, Western Australia, 132p.<br>8. Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp. | |
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| **WA – Northern shark fishery (NSF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | The NSF is in the North Coast Bioregion. The North Coast bioregions fisheries officers use a risk assessment based approach to fisheries compliance to ensure areas and activities of a high risk of non-compliance are targeted. A range of compliance duties are carried out in the bioregion including investigations, catch, licence, gear, processor, retail and transport inspections. These are carried out through roadside checks, land & sea patrols and aerial surveillance. [1]<br>During 2010/11, there were 154 compliance contacts made with the commercial fishing industry in the North Coast Bioregion, resulting in 9 infringement warnings, 13 infringement notices and 7 prosecutions. [1] Information on specific fisheries involved or infringement type was not reported, however since there has been no fishing in this fishery since 2008/09[1], none of those breaches would have been from the NSF.<br>Illegal fishing by foreign vessels has been reported in the vicinity of the NSF area. [2] Estimates are not available specifically for the NSF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] |
| | 2.11 Management history: | The NSF underwent strategic assessment during 2006. [3]<br>The fishery is comprised of two sectors, the state-managed WA North Coast Shark Fishery (WANCSF) in the Pilbara and western Kimberley and the Joint Authority Northern Shark Fishery (JANSF) in the eastern Kimberley. [1]<br>Formal management arrangements have not been implemented in the JANSF and management arrangements for this fishery (and the associated WANCSF) have been a matter of ongoing dialogue between the State and Commonwealth. In April 2008 the JANSF's export approval under the EPBC Act was |

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| | | revoked due to the lack of formal management arrangements and concerns about the fishery's ecological sustainability. [1]<br>Main management tools are mainly input controls such as limited entry, gear restrictions, effort limits and spatial closures. [3]<br>There is no management plan, however the fishery is managed under the Western Australian Fish Resources Management Regulations 1995 (FRMR) in force under the Western Australian Fish Resources Management Act 1994. [3]<br>The NSF has not operated since 2008/09. [1] |
| | 2.12 Management plan or equivalent: | The NSF is managed under the Western Australian Fish Resources Management Regulations 1995 (FRMR) in force under the Western Australian Fish Resources Management Act 1994. [3] |
| | 2.13 Aim of harvest regime in management planning: | The objectives of the WA Fish Resources Management Act 1994 are (a) to develop and manage fisheries and aquaculture in a sustainable way; and (b) to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations. [4]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | There are no restrictions on the catch of any of the five listed shark species in the NSF. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are numerous State and Commonwealth MPAs that overlap with the area of the NSF. Many of those MPAs contain multiple use areas, and some fishing methods used by the NSF are permitted in some zones. [5]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | The NSF is managed mainly through input controls such as limited entry, gear restrictions, effort limits and spatial closures. [3]<br>Shark finning is prohibited in WA. [6]<br>A compliance program is in place, however compliance rates specific to the NSF are not reported. [1] VMS is used to monitor the fishery.<br>There are effort limits in place. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | NSF operators are required to complete daily/trip catch and effort logbooks. [1] Fishers are required to report numbers of sharks by species per fishing session, and total processed weight for the trip by species. There is no capacity to report discards. "Hammerheads" is one of the prefilled species in the logbook, and logbook data received contained records of "Shark, Hammerheads", and "Shark, Oceanic Whitetip".<br>Observer data is available from field research conducted in the NFS during 2000–2003. [10] There is no ongoing observer program, however several reports have planned to implement such a program. [3,8]<br>Population estimates are not available for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Information on validation of NSF logbooks was not found.<br>Observer data from field research conducted in the NFS during 2000–2003 identified catch of sharks to species. [10]<br>Commercial data by DFWA identified Oceanic Whitetip Sharks to species level, but reported all hammerheads as "Sharks, Hammerhead". |

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| | | Medium confidence was assigned to this factor because the logbook system that has not been validated, observer data available is nearly 10 year old, and commercial data does not identify hammerheads to species. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches Oceanic Whitetip Sharks are low in this fishery, while catches of hammerheads (all species including Winghead Sharks) averaged 27.6 t per year during 2006/07–2008/09. [1] |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many MPAs in the area of the NSF with zones that are strictly protected. [5] Determination of the proportion of the strictly protected area in the area of the NSF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and compliance activities are reported for each Bioregion [1], however details of the compliance breaches are not available. It is unknown if any of the reported breaches were by NSF fishers, or if they related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through input controls including effort limits, gear restrictions limited entry. [1]<br>Spatial closures are also in place.<br>VMS is used to monitor the fishery. [1] |
| **Risk assessment** | An ERA published during 2011 has been conducted for the ecosystems of the Kimberly, and while they included hammerhead catches in the analyses, they did not explicitly assess the risk to hammerheads. [9] That ERA demonstrated that there has been no reduction in either mean trophic level or mean maximum length in the finfish catches recorded within the Kimberly (i.e. no fishing down of the food web) over the past 30 years. | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trigger limits for the five shark species of interest.<br>2.19 Remove generic shark references in logbooks and improve species identification in logbook data.<br>2.20 Collect more recent observer data to describe species composition.. | |
| **References** | 1. Fletcher, W.J. and Santoro, K. (eds). 2012. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2011/12: The State of the Fisheries. Department of Fisheries, Western Australia.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. DEH. (2006). Assessment of the Western Australian Tropical Shark Fisheries. Department of Environment and Heritage, Western Australia.<br>4. Fish Resources Management Act 1994. (Incorporating the amendments proposed by the Fish Resources Management Amendment Bill 2011 (Bill No. 204 — 1B))<br>5. http://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Marine-Protected-Areas/Pages/Marine-Reserves.aspx (Accessed August 2013)<br>6. Fish Resources Management Regulations 1995. (Version 12-a0-00)<br>7. McAuley, R., Lenanton, R., Chidlow, J., Allison, R. and Heist, E. 2005. Biology and stock assessment of the thickskin (sandbar) shark, Carcharhinus plumbeus, in Western Australia and further refinement of the dusky shark, Carcharhinus obscurus, stock assessment, Final FRDC Report – Project 2000/134, Fisheries Research Report No. 151, Department of Fisheries, Western Australia, 132p.<br>8. DOF. (2005). Application of the Australian Government Department of Environment and Heritage on the Western Australian Tropical Shark Fisheries. Department of Fisheries, Western Australia.<br>9. Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp.<br>10. Bensley N, Woodhams J, Patterson HM, Rodgers M, McLoughlin K, Stobutzki I, and Begg GA 2009, Shark Assessment Report for the Australian National Plan of Action for the Conservation and Management of Sharks, final report to the Department of Agriculture, Fisheries and Forestry, Bureau of Rural Sciences, Canberra. | |

| **WA – Pilbara fish trawl fishery (PFTF)** | | |
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| **Harvest management** | 2.10 Illegal harvest or trade: | The PFTF is in the North Coast Bioregion. The North Coast bioregions fisheries officers use a risk assessment based approach to fisheries compliance to ensure areas and activities of a high risk of non-compliance are targeted. A range of compliance duties are carried out in the bioregion including investigations, catch, licence, gear, processor, retail and transport inspections. These are carried out through roadside checks, land & sea patrols and aerial surveillance. [1]<br>During 2010/11, there were 154 compliance contacts made with the commercial fishing industry in the North Coast Bioregion, resulting in 9 infringement warnings, 13 infringement notices and 7 prosecutions. [1] Information on specific fisheries involved or infringement type was not reported.<br>Illegal fishing by foreign vessels has been reported in the vicinity of the PFTF area. [2] Estimates are not available specifically for the PFTF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] |
| | 2.11 Management history: | The PFTF underwent strategic assessment during 2004, 2007 and 2010. [1]<br>It is managed through combination of area closures, gear restrictions, and by the use of input controls in the form of individual transferable effort allocations monitored by a VMS. [1]<br>The fishery is managed under the Pilbara Fish Trawl Fishery (Interim) Management Plan 1997, the WA Fish Resources Management Act 1994 (FRM Act) and the WA Fish Resources Management Regulations 1995. [1] The management plan has undergone amendment. [3] |
| | 2.12 Management plan or equivalent: | The PFTF is managed using both input and output controls through the Pilbara Fish Trawl Fishery (Interim) Management Plan 1997. [3] |
| | 2.13 Aim of harvest regime in management planning: | There are no stated objectives in the Pilbara Fish Trawl Fishery (Interim) Management Plan 1997. [3]<br>The objectives of the WA Fish Resources Management Act 1994 are (a) to develop and manage fisheries and aquaculture in a sustainable way; and (b) to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations. [4]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | Under statutory requirements, no elasmobranchs can be retained in this fishery. [5] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are no multi-use MPAs in the area open to trawling in the PFTF. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Under statutory requirements, no elasmobranchs can be retained in this Fishery since 7 May 2008. Logbook information and compliance checks monitor adherence to the statutory prohibition. [5]<br>The PFTF is managed mainly through combination of area closures, gear restrictions, and by the use of input controls |

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| | | in the form of individual transferable effort allocations monitored by a VMS. [1]<br>Shark finning is prohibited in WA. [6]<br>BRDs are compulsory in the PFTF to reduce bycatch of large animals such as sharks. [7] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | PFTF operators are required to complete daily/trip catch and effort logbooks and unload returns. [1] Fishers are required to report estimated live weight by species in daily logbooks, and measured whole or processed weights in the unload returns. . Logbooks have the capacity to report "total Scalefish discards".<br>As sharks cannot be retained in this fishery, there are no records of the five species of interest in the logbook database.<br>Observer data has been collected during various programs, and covered <10% of effort until 2006. [7] While DoFWA set a target observer coverage of 22% of total fishing effort from 2006–07 onwards, coverage has range 8%–17 during 2006–2010. [8] The observer program in this fishery is reportedly ongoing. [7]<br>Detailed observer data for this fishery was not obtained, however, Great Hammerhead, Scalloped Hammerhead and Smooth Hammerhead have all been reported as bycatch in this fishery. [7]<br>Population estimates are not available for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Information on validation of logbooks was not found.<br>An ongoing observer program is in place for this fishery which covered 8%–17 of the effort during 2006–2010. [8]<br>Catch composition of bycatch in the PFTF has been described, and this work identified sharks hammerheads to species level. [7]<br>VMS is compulsory for all vessels. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Sharks can not be landed by the PFTF. [5] While there is an ongoing observer program, estimates of bycatch weights for the fishery were not found. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | Currently a large amount of the PFTF is closed to trawling and has been since the implementation of the (Interim) Management Plan. [7] Determination of the proportion of the strictly protected area in the area of the PFTF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and compliance activities are reported for each Bioregion [1], however details of the compliance breaches are not available. It is unknown if any of the reported breaches were by PFTF fishers, or if they related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through input controls including transferable time/gear effort units, gear type and configurations and limited entry. [1] Spatial closures are also in place. The PFTF are prohibited from landing sharks. [5]<br>VMS is used to monitor the fishery, and use of BRDs is compulsory, which to reduce catch of large sharks. [1] |
| **Risk assessment** | ERA have been conducted for the ecosystems of the Pilbara, and while they included hammerhead catches in the analyses, they did not explicitly assess the risk to hammerheads. [9] That ERA demonstrated that there has been no reduction in either mean trophic level or mean maximum length in the finfish catches recorded within the Pilbara (i.e. no fishing down of the food web) over the past 30 years. | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level. | |

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| | 2.19 Allow for reporting of discarded shark in the logbooks and/or use observer program to estimate total annual discard of sharks of interest. | |
| **References** | 1. Fletcher, W.J. and Santoro, K. (eds). 2012. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2011/12: The State of the Fisheries. Department of Fisheries, Western Australia.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Pilbara Fish Trawl Fishery (Interim) Management Plan 1997. (Doc 16.10)<br>4. Fish Resources Management Act 1994. (Incorporating the amendments proposed by the Fish Resources Management Amendment Bill 2011 (Bill No. 204 — 1B))<br>5. DOF. (2010). Application to the Department of the Environment, Water, Heritage and the Arts on the Pilbara Fish Trawl Interim Managed Fishery. Department of Fisheries, Western Australia.<br>6. Fish Resources Management Regulations 1995. (Version 12-a0-00)<br>7. DOF. (2010). A Bycatch Action Plan for the Pilbara Trawl Interim Managed Fishery. Department of Fisheries, Western Australia.<br>8. Allen, S.J. and Loneragan, N.R. (2010). Reducing dolphin bycatch in the Pilbara finfish trawl fishery. FRDC Project 2008/048. Murdoch University, Western Australia.<br>9. Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp. | |
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| **WA – Temperate demersal gillnet and demersal longline fisheries (TDGDLF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance officers undertake a variety of compliance activities including land, at-sea, inspection of vessels, catches, fishing gear, marine safety equipment, covert investigations and verification of licenses for both the commercial and recreational fisheries. They continue to refine compliance planning to deliver greater efficiencies and outcomes through the use of risk assessments and intelligence processes. [1] A formal quantitative risk assessment for the TDGDLF was undertaken in January 2011. [2]<br>The TDGDLF covers both the South and West Coast Bioregions (and a small part of the Gasgoyne Coast Bioregion). During 2010/11, there were 308 compliance contacts made with the commercial fishing industry in the South Coast Bioregion, resulting in 6 infringement warnings, 11 infringement notices and 2 prosecutions. [1]<br>In the same year, 247 compliance contacts made with the commercial fishing industry in the West Coast Bioregion, resulting in 36 infringement warnings, 16 infringement notices and 41 prosecutions. [1]<br>Information on specific fisheries involved or infringement type was not reported. |
| | 2.11 Management history: | The TDGDLF underwent strategic assessment during 2006, 2009 and 2012. [1] The fishery is managed using both input and output controls through the Joint Authority Southern Demersal Gillnet and Demersal Longline Limited Entry Fishery Notice 1992, the West Coast Demersal Gillnet and Demersal Longline (Interim) Management Plan 1997, the WA Fish Resources Management Act 1994 (FRM Act) and the WA Fish Resources Management Regulations 1995. [1] Both management plans have undergone regular amendments. [3,4] |
| | 2.12 Management plan or equivalent: | The TDGDLF is managed under the Joint Authority Southern Demersal Gillnet and Demersal Longline Limited Entry Fishery Notice 1992 and the West Coast Demersal Gillnet and Demersal Longline (Interim) Management Plan 1997. [1] |
| | 2.13 Aim of harvest regime in management planning: | There are no stated objectives in either the Joint Authority Southern Demersal Gillnet and Demersal Longline Limited Entry Fishery Notice 1992 or the West Coast Demersal Gillnet and Demersal Longline (Interim) Management Plan 1997. [3,4]<br>The objectives of the WA Fish Resources Management |

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| | | Act 1994 are (a) to develop and manage fisheries and aquaculture in a sustainable way; and (b) to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations. [5]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | There is no restriction on the catch of any of the five listed shark species in the TDGDLF. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are numerous State and Commonwealth MPAs that overlap with the area of the TDGDLF. Many of those MPAs contain multiple use areas, and some fishing methods used by the TDGDLF are permitted in some zones. [6]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | No measures specifically in place to manage shark harvest. The TDGDLF is managed mainly through input controls including transferable time/gear effort units, gear type and configurations and limited entry. [1]<br>Shark finning is prohibited in WA. [7]<br>A compliance program is in place, however compliance rates specific to the TDGDLF are not reported. [1] VMS is used to monitor the fishery.<br>A general prohibition of metal trace wire and large hooks is in place (except in the Northern Shark and Mackerel Fisheries) to reduce catch of large sharks. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | TDGDLF operators are required to complete daily/trip catch and effort logbooks. [1] Fishers are required to report numbers of sharks by species per fishing session, and total processed weight for the trip by species. There is no capacity to report discards. "Hammerheads" is one of the prefilled species in the logbook.<br>Observer data appears to be restricted to specific research programs. Data on the hammerheads from the TDGDLF is presented in at least two different studies [8,9], however the most recent of those completed sampling during 2003, and no more recent studies reporting the catch composition of the TDGDLF was received from Department of Fisheries WA, or found in the literature. The DFWA do not consider that an ongoing monitoring program for bycatch species is necessary in the TDGDLF. [2]<br>Population estimates are not available for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | TDGDLF logbooks have been validated. [2]<br>Catch composition of the TDGDLF has been described in the past[8], and DFWA believe that ongoing monitoring program for bycatch species is necessary. [2]<br>Commercial data by DFWA identified Oceanic Whitetip Sharks to species level, but reported all hammerheads as "Sharks, Hammerhead".<br>Most observer data reported hammerheads to species, however there was some "Hammerhead (general)" in the data.<br>Medium confidence was assigned to this factor because despite logbook system that has been validated, and past description of bycatch composition that identified most hammerheads to species level, bycatch data is more than |

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| | | 10 years old, and commercial data does not identify hammerheads to species. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches Oceanic Whitetip Sharks are low in this fishery, while catches of hammerheads (all species including Winghead Sharks) was 67.6 t during 2010/11. [1] |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many MPAs in the area of the TDGDLF with zones that are strictly protected. [6] Determination of the proportion of the strictly protected area in the area of the TDGDLF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and compliance activities are reported for each Bioregion [1], however details of the compliance breaches are not available. It is unknown if any of the reported breaches were by TDGDLF fishers, or if they related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through input controls including transferable time/gear effort units, gear type and configurations and limited entry. [1] Spatial and temporal closures are also in place.<br>VMS is used to monitor the fishery, and there is a general prohibition of metal trace wire and large hooks is in place (except in the Northern Shark and Mackerel Fisheries) to reduce catch of large sharks. [1] |
| **Risk assessment** | Ranked risk assessment has been completed on a bioregional level for the West Coast Bioregion. Risk to Smooth Hammerhead in the West Coast Bioregion was scored as Low-medium, and it was noted that "as targeted shark catches are carefully regulated, regularly monitored and considered to be sustainable, the bycatch scores estimated here do not necessarily represent significant risks to the species' populations/stocks." [10]<br>An ERA has been conducted for the ecosystems of the West Coast and South Coast bioregions, and while they included hammerhead catches in the analyses, they did not explicitly assess the risk to hammerheads. [11] | |
| **Recommendations** | 2.14 Implement trip limits for the five listed shark species.<br>2.19 Remove generic shark references in logbooks and provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the five listed shark species, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Fletcher, W.J. and Santoro, K. (eds). 2012. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2011/12: The State of the Fisheries. Department of Fisheries, Western Australia.<br>2. DOF. (2012). Application to the Department of Sustainability, Environment, Water, Population and Communities on Western Australia's Temperate Demersal Gillnet and Demersal Longline Fisheries. Department of Fisheries, WA.<br>3. Joint Authority Southern Demersal Gillnet and Demersal Longline Limited Entry Fishery notice 1992 (Doc. Number 27-15)<br>4. West Coast Demersal Gillnet and Demersal Longline Interim Managed Fishery Management Plan 1997 (Doc. Number 32-18)<br>5. Fish Resources Management Act 1994. (Incorporating the amendments proposed by the Fish Resources Management Amendment Bill 2011 (Bill No. 204 — 1B))<br>6. http://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Marine-Protected-Areas/Pages/Marine-Reserves.aspx (Accessed August 2013)<br>7. Fish Resources Management Regulations 1995. (Version 12-a0-00)<br>8. McAuley, R. and Simpfendorfer C. 2003. Catch composition of the Western Australian temperate demersal gillnet and demersal longline fisheries, 1994 to 1999, Fisheries Research Report No. 146, Department of Fisheries, Western Australia, 78 pp.<br>9. McAuley, R., Lenanton, R., Chidlow, J., Allison, R. and Heist, E. 2005. Biology and stock assessment of the thickskin (sandbar) shark, Carcharhinus plumbeus, in Western Australia and further refinement of the dusky shark, Carcharhinus obscurus, stock assessment, Final FRDC Report – Project 2000/134, Fisheries Research Report No. 151, Department of Fisheries, Western Australia, 132p. | |

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| | 10. Evans, R. and Molony, B.W. (2010). Ranked Risk Assessment for Bycatch in Multiple Fisheries: a Bioregional Risk Assessment Method. Department of Fisheries, WA.<br>11. Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp. | |
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| **NSW – Ocean Trawl Fishery (OTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | NSW DPI has implemented a number of initiatives to deter illegal fishing, including intelligence-driven compliance operations, strategic patrols, surveillance, quality field based recreational and commercial inspections. [1] These initiatives have been supported by enhancements to intelligence management and analysis, case management and strategic planning systems. [1]<br>A 2004 review of illegal fishing in NSW found no specific issues with sharks or the OTF. [2] The report did however find under-reporting of catch figures by commercial fishers (the fisheries were not revealed), but that the management agencies acknowledged the problem and were putting systems in place to reduce this problem.<br>Rates of compliance during 2009/10 and 2010/11 were 87% and 89.6% respectively. [1] Details of compliance breaches were not reported. |
| | 2.11 Management history: | The OHF underwent strategic assessment during 2004, and 2008. The fishery is managed using both input and output controls through the NSW Fisheries Management Act 1994, the Fisheries Management (General) Regulation 2010 and the Fisheries Management (Ocean Trawl Share Management Plan) Regulation 2006. [1] A fishery management strategy is in place for this fishery, that contains the vision, goals and objectives for the fishery, a broad description of the way the fishery operates, and outlines the future management framework. [3] It also outlines a program for monitoring the performance of the fishery against the management goals. [3] |
| | 2.12 Management plan or equivalent: | The OHF is managed under the Fisheries Management (Ocean Trawl Share Management Plan) Regulation 2006. [1] Performance of the fishery is reviewed against the fishery management strategy. [3] |
| | 2.13 Aim of harvest regime in management planning: | The objectives of the Fisheries Management (Ocean Trawl Share Management Plan) Regulation 2006 are to 1) contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to managing the impacts of the fishery on the environment and to ensuring ecologically sustainable development; and 2) contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to promoting viable commercial fishing. [4]<br>There are seven goals of the fishery management strategy. They are 1) manage the OTF in a manner that promotes the conservation of biological diversity in the marine environment; 2) maintain stocks of primary and key secondary species harvested by the OTF at sustainable levels; 3) promote the conservation of threatened species, populations and ecological communities and protected species of fish likely to be impacted by the operation of the OTF; 4) appropriately share the resource and carry out fishing in a manner that minimises negative social impacts; 5) promote a viable OTF, consistent with ecological sustainability; 6) facilitate effective and efficient compliance, research and management of the OTF; and 7) improve knowledge about the OTF and the resources on which it relies. [3]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |

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| | 2.14 Quotas: | The OTF has catch limits for a number of species, but not for sharks other than those protected. [1]<br>Scalloped Hammerhead and Great Hammerhead are listed as Endangered and Vulnerable species respectively in NSW, and they can not be retained under NSW State managed fishing licences. [5] There are no catch limits for Smooth Hammerhead, Oceanic Whitetip Shark or Porbeagle Shark in the OTF. [6]<br>This factor was scored Uncertain because there is full protection for some species in this fishery, but no output controls in place for others. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are numerous State and Commonwealth MPAs that overlap with the area of the OHF. Many of those MPAs contain multiple use areas, and some fishing methods used by the OHF are permitted in some zones. [7]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | While there is a ban on the take of Scalloped Hammerhead and Great Hammerhead in NSW [5], there are no restrictions on the take of Smooth Hammerhead, Oceanic Whitetip Shark and Porbeagle Shark. However, catches of these sharks by the OTF is very low.<br>Shark finning is prohibited in NSW. [1]<br>A compliance program is in place, and rates of compliance during 2009/10 and 2010/11 were 87% and 89.6% respectively. [1]<br>Approved BRDs must be used in the prawn trawl sector. [1\]<br>Therefore, it could be considered to have high confidence in harvest management for Scalloped and Great Hammerhead, however as there are no measures for the other species, this is not able to be assessed. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | OTF operators are required to complete daily catch and effort logbooks. [1] Fishers are required to report weight (either whole or processed) by species. Logbooks have the capacity to report numbers of fish. There is no capacity to report discards.<br>There has only been one observer program reported in the OTF, targeting the ocean prawn trawl sector. [8] That study undertook 30 trips and observed 83 tows during 2007–08.<br>Population estimates are not available for any of the five listed shark species in this fishery, however CPUE data from the NSW Shark Meshing Program has been used to describe changes to relative abundance of hammerheads in NSW. [9] |
| | 2.20 Confidence in harvest monitoring: | Details of logbook validation for the OTF were not found apart from the statement that "Data is subject to ongoing validation". [1]<br>There has been one observer program in the OTF, and that study undertook 30 trips and observed 83 tows during 2007–08. [8]<br>Commercial data by NSW DPI identified the sharks to species level.<br>Observer data has not been provided. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches of the five species of interest are low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many MPAs in the area of the OTF that contain areas where the fishery can not operate. Determination of |

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| | | the proportion of the strictly protected area in the area of the OTF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and rates of compliance during 2009/10 and 2010/11 were 87% and 89.6% respectively[1], however details for the compliance breaches are not available, and it is unknown if any of those related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through trip limits for some species, and Scalloped Hammerhead and Great Hammerhead cannot be landed. [5]<br>Input management measures used to control effort include limited entry, restrictions on gear (type and size), temporal and spatial closures and vessel size. [1] Approved BRDs must be used in the prawn trawl sector. [1] |
| **Risk assessment** | ERA reported that Hammerheads comprised 0.05% and 0.01% of the catch by the fish trawl and prawn trawl sectors respectively, and were not considered during risk assessment. [10] The risk to "Sharks (whalers)", which may have included some Oceanic Whitetip Shark, was assessed as Moderately Low. [10] | |
| **Recommendations** | 2.14 Implement trip limits for the listed shark species other Scalloped and Great Hammerhead<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the listed shark species other Scalloped and Great Hammerhead, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Anon. 2011. Submission to the Department of the Sustainability, Environment, Water, Population and Communities on behalf the NSW fishing industry seeking ongoing export approval for the NSW Ocean Trawl Fishery – November 2011. NSW Department of Primary Industries.<br>2. Palmer, M. 2004. Report on Illegal Fishing for Commercial Gain or Profit in NSW. Department of Primary Industries, Sydney.<br>3. Anon. 2007. Fishery Management Strategy for the Ocean Trawl Fishery. NSW Department of Primary Industries, Sydney.<br>4. Fisheries Management (Ocean Trawl Share Management Plan) Regulation 2006 (current as of 15 December 2006 – accessed July 2013)<br>5. Fisheries Management Act 1994 No 38. (Current version for 20.11.2012 to date (generated on 18.07.2013)<br>6. Anon. 2012. Proposed determination, The Smooth Hammerhead – *Sphyrna zygaena* as a vulnerable species. Fisheries Scientific Committee, July 2012.<br>7. http://www.mpa.nsw.gov.au<br>8. Macbeth, W.G., Johnson, D.D., and Gray, C.A. 2008. Assessment of a 35-mm square-mesh codend and composite square-mesh panel configuration in the ocean prawn trawl fishery of northern New South Wales. Northern Rivers Catchment Management Authority Project No. IS7-8-243-06. NSW Department of Primary Industries – Fisheries Final Report Series No. 13 ISSN 1449-9967. Cronulla, Australia.<br>9. Anon. 2012. Proposed determination, The Smooth Hammerhead – *Sphyrna zygaena* as a vulnerable species. Fisheries Scientific Committee, July 2012.<br>10. Anon. 2004. Environmental Impact Statement on the Ocean Trawl Fishery in NSW Public Consultation Document. Department of Primary Industries, NSW. | |
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| **NSW – Ocean Hauling Fishery (OHF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | NSW DPI reported during 2008 that they were developing refined compliance risk identification and assessment processes based on standardised risk assessment methodologies to better plan objective compliance services. [1]<br>A 2004 review of illegal fishing in NSW found no specific issues with sharks or the OTLF. [2] The report did however find under-reporting of catch figures by commercial fishers (the fisheries were not revealed), but that the management agencies acknowledged the problem and were putting systems in place to reduce this problem.<br>Rates of compliance during 2004/05 and 2005/06 were 96% and 96% respectively. [1] Details of compliance breaches were not reported. |
| | 2.11 Management history: | The OHF underwent strategic assessment during 2003, and 2008. The fishery is managed using both input and |

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| | | output controls through the NSW Fisheries Management Act 1994, the Fisheries Management (General) Regulation 2010, the Fisheries Management (Supporting Plan) Regulation 2006 and the Fisheries Management (Ocean Hauling Share Management Plan) Regulation 2006. [1] A fishery management strategy is in place for this fishery, that contains the vision, goals and objectives for the fishery, a broad description of the way the fishery operates, and outlines the future management framework. [3] It also outlines a program for monitoring the performance of the fishery against the management goals. [3] |
| | 2.12 Management plan or equivalent: | The OHF is managed under the Fisheries Management (Ocean Hauling Share Management Plan) Regulation 2006. [1] Performance of the fishery is reviewed against the fishery management strategy. [3] |
| | 2.13 Aim of harvest regime in management planning: | The objectives of the Fisheries Management (Ocean Hauling Share Management Plan) Regulation 2006 are to 1) contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to managing the impacts of the fishery on the environment and to ensuring ecologically sustainable development; and 2) contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to promoting viable commercial fishing. [4]<br>There goals of the fishery management strategy follow those of the Fisheries Management Act 1994, of which the main objective is to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. [3]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | The OHF has daily catch limits that apply to some species, but not sharks. [5]<br>Scalloped Hammerhead and Great Hammerhead are listed as Endangered and Vulnerable species respectively in NSW, and they can not be retained under NSW State managed fishing licences. [6] There are no catch limits for Smooth Hammerhead in the OHF. [7]<br>This factor was scored Uncertain because there is full protection for some species in this fishery, but no output controls in place for others. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are numerous State MPAs that overlap with the area of the OHF. Many of those MPAs contain multiple use areas, and some fishing methods used by the OHF are permitted in some zones. [8]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | While there is a ban on the take of Scalloped Hammerhead and Great Hammerhead[6], there are no restrictions on the take of Smooth Hammerhead (Oceanic Whitetip Shark and Porbeagle sShark are not discussed here because this in an inshore fishery). However, catch of sharks by the OHF is very low.<br>Shark finning is prohibited in NSW. [1]<br>A compliance program is in place, and rates of compliance during 2004/05 and 2005/06 were 96% and 96% respectively. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | OHF operators are required to complete daily catch and effort logbooks. [1] Fishers are required to report weight (either whole or processed) by species. Logbooks have |

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| | | the capacity to report numbers of fish. There is no capacity to report discards.<br>There have been at least two observer programs in the OHF, one targeting the beach netting sector and the other the garfish sector. [1] Report of the ocean netting sector is not publically available, but the garfish sector report describes sampling effort of 12 fishing days covering 31% of the effort during 2005–06. [10]<br>Population estimates are not available for any of the five listed shark species in this fishery, however CPUE data from the NSW Shark Meshing Program has been used to describe changes to relative abundance of hammerheads in NSW. [7] |
| | 2.20 Confidence in harvest monitoring: | The only information on logbook validation for the OHF was for the garfish sector. [10] This report found numerous problems including poor correlation of catch and effort between monthly returns and daily logbooks, under-reporting, fishing during closed seasons and in closed areas, and fishing in areas using prohibited fishing gear.<br>There have been at least two observer programs, however information on only one of those programs was publically available, and described sampling effort of 12 fishing days covering 31% of the effort during 2005–06. [10]<br>Commercial data by NSW DPI identified the sharks to species level.<br>Observer data has not been provided. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches of the five species of interest are very low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many MPAs in the area of the OHF that contain areas where the fishery can not operate. Determination of the proportion of the strictly protected area in the area of the OHF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and rates of compliance during 2004/05 and 2005/06 were 96% and 96% respectively[1], however details for the compliance breaches are not available, and it is unknown if any of those related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through daily catch limits for some species, and Scalloped Hammerhead and Great Hammerhead can not be landed. [6]<br>Input management measures used to control effort include limited entry, restrictions on gear (type and size) closed areas and vessel size. [1] |
| **Risk assessment** | ERA conducted for the OHF did not consider sharks, likely because species of sharks and rays are only occasionally taken in small quantities. [11] | |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers could be implemented for the listed shark species other Scalloped and Great Hammerhead.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Collect more recent observer data to describe species composition of the catch and quantify discards. Ensure any catch of the five species of interest is reported at species level in the logbooks.<br>2.26 Implement trip limits for the listed shark species other Scalloped and Great Hammerhead, and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Anon. 2008. Submission to the Department of the Environment, Heritage, Water and the Arts on behalf the NSW fishing industry seeking ongoing export approval for the NSW Ocean Hauling Fishery – February 2008. NSW Department of Primary Industries.<br>2. Palmer, M. 2004. Report on Illegal Fishing for Commercial Gain or Profit in NSW. Department of Primary Industries, Sydney.<br>3. Anon. 2003. Fishery Management Strategy for the Ocean Hauling Fishery. NSW Fisheries.<br>4. Fisheries Management (Ocean Hauling Share Management Plan) Regulation 2006 (current as of | |

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| | 15 December 2006 – accessed July 2013)<br>5. 2003. Assessment of the New South Wales Ocean Hauling Fishery. Department of the Environment and Heritage, Canberra.<br>6. Fisheries Management Act 1994 No 38. (Current version for 20.11.2012 to date (generated on 18.07.2013)<br>7. Anon. 2012. Proposed determination, The Smooth Hammerhead – *Sphyrna zygaena* as a vulnerable species. Fisheries Scientific Committee, July 2012.<br>8. http://www.mpa.nsw.gov.au<br>9. Anon. 2011. Fisheries Management Act 1994 Section 8 Notification – Fishing Closure, Prohibition of Shark Finning. NSW DPI Official Notices, 2 September 2011.<br>10. Stewart, J. 2007. Observer study in the Estuary General sea garfish haul net fishery in NSW. NSW Department of Primary Industries, Sydney.<br>11. Anon. 2002. Ocean Hauling Fishery Environmental Impact Statement Public Consultation Document. NSW Fisheries, Sydney. | |
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| **NSW – Ocean Trap & Line Fishery (OTLF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Industry and Investment reported during 2009 that they were developing refined compliance risk identification and assessment processes based on standardised risk assessment methodologies to better plan objective compliance services. [1]<br>A 2004 review of illegal fishing in NSW found no specific issues with sharks or the OTLF. [10] The report did however find under-reporting of catch figures by commercial fishers (the fisheries were not revealed), but that the management agencies acknowledged the problem and were putting systems in place to reduce this problem.<br>Rates of compliance during 2006/07 and 2007/08 were 89% and 86% respectively. [1] Details of compliance breaches were not reported. |
| | 2.11 Management history: | The OTLF underwent strategic assessment during 2006, and 2010. The fishery is managed using both input and output controls through the NSW Fisheries Management Act 1994, NSW Fisheries Management (General) Regulation 2002, NSW Fisheries Management (Supporting Plan) Regulation 2006 and the NSW Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006. [2] A fishery management strategy is in place for this fishery, that contains the vision, goals and objectives for the fishery, a broad description of the way the fishery operates, and outlines the future management framework. It also outlines a program for monitoring the performance of the fishery against the management goals. [3] |
| | 2.12 Management plan or equivalent: | The OTLF is managed under the NSW Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006. [2] Performance of the fishery is reviewed against the fishery management strategy. [3] |
| | 2.13 Aim of harvest regime in management planning: | The objectives of the NSW Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 are to 1) contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to managing the impacts of the fishery on the environment and to ensuring ecologically sustainable development; and 2) Contribute, in conjunction with other fishing regulatory controls (as defined in section 7A of the Act), to promoting viable commercial fishing. [4]<br>There are seven goals of the fishery management strategy. They are 1) manage the OTLF in a manner that promotes the conservation of biological diversity in the marine environment; 2) maintain stocks of primary and key secondary species harvested by the OTLF at sustainable levels; 3) promote the conservation of threatened species, populations and ecological communities and protected species of fish likely to be impacted by the operation of the OTLF; 4) appropriately share the resource and carry out fishing in a manner that minimises negative social |

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| | | impacts; 5) promote a viable commercial fishery, consistent with ecological sustainability; 6) facilitate effective and efficient compliance, research and management of the OTLF; and 7) improve knowledge about the OTLF and the resources on which it relies. [3]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | The OTLF has daily catch limits (or trip limits) that apply to a range of species taken from NSW waters. For a number of sharks, including Whaler sharks (includes Oceanic Whitetip Shark), Mackerel sharks (includes Porbeagle Sharks) and Hammerhead sharks a weekly catch limit of 750 kg whole or 500 kg processed is in place[5]. Further, if the total annual catch of sharks reaches 70 t, bycatch limits of two carcases per week are imposed[6]. If the annual catch reaches 85.9 t, no landing of sharks will be permitted. [6]<br>Scalloped Hammerhead and Great Hammerhead are listed as Endangered and Vulnerable species respectively in NSW, and they can not be retained under NSW State managed fishing licences. [13] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are numerous State and Commonwealth MPAs that overlap with the area of the OTLF. Many of those MPAs contain multiple use areas, and some fishing methods used by the OTLF are permitted in some zones. [7]<br>Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There are weekly trip limits in place to restrict the catch of sharks in the OTLF. [5] Additional catch limits are imposed if the annual catch of sharks exceeds 70 t, and landing of shark if prohibited if the annual catch exceeds 85.9 t. [6]<br>Shark finning is prohibited in the OTLF. [1]<br>A compliance program is in place, and rates of compliance during 2006/07 and 2007/08 were 89% and 86% respectively. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | OTLF operators are required to complete daily catch and effort logbooks[1]. Fishers are required to report weight (either whole or processed) by species. Logbooks have the capacity to report numbers of fish. There is no capacity to report discards.<br>Two scientific observer programs have been undertaken to collect data on the species composition of the discarded catch, as well as the level of discarding[2]. During one of those programs, 114 fishing days were observed during 2008–2009, equating to 37% coverage for the areas sampled (northern NSW)[8]. This program observed small quantities of both Smooth and Scalloped Hammerhead in the catches. The other program had sampled 214 fishing trips as of summer 2009[1].<br>Population estimates are not available for any of the five listed shark species in this fishery, however CPUE data from the NSW Shark Meshing Program has been used to describe changes to relative abundance of hammerheads in NSW[6]. |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the OTLF is subject to ongoing validation. [1]<br>There have been two observer programs that observed 114 fishing days and 214 fishing trips respectively[8,1]. A detailed report is available for only one of those programs, and the report for the other is nearing completion.<br>Commercial data provided separated each of the five |

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| | | shark to species level.<br>Observer data has not been provided, however the report that is publically available describes each of the shark species to species levels. [8] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches of the five species of interest are low. During 2009–12, total catches of Smooth Hammerhead, Scalloped Hammerhead, Great Hammerhead, Porbeagle Shark and Oceanic Whitetip Shark were 3.9 t, 8.8 t, 4.1 t, 0.4 t and 0.5 t respectively. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many MPAs in the area of the OTLF that contain areas where the fishery can not operate. Determination of the proportion of the strictly protected area in the area of the OTLF would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | A compliance program is in place, and rates of compliance during 2006/07 and 2007/08 were 89% and 86% respectively[1], however details for the compliance breaches are not available, and it is unknown if any of those related to breaches of regulated waters conditions. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through trip/weekly limits for some species including sharks. [5] Annual catch limits are also in place that trigger increasingly precautionary catch limits. Wire trace line prohibited within three nautical miles of the natural coastline, which reduces shark catch. [2] Input management measured used to control effort include limited entry and restrictions on gear (type and size)[2]. |
| **Risk assessment** | ERA considered Sharks (mixed) as High risk, with a High fishery impact profile and Moderately low resilience. [1] | |
| **Recommendations** | 2.14 There are reasonably strong controls on shark captures in this fishery. If they were to be strengthened at all, separate trip limits and maximum size limits for the listed shark species other Scalloped and Great Hammerhead could be introduced.<br>2.19 Provide facility to report discards in commercial logbooks. | |
| **References** | 1. Anon. 2009. Submission to the Department of the Environment, Heritage, Water and the Arts on behalf the NSW fishing industry seeking ongoing export approval for the NSW Ocean Trap and Line Fishery – March 2009. Industry and Investment NSW.<br>2. Anon. 2010. Assessment of the New South Wales Ocean Trap and Line Fishery. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Cronulla.<br>3. Anon. 2006. Fishery Management Strategy for the NSW Ocean Trap and Line Fishery. NSW Department of Primary Industries.<br>4. Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (current as of 3 March 2011 – accessed July 2013)<br>5. New South Wakes Government Gazette No. 9. Page 95.<br>6. Fisheries Scientific Committee. (2012). Proposed Determination, The Smooth Hammerhead – Sphyrna zygaena as a Vulnerable Species. NSW Department of Primary Industries, NSW.<br>7. http://www.mpa.nsw.gov.au<br>8. Macbeth, W.G., Geraghty, P.T., Peddemors, V.M. and Gray, C.A. (2009). Observer-based study of targeted commercial fishing for large shark species in waters off northern New South Wales. Industry & Investment NSW.<br>9. Anon. 2006. Ocean Trap and Line Fishery, Environmental Impact Statement, Public Consultation Document. NSW Department of Primary Industries, NSW.<br>10. Palmer, M. 2004. Report on Illegal Fishing for Commercial Gain or Profit in NSW. Department of Primary Industries, Sydney.<br>11. Fisheries Management Act 1994 No 38. (Current version for 20.11.2012 to date (generated on 18.07.2013) | |
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| **Queensland – River and Inshore Beam Trawl Fishery (RIBTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | A compliance risk assessment (CRA) was completed for Queensland's East Coast Trawl Fisheries in 2005 and again in 2008–09. [1]<br>During 2009, a total of 31 units were inspected in the RIBTF. Of these, 29 were commercial vessel inspections. |

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| | | The remaining inspections were of marketer premises. No offences were detected during 2009. [1]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the RIBTF area. [2] Estimates are not available specifically for the RIBTF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] |
| | 2.11 Management history: | The RIBTF underwent strategic assessment during 2006, 2009, and 2011. The fishery is managed using both input and output controls through the Fisheries (East Coast Trawl) Management Plan 2010, Queensland Fisheries Act 1994 and the Queensland Fisheries Regulation 2008. [3] A performance measurement system is in place for this fishery. [4] |
| | 2.12 Management plan or equivalent: | The RIBTF is managed under the Fisheries (East Coast Trawl) Management Plan 2010. [5] Performance of the fishery is regularly reviewed against the performance measurement system. [1,4] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Fisheries (East Coast Trawl) Management Plan 2010 is the same as that for the Fisheries Act 199 . That is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote ecologically sustainable development." [5]<br>Objectives of the performance measurement system relating to bycatch are: plan objective - ensure the sustainability of the east coast trawl fishery's ecological systems; and operational objective - minimise risk to benthic communities in east coast trawl fisheries while providing for an economically viable commercial fishery. [4]<br>This objective does not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | The IBTF can only take "principle fish" and "permitted fish". None of the five listed shark species fall under those categories. [5]<br>While this description does not match any of the options for this factor, no take could be considered to be the most conservative "quota" possible. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There is a large overlap in the areas of the RIBTF and MPAs including the GBRMP, and it is likely that some of the shark bycatch comes from within these MPAs, however the fishery largely operates in rivers and creeks outside of the GBRMP. [3] Spatial analysis of catch and effort data is required to determine the bycatch of sharks within MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Sharks are not permitted to be landed by the RIBTF. Mandatory use of BRDs and TEDs in areas other than a river or creek. [1] No vessels in the RIBTF were prosecuted for contravening a condition of an authority regarding the use of TEDs and BRDs. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | RIBTF operators are required to complete daily catch and effort logbooks. [1] There is no facility to report discards in |

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| | | logbooks.<br>Observer coverage during 2007 was 15 days (0.5% of effort). [3] During 2009 and 2010, 7 and 14 observer days were completed. [1] No days were allocated to observer coverage of this fishery in 2011. [1]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [6]<br>Performance measures relating to bycatch are assessed annually, based on compliance of use of BRDs and TEDs. [1] There was 100% compliance during 2009 and 2010. [1] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the RIBTF completed in 2007. [1]<br>There is an observer program that monitored 7 days in 2009, but 15 days during 2010. [1]<br>There was only a small number of Hammerhead Sharks, Scalloped Hammerheads and Whaler and Weasel Sharks reported in observer data. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however weight is often not reported. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observer catches of the five species of interest are very low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the RIBTF that contain areas where the fishery can not operate, however the proportion of the strictly protected area in the area of the RIBTF was not found, and would require spatial analysis that is outside the scope of this project. 66% of the GBRMP is closed to trawling. [3] |
| | 2.25 Effectiveness of strict protection measures: | There were compliance breaches for contravening a regulated waters declaration during 2009 and 2010. [1] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through possession limits for some species and restriction to landing principle and permitted species. [1] No sharks are principle or permitted species. Input management measured used to control effort include limited entry and restrictions on gear (type and size) vessels. TEDs and BRDs are used to reduce bycatch including large sharks. [1] |
| **Risk assessment** | An ERA was conducted for the RIBTF during 2010–11, however that ERA is unpublished. [1] | |
| **Recommendations** | 2.10 Estimate IUU catch<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve species identification of observers. Required estimation of weight in observer records. | |
| **References** | 1. Anon. 2011. Annual status report 2011, River and Inshore Beam Trawl Fishery. State of Queensland.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2009. Assessment of the River and Inshore Beam Trawl Fishery. Department of Environment, Water, Heritage and the Arts, Canberra.<br>4. Anon. 2009. Performance Measurement System, East Coast Trawl. Queensland Government, Brisbane.<br>5. Fisheries (East Coast Trawl) Management Plan 2010. (Current as at 21 December 2012).<br>6. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland. | |
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| **Queensland – Gulf of Carpentaria Inshore Fin Fish Fishery (GOCIFFF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | A compliance risk assessment for the GOCIFFF was completed in April 2006.<br>During 2010, 3558 inspections were carried out including 52 commercial net fishing vessel inspections. [3] Only 1 offence was reported for commercial fishers, and that was |

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| | | for failing to submit logbooks on time. [3]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the GOCIFFF area. [2] Estimates are not available specifically for the GOCIFFF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2]<br>In 2010, there were two apprehensions recorded by the Australian Fisheries Management Authority within both the eastern and western vertical lines encapsulating the Gulf of Carpentaria boundaries. Both vessels came from Merauke. One vessel was a Type 3 Indonesian shark boat, the other being a Type 4 Indonesian shark boat. Both vessels were apprehended very close to the 200 nm mile line and not deep within the GOC.. [3] |
| | 2.11 Management history: | The GOCIFFF underwent strategic assessment during 2004, 2007, and 2010. The fishery is managed using both input and output controls through the Fisheries (Gulf of Carpentaria Inshore Fin Fish) Management Plan 1999 (Gulf Management Plan), Queensland Fisheries Act 1994 and the Queensland Fisheries Regulation 2008. [3] A performance measurement system is in place that has under gone review. [4] |
| | 2.12 Management plan or equivalent: | The GOCIFFF is managed under the Fisheries (Gulf of Carpentaria Inshore Fin Fish) Management Plan 1999 (Gulf Management Plan). [4] Performance of the fishery is regularly reviewed against the performance measurement system. [3,4] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Gulf Management Plan are to (a) maintain inshore fin fish stocks at sustainable levels; and (b) protect spawning target species; and (c) minimise unintended adverse effects of fishing on protected wildlife; and (d) provide a viable commercial fin fish net fishery that gives economic and social benefits to the local, regional and State economies; and (e) provide a recreational fishery that gives economic and social benefits to the local and regional economies; and (f) satisfy the traditional or customary fishing needs of Aborigines and Torres Strait Islanders. [5]<br>There are specific objectives in the Performance Measurement System relating to whaler and hammerhead sharks. These are described in 2.19.<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | Queensland Fisheries have implemented an annual Total Allowable Commercial Catch of 600 t of sharks for all fisheries combined. [6] There are no possession or trip limits for any of the shark species of interest in the GOCIFFF. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are currently no multi-use MPAs in the area of the GOCIFFF that allow fishing. When managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014 [7], commercial fishing including that undertaken by the GOCIFFF may be allowed in certain management zones. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There are no possession or trip limits for any of the shark |

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| | | species of interest in the GOCIFFF. There is a maximum size limit of 150 cm for sharks and rays. [8] It is an offence for a fisher to possess a shark or ray fin on a boat without also possessing the body (including trunk or fillets) of the same shark or ray. [8] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | **Quantitative indices**. GOCIFFF operators are required to complete daily catch and effort logbooks. [8] Logbooks require reports of number, weight and form of sharks. Hammerhead Sharks is one of the species pre-printed on both logbooks used in this fishery. There is no facility for reporting discards.<br>Totals of 61 and 0 observer days were monitored by during 2009 and 2010 respectively. [9,3]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [6]<br>There are performance measures in place specifically for whaler and hammerhead sharks that relate to the trends in standardised catch rates and number of licences for which shark exceed 20% of the total catch. [3] There performance measures are assessed annually. |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the GOCIFFF has not been carried out. [3]<br>There is an observer program that monitored 61 days in the fishery during 2009 [9], but 0 days during 2010. [3]<br>All hammerhead shark reported in 2005 and 2006 commercial logbooks, and some of that reported in 2007 was reported as "Shark – scalloped hammerhead". Most of that reported in 2007 logbook, and all since has been reported as "Hammerhead sharks". A small amount of "Shark – whaler unspecified" was also landed, which may have included some Oceanic Whitetip Shark (however no Oceanic Whitetip Shark were reported in observer data).<br>Nearly all of the hammerhead shark reported in observer data was identified to species, and included both Great Hammerhead and Scalloped Hammerhead. There were small numbers of "Hammerhead Sharks" and "whaler and weasel shark". The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however weight is often not reported.<br>Use of VMS was not reported, so we assume it is not used in this fishery. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catches of the five species of interest are very low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are many area within the fishery closed to commercial fishing. There are 24 of those areas outlined in the commercial fishing handbook. [8] The area of the fishery that these closures cover requires spatial analysis which is outside the scope of this project.<br>When managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014 [7], commercial fishing including that undertaken by the GOCIFFF may be prohibited in certain management zones. |
| | 2.25 Effectiveness of strict protection measures: | During 2010, there were no offences reported relating to fishing in prohibited waters. [3] |
| | 2.26 Regulation of harvest effort: | There are no possession or trip limits for any of the shark species of interest in the GOCIFFF. Input management measured used to control effort include limited entry and restriction on gear (type and size) and vessel size and |

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| | | special and temporal closures. [3] |
| **Risk assessment** | ERA for the GOCIFFF treated offshore and inshore netting sectors separately. [10] For the offshore sectors, Hammerheads (*Sphyrnidae*) and Other Whalers (*Carcharhinidae*) were assigned a risk rating for impact on breeding stock of Moderate. Sharks and Rays (*Lamniformes* and *Rajiformes*) were assessed together for the inshore sector, and not assigned a risk rating o, but referred the reader to an earlier ERA.<br>A more recent ERA found that for both the offshore and inshore netting sectors of the GOCIFFF, Great Hammerhead had susceptibility and recovery ranks above 2.33, and were amongst the least sustainable species in this fishery. [11] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records. | |
| **References** | 1. Anon. 2007 Assessment of the Gulf of Carpentaria Inshore Fin Fish Fishery. Department of, Environment and Water Resources, Canberra.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2011. Annual status report, Gulf of Carpentaria Inshore Fin Fish Fishery 2011. State of Queensland.<br>4. Anon. 2008. Interim Performance Measurement System, Gulf of Carpentaria Fin Fish Fisheries. Department of Primary Industries and Fisheries, Brisbane.<br>5. Fisheries (Gulf of Carpentaria Inshore Fin Fish) Management Plan 1999 (Subordinate Legislation 1999 No. 55)<br>6. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>7. http://www.environment.gov.au/marinereserves/north/index.html<br>8. Anon. 2011. Guidelines for Commercial operators in the Gulf of Carpentaria Inshore Fin Fish Fishery. Department of Employment, Economic Development and Innovation, Brisbane.<br>9. Anon. 2010. Annual status report, Gulf of Carpentaria Inshore Fin Fish Fishery 2010. State of Queensland.<br>10. Zeller, B. and Snape, N. (2006). Ecological Risk Assessment of Queensland-Managed Fisheries in the Gulf of Carpentaria. Department of Primary Industries and Fisheries, Brisbane, Queensland.<br>11. Salini, J., McAuley, R., Blaber, S., Buckworth, R., Chidlow, J., Gribble, N., Ovenden, J., Peverell, S., Pillans, R., Stevens, J., Stobutzki, I., Tarca, C., Walker, T. 2007, Northern Australian sharks and rays: the sustainability of target and bycatch species, phase 2. Final Report on FRDC Project 2002/064. FRDC & CSIRO. ACT. | |
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| **Queensland – Gulf of Carpentaria Developmental Fin Fish Trawl Fishery (GCDFFTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Information on compliance risk assessments and a risk-based compliance strategy was not found.<br>During 2009, the Queensland Boating and Fisheries Patrol conducted two inspections in the GCDFFTF with no offences detected. [1]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the GCDFFTF area. [2] Estimates are not available specifically for the GCDFFTF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2]<br>In 2009, only one Illegal, Unreported and Unregulated (IUU) incursion was recorded by the AFMA in the Gulf of Carpentaria. [3] |
| | 2.11 Management history: | The GCDFFTF underwent strategic assessment during 2004, 2007, and 2010. [4] The fishery is managed using both input and output controls through the Queensland Fisheries Act 1994 and the Queensland Fisheries Regulation 2008. [4] A performance measurement system is in place that has under gone review. [1] |

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| | 2.12 Management plan or equivalent: | The GCDFFTF is managed under the Queensland Fisheries Act 1994. [4] Performance of the fishery is reviewed annually against the performance measurement system. [1,5] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Fisheries Act 199 is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote ecologically sustainable development." [6]<br>The objectives of the Performance Measurement System are: target species - ensure a sustainable yield from crimson snapper and saddletail snapper (red snapper) stocks; byproduct species - ensure the sustainability of by-product species taken in the GOCDFTF; bycatch species - reduce the level of bycatch (including undersized target and by-product species) taken in the GOCDFTF and ensure the sustainability of sawfish, sharks and rays taken as bycatch. [5]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | A TAC is set for the target species of the GOCDFTF, and there are possession limits for some byproduct species[4]. Sharks are not permitted to be retained in this fishery[4]. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are currently no multi-use MPAs in the area of the GOCDFTF that allow fishing. When managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014 [7], commercial fishing including that undertaken by the GOCDFTF may be allowed in certain management zones. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Sharks are not permitted to be landed by the GOCDFTF. [4] The use of BRDs and TEDs have been trialled, [1] and BRDs are used voluntarily. [4] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | GOCDFTF operators are required to complete daily catch and effort logbooks, which includes the capacity to report total discards. [1] Only weight and not numbers are reported.<br>A total of 9 observer days were monitored by during 2009. [1]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [8] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the GOCDFTF was carried out during 2007. [1]<br>There is an observer program that monitored 9 days in the fishery during 2009. [1] Only a very small amount of Great Hammerhead and Scalloped Hammerhead were reported in the observer data from this fishery, all identified to species. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however weight is often not reported.<br>Use of VMS was not reported, so we assume it is not used in this fishery. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported bycatch of the five species of interest are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |

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| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are currently no areas within this fishery closed to trawling, however when managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014 [7], commercial fishing including that undertaken by the GOCDFTF may be prohibited in certain management zones. |
| | 2.25 Effectiveness of strict protection measures: | There are currently no areas within this fishery closed to trawling. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACs for target species, possession limits for bycatch species and a zero take of shark species. [4] Input management measured used to control effort include limited entry and restriction on gear (type and size) and vessel size. [4] The use of BRDs and TEDs have been trialled, [1] and BRDs are used voluntarily. [4] |
| **Risk assessment** | ERA for the GOCDFTF considered Sharks and Rays together, and noted that the annual catch is estimated at "a few tonnes", and that there is a nil in-possession limit for those animals. [9] A risk for impact on the breeding stock was rated as Moderate. | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.20 Improve reporting of shark weight in observer records. | |
| **References** | 1. Anon. 2010. Annual status report 2010, Gulf of Carpentaria Developmental Fin Fish Fishery. State of Queensland.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2010. Gulf of Carpentaria Developmental Fin Fish Trawl Fishery 2010, Progress against DEWHA conditions and recommendations. State of Queensland.<br>4. Anon. 2011 Assessment of the Gulf of Carpentaria Developmental Fin Fish Trawl Fishery. Department of Sustainability, Environment, Water, Population and Communities, Canberra.<br>5. Anon. 2008. Interim Performance Measurement System, Gulf of Carpentaria Fin Fish Fisheries. Department of Primary Industries and Fisheries, Brisbane.<br>6. Fisheries Act 1994 (Current as at 22 November 2012)<br>7. http://www.environment.gov.au/marinereserves/north/index.html<br>8. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>9. Zeller, B. and Snape, N. (2006). Ecological Risk Assessment of Queensland-Managed Fisheries in the Gulf of Carpentaria. Department of Primary Industries and Fisheries, Brisbane, Queensland. | |
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| **Queensland – Fin Fish (Stout Whiting) Trawl Fishery (FFTF) Gulf of Carpentaria Developmental Fin Fish Trawl Fishery** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessments and a risk-based compliance strategy have been implemented in the FFTF. [1] Compliance is reported annually in fishery status reports, and during 2009, seven inspections were conducted which resulted in 4 fisheries infringement notices. [1]<br>Current illegal fishing by foreign vessels is unknown, but is likely to be low because of the location. |
| | 2.11 Management history: | The FFTF underwent strategic assessment during 2004, 2007, and 2011. The fishery is managed using both input and output controls through the Queensland Fisheries Act 1994 and the Queensland Fisheries Regulation 2008. [3] Management arrangements have undergone review, and a performance measurement system is in place. [4] |
| | 2.12 Management plan or equivalent: | The FFTF is managed under the Queensland Fisheries Act 1994. [3] Performance of the fishery is reviewed annually against the performance measurement system. [3,5] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Fisheries Act 199 is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote |

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| | | ecologically sustainable development." [6]<br>The objectives of the Performance Measurement System are: target species - ensure stocks of target species are maintained or improved; bycatch species - Minimise the level of bycatch (including protected species) in the FFTF. [5]<br>These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | A TACC is set for the target species of the FFTF, and fishers can only retain certain "permitted species". No sharks are target or permitted species. [3] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There appears to be some overlap of the area of the FFTF with the Morton Bay MP and the Great Sandy MP, however the extent of the catch that comes from within the MPs requires spatial analysis of the catch data. [1,7] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Sharks are not permitted to be landed by the FFTF. [1] The use of TEDs is compulsory except when using Danish seine gear. [1] There were no breaches of compliance related to use of TEDs during 2009. [1] VMS is required on all vessels. [3] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | FFTF operators are required to complete daily catch and effort logbooks, which includes the capacity to report discards. [1] Discarded sharks are not reported to species, but as "Shark – other than SOCI" (Species of Conservation Interest). Only weight and not numbers are reported.<br>Totals of 19 and 94 days were monitored by observers in the FFTF during 2009 and 2010 respectively. [1]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [8] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the FFTF was carried out during 2007. [1]<br>There is an observer program that monitored 94 days in the fishery during 2010. [1] Only a very small amount of Scalloped Hammerhead were reported in the observer data from this fishery, all identified to species. There was also a very small amount of "Whaler and Weasel Sharks" reported, some of which may include Oceanic Whitetip Shark, however none was reported in the observer data. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however weight is often not reported.<br>VMS is compulsory on FFTF vessels. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported bycatch of the five species of interest are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There is some overlap between are the area of the FFTF with the Morton Bay MP and the Great Sandy MP, however it does not appear that the overlap contains areas that prohibit trawling. [1,7] |
| | 2.25 Effectiveness of strict protection measures: | During 2009, there were four Fisheries Infringement Notices issued in the FFTF, one of which was issued to commercial operators for contravening a regulated waters |

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| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACs for target species, annual and trip limits for permitted species and a zero take of shark species. [1] Input management measured used to control effort include limited entry and restriction on gear (type and size) and vessel size. [1] The use of TEDs is compulsory except when using Danish seine gear, to reduce bycatch including large sharks. [1,6] |
| **Risk assessment** | ERA for the FFTF did not assess the risk to any of the five listed shark species, or sharks in general. [2] Annual quantities of discarded bycatch were reported for Sharks as 3,312 kg and 42kg during 2001 and 2002 respectively. [2] | |
| **Recommendations** | 2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records. | |
| **References** | 1. Anon. 2011. Annual status report 2010, Fin Fish (Stout Whiting) Trawl Fishery. State of Queensland.<br>2. Zeller, B. (Ed). 2003. Ecological Assessment of the Queensland Fin Fish (Stout Whiting) Trawl Fishery. Department of Primary Industries and Fisheries, Brisbane.Anon. 2011 Assessment of the Queensland Fin Fish (Stout Whiting) Trawl Fishery. Department of Sustainability, Environment, Water, Population and Communities, Canberra.<br>3. Anon. 2010. Fin Fish (Stout Whiting) Trawl Fishery 2010, Progress against SEWPaC conditions and recommendations. State of Queensland.<br>4. Anon. 2007. Performance Measurement System, Finfish (Stout Whiting) Trawl Fishery. Department of Primary Industries and Fisheries, Brisbane.<br>5. Fisheries Act 1994 (Current as at 22 November 2012)<br>6. http://www.nprsr.qld.gov.au/marine-parks/index.html (accessed July 2013)<br>7. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>8. | |
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| **Queensland – East Coast Spanish Mackerel Fishery (ECSMF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessments and a risk-based compliance strategy have been implemented in the ECSMF[1.] Compliance is reported annually in fishery status reports, and during 2009–10, overall compliance rate was 97%. [2] Illegal fishing by foreign vessels has been reported in the vicinity of the ECSMF area. [3] Estimates are not available specifically for the ECSMF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [3] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The ECSMF underwent strategic assessment during 2004, 2007, and 2012. The fishery is managed using both input and output controls through the Queensland Fisheries Act 1994 and the Queensland Fisheries Regulation 2008. [4] Management arrangements have undergone review, and a performance measurement system is in place. [5] |
| | 2.12 Management plan or equivalent: | The ECSMF is managed under the Fisheries Act 1994 and the Fisheries Regulation 2008. [2] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Fisheries Act 199 is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote ecologically sustainable development." [6]<br>The objectives of the Performance Measurement System are: target species - Ensure that Spanish mackerel stocks are maintained and improved; bycatch species - Maintain an acceptable bycatch ratio in the commercial fishery, and to minimise the impact of the Spanish mackerel Fishery operations on protected species. [5] |

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| | | These objectives do not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | Catch of Spanish Mackerel is managed through a TAC in the ECSMF[2]. One of the performance measures of the Performance Measurement System is that discards do not exceed 10% of the total catch when targeting Spanish Mackerel. [5]<br>Queensland Fisheries have implemented an annual Total Allowable Commercial Catch of 600 t for all sharks for all fisheries combined. [7] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There is a large overlap in the areas of the ECSMF and the GBRMP, and while it is likely that some of the shark bycatch comes from within the GBRMP, spatial analysis of catch and effort data is required to determine this. [2] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | A Performance Measurement System is in place that has performance measures related to discarded bycatch. [5] This is monitored through an observer program. [2] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | ECSMF operators are required to complete daily catch and effort logbooks, reporting processed weight and number of fish. There is no facility to report discards in logbooks.<br>No observer days were achieved for the ECSMF during 2008–09 because during the trips undertaken with the intention of sampling the ECSMF, the main species landed was Spotted Mackerel which transferred the observer coverage to the ECIFFF. [2] During 2010–11, 57 observer days were undertaken in the ECSMF. [4]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [8] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the ECSMF was carried out during 2007. [2]<br>There is an observer program that monitored 57 days in the fishery during 2010–11. [4]<br>Only a very small amount of hammerheads were reported in the logbook data from this fishery. All records from 1998–2006 were identified to species (Scalloped Hammerhead) and since 2008, all were reported as "Hammerhead Sharks". Data from 2007 contained records of both Scalloped Hammerhead and "Hammerhead Sharks". Discussions with a Qld fisheries manager suggest that this reduction in resolution was brought about from changes to logbook forms. "Shark - whaler unspecified" were reported in commercial catches, some of which may include Oceanic Whitetip Shark. There were no observer reported catches of the five shark species of interest. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported bycatch of the five species of interest are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the ECSMF that contain areas where the fishery can not operate, however the proportion of the strictly protected area in the area of the ECIFFF was not found, and would require spatial analysis |

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| | | that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | During 2009, there were no compliance breaches reported for contravening a regulated waters declaration by ECOTF commercial operators. [2] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TAC for target species[2], and there are performance indicators for discarded bycatch[5]. Input management measured used to control effort include limited entry and restriction on gear (type and size), vessel size and the number of tender boats used. [4] |
| **Risk assessment** | E A did not explicitly address any of the five listed shark species, but did consider "Sharks (not including Grey Nurse Shark)". Despite the low frequency of captures, sharks were assigned a low-moderate risk because of the "ecological characteristics" of sharks in general. [9] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Provide facility to report shark species and discards in commercial logbooks. | |
| **References** | 1. Anon. 2009. Annual status report 2009, East Coast Spanish Mackerel Fishery. State of Queensland.<br>2. Anon. 2010. Annual status report 2010, East Coast Spanish Mackerel Fishery. State of Queensland.<br>3. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>4. Anon. 2012. Assessment of the East Coast Spanish Mackerel Fishery. Department of Sustainability, Environment, Water, Population and Communities, Canberra.<br>5. Anon. 2011. Performance Measurement System, East Coast Spanish Mackerel Fishery. Queensland Government.<br>6. Fisheries Act 1994 (Current as at 22 November 2012)<br>7. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>8. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>9. Anon. 2005. Report on the Bycatch and byproduct risk assessment for the East Coast Spanish Mackerel Fishery. Department of Primary Industries and Fisheries, Brisbane. | |
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| **Queensland – East Coast Otter Trawl Fishery (ECOTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessments and a risk-based compliance strategy have been implemented in the ECOTF. [1] Compliance is reported annually in fishery status reports, and during 2010, overall compliance rate was 85%. [1]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the ECOTF area. [2] Estimates are not available specifically for the ECOTF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The ECOTF underwent strategic assessment during 2004, 2007, and 2010. The fishery is managed using both input and output controls through the Fisheries (East Coast Trawl) Management Plan 2010 [3], which replaced the Fisheries (East Coast Trawl) Management Plan 1999. [4] There is a performance measurement system in place, and management arrangements have undergone review. [4] |
| | 2.12 Management plan or equivalent: | The ECOTF is managed under the Fisheries (East Coast Trawl) Management Plan 2010. [3] |
| | 2.13 Aim of harvest regime in management | The objective of the Fisheries (East Coast Trawl) |

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| | planning: | Management Plan 2010 is the same as that for the Fisheries Act 199 . That is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote ecologically sustainable development." [3]<br>Objectives of the performance measurement system for bycatch are to: ensure the sustainability of the east coast trawl fishery's ecological systems, and minimise the catch of non-target species (including protected species) in east coast trawl fisheries. [4]<br>These objectives do not match any of the options for this factor, however they could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | The ECOTF can only take "principle fish" and "permitted fish". None of the five listed shark species fall under those categories. [3]<br>While this description does not match any of the options for this factor, no take could be considered to be the most conservative "quota" possible. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There is a large overlap in the areas of the ECOTF and MPAs including the GBRMP, and while it is likely that some of the shark bycatch comes from within the GBRMP, spatial analysis of catch and effort data is required to determine this. [1] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Sharks are not permitted to be landed by the ECOTF. The use of TEDs and BRDs are compulsory, which reduces incidental bycatch. Compliance in the use of TEDs and BRDs is high. [2] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | ECOTF operators are required to complete daily catch and effort. There is no facility to report discards in current logbooks.<br>A total of 138 days were monitored by observers in the ECOTF during 2010. [1]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [5] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation for the ECOTF was carried out during 2007. [1]<br>There is an observer program that monitored 138 days in the fishery during 2010. [1] Only a very small amount of hammerheads were reported in the observer data from this fishery, about half of which was not identified by species. Similarly, there was a very small amount of "Whaler and Weasel Sharks" reported, some of which may include Oceanic Whitetip Shark. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however weight is often not reported.<br>VMS is compulsory on ECOTF vessels. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported bycatch of the five species of interest are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the ECOTF that contain areas where the fishery can not operate, however the |

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| | | proportion of the strictly protected area in the area of the ECIFFF was not found, and would require spatial analysis that is outside the scope of this project. 66% of the GBRMP is closed to trawling. [1] VMS is compulsory on ECOTF vessels. [1] |
| | 2.25 Effectiveness of strict protection measures: | During 2010, there were 23 Fisheries Infringement Notices and 5 cautions issued to ECOTF commercial operators for contravening a regulated waters declaration. [1] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACs for target species, and trip limits and a zero take of shark species. [1] Input management measured used to control effort include limited entry and gear (type and size) restrictions. TEDs and BRDs are used to reduce bycatch including large sharks. [1,6] |
| **Risk assessment** | An ERA has been conducted for the ECOTF in the GBRMP, which considered 33 sharks and rays that were thought could potentially be impacted by the fishery. None of the species of interest were included[7]. | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.19 Provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records | |
| **References** | 1. Anon. 2011. Annual status report 2011, East Coast Otter Trawl Fishery. State of Queensland.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Fisheries (East Coast Trawl) Management Plan 2010 (Current as at 21 December 2012<br>4. Anon. 2009. Performance Measurement System, East Coast Trawl Fishery. Queensland Government.<br>5. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>6. Pears, R.J., Morison, A.K., Jebreen, E.J., Dunning, M.C., Pitcher, C.R., Courtney, A.J., Houlden, B. and Jacobsen, I.P. 2012, Ecological risk assessment of the East Coast Otter Trawl Fishery in the Great Barrier Reef Marine Park: Summary report, Great Barrier Reef Marine Park Authority, Townsville. | |
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| **Queensland – East Coast Inshore Fin Fish Fishery (ECIFFF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessments and a risk-based compliance strategy have been implemented in the ECIFFF. [1] Compliance is reported annually in fishery status reports, and during 2009–10, compliance rate for the line sector (commercial and non-commercial) was 98%, that included 10 offences by five operators. [2] In the same year, compliance by the net sector (commercial and non-commercial) was 89%, of which 42 offences were by 26 different commercial operators. [2] No offences relating to illegal finning were detected in 2009–10. [2]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the ECIFFF area. [10] Estimates are not available specifically for the ECIFFF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [10] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The ECIFFF underwent strategic assessment during 2005, 2009, and 2012. The fishery is managed using both input and output controls through the Fisheries Act 1994 and the Fisheries Regulation 2008. [2] Management arrangements have undergone both internal and independent review, and there is a performance measurement system in place. [3, 4, 12] |
| | 2.12 Management plan or equivalent: | The ECIFFF is managed under the Fisheries Act 1994 and |

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| | | the Fisheries Regulation 2008. [2] |
| | 2.13 Aim of harvest regime in management planning: | The objective of the Fisheries Act 199 is "to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to (a) apply and balance the principles of ecologically sustainable development; (b) promote ecologically sustainable development." [5]<br>Objectives of the performance measurement system are: retained species – maintain commercial harvest of sharks at a precautionary level, maintain historical proportions of the harvest between "S" symbol holders and non-"S" symbol holders and reduce illegal finning at sea; bycatch – minimise the percentage of commercial catch that is bycatch. [12]<br>These objectives do not match any of the options for this factor, however they could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | Total allowable catches are used as management measures in the ECIFFF. There are possession limits in place for this fishery, but the limit depends on the fishery symbols attached to each particular license. Fishers without an S symbol are restricted to a possession limit of ten net-caught and four line-caught sharks. [2] Queensland Fisheries have implemented an annual Total Allowable Commercial Catch of 600 t all sharks for all fisheries combined. [2] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There is a large overlap in the areas of the ECIFFF and the GBRMP, and while it is likely that a high proportion of the catch comes from within the GBRMP, spatial analysis of catch and effort data is required to determine this. [6] At the year of publication (2006), the area of the GBRMP protected by closed green zones was 33.3% (114,530 km). [6] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Improvements to control of shark harvest were published during 2011, which included limiting the number of fishing operations authorised to take sharks and rays above incidental catch limits, a TACC of 600 t, maximum size limit of 150 cm, increased reporting requirements, restriction on the form of landed sharks and gear restrictions. [7] These incidental catch limits and size limits apply to the ECIFFF, but depend on the fishing symbols attached to the license. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | ECIFFF operators are required to complete daily catch and effort logbooks and must report catches of ECIFFF through the quota reporting system (which includes catch disposal records). There is no facility to report discards. "Whaler Shark" and "H/head Shark" are pre-filled species available on the logbook, and there is space left for writing the species name.<br>There is an observer program that monitored 97 days in the fishery during 2009–10. [2]<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [8] |
| | 2.20 Confidence in harvest monitoring: | Logbook validation has been carried by onboard observers for S symbol holders. [2] Percent of logbooks correctly completed during 2009–10 was >99% for both net and line sectors. [2] Since 2009, 85% of reported catch of hammerheads in the commercial logbooks were not identified to species. While there were small catches of Oceanic Whitetip Shark reported to species, there were |

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| | | large quantities of "Shark – whaler unspecified" reported, some of which may include Oceanic Whitetip Shark. There is an observer program that monitored 97 days in the fishery during 2009–10. [2] Only 8% of hammerheads reported by observers in the ECIFFF were not identified by species. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however, weights were often not reported. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | During 2009–10, catches of hammerhead and "whaler unspecified" (may include Oceanic Whitetip Shark) were 19 t and 58 t respectively. [2] |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the ECIFFF that contain areas where the fishery can not operate, however the proportion of the strictly protected area in the area of the ECIFFF was not found, and would require spatial analysis that is outside the scope of this project. At the year of publication (2006), the area of the GBRMP protected by closed green zones was 33.3% (114,530 km). [6] |
| | 2.25 Effectiveness of strict protection measures: | During 2009–10, there was only one caution and one Fisheries Infringement Notice given to a ECIFFF commercial operators for contravening a regulated waters declaration. [2] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACs for target species, and trip limits and a TACC for shark species depending on the fishing licence endorsement. [2] Input management measures used to control effort include limited entry and gear (type and size) restrictions. The requirements for landing form of sharks depends on the symbols attached to the fishing licence, however regardless of the symbol, it is an offence for a fisher to possess a shark or ray fin on a boat without also possessing the body of the same shark or ray. [9] |
| **Risk assessment** | ERA for the ECIFFF rated Great Hammerhead and Scalloped Hammerhead as Medium and Low risk respectively[11]. It was highlighted however, that most of the fishing mortality to Great Hammerhead was to the juvenile, sub-adult and adult male population, and that if the adult female population should be subject to fishing mortality in other fisheries, then significant concern may be warranted. [11] Oceanic Whitetip Sharks were not considered in the ERA. | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trip limits for the listed shark species by licence with an S symbol.<br>2.19 Improve reporting to species level and provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark weight in observer records | |
| **References** | 1. Anon. 2011. East Coast Inshore Fin Fish Fishery 2011 Progress against SEWPaC conditions and recommendations. Department of Employment, Economic Development and Innovation, Queensland.<br>2. Anon. 2011. Annual status report 2010, East Coast Inshore Fin Fish Fishery. State of Queensland.<br>3. Anon. 2011. Review of commercial fishing in the East Coast Inshore Fin Fish Fishery. State of Queensland.<br>4. Gunn, J., Meere, F. and Stevens, J. 2008. Independent Review Proposed Management Arrangements for Queensland's East Coast Inshore Fin Fish Fishery. eview for the Minister for the Environment, Heritage and the Arts.<br>5. Fisheries Act 1994 (Current as at 22 November 2012)<br>6. Anon. 2006. Assessment of the Queensland East Coast Inshore Finfish Fishery. Department of the Environment and Heritage, Canberra.<br>7. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>8. Anon. 2011. Plan for Assessment of Queensland East Coast Shark Resources 2009–14. Department of Employment, Economic Development and Innovation, Queensland.<br>9. Anon. 2009. Guidelines for commercial operators in the East Coast Inshore Finfish Fishery. Department of Employment, Economic Development and Innovation, Queensland. | |

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| | 10. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>11. Tobin A.J., Simpfendorfer, C.A., Mapleston, A., Currey, L., Harry, A. V., Welch, D.J., Ballagh, A.C., Chin, A., Szczenski, N., Schlaff, A., White, J. and Moore, B. (2010) 'A quantitative ecological risk assessment of sharks and finfish of Great Barrier Reef World Heritage Area inshore waters: A tool for fisheries and marine park managers: Relative risk of species and potential mitigation strategies for the east coast inshore fin fish fishery.' Marine and Tropical Sciences Research Facility, Cairns. 44pp.<br>12. Anon. 2009. Performance Measurement System for the East Coast Inshore Fin Fish Fishery. Queensland Primary Industries and Fisheries. Brisbane. |


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| **Queensland – Coral Reef Fin Fish Fishery (CRFFF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessments and a risk-based compliance strategy have been implemented in the CRFFF[1]. Compliance is reported annually in fishery status reports, and during 2010–11, compliance rate for the commercial sector was 91%. [2]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the CRFFF area. [3] Estimates are not available specifically for the CRFFF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [3] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The CRFFF underwent strategic assessment during 2005 and 2010, and is a third assessment commenced during 2011. The fishery is managed using a comprehensive set of input and output controls that are in place under the Fisheries Regulations 2008 and the Fisheries (Coral Reef Fin Fish) Management Plan 2003. [2]<br>There is a performance measurement system that has undergone review. [9] |
| | 2.12 Management plan or equivalent: | The CRFFF is managed under the Fisheries (Coral Reef Fin Fish) Management Plan 2003. [3] |
| | 2.13 Aim of harvest regime in management planning: | The objective of this management plan is to provide for the use, conservation and enhancement of the community's coral reef fin fish resources by managing commercial fishing for the reef line fishery in a way that seeks to— (a) apply and balance the principles of ecologically sustainable development; and (b) promote ecologically sustainable development. [3]<br>The objective for bycatch in the performance measurement system is to: maintain an acceptable bycatch ratio in the commercial fishery. [9]<br>There objectives do not match any of the options for this factor, however they could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |
| | 2.14 Quotas: | Total allowable catches are used as management measures in the CRFFF. There are possession limits in place for this fishery for some coral reef fin fish, but not for sharks[2]. Queensland Fisheries have implemented an annual Total Allowable Commercial Catch of 600 t all sharks for all fisheries combined. [6] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | Most of the area of the CRFFF and approximately 95% of reported commercial catch is taken from areas within the GBRMP. [2] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | **None.** The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Improvements to control of shark harvest were published |

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| | | during 2011, which included limiting the number of fishing operations authorised to take sharks and rays above incidental catch limits, a TACC of 600 t, maximum size limit of 150 cm, increased reporting requirements, restriction on the form of landed sharks and gear restrictions[6]. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | **Quantitative indices**. CRFFF operators are required to complete daily catch and effort logbooks and must report catches of CRFFF through the quota reporting system (which includes catch disposal records). There is no facility to report discards in logbooks.<br>There is an observer program that monitored 72 days in the fishery during 2010–11[2]. The observer database contains fields to report species, number, weight, length, sex and fate of sharks, however, no weights were recorded in the data sent.<br>Population estimates are not available for any of the five listed shark species in this fishery, however Queensland Fisheries have put in place data collection systems to enable quantitative stock assessments to be conducted in the near future. [8] |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches in their logbooks and catch disposal records, and logbook validation has been carried out. [2] No catches of the species of interested were reported in commercial logbooks.<br>There is an observer program that monitored 72 days in the fishery during 2010–11. [2] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | **Neutral.** Observed catches of the shark species of interest by this fishery are extremely low. |
| | 2.22 Incentives for species conservation: | **None.** There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | **None.** There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | **Uncertain** There are MPAs in the area of the CRFFF that contain areas where the fishery can not operate, however the proportion of the strictly protected area in the area of the CRFFF was not found, and would require spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | **High.** During 2010–11, there was only one caution given to a CRFFF commercial operator for contravening a regulated waters declaration. [2] |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACs for target species, and trip limits for coral reef fin fish and a State wide TACC for shark species[2]. Input management measured used to control effort include limited entry and gear (type and size) restrictions. Fins are required to be landed attached to the carcass[5]. |
| **Risk assessment** | There are two ERAs for the CRFFF, however, neither address the shark species of interest or sharks in general. There is however a *Plan for Assessment of Queensland East Coast Shark Resources*, which documents the specific data needs for future stock assessment and describes Fisheries Queensland programs in place or implemented since 2009 that address these needs. [8] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.19 Improve reporting to species level and provide facility to report discards in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Implement trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Anon. 2008. Assessment of the Coral Reef Fin Fish Fishery, November 2008. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>2. Anon. 2011. Annual status report 2011, Coral Reef Fin Fish Fishery. State of Queensland.<br>3. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania. | |

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| | 4. http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/F/FisherCRFFMP03.pdf (Accessed July 2013)<br>5. Fisheries Regulation 2008 (Qld) – Current as 1 July 2013.<br>6. Anon. 2011. Implementation and continued improvement of Queensland's harvest strategy for sharks Wildlife Trade Operation Condition 9. Department of Employment, Economic Development and Innovation, Queensland.<br>7. http://www.gbrmpa.gov.au/zoning-permits-and-plans/zoning/zoning-maps (Accessed July 2013)<br>8. Anon. 2011. Plan for Assessment of Queensland East Coast Shark Resources 2009–14. Department of Employment, Economic Development and Innovation, Queensland.<br>9. Anon. 2011. Performance Measurement System, Coral Reef Fin Fish Fishery, Version 2 – February 2011. Department of Employment, Economic Development and Innovation, Queensland. | |
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| **Northern Territory – Barramundi Fishery (BF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Major issues of concern during 2011 with respect to compliance in the commercial sector were the use of gillnets in excess of entitlement, fishing in closed waters and the inadequate marking of gear. [1]<br>Current illegal fishing by foreign vessels is unknown, however because the fishery only extends 3 nm offshore, it is likely to be low to none. |
| | 2.11 Management history: | The BF is managed under the Northern Territory Fisheries Act, Northern Territory Fisheries Regulations and the Barramundi Fishery Management Plan. [3] The Plan has undergone numerous reviews and amendments. The fishery has an EMS that covers: compliance and legislation, minimising waste of retained species, minimising impact on non-retained, protected species and the environment, and assessment of potential external risks to the fishery. [3] |
| | 2.12 Management plan or equivalent: | The BF is managed under the Barramundi Fishery Management Plan. |
| | 2.13 Aim of harvest regime in management planning: | No aim or objective is listed in the Plan. Proposed objectives are; Target species – 1) to maintain the sustainability of the barramundi fishery resource, 2) each sector (FTO, recreational, commercial, Indigenous) to optimise the monetary value of their catch, and 3) maintain and enhance quality fishing experiences for recreational fishers into the future; Byproduct species - ensure ecological sustainability of byproduct species. [1] |
| | 2.14 Quotas: | Sharks are a common byproduct although the amount that can be taken is restricted to 500 kg of converted whole shark weight on board each vessel at any time. [1]<br>While not strictly described by the assigned category, trip limits are more precautionary than "no quotas". |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are currently several MPAs in this area, and fishing by the BF is permitted in some areas. 4 The extent of the catch coming from these areas is uncertain and requires spatial analysis of catch and effort data. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is a 500 kg trip limit of sharks in the BF. [1] There were major issues of concern during 2011 with respect to compliance in the commercial sector where the use of gillnets in excess of entitlement, fishing in closed waters and the inadequate marking of gear. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks and observer program. [1] Logbooks have the facility to report discards by number only. The observer program monitored 10 days during 2011. [1]<br>Descriptions of observer results were provided by NT DPIF staff as follows. Monitoring information from the Barramundi Fishery reports that hammerheads of all three |

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| | | species are an uncommon catch probably due to the area's where this fishery predominantly operates. In those monitoring trips where hammerhead catch has been observed the most common species is the Winghead Shark. Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches by weight (processed) in their logbooks. [1] Commercial data obtained from NT DPIF contained records of "Hammerhead Shark", not reported to species. Some records contained 0 kg weight. There were no reported discards of these species in the commercial data provided. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Catch of the five species of interest in the BF is likely to be low, however this has not been reported, and can not be calculated from the data provided because of the "0 kg" values, and potential prevalence of the non-listed species "Winghead Shark" in the catch. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are several MPAs in the area of the BF than have no-take areas. The Management Plan also specifies many "closure lines". [2] Calculation of the proportion strictly protected requires spatial analysis that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | There were major issues relating to fishing in closed waters during 2011. [1] |
| | 2.26 Regulation of harvest effort: | Catch of sharks in the BF is controlled through 500 kg trip limits. [1] Input management measured used to control effort include limited entry, gear restrictions and closed areas and seasons. [1] |
| **Risk assessment** | ERA for the BF was not found. | |
| **Recommendations** | 2.19 Improve reporting to species level in commercial logbooks and include discard weights.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Potentially implement maximum size limit for Smooth Hammerhead, Oceanic Whitetip Shark or Porbeagle Shark. | |
| **References** | 1. Northern Territory Government (2012). Fishery Status Reports 2011. Northern Territory Government Department of Resources. Fishery Report No. 111.<br>2. Barramundi Fishery Management Plan (As in force at 1 February 2010, amended 2012)<br>3. Anon. 2010. Northern Territory Barramundi Fishery, Environmental Management System. Northern Territory Seafood Council and Fisheries Research and Development Corporation, Northern Territory.<br>4. Anon. 2011. Cobourg Marine Park Plan of Management. Prepared by the Cobourg Peninsula Sanctuary and Marine Park Board and Parks and Wildlife Service of the Northern Territory. | |
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| **Northern Territory – Demersal Fishery (DF) – multi sector that now includes the original Finfish Trawl and Demersal Fisheries** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | There were no compliance issues were recorded for the Trap and Line sector during 2010 or the Trawl sector during 2011. [1]<br>Illegal fishing by foreign vessels has been reported in the area of the DF. [2] Estimates are not available specifically for the DF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The DF underwent strategic assessment during 2004 and 2009. The DF is managed under the Northern Territory Fisheries Act and the Northern Territory Fisheries |

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| | | Regulations. [3] The fishery has an EMS that covers: compliance and legislation, minimising waste of retained species, minimising impact on non-retained, protected species and the environment, and assessment of potential external risks to the fishery. [4] |
| | 2.12 Management plan or equivalent: | The DF is managed under the Northern Territory Fisheries Act and the Northern Territory Fisheries Regulations. |
| | 2.13 Aim of harvest regime in management planning: | The overall management objective for the fishery is to maintain catches of goldband snapper and red snappers by all sectors within acceptable ranges. [1] There is a management objectives for shark bycatch that is to "to maintain shark bycatch below 50% of the annual estimated bycatch weight." [5] |
| | 2.14 Quotas: | Outputs are monitored through TACC for some species, reference trigger points for the catch of target, byproduct and bycatch species. [3] The trigger reference points for bycatch of sharks is "Observed or reported shark bycatch increases by more than 0 % of the previous year's shark bycatch weight." [5] The DF is not permitted to retain any shark products. [8]<br>While this description does not match any of the options for this factor, no take could be considered to be the most conservative "quota" possible. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The DF covers waters from 15 nm off the NT coastline to the extent of the EEZ, excluding the area of the Timor Reef Fishery. There are currently no multi-use MPAs in the area of the DF that allow fishing. When managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014 [6], commercial fishing including that undertaken by the DF may be allowed in certain management zones. [7] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | The DF is prohibited from landing shark products[8], and recent assessment reported no compliance issues during 2010 in the Trap and Line sector, or during 2011 in the Trawl sector. [1]<br>Arriving and departing vessels are inspected at the Port of Darwin, which is the only catch landing point currently used by fishery operators. Logbook returns submitted by fishery operators are validated against market returns. All operators are required to specify in their market returns where they are selling their product. Where required, returns submitted by traders/processors are also analysed and used to validate fishery logbook returns. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks and observer program. [1] There has been some onboard observer trip conducted, however information on this program could not be found, and data was not provided. Descriptions of observer results were provided by NT DPIF staff as follows. Hammerhead sharks were captured in low numbers on dropline gear early in the fishery, but have not been recorded since 1991. Observer records show that small numbers of hammerhead sharks are captured with trawl gear, but most are released alive from the hopper before the catch is brought on board. Records also show that since a bycatch reduction device was fitted to the trawl net in 2006 the capture of large sharks and rays has been considerably reduced.<br>Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches in their logbooks. [1] Logbooks have the facility to report weights of each species discarded. There was only a very small number of logbook records for "Hammerhead Sharks" that were caught during the |

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| | | 1990s.<br>There is an observer program for this fishery, however details and data from that program were not provided, other than a qualitative description by NT DPIF staff. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | **Neutral.** Based on qualitative descriptions of observer program from NT DPIF staff, observed catches of the shark species of interest by this fishery are very low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are currently no strictly protected area in the area of the DF. |
| | 2.25 Effectiveness of strict protection measures: | Not applicable. |
| | 2.26 Regulation of harvest effort: | The DF is prohibited from retaining shark products. [8]<br>Input management measured used to control effort include limited entry and gear restrictions. [3]<br>BRDs are used which reduce the capture of large sharks and rays, while the use of hoppers helps return those species to the water in a timely manner. [9]<br>VSM is required on all DF vessels. [4] |
| **Risk assessment** | Sharks and Rays were considered in the ERA for the Finfish Trawl sector for the DF, and the risk to the Impact on breeding stock was assessed as Negligible. This is because they are "almost always released alive as the FTF has a no-take policy on sharks and rays." [10] | |
| **Recommendations** | 2.10 Estimate IUU catch<br>2.20 Improve reporting to species level in both logbooks and by observers. | |
| **References** | 1. Northern Territory Government (2012). Fishery Status Reports 2011. Northern Territory Government Department of Resources. Fishery Report No. 111.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2009. Assessment of the Northern Territory Demersal Fishery, May 2009. Department of Environment, Water, Heritage and the Arts. Canberra.<br>4. Anon. 2012. Demersal Fishery, Environmental Management System. Northern Territory Seafood Council and Fisheries Research and Development Corporation, Northern Territory.<br>5. Anon. (2013) Demersal Fishery Operating Decision Rules. http://www.nt.gov.au/d/Fisheries/index.cfm?newscat1=&newscat2=&header=Demersal%20Fishery (Accessed July 2013)<br>6. http://www.environment.gov.au/marinereserves/north/index.html (Accessed July 2013)<br>7. North Commonwealth Marine Reserves Network Management Plan 2014-24 (Cwlth) - F2013L00426<br>8. Northern Territory Fisheries Regulations 2012 (As in force at 14 December 2012)<br>9. Anon. 2009. Assessment of the Northern Territory Finfish Trawl Fishery, May 2009. Department of Environment, Water, Heritage and the Arts. Canberra.<br>10. Anon. 2009. Ecological Risk Assessment of the Northern Territory Offshore Snapper Fisheries. Northern Territory Government's Department of egional Development, Primary Industry Fisheries and Resources, Darwin. | |
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| **Northern Territory – Offshore Net and Line Fishery (ONLF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | In 2011, no significant domestic compliance issues were recorded for the ONLF, and based on previous operations, risk of non compliance in the fishery is considered low. [1, 7]<br>Illegal fishing by foreign vessels has been reported in the area of the ONLF. [2] Estimates are not available specifically for the ONLF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The ONLF underwent strategic assessment during 2007 |

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| | | and 2012. The ONLF is managed under the Northern Territory Fisheries Act and the Northern Territory Fisheries Regulations. [3] The fishery has an EMS that covers: identification and assessment of potential environmental impacts and risks concerning the fishery, their likelihood of occurrence and predicted consequences; identification and assessment of aspects of the fishery with the potential to lead to negative public perceptions regarding its environmental sustainability; describing actions to reduce those risks and improve the fishery; providing for an ongoing process for the EMS and the environmental performance of the fishery to be continually reviewed and improved; and improving the public perception of the fishery and promoting the environmental responsibility of the industry. [3] No information on specific stock assessments of the species of interest was found. |
| | 2.12 Management plan or equivalent: | The ONLF is managed under the Northern Territory Fisheries Act and the Northern Territory Fisheries Regulations. |
| | 2.13 Aim of harvest regime in management planning: | While none of the objectives in the Northern Territory Fisheries Act refer to maximising economic yield, the fisheries is assessed against reference points for sustainable yield. [4] The management objective for byproduct species (such as Great Hammerhead) is to *ensure ecological sustainability of these species in all fisheries.* [5] |
| | 2.14 Quotas: | Current management of the ONLF is primarily based on input controls including limited entry and total allowable effort limits, and gear restrictions. [3] There are no quotas of bycatch limits on the take of the five species of interest. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The ONLF covers all waters off the NT to the extent of the EEZ. [3] There are currently several MPAs in this area, and ONLF is permitted in some areas. [6] The extent of the catch coming from these areas is uncertain. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | The ONLF targets sharks, and while there are input controls including total allowable effort, there is no restriction on the take of the five species of interest. [3]<br>Fin ratio conditions apply in the ONLF, which require a 5% proportionate amount of fin and trunk to be landed. These arrangements are in place to deter the targeting of large sharks for their fins only. [1]<br>The Water Police Section of the NT Police, Fire and Emergency Services is responsible for all fisheries compliance and enforcement in the NT under the Fisheries Act 1988. Water Police monitor and enforce management arrangements for the fishery through the inspection of vessels arriving and departing through the single Port of Darwin. This includes verification of catch returns against fish trader/processor returns. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks and observer program. [1] There is a long running observer program for the ONLF routinely collects information such as length frequency, age maturity and vertebrate for aging which feed into the stock assessment for other shark species. [5]<br>Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches by number and weight in their logbooks. There also have the facility to report discard weights. 100% of logbook records received from Department of Primary Industry and Fisheries were for species "Hammerhead Shark". Until 200 , Winghead |

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| | | Sharks were also reported as "Hammerhead Shark"). Current logbooks contain pre-filled species "Winghead Shark (*E. blochii*)" and "Hammerhead (*Sphyrna* spp.)". Weight is reported as processed weight, and conversions are applied to calculate whole weight.<br>There is an established observer program, which covered 3.2% and 2.8% of fishing effort during 2011 and 2012 respectively. All observer records received from DPIF were identified to species level. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | During 2010 and 2011, catch of hammerhead sharks comprised 8% and 12% of the total catch by the ONLF, totalling 103 t and 141 t respectively. [3, 1] |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are MPAs in the area of the ONLF that contain areas where the fishery cannot operate, however the proportion of the strictly protected area in the area of the ONLF was not found. |
| | 2.25 Effectiveness of strict protection measures: | Information on the effectiveness of strict protection measures was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through Total Allowable Effort allocated through individually transferable effort units. [1] TAE may be revised up or down from year to year depending on the best available information on the sustainable catch and effort limits in the fishery. [1] Input management measured used to control effort include, limited entry, gear (type and size) restrictions and bycatch limits. [1] Fin ratio conditions apply in the ONLF, which require a proportionate amount of fin and trunk to be landed. These arrangements are in place to deter the targeting of large sharks for their fins only. [1] |
| **Risk assessment** | An ERA completed in 2007 identified Great Hammerhead as having potentially higher risk from interaction with the ONLF, however that was based on data to 2004. [5,8] A more recent ERA of the fishery involving stakeholders and scientific experts was conducted in 2009. The main outcome of the workshop was that all shark species were considered to be fished well within sustainable limits due to the small catches taken by the small number of operators in the fishery. [1] | |
| **Recommendations** | Develop performance measures for Hammerheads.<br><br>2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 and 2.18 Implement trip limits for the listed shark species<br>2.18 Require landing with of sharks with fins naturally attached<br>2.19 Remove generic group reference and improve reporting to species level in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records.<br>2.26 Implement trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Northern Territory Government (2012). Fishery Status Reports 2011. Northern Territory Government Department of Resources. Fishery Report No. 111.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2012. Assessment of the Northern Territory Offshore Net and Line Fishery, December 2012. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>4. Anon. 2012. Northern Territory Offshore Net and Line Fishery Environmental Management System. Offshore Net and Line Fishery Industry, Darwin.<br>5. Davies, R. 2010. Northern Territory Offshore Net and Line Fishery, Wildlife Trade Operation (WTO) Certification, Final Report 2010. Final report prepared for the Department of Environment, Water, Heritage and the Arts (DEWHA) as required for assessment under Part 13 and 13 A of the Environment Protection and Biodiversity Conservation Act. Department of Resources, Darwin.<br>6. Anon. 2011. Cobourg Marine Park Plan of Management. Prepared by the Cobourg Peninsula Sanctuary and Marine Park Board and Parks and Wildlife Service of the Northern Territory.<br>7. Beatty, T. 2007. Northern Territory Offshore Net and Line Fishery Export Exemption | |

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| | Submission, re-assessment Report October 2007. A report prepared for the Department of Environment and Water Resources (DEW) as required for assessment under Part 13 and 13 A of the EPBC Act. Department of Primary Industry, Fisheries and Mines, Darwin.<br>8. Salini, J., McAuley, R., Blaber, S., Buckworth, R., Chidlow, J., Gribble, N., Ovenden, J., Peverell, S., Pillans, R., Stevens, J., Stobutzki, I., Tarca, C., Walker, T. 2007, Northern Australian sharks and rays: the sustainability of target and bycatch species, phase 2. Final Report on FRDC Project 2002/064. FRDC & CSIRO. ACT. | |
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| **Commonwealth – Western Tuna and Billfish Fishery (WTBF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | All WTBF vessels are required to have an approved ICVMS fitted. [1] No illegal harvest of trade by the WTBF has been reported.<br>Illegal fishing by foreign vessels has been reported in the area of the WTBF. [2] Estimates are not available specifically for the WTBF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The WTBF underwent strategic assessment during 2003 and 2009. The fishery is managed under the *Western Tuna and Billfish Fishery Management Plan 2005* that came into effect on 1 July 2010. [1] The fishery has a harvest strategy, bycatch and a discard work plan. [3]<br>It is also part of the Indian Ocean Tuna Commission (IOTC) which recently banned the retention of Oceanic Whitetip, which is implemented within the fishery in Australian waters as well. |
| | 2.12 Management plan or equivalent: | The WTBF is managed by AFMA under the *Western Tuna and Billfish Fishery Management Plan 2005*. [4] To guide fishers operating in these fisheries, management arrangements are documented in the 'North West Slope Trawl Fishery and Western Deepwater Trawl Fishery Statement of Management Arrangements, September 2012'. [3] |
| | 2.13 Aim of harvest regime in management planning: | Objective (c) of the *Western Tuna and Billfish Fishery Management Plan 2005* is *to maximise economic efficiency in the exploitation of the resources of the fishery.* [4] |
| | 2.14 Quotas: | One of the management tools used in the WTBF is the setting of TACCs for target species, and bycatch limits for some other species. [5, 1] In northern waters (WA, NT and Qld) there is a limit of 20 fish of Subclass *Elasmobranchii* (sharks) and Family *Serranidae*. [1] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The WTBF covers a large area across Australia from Queensland to South Australia including Cocos Island and Christmas Island. There are numerous MPAs in this area, and commercial fishing by the WTBF may be permitted in some MPAs. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is effective implementation of permit conditions by AFMA. AFMA have conducted assessment of compliance risks, and outlined actions taken to reduce those risks. [6] Sharks must be landed with their fins still attached to the carcass and it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed. [1] The use of wire trace is prohibited to reduce shark bycatch, and compliance operations have not |

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| | | reported any fishers using wire traces. [6] According to the Ecological Risk Mitigation Strategy, if the landed amount of any one species of shark reaches 50 t, AFMA will review its management of shark interactions in the WTBF. Oceanic Whitetip Shark are not allowed to be retained in this fishery anymore due to Conservation and Management Measures agreed to in IOTC. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks, catch disposal records, ICVMS and the observer program. [1] Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches in their logbooks, which also have the facility to report number of each species discarded. There is an established observer program, which covered more than 2.5% and 1.7% of fishing effort during 2010 and 2011 respectively[5]. ICVMS is required on all vessels. [1] In addition, catch verification can also be facilitated using a system of AFMA authorised fish receivers and catch disposal records (CDRs). Most of the shark species of interest were identified to species level in the logbook, with only about 6% of the catch of hammerheads reported as "Hammerhead sharks". The ERA stated that "Smooth and Scalloped Hammerhead sharks are often not well distinguished by observers", and this was reflected in the observer data obtained with about 30% hammerheads recorded as "Hammerhead sharks". No weights were recorded for in the observed data base for hammerheads or Oceanic Whitetip Sharks prior to 2008. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are very low, particularly since 2004. Behind Blue Whaler Sharks, Oceanic Whitetip Shark were the second most caught shark species (4% of sharks). [7] While annual catches of Oceanic Whitetip Shark reported in logbooks averaged 2,142 kg during 2001–2004 [7], they have been less than 1,000 kg per year since. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the WTBF[1], however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through TACCs, limited entry, gear (type and size) restrictions and bycatch limits. [1] An observer program is in place and ICVMS is required on all vessels. [1] There is a trip limit of 20 sharks, and use of wire trace is prohibited to decrease bycatch of sharks. Shark finning is banned, as is landing livers without the carcass. Further, carriage of line cutters and de-hookers is mandatory, and their use encouraged, and there have been education programs conducted on reducing interactions with turtles, sharks and seabirds. [6] |
| **Risk assessment** | Level 2 ERA assessed the risk to Oceanic Whitetip Shark, Smooth Hammerhead and Scalloped Hammerhead as Medium, High and Medium risk respectively. [7] It was considered that Oceanic Whitetip Shark did not require further assessment because of the low numbers caught. There was uncertainty regarding the identification of hammerheads in the data, and that "Smooth and scalloped hammerhead sharks are often not well distinguished by observers".<br>During SAFE assessment, $F_{cur}$ (current fishing mortality) was <0.005 for Oceanic Whitetip Shark, Smooth Hammerhead and Scalloped Hammerhead, and $F_{msm}$ (maximum sustainable (instantaneous) fishing mortality) for each of those species was 0.12, 0.10 and 0.11 respectively. [8] None of those species were considered during the most recent Ecological Risk Management report. [9] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level. | |

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| | 2.19 Only slight improve needed in reporting to species level in commercial logbooks.<br>2.20 Improve reporting of shark to species level and shark weight in observer records. | |
| **References** | 1. AFMA. 2013. Western Tuna and Billfish Fishery (WTBF) Management Arrangements Booklet. Australian Fisheries Management Authority. Canberra, Australia.<br>2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. AFMA. 2009. Assessment of the Commonwealth North West Slope Trawl Fishery and the Commonwealth Western Deepwater Trawl Fishery, December 2012. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>4. Western Tuna and Billfish Fishery Management Plan 2005 (Cwlth) - F2006C00722<br>5. Woodhams, J., Vieira, S. and Stobutzki, I. (eds). 2012. Fishery status reports 2011. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.<br>6. AFMA. 2009. Annual Status Report, Western Tuna and Billfish Fishery, August 2009. Australian Fisheries Management Authority. Canberra, Australia.<br>7. Webb, H. C. Bulman, M. Sporcic, J. Dowdney, M. Fuller, T. Smith. A. Hobday (2007) Ecological Risk Assessment for the Effects of Fishing: report for Western Tuna and Billfish sub-Fishery. Report for the Australian Fisheries Management Authority.<br>8. Zhou, S., Fuller, M. and Smith, T. 2009. Rapid quantitative risk assessment for fish species in additional seven Commonwealth fisheries. Report for the Australian Fisheries Management Authority, Canberra.<br>9. AFMA. 2010. Ecological Risk Management Report for the Western Tuna and Billfish Fishery. Australian Fisheries Management Authority, Canberra. | |
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| **Commonwealth – Western Deepwater Trawl Fishery (WDTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | All WDTF vessels are required to have an approved VMS fitted. [1] Compliance by the WDTF has not been reported. Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The WDTF underwent strategic assessment during 2003, 2007 and 2012. The fishery is managed using a consultative arrangement that includes the Western Trawl Consultative Panel which is comprised of industry, research, state and Commonwealth government representatives. [1] The fishery has a harvest strategy, bycatch and a discard work plan. [3] |
| | 2.12 Management plan or equivalent: | The WDTF is managed by AFMA under the Fisheries Management Act 1991 and Fisheries Management Regulations 1992. To guide fishers operating in these fisheries, management arrangements are documented in the 'North West Slope Trawl Fishery and Western Deepwater Trawl Fishery Statement of Management Arrangements, September 2012'. [3] |
| | 2.13 Aim of harvest regime in management planning: | The WDTF is managed in accordance with the objectives specified in section 3 of the Fisheries Management Act 1991. [3] One of these objectives is *maximising the net economic returns to the Australian community from the management of Australian fisheries.* [4] |
| | 2.14 Quotas: | One of the management tools used in the WDTF is a harvest strategy that contains catch triggers for scampi, bugs and eight species of finfish, however there are no catch restrictions on the take of the five species of interest. [9] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The only MPA currently in the area of the WDTF is the Ningaloo Marine Park, but no commercial fishing as allowed in the Commonwealth waters of that MPA. [2] When managements plans for the North-west and South-west Commonwealth Marine Reserves Networks come info effect in July 2014 [6, 7], commercial fishing including that undertaken by the WDTF may be allowed in certain management zones. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Because of the small size of the fishery, no compliance risk assessment has been undertaken for the WDTF AFMA. AFMA compliance will respond accordingly to |

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| | | intelligence that suggests any breach of these provisions. [8]<br>There is an observer program that covered 1.6% and 36.4% of fishing days during 2009/10 and 2010/11 respectively. [5]<br>Sharks must be landed with their fins still attached to the carcass and it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed. [1] However, as there are no restrictions on harvest of these species, confidence in management of this harvest cannot be assessed.<br>Porbeagle Sharks cannot be targeted, and can only be retained if they are dead at retrieval. [1]<br>Illegal fishing by foreign vessels in this area is unknown. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks. Catches are reported by weight for each species, and there is facility to report discards by weight.<br>VMS and the observer program. [1] Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches in their logbooks, which also have the facility to report discards. There are only very few records of catches of Oceanic Whitetip Shark in the logbooks, all identified to species.<br>Despite the lack of compliance risk assessment and catch disposal records, there is an established observer program, which covered more than 36% of fishing days during 2010/11. [5] There are no records of any of the five species of interest in the observer data. VMS is required on all vessels. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are extremely low. Captures of Oceanic Whitetip Shark were reported in only three logbook records. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | <5%. There is only one MPA in the area of the DWTF, Ningaloo Marine Park, of which there is only a small overlap with the area of the fishery. [2] |
| | 2.25 Effectiveness of strict protection measures: | Information on the effectiveness of strict protection measures was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through a set input controls such as limited entry and gear restrictions, and also trigger limits for scampi, buts and some finfish. [9] An observer program is in place that covered 1.6% and 36.4% of fishing days during 2009/10 and 2010/11 respectively. [5]<br>During 2010-11 there were 1 fishing permits in the DWTF, however there was only 2 active vessels, and they fished a total of 22 days. [5]<br>Porbeagle Sharks can not be targeted, and can only be retained if they are dead at retrieval. [1]<br>Despite limited entry to this fishery, there are no limits on the take of the five listed shark species. |
| **Risk assessment** | None of the shark species of interest were explicitly considered during E As, and "Sharks - other" was not considered because only 40kg had been caught during 2001–04. [10] | |
| **Recommendations** | 2.14 Implement trigger limits for the five shark species of interest.<br>2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. AFMA (ed & rev) 2012. North West Slope Trawl Fishery and Western Deepwater Trawl Fishery, Statement of Management Arrangements, September 2012. Australian Fisheries Management Authority. Canberra, Australia.<br>2. Anon. 2005. Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area. Western Australia Department of Environment and Conservation.<br>3. Anon. 2012. Assessment of the Commonwealth North West Slope Trawl Fishery and the Commonwealth Western Deepwater Trawl Fishery, December 2012. Department of Sustainability, Environment, Water, Population and Communities. Canberra. | |

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| | 4. Fisheries Management Act 1991 (Cwlth) - C2013C00238<br>5. Woodhams, J., Vieira, S. and Stobutzki, I. (eds). 2012. Fishery status reports 2011. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.<br>6. http://www.environment.gov.au/marinereserves/north-west/index.html (Accessed July 2013)<br>7. http://www.environment.gov.au/marinereserves/south-west/index.html (Accessed July 2013)<br>8. Anon. 2012. Status Report for Re-assessment for Export Approval Under the EPBC Act, North West Slope and Western Deepwater Trawl Fisheries. February 2012. Australian Fisheries Management Authority. Canberra, Australia.<br>9. Anon. 2011. Harvest Strategy for the Western Deepwater Trawl Fishery and North West Slope Trawl Fishery. Australian Fisheries Management Authority. Canberra, Australia.<br>10. Wayte, S., Dowdney, J., Williams, A. Fuller, M., Bulman, C., Sporcic, M., Smith, A. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Western Deepwater Trawl Fishery. Report for the Australian Fisheries Management Authority, Canberra. | |
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| **Commonwealth – North West Slope Trawl Fishery (NWSTF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | All NWSTF vessels are required to have an approved VMS fitted. [1] Compliance by the NWSTF has not been reported.<br>Illegal fishing by foreign vessels has been reported in the area of the NWSTF. [2] Estimates are not available specifically for the NWSTF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [2] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The NWSTF underwent strategic assessment during 2003, 2007 and 2012. The fishery is managed using a consultative arrangement that includes the Western Trawl Consultative Panel which is comprised of industry, research, state and Commonwealth government representatives. [1] The fishery has a harvest strategy, bycatch and a discard work plan. [3] |
| | 2.12 Management plan or equivalent: | The NWSTF is managed by AFMA under the Fisheries Management Act 1991 and Fisheries Management Regulations 1992. To guide fishers operating in these fisheries, management arrangements are documented in the 'North West Slope Trawl Fishery and Western Deepwater Trawl Fishery Statement of Management Arrangements, September 2012'. [3] |
| | 2.13 Aim of harvest regime in management planning: | The NWSTF is managed in accordance with the objectives specified in section 3 of the Fisheries Management Act 1991. [3] One of these objectives is *maximising the net economic returns to the Australian community from the management of Australian fisheries.* [4] |
| | 2.14 Quotas: | One of the management tools used in the NWSTF is a harvest strategy that contains catch triggers for scampi, prawns and some finfish, however there are no catch restrictions on the take of the five species of interest. [5] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are currently no multi-use MPAs in the area of the NWSTF that allow fishing. When managements plans for the North-west Commonwealth Marine Reserves Network come info effect in July 2014 [6], commercial fishing including that undertaken by the NWSTF may be allowed in certain management zones. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Because of the small size of the fishery, no compliance risk assessment has been undertaken for the NWSTF AFMA. AFMA will continue to monitor activity in the fishery via VMS, specifically with regard to the newly |

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| | | implemented NWSTF move-on provisions of interactions with vulnerable marine ecosystems. AFMA compliance will respond accordingly to intelligence that suggests any breach of these provisions. [7]<br>There is an observer program that covered 21.4% and 22.7% of fishing days during 2009/10 and 2010/11 respectively. [5]<br>Sharks must be landed with their fins still attached to the carcass and it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed. [1]<br>However, as there are no restrictions on harvest of these species, management of their harvest cannot be assessed. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks, VMS and the observer program. [1] Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | Fishers report catches in their logbooks, which also have the facility to report discards. There were no records of the five species of interest in the logbook data. Despite the lack of compliance risk assessment and catch disposal records, there is an established observer program, which covered more than 20% of fishing days during 2009/10 and 2010/11. [5] The very small number of records of There were no hammerheads in the observer database not identified to species, however there were "Whaler and weasel sharks" recorded, nearly all of which were discarded".<br>VMS is required on all vessels. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | <5%. There are three MPAs in the area of the NWSTF, Cartier Island Marine Reserve (172 $km^2$), Ashmore Reef Marine National Nature Reserve (583 $km^2$) and Mermaid Reef Marine National Park (540 $km^2$). [6] Together the comprise less than 5% of the area of the fishery. |
| | 2.25 Effectiveness of strict protection measures: | Information on the effectiveness of strict protection measures was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through a set input controls such as limited entry and gear restrictions, and also trigger limits for scampi, prawns and some finfish. [5]<br>An observer program exists, which covered more than 20% of fishing days of fishing effort during 2009/10 and 2010/11 respectively. [5] During 2010-11 there were 7 fishing permits in the NWSTF, however there was only 1 active vessel and it fished for 97 days in this fishery. [5]<br>Despite limited entry to this fishery, there are no limits on the take of the five listed shark species. |
| **Risk assessment** | There is only one high risk, priority species of the NWSTF, the Scarlet Prawn (*Aristaeopsis edwardsiana*). [8] None of the shark species of interest were explicitly considered during ERAs, however "sharks" was considered and assigned Negligible impact with high confidence. [9] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Implement trigger limits for the five shark species of interest.<br>2.20 Improve reporting of shark to species level in observer records.<br>2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. AFMA (ed & rev) 2012. North West Slope Trawl Fishery and Western Deepwater Trawl Fishery, Statement of Management Arrangements, September 2012. Australian Fisheries Management Authority. Canberra, Australia. | |

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| | 2. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania.<br>3. Anon. 2012. Assessment of the Commonwealth North West Slope Trawl Fishery and the Commonwealth Western Deepwater Trawl Fishery, December 2012. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>4. Fisheries Management Act 1991 (Cwlth) - C2013C00238<br>5. Woodhams, J., Vieira, S. and Stobutzki, I. (eds). 2012. Fishery status reports 2011. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.<br>6. http://www.environment.gov.au/marinereserves/north-west/index.html (Accessed July 2013)<br>7. Anon. 2012. Status Report for Re-assessment for Export Approval Under the EPBC Act, North West Slope and Western Deepwater Trawl Fisheries. February 2012. Australian Fisheries Management Authority. Canberra, Australia.<br>8. Anon. 2010. Ecological Risk Management, Report for the North West Slope Fishery, April 2010. Australian Fisheries Management Authority. Canberra, Australia.<br>9. Wayte, S., J. Dowdney, A.Williams, C.Bulman, M.Sporcic, M.Fuller, and A.Hobday (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the North West Slope Trawl Fishery. Report for the Australian Fisheries Management Authority, Canberra. | |
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| **Commonwealth – Torres Strait Prawn Fishery (TSPF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Compliance risk assessment for the Torres Strait Prawn Fishery was undertaken by the Australian Fisheries Management Authority and Fisheries Queensland in 2005, and Fisheries Queensland reviewed the compliance risk assessment in May 2008. Since the 2009 reassessment of the fishery under the EPBC Act, the risks identified in 2005 and 2008 have been incorporated into the Queensland Fisheries Compliance Plan. [1]<br>All Torres Strait prawn trawlers are required to have an approved VMS fitted.<br>Most recent assessment of compliance in the fishery found 100% compliance rate (56 patrols, inspected 9 commercial vessels). [2]<br>Illegal fishing by foreign vessels has been reported in the area of the TSPF. [7] Estimates are not available specifically for the TSPF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [7] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The TSPF underwent strategic assessment during 2004, 2007 and 2011. The fishery is managed using a consultative structure that includes Fishery Working Groups, a Management Advisory Committee, a Scientific Advisory Committee and a Resource Assessment Group. [3] |
| | 2.12 Management plan or equivalent: | The fishery is managed by the Protected Zone Joint Authority under the Torres Strait Prawn Fishery Management Plan 2009, in force under the Torres Strait Fisheries Act 1984 and the Torres Strait Fisheries Regulations 1985, and Fisheries Management Notices. [1] |
| | 2.13 Aim of harvest regime in management planning: | Objective 2 of the Torres Strait Prawn Fishery Management Plan 2009 is *Promote economic efficiency in the utilisation of the fisheries resources within the TSPF*. [4] |
| | 2.14 Quotas: | It is a condition of a TSPF licence and TSPF Treaty endorsement that the holder does not take, process, or carry any shark or shark products. [4] While not strictly described by the assigned category, it is appropriate to assign the most conservative category to the strict no take of sharks. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | Most of the catch in the TSPF is taken from within the Torres Strait Protected Zone (TSPZ). About 20% of the area of the TSPZ is fished. [5] |

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| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Compliance risk assessment for the TSPF was undertaken by the AFMA and Fisheries Queensland in 2005, and Fisheries Queensland reviewed the compliance risk assessment in May 2008. Since the 2009 reassessment of the fishery under the EPBC Act, the risks identified in 2005 and 2008 have been incorporated into the Queensland Fisheries Compliance Plan. [1] Observer coverage was 1.12% and 3.75% of effort during 2010 and 2011. [5] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch and effort are monitored through fishing logbooks, VMS and the observer program. [2] Fishers are prohibited from taking, processing or carrying any species of shark in the TSPF. [4] Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There were no records of the five species of interest in the logbook data, as they are not allowed to retain these species. Fishers are not required to report discards in their logbooks, however there is an established observer program, which covered 3.75% of fishing effort during 2011. [5] VMS is required on all vessels. [2] There is a recorded catch of a Porbeagle Shark in the observer data, which is well out of its range. The reason for this is unclear, and may have been a legitimate interaction, a misidentification, or a key punching error. A very small number of Scalloped Hammerhead were reported to species, and a very small number of "Whaler and weasel sharks" not reported to species in the observer database. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the TSPF[3], however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through a set Total Allowable Effort, limited entry, gear (type and size), seasonal and area closures. [2] Observer and compliance programs are in place. It is a condition of a TSPF licence and TSPF Treaty endorsement that the holder does not take, process, or carry any shark or shark products. [4] |
| **Risk assessment** | ERA did not explicitly assess any of the five listed shark species because there was no evidence of catch of them at the time of writing, "Sharks and ays (large)" are assessed, and it was noted that "Sharks and rays larger than ~1m were known to be caught during prawn fishing and are now exclude from the catch by the use of TEDs. It is assumed that this has increased their survival rate, but no data is available to confirm this." isk to that group was considered moderate, but with low confidence because of lack of data. [6] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.20 Improve reporting of shark to species level in observer records, and require reporting of discards of sharks in commercial logbooks. | |
| **References** | 1. Anon. 2013. Assessment of the Torres Strait Prawn Fishery, March 2013. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>2. Anon. 2012. Annual Report Torres Strait Prawn Fishery Export Accreditation, February 2012. Australian Fisheries Management Authority, Canberra.<br>3. Cocking, L., Turnbull, C., Jacobsen, I. and Hill, F. (2013), Torres Strait Prawn Fishery | |

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| | Handbook 2013, Australian Fisheries Management Authority. Canberra, Australia.<br>4. Torres Strait Prawn Fishery Management Plan 2009 (Cwlth) - F2009L00505<br>5. Woodhams, J., Vieira, S. and Stobutzki, I. (eds). 2012. Fishery status reports 2011. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.<br>6. Turnbull, C., Furlani, D., Bulman, C. and Dowdney, J. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Torres Strait Prawn Fishery. Report for the Australian Fisheries Management Authority, Canberra.<br>7. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania. | |
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| **Commonwealth – Southern and Eastern Scalefish and Shark Fishery (multiple sectors)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | AFMA employs a risk based compliance strategy that integrates a range of tools and activities to monitor non-compliance including, compulsory VMS, education, vessel inspections, at-sea compliance, aerial surveillance, intelligence reports and an information program. [1] No assessment of or evidence of illegal harvesting by the SESSF was identified. |
| | 2.11 Management history: | The SESSF is management under a management plan that is regularly updated. It currently operates under the Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 (amended February 2012). [2] |
| | 2.12 Management plan or equivalent: | The SESSF is currently managed under the Scalefish and Shark Fishery Management Plan 2003. [2] |
| | 2.13 Aim of harvest regime in management planning: | Objective (c) of the Management Plan is *to maximise economic efficiency in the exploitation of scalefish and shark resources within the fishery*. [2] |
| | 2.14 Quotas: | There are 34 species of species groups managed under quota in the SESSF, however none are the species of interest in this report. [3] There is no limit on the take of any of the five listed shark species. Because it was highlighted during the ERA process as a high risk species in the Shark Gillnet sub-sector of the GHATS, trigger limits have been set which are monitored annually and if breached, will trigger more detailed investigation. [7] There is no lower limit for Smooth Hammerhead, but the upper limit is 10 t by the Shark Gillnet sub-sector. [9] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are wide spread and complex temporal and spatial closures in place in the SESSF, including Commonwealth Marine Reserves in the South-East, South-West, East and West marine bioregions. [3] Managements plans for the Temperate East and South-west Commonwealth Marine Reserves Networks come info effect in July 2014 [4,5], while that for the South-east Network is already in effect, and fishing methods other than demersal trawl and Danish seine may be used in habitat protection and multiple use zones in this MPA in accordance with a class approval from the Director of National Parks. [6] It is possible that some catch of the five listed shark species comes from within protected areas, however this has not been quantified. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There are no limits on the harvest of these species therefore; there can be no assessment of the confidence in harvest management. AFMA run a risk-based compliance program for the SESSF. [3] There is an observer program for each of the sectors that during 2012, covered about 2.5% (CTS), 8.5% (GHATS) and 4.1% of fishing operations. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, and catch disposal records. [3] Fishers are required to report weight, or processed weight with the appropriate form code, and for the gillnet and line sectors, number retained. Population |

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| | | estimates are not made for any of the five listed shark species in this fishery. Trigger limits have been set for catches of Smooth Hammerhead in the Shark Gillnet sub-sector of the GHATS that are monitored annually and will activate investigation if triggered.[7] |
| | 2.20 Confidence in harvest monitoring: | There is an established observer program which covered 2.5%–8.5% of fishing operations during 2012. VMS is required on all vessels. [3] Logbook data have been periodically compared with observer data and inconsistencies have been followed up. [8] The taxonomic level of hammerheads reported in fisheries logbooks varies with sector. All records of hammerheads in the GHATS are either Scalloped Hammerhead or Smooth Hammerhead, the GABTS only reported Scalloped Hammerhead during 2001–2004 and then apparently transitioned to reporting all hammerheads as Smooth Hammerhead during 2005, and since 2008 have reported both "Hammerhead sharks" and Smooth Hammerhead. The CTS reported all catches of hammerheads to species, but like the GABTS, appeared to transition reporting from Scalloped Hammerhead to Smooth Hammerhead during 2004–05.<br>Porbeagle Sharks cannot be targeted, and can only be retained if they are dead at retrieval. [3]<br>Observer data in all sectors report some hammerheads to species lever, but also some as "Hammerhead sharks". There are also some records of "Whaler and weasel sharks" in the observer and logbook data. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are relatively low. For all sectors combined, total catch of Porbeagle Shark has been less than 2 t since 2001, and average annual catch of hammerheads has averaged less than 8 t per year since that time. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the SESSF[3], however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size), seasonal and area closures, and TACs for target species. [3] Observer and compliance programs are in place. The Shark Gillnet sub-sector of the GHATS has a 10 t upper trigger limit, which is monitored annually and if breached, will trigger more detailed investigation. [9]<br>Porbeagle Sharks cannot be targeted, and can only be retained if they are dead at retrieval. [3]<br>There are no limits on the catches of the species of interest. |
| **Risk assessment** | ERA identified Smooth Hammerhead as a high risk species for the Shark Gillnet sub-sector of the GHATS [7]. Consequently, a 10 t upper trigger limit has been applied which is monitored annually and if breached, will trigger more detailed investigation. [9]<br>Level 2 ERA for the GABTS identified Scalloped Hammerhead as a high risk species [10], however, subsequent rapid quantitative Level 3 assessment reduced the risk to low. [11] A previous risk assessment suggested that the Scalloped Hammerhead assessed is actually misidentified Smooth Hammerhead. [12]<br>Porbeagle Shark (medium risk), Smooth Hammerhead (high risk) and Scalloped Hammerhead (medium risk) were assessed and medium, high and medium risk respectively for the CTS during an early ERA report [13]. Smooth Hammerhead was reduced to low risk following Level 3 SAFE assessment. | |
| **Recommendations** | 2.14 Implement catch or trip limits for the five shark species of interest.<br>2.20 Improve reporting of shark to species level in observer records. Check on the correct identification of shark species in commercial logbook data | |

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| | 2.26 Implement catch limits or trip limits for the listed shark species and potentially implement maximum size limits to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Anon. 2009. Southern and Eastern Scalefish and Shark Fishery Wildlife Trade Operation Re-assessment 2009. Australian Fisheries Management Authority, Canberra.<br>2. Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 (Cwlth) - F2012C00159<br>3. AFMA (ed & rev) 2013, Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet 2013, Australian Fisheries Management Authority. Canberra, Australia.<br>4. http://www.environment.gov.au/marinereserves/temperate-east/index.html (Accessed July 2013)<br>5. http://www.environment.gov.au/marinereserves/south-west/index.html (Accessed July 2013)<br>6. Anon. 2013. A Guide for Users of the South-east Commonwealth Marine Reserves Network. July 2013. Director of National Parks. Australian Government.<br>7. Anon. 2010. Ecological Risk Management, Report for the Shark Gillnet Sector of the Gillnet Hook and Trap Fishery, April 2010. Australian Fisheries Management Authority, Canberra.<br>8. Anon. 2013. Assessment of the Southern and Eastern Scalefish and Shark Fishery. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>9. AFMA. 2012. EPBC Act Reassessment of the Southern and Eastern Scalefish and Shark Fishery, May 2012. Australian Fisheries Management Authority, Canberra.<br>10. Anon. 2008. Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results, December 2008. Australian Fisheries Management Authority, Canberra.<br>11. Anon. 2008. Ecological Risk Management Report for the Great Australian Bight Trawl Sub-fishery of the Southern and Eastern Scalefish and Shark Fishery, December 2008. Australian Fisheries Management Authority, Canberra.<br>12. Daley, R, Knuckey, I., Dowdney, J., Williams, A., Bulma, C., Sporcic, M., Fuller, M., Smith, T. (2007). Draft Ecological Risk Assessment for the Effects of Fishing. Report fop the Great Australian Bight trawl sub-fishery of the Southern and Eastern Scalefish and Shark Fishery. Report for the Australian Fisheries Management Authority. Canberra, Australia.<br>13. Wayte, S., Dowdney, J., Williams, A., Bulman, C., Sporcic, M., Fuller, M., Smith, A. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the otter trawl sub-fishery of the Commonwealth trawl sector of the Southern and Eastern Scalefish and Shark Fishery. Report for the Australian Fisheries Management Authority, Canberra.<br>14. Anon. 2010. Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results Report for the Otter Trawl Fishery July 2010. Australian Fisheries Management Authority, Canberra. | |
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| **Commonwealth – Northern Prawn Fishery** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | AFMA employs a risk based compliance strategy that integrates a range of tools and activities to monitor non-compliance including, compulsory ICVMS, vessel inspections, at-sea compliance, aerial surveillance, intelligence reports and an information program. [1]<br>Illegal fishing by foreign vessels has been reported in the area of the TSPF. [11] Estimates are not available specifically for the TSPF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [11] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The NPF is management under a management plan that is regularly updated. It currently operates under the Northern Prawn Fishery Management Plan 1995 (amended February 2012). [2] |
| | 2.12 Management plan or equivalent: | The NPF is currently managed under the Northern Prawn Fishery Management Plan 1995. [2] |
| | 2.13 Aim of harvest regime in management planning: | The objectives in the NPF Management Plan 1995 do not explicitly refer to economics of the fishery, however Objective (a) refers to pursuing objectives of the Fisheries Act 1991. [2] Objective 1 (c) of the Fisheries Act 1991 is *maximising the net economic returns to the Australian community from the management of Australian fisheries*. [3] |
| | 2.14 Quotas: | The NPF fishery are prohibited from retaining all species |

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| | | of sharks including fins, teeth, skin and saw shark beaks. [4] While not strictly described by the assigned category, it is appropriate to assign the most conservative category to the strict no take of sharks. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are currently no multi-use MPAs in the area of the NPF that allow fishing. When managements plans for the North Commonwealth Marine Reserves Network come info effect in July 2014[5], commercial fishing including that undertaken by the NPF may be allowed in certain management zones. [6] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | **None.** The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is high confidence in the effective implementation of the management plan, which restricts harvest of sharks. AFMA have a Compliance Plan for the NPF to identify risks to compliance and describe strategies to manage potential risks. [1] ICVMS, vessel inspections, at-sea compliance, intelligence reports and an information program are all used to manage compliance. [1]<br>There is an observer program that covered 2.4% of the fishing effort during 2011. [7] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through daily fishing logbooks. [1] Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is an established observer program which covered 2.4% (scientific) and 10.5% (crew member) of the effort during 2011. [7] ICVMS is required on all vessels. [1] In addition to Observer coverage, logbook data is verified by processor records obtained for landed catch and by transhipment documentation. [8] Compliance with logbooks has been assessed as high. [8]<br>There are no record of catches of any of the five species of interest in the logbook data. There are some observer records of "Hammerhead sharks", but most are reported to species. While there are no records of Oceanic Whitetip in the observer data (as expected because of the location of the fishery), there are significant records of "Whaler and weasel sharks" in the data. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Observed catches of the shark species of interest by this fishery are relatively low. For each shark species that interactions occurred, average observed catch was <100kg per year (not weighted up to total effort). |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the NPF, however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size), seasonal and area closures, and soon TACs for target species. [9] An observer program and effective compliance plan are in place. The landing of sharks or shark products is prohibited. [4] Further, use of TEDs is compulsory, [4] which reduces catch of sharks. |
| **Risk assessment** | The most recent ERA report for the NPF retained only two Chondrichthyans, none of which are species of interest. [10] While highlighted in previous risk assessments, the Great Hammerhead has been removed because "it will be readily excluded by TED because of its large size (610 cm maximum length) and should not be deemed to be 'at risk' from NPF activity" [10] | |

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| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.20 Improve reporting of shark to species level in observer records, and require reporting of discards of sharks in commercial logbooks. | |
| **References** | 1. Anon. 2008. Status Report for Re-assessment for Export Approval Under the EPBC Act, Northern Prawn Fishery. Australian Fisheries Management Authority, Canberra.<br>2. Northern Prawn Fishery Management Plan 1995 (Cwlth) - F2012C00160<br>3. Fisheries Management Act 1991 (Cwlth) - C2013C00238<br>4. AFMA (ed & rev) 2012. Northern Prawn Fishery Operational Information 2012, Australian Fisheries Management Authority. Canberra, Australia.<br>5. http://www.environment.gov.au/marinereserves/north/index.html (Accessed July 2013)<br>6. North Commonwealth Marine Reserves Network Management Plan 2014-24 (Cwlth) - F2013L00426<br>7. Woodhams, J., Vieira, S. and Stobutzki, I. (eds). 2012. Fishery status reports 2011. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.<br>8. Anon. 2003. Assessment of the Northern Prawn Fishery. Department of Environment and Heritage. Canberra.<br>9. Anon. 2012. Draft strategic assessment report, Northern Prawn Fishery. Australian Fisheries Management Authority. Canberra.<br>10. Anon. 2012. Ecological Risk Management, Report for the Northern Prawn Fishery, Tiger Prawn and Banana Prawn Sub-fisheries. Australian Fisheries Management Authority. Canberra.<br>11. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania. | |
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| **Commonwealth – Eastern Tuna and Billfish Fishery** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | AFMA employs a risk based compliance strategy that contains five main elements, compulsory ICVMS, vessel inspections, fish receiver inspections, at-sea compliance and an information program. [1] No assessment of or evidence of illegal harvesting by ETBF was identified. |
| | 2.11 Management history: | The ETBF is management under a management plan that is regularly updated. It currently operates under the Eastern Tuna and Billfish Fishery Management Plan 2010. [2] |
| | 2.12 Management plan or equivalent: | The ETBF is currently managed under the Eastern Tuna and Billfish Fishery Management Plan 2010. [2] |
| | 2.13 Aim of harvest regime in management planning: | One major objective is *to maximise the net economic returns to the Australian community from the management of the fishery* [3] |
| | 2.14 Quotas: | The ETBF currently allows no take of Oceanic Whitetip Sharks, and a combined total of 20 sharks of other species per trip. [2] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | While this has not been quantified, it is likely to be low given management arrangement sand the vast area covered by the fishery. Operations within the Coral Sea Zone are limited to a small number of permits, which are subject to restrictions limiting the number of hooks that can be set (500 per shot) and carried (250 spare hooks).[3] Pelagic longlines can be used in some zones of MPAs (for example Habitat Protection Zones in the Temperate East Commonwealth Marine Reserves Network [4]). |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is high confidence in the effective implementation of permit conditions. AFMA have conducted assessment of compliance risks, and outlined actions taken to reduce those risks. Shark fins must remain naturally attached to the carcass. [1] Sharks must be landed with their fins still attached to the carcass and it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed. [2] The use of wire trace is prohibited to reduce shark bycatch. [4]<br>Porbeagle Sharks cannot be targeted, and can only be |

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| | | retained if they are dead at retrieval. [2] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, and catch disposal records. [2] Fishers are required to report number and estimated weight of fish caught, and estimated number of fish discarded.<br>Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is high confidence in the monitoring of retained catches in this fishery, and there is an established observer program which aims to cover 8.5% of the effort. ICVMS is required on all vessels. [1] In addition to Observer coverage, catch verification is also facilitated using a system of AFMA authorised fish receivers and catch disposal records (CDRs). [1] While most hammerhead catch is reported by species, about 1/3 (by weight) has been reported as "hammerhead sharks" since 2001. Since November 2007, catch numbers have been recorded in logbooks as well as weight. There has been very little of any of the five species of interest reported by observers in this fishery, however all records of hammerheads were reported as "Hammerhead Sharks". All Porbeagle Shark and Oceanic Whitetip Shark appeared to have been identified to species. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported catches of the shark species of interest by this fishery are relatively low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the ETBF[2], however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size) restrictions and trigger limits. [3] An observer program is in place and ICVMS is required on all vessels. [3] There is a trip limit of 20 sharks, and use of wire trace is prohibited to decrease bycatch of sharks. Shark finning is banned, as is landing livers without the carcass. Further, use of line cutters and de-hookers is encouraged, and there have been education programs conducted on reducing interactions with turtles, sharks and seabirds. [2] |
| **Risk assessment** | Level 2 ecological risk assessment assigned High risk category to Porbeagle Shark, and Medium to Scalloped Hammerhead, Smooth Hammerhead and Oceanic Whitetip Shark. [6] Spatial overlap for each of those species was *Low overlap*. However, residual risk assessment lowered the risk to Porbeagle Shark to Medium because of reduced shark bycatch through the ban on use of wire trace. [7] | |
| **Recommendations** | 2.20 Improve reporting of hammerhead shark to species level in observer records. | |
| **References** | 1. Anon. 2010. AFMA submission for Reassessment of the Eastern Tuna and Billfish Fishery. Australian Fisheries Management Authority, Canberra.<br>2. Anon. 2013. Eastern Tuna and Billfish Fishery Management Arrangements Booklet 2013 Fishing Season. Australian Fisheries Management Authority, Canberra.<br>3. Eastern Tuna and Billfish Fishery Management Plan 2010 (Cwlth) - F2011L00120<br>4. Director of National Parks 2013, Temperate East Commonwealth Marine Reserves Network Management Plan 2014–24, Director of National Parks, Canberra.<br>5. Anon. 2011. Assessment of the Eastern Tuna and Billfish Fishery. Department of Sustainability, Environment, Water, Population and Communities. Canberra<br>6. Webb, H., A. Hobday, J. Dowdney, C. Bulman, M. Sporcic, T. Smith, I. Stobustzki, M. Fuller, D. Furlani (2007) Ecological Risk Assessment for the Effects of Fishing: Eastern Tuna & Billfish Fishery: Longline Sub-fishery. Report for the Australian Fisheries Management Authority.<br>7. Anon. 2009. Residual Risk Assessment of the Level 2 Ecological Risk Assessment, Species | |

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| | Results, Report for the Eastern Tuna and Billfish Fishery. Australian Fisheries Management Authority, Canberra. | |
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| **Commonwealth – Heard Island and McDonald Islands Fishery** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | There has been significant IUU of Toothfish in the past, however there has been a significant decline in recent year. Estimate IUU catch has been 0 t since 2006/07. [1] |
| | 2.11 Management history: | The HIMI fishery is management under an adaptive management framework that includes a management plan and supporting legislative instruments, developed under the Fisheries Management Act 1991. [2] |
| | 2.12 Management plan or equivalent: | The HIMI fishery is currently managed under the Heard Island and McDonald Islands Fishery Management Plan 2002. [2] |
| | 2.13 Aim of harvest regime in management planning: | One major objective is *to maximise economic efficiency in the exploitation of the resources of the fishery* [3] |
| | 2.14 Quotas: | Fishers are required to retain all bycatch to avoid interactions with seabirds and mammals, however this does not apply to sharks, jellyfish, sponges, crabs and corals which are usually released. [2] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are Marine Reserves and Conservation Zones within the Australian EEZ. No fishing is permitted within the Marine Reserves, but some fishing has been allowed in the Conservation Zones. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | None. The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is high confidence in the effective implementation of permit conditions. AFMA have conducted assessment of compliance risks, and outlined actions taken to reduce those risks. [1] Sharks are not retained, and are returned to the ocean. AFMA have assessed that there is a high level of compliance in the fishery. [1] Vessels are required to use ICVMS, and two observers are on board every trip. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, a Catch Documentation Scheme (CDS) and 200% observer coverage. [1] Fishers are required to report number and estimated weight of fish caught, and estimated number of fish discarded. Observers report number and weights of sharks caught.<br>Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is high confidence in the monitoring of catches in this fishery. There is an established observer program with two observers onboard for all trips, and ICVMS is required on all vessels. [1] In addition to Observer coverage, catch verification is also facilitated using a system of AFMA authorised fish receivers and CDS. [1] Observers verify the vessel supplied information eg: shot by shot catch estimates and conversion ratios from factory operations. [1] The two AFMA authorised observers maintain independent records that are used to verify the vessel supplied information. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported catches of the shark species of interest by this fishery are relatively low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the Australian EEZ, however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection | Information on compliance related to commercial fishing |

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| | measures: | in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size) restrictions and quotas for target species, but there are also bycatch provisions. [2] An observer program is in place and ICVMS is required on all vessels. [1] All sharks caught must be release to the ocean. |
| **Risk assessment** | Under the Level 2 PSA, 17 species were assessed as being at high risk including one target species, seven byproduct species, three discard species and six TEP species. [1] After the application of the Level 2 Residual Risk Guidelines, one species, porbeagle sharks, remained at high risk. [1] However, an additional quantitative SAFE Level 3 assessment of the impacts on the fishery was undertaken and found that no species were in the high risk category. [1] | |
| **Recommendations** | None. | |
| **References** | 1. Anon. (2012). Submission for the re-assessment of the Heard Island and McDonald Islands Fishery. Australian Fisheries Management Authority, Canberra.<br>2. Anon. (2007). Assessment of the Heard Island and McDonald Islands Fishery. DEWR, Canberra.<br>3. Heard Island and McDonald Islands Fishery Management Plan 2002 (Cwlth) - F2012C00164 | |
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| **Commonwealth – Macquarie Island Toothfish Fishery** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | There has only been one known IUU incursion .in the EEZ around Macquarie Island since 1994 when the fishery began during 1994. That vessel was apprehended. |
| | 2.11 Management history: | The MITF is management under an adaptive management framework that includes a management plan and supporting legislative instruments, developed under the Fisheries Management Act 1991. [2] |
| | 2.12 Management plan or equivalent: | The MITF is currently managed under the Macquarie Island Fishery Management Plan 2006. [2] |
| | 2.13 Aim of harvest regime in management planning: | One major objective is *to maximise economic efficiency in the exploitation of the resources of the fishery* [3] |
| | 2.14 Quotas: | Fishers are required to retain all bycatch to avoid interactions with seabirds and mammals, however this does not apply to sharks, jellyfish, sponges, crabs and corals which are usually released. [2] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There is a Marine National Park Zone and two Habitat Protection Zones within the Australian EEZ. [4] No fishing is permitted within the Marine National Park Zone, but some fishing (not trawling) may be allowed in the Habitat Protection Zones in accordance with a class approval from the Director of National Parks. [4] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | None. The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is high confidence in the effective implementation of permit conditions. AFMA have conducted assessment of compliance risks, and outlined actions taken to reduce those risks. [1] Sharks are not retained, and are returned to the ocean. AFMA have assessed that there is a high level of compliance in the fishery. [1] Vessels are required to use ICVMS, and two observers are on board every trip. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, a Catch Documentation Scheme (CDS) and 200% observer coverage. [1] Fishers are required to report number and estimated weight of fish caught, and estimated number of fish discarded. Observers report number and weights of sharks caught.<br>Population estimates are not made for any of the five listed shark species in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is high confidence in the monitoring of catches in this fishery. There is an established observer program with two observers onboard for all trips, and ICVMS is required on all vessels. [1] In addition to Observer coverage, catch verification is also facilitated using a system of AFMA authorised fish receivers and CDS. [1] Observers verify the vessel supplied information eg: shot |

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| | | by shot catch estimates and conversion ratios from factory operations. [1] The two AFMA authorised observers maintain independent records that are used to verify the vessel supplied information. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported catches of the shark species of interest by this fishery are relatively low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | There are a number of closed areas within the Australian EEZ, however spatial analysis is required to determine the proportion protected, and that is outside the scope of this project. |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance related to commercial fishing in protected areas was not found. |
| | 2.26 Regulation of harvest effort: | **Effective.** The fishery is managed mainly through limited entry, gear (type and size) restrictions and quotas for target species, but there are also bycatch provisions. [2] An observer program is in place and ICVMS is required on all vessels. [1] All sharks caught must be release to the ocean. |
| **Risk assessment** | Under the Level 2 productivity/susceptibility analysis (PSA), 48 species were assessed as being at high risk including one target species, 41 byproduct species, three discard species and three threatened, endangered or protected (TEP) species. After the application of the Level 2 Residual Risk Guidelines, no species remained at high risk. An additional quantitative Sustainability Assessment of Fishing Effects (SAFE) Level 3 assessment of the impacts on the fishery also determined that no species were in the high risk category. [1] | |
| **Recommendations** | None. | |
| **References** | 1. Anon. (2010). Annual Status Report. Macquarie Island Toothfish Fishery. AFMA, Canberra.<br>2. Anon. (2011). Assessment of the Heard Island and McDonald Islands Fishery. SEWPAC, Canberra.<br>3. Macquarie Island Toothfish Fishery Management Plan 2006 (Cwlth) - F2013C00157<br>4. http://www.environment.gov.au/marinereserves/south-east/activities.html#summary | |
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| **Commonwealth – Coral Sea (multi-sector)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | All AFMA licensed vessels in the CSF must operate ICVMS to allow AFMA to monitor their activity. There is no evidence of illegal harvesting by CSF. [1]<br>Illegal fishing by foreign vessels has been reported in the vicinity of the CSF. [9] Estimates are not available specifically for the CSF, but total estimated illegal catch of sharks by Indonesian vessels during 2006 in Northern Australian Waters ranged 290–1071 t. That catch comprised 5.2%-7.2% Scalloped Hammerhead and 2.7%–7.7% Great Hammerhead by weight. No estimates of annual catch of Taiwanese vessels was made, but catch composition comprised 6.9% Smooth Hammerhead, 0.4%–2.2% Scalloped Hammerhead and 3.7%–4.7% Oceanic Whitetip Shark. [9] Current illegal fishing by foreign vessels is unknown. |
| | 2.11 Management history: | The Coral Sea Fishery operates under a permit system. Regular reviews of management arrangements are undertaken, and harvest strategies have been in place since July 2008. [1] |
| | 2.12 Management plan or equivalent: | The fishery is managed via permit conditions. Risks are managed through the CSF Harvest Strategy and Bycatch and Discard Work Plan. [1] |
| | 2.13 Aim of harvest regime in management planning: | The CSF is managed in accordance with the objectives specified in section 3 of the Fisheries Management Act 1991. [1] One of these objectives is *maximising the net economic returns to the Australian community from the management of Australian fisheries.* [2] |
| | 2.14 Quotas: | There are no quotas for any of the five shark species of interest. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The Coral Sea Commonwealth Marine Reserve protects |

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| | | the waters of the Coral Sea that fall within Australia's EEZ, however under transitional arrangements, there are as yet no changes on the water for marine users. [4] Two Marine Protected Areas exist within the bounds of the CSF and cover an area of approximately 17,000 square kilometres. No commercial fishing is permitted in these reserves.[3] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | AFMA have conducted assessment of compliance risks, and outlined actions taken to reduce those risks. Shark fins must remain naturally attached to the carcass. [1] Shark livers may not be carried, retained or landed without the carcass. [3]<br>Trawl operators are required to use BRDs when trawling for crustaceans. [1] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, and catch disposal records. [3] Fishers in the Line and Trap sectors are required to report processed weight and number of catch by species, and there is facility to report weight of discards. Fishers using Trawl gear are required to report processed weight of catch by species, and there is facility to report weight of discards.<br>Population estimates are not made for any of the five listed shark species in this fishery, however there are provisions in the harvest strategy to respond to variations of catch metrics for individual species outside of acceptable ranges. [3] |
| | 2.20 Confidence in harvest monitoring: | There is an established observer program. Logbook records obtained identified hammerheads to species level, however the group code Whaler and Weasel Sharks (which may include Oceanic Whitetip Sharks) was also in the data. There was only one record of any of the five species of interest in the observer data, and that was a Hammerhead that was not identified to species. VMS is required on all vessels. [3] In addition to observer coverage, catch verification is also facilitated using a system of AFMA authorised fish receivers and catch disposal records (CDRs). These apply to all sectors with the exception of the Aquarium sector. [1] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Logbook catches of Hammerhead Sharks and Whalers and Weasel Sharks are <1% of global catches for these species and catches reported in observer data are <100 kg total. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | Two Marine Protected Areas exist within the bounds of the CSF and cover an area of approximately 17,000 $km^2$, which represents about 1.7% of the 972,000 $km^2$ Coral Sea Fishery. No commercial fishing is permitted in these reserves.[3]<br>Once the new MPAs are introduced with corresponding management arrangements during 2014, the level of protection should increase to >15%. |
| | 2.25 Effectiveness of strict protection measures: | Surveillance and compliance are addressed in the management plan for the two nature reserves including outlines of goals and strategies [5], however because of the very large area and remote location, the confidence has been reduced from high. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size) restrictions and trigger limits. [3] An observer program is in place and VMS is required on all |

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| | | vessels. [3]<br>Trawl operators are required to use BRDs when trawling for crustaceans. [1]<br>There is little effective restriction on potential harvest of any of the five listed shark species. |
| **Risk assessment** | Demersal Long Longline – ERA states that sharks are often recorded in logbooks to genus level only. A number of fishing activities were lists as "moderate intensity/ minimal impact" or the lesser "occurs rarely/minimal impact" for Carcharhinidae family (which include Oceanic Whitetip Shark). These include Gear loss, Navigation/steaming, Organic waste disposal, Exhaust, Activity/presence on water and Other non-extractive activities. [6]<br>Auto Long Longline - A number of fishing activities were lists as "moderate intensity/ maximum impact that still meets an objective", "moderate intensity/ minimal impact" or the lesser "occurs rarely/minimal impact" for shark species (which include Oceanic Whitetip Shark). These include Fishing, Gear loss, Navigation/steaming, Onboard processing, Provisioning, Organic waste disposal, Activity presence on water, Other non-extractive activities. [7]<br>Other line - ERA states that sharks are often recorded in logbooks to genus level only. A number of fishing activities were listed as "moderate intensity/ minimal impact" or the lesser "occurs rarely/minimal impact" for *Carcharhinus spp* (which include Oceanic Whitetip Shark). These include Fishing, Gear loss, Navigation/steaming, Activity/presence on water and Other non-extractive activities. One of the key uncertainties was the accuracy of the species taken by the fishery, with 25% of all catch records being identified to genus or family grouping only. [8] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required. This was done across all of northern Australia (Marshall 2011) but needs to be disaggregated to fishery level.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.20 Observer data on retained and discarded shark species should be identified down the species level. Commercial logbook data is generally identified to species level for hammerheads but whalers and weasel sharks are often grouped but any Oceanic Whitetip Sharks should be specifically identified (there was none apparent in the observer data).<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature population. | |
| **References** | **1.** Anon. 2010. Strategic Assessment Report: September 2010 Coral Sea Fishery. Australian Fisheries Management Authority.<br>**2.** Fisheries Management Act 1991 (Cwlth) - C2013C00238<br>**3.** Anon. 2011. 2011 Fishing Season: Coral Sea Fishery Management Arrangements Booklet. Australian Fisheries Management Authority.<br>**4.** http://www.environment.gov.au/marinereserves/coralsea/overview.html (accessed June 2013)<br>**5.** Anon. 2001. Coringa-Herald National Nature Reserve and Lihou Reef National Nature Reserve Management Plan. Environment Australia.<br>**6.** Furlani, D., Fuller, M., Bulman, C., Dowdney, J. and Sporcic, M. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Demersal longline Sub- fishery of the Coral Sea Fishery. Report for the Australian Fisheries Management Authority, Canberra.<br>**7.** Furlani, D., Fuller, M., Dowdney, J., Bulman, C., and Sporcic, M. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Auto longline Sub-fishery of the Coral Sea Fishery. Report for the Australian Fisheries Management Authority, Canberra.<br>**8.** Furlani, D., Fuller, M., Dowdney, J., Bulman, C., and Sporcic, M. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Other Line Sub-fishery of the Coral Sea Fishery. Report for the Australian Fisheries Management Authority, Canberra.<br>9. Marshall, L. (2011). The Fin Blue Line, Quantifying Fishing Mortality Using Shark Fin Morphology. PhD Thesis. University of Tasmania. | |
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| **Commonwealth – Australian High Seas Fisheries** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Illegal harvest in the area of this fishery is unquantified. |
| | 2.11 Management history: | This fishery manages harvest through limited entry, gear restrictions, catch trigger limits, and come under the influence of two regional fisheries treaties, the Convention on the Conservation and Management of High Seas Fisheries Resources in the South Pacific Ocean which establishes the South Pacific Regional Fisheries Management Organisation (SPRFMO), and the Southern Indian Ocean Fisheries Agreement (SIOFA) [1] |
| | 2.12 Management plan or equivalent: | Australia's High Seas Permits are managed via permit conditions [4], which are set at the start of each year, guided by the multilateral treaties SPRFMO and SIOFA. [1] |
| | 2.13 Aim of harvest regime in management | The objective of the SPRFMO is *through the application* |

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| | planning: | *of the precautionary approach and an ecosystem approach to fisheries management, to ensure the long-term conservation and sustainable use of fishery resources and, in so doing, to safeguard the marine ecosystems in which these resources occur*. [2] The objective of the South Indian Ocean Fisheries Agreement (SIOFA) is to *ensure the long-term conservation and sustainable use of fishery resources other than tuna in areas that fall outside national jurisdictions.* [3] |
| | 2.14 Quotas: | Catch trigger limits of target species (not sharks) and vulnerable marine ecosystems initiate a review of management arrangements. [4] There are no restrictions of quantities of sharks taken. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | The single Australian company that trawls in the SIOFA Area is the founding member of SIODFA and has abided by voluntary closures since implementation in 2006. [7] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership**.** |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | One of the mandatory requirements on permits is that sharks must be landed with fins and livers unremoved, however there is no restriction on the take of the five listed shark species. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing logbooks, and "weight of evidence approach is taken to assessing main commercial species. [5] Level of species identification in logbooks was generally good with Oceanic Whitetip Shark and Porbeagle Shark reported to species, but there was a small amount of "Whaler and weasel sharks" in the data. No hammerheads were reported in the logbooks for this fishery. Only catch weights have been reported, not number. Discard weight has been reported in commercial catches, and there were no records of any of the five species of interest were in the observer data.<br>Population estimates are not made for any of the five listed shark species in this fishery.<br>SPRFMO require reporting of estimates of live weight of retained and discard species (if possible). [8] Information on reporting requirements in the SIOFA could not be found. |
| | 2.20 Confidence in harvest monitoring: | There is high confidence in the monitoring of retained catches in this fishery, and there is an established observer program whereby trawl operations under Australia's High Seas Permits have 100 per cent observer coverage, and for non-trawl operations the first trip must have an observer onboard and 10 per cent coverage for trips thereafter. VMS is required on all vessels. [4] |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | Reported catches of the Oceanic Whitetip Shark and Porbeagle Shark by this fishery are very low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | Although While SPRFMO interim measures do not specify any closures in it's area, AFMA have closed he South Tasman Rise to Australian fishing effort inside and outside the EEZ boundary since 2007, removing nine of the 20' blocks of the Australian footprint from permits. This equates to less than 0.1% of the total SPRFMO area. Only 1.1% of the ~59 million $km^2$ SPRFMO area is considered fishable by bottom methods (<2000 m depth). [6]<br>Only 1.7% of the ~27 million $km^2$ SIOFA area is |

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| | | considered fishable by bottom methods (<2000 m depth). There are 10 voluntary closed areas within the SIOFA boundary comprise a total area of 223,121 km$^2$. The closures cover between 0.5 and 10.5% of each of the fishable bathomes, and between 0.5 and 5% of the total area of the fishing grounds. [7] |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance could not be found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through limited entry, gear (type and size) restrictions and trigger limits. [3] An observer program is in place and VMS is required on all vessels. [4] There is uncertainty as there is no restriction on potential harvest of any of the five listed shark species. |
| **Risk assessment** | Impact assessments of the bottom fishery have been completed for both the SIOFA and SPRFMO regions, however neither specifically assessed the risk to sharks. [9,10]<br>In the 2013 assessment of the fishery, SEWPAC stated "The department is unaware of any risk assessment of the vulnerability of other bycatch and discard species, such as bony fish, sharks, rays and mobile invertebrates, to fishing operations of non-migratory species on the high seas by Australian flagged vessels. " [4] | |
| **Recommendations** | 2.10 An estimate of the annual catch of each of the five species of interest by IUU fishing is required.<br>2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for the five listed shark species could be implemented.<br>2.26 A maximum size limit could be implemented for the non-trawl sector to ensure stricter protection of a portion of the mature population. | |
| **References** | 1. Woodhams J, Stobutzki I, Noriega R and Roach J (2012). Sustainability of harvest levels by Australian flagged vessels in high seas areas of the South Pacific Ocean and Southern Indian Ocean. ABARES report to client prepared for the Australian Fisheries Management Authority, Canberra, November 2012.<br>2. Anon. Undated. Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean. http://www.southpacificrfmo.org/assets/Convention-and-Final-Act/2353205-v2-SPRFMOConvention-textascorrectedApril2010aftersignatureinFebruary2010forcertificationApril2010.pdf (Accessed June 2013)<br>3. http://www.fao.org/fishery/rfb/siofa/en (Accessed June 2013)<br>4. Anon. 201 . Assessment of Australia's High Seas Permits. Department of Sustainability, Environment, Water, Population and Communities. Canberra.<br>5. Woodhams, J, Stobutzki, I, Noriega, R & Roach, J 2012, Sustainability of harvest levels by Australian flagged vessels in the high seas areas of the South Pacific Ocean and South Indian Ocean, ABARES report to client prepared for the Australian Fisheries Management Authority, Canberra, November 2012.<br>6. Williams, A., Althaus, F., Fuller, M., Klaer, N. and Barker, B. 2011. Australian report for the South Pacific Regional Fisheries Management Organisation (SPRFMO). CSIRO Marine and Atmospheric Research. Hobart.<br>7. Williams, A., Althaus, F., Fuller, M., Klaer, N. and Barker, B. 2011. Australian report for the Southern Indian Ocean Fisheries Agreement (SIOFA). CSIRO Marine and Atmospheric Research. Hobart.<br>8. Anon (2013) 1st Commission Meeting 28 January - 1 February 2013. Annex N. CMM 1.03. Conservation and Management Measure on Standards for the Collection, Reporting, Verification and Exchange of Data. SPRFMO. New Zealand.<br>9. CSIRO. 2011. Australian report for the Southern Indian Ocean Fisheries Agreement (SIOFA). CSIRO, Hobart.<br>10. CSIRO. 2011. Australian report for the South Pacific Regional Fisheries Management Organisation (SPRFMO). CSIRO, Hobart. | |
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| **South Australia – Marine Scalefish Fishery (MSF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Illegal catch of hammerheads is unquantified, but likely to be small. |
| | 2.11 Management history: | This fishery is managed under a management plan with a limited operational period and is subject to regular review. [1] |
| | 2.12 Management plan or equivalent: | Management Plan for the South Australian Marine Scalefish Fishery (2006) [1] |
| | 2.13 Aim of harvest regime in management planning: | One major objective is *Optimal utilisation of Marine Scalefish Fishery resources within the constraints of sustainability imperatives.* |

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| | | *a. Improve economic efficiencies and financial returns to the commercial fishery* [1] |
| | 2.14 Quotas: | There are quotas and trip limits for some species caught in this fishery, but not for the five species of interest. [2] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | A network of 19 zoned marine parks covering 44% of State waters were established during 2009 in South Australia, and about 6% of State waters will be no-take when the sanctuary ones have been "phased in" during October 2014. [3] Reporting of fishing location is at too coarse a scale to enable accurate assessment of harvest within protected areas, however analysis of historical fishing effort for handline, haulnet, longline and "other" gear types in this fishery, estimated that 3.14%, 9.76%, 3.91% and 3.11% of historical effort occurred in areas that will be designated as sanctuary zones. [4] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Finning is prohibited in the MSF. [9] Information on compliance rates could not be found |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing returns. [1] Fishers report headed and gutted weights, and this is multiplied by 1.8 to calculate whole weight. Numbers of sharks are not required or reported. Population estimates are not made for Smooth Hammerhead in this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is low confidence in the monitoring of retained catches of these sharks in this fishery, however all of the reported catches of hammerheads were recorded as the group "Hammerhead Shark", and they have only been differentiated from "Sharks" since 2007. Fishers have the capacity to report non-retained catch in logbooks, however this is voluntary. [5] There has been one limited fishery observer program in the fishery during September 2007 to August 2008. [7] That program only monitored the three main gear types used, handlines, longlines and haul nets, and observed a total of 122 fishing operations during that time. Of the 16 different elasmobranchs observed during that study, none of the five listed shark species were amongst them. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | The reported retained catch of hammerheads by this fishery is relatively low (<6 t per year). |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | Approximately % of South Australia's marine waters are proposed for protection from fishing by marine sanctuaries after October 2014. [3] Currently, there are 16 aquatic reserves that have different rules restricting certain activities. These are generally small in area except for the 1,690 km x 3 nm Far West Coast Marine Park that is already in existence. [6] |
| | 2.25 Effectiveness of strict protection measures: | Information on compliance of strict protection measures could not be found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed mainly through input controls including limited entry, gear (type and size) restrictions. [3] There is uncertainty as to the effectiveness of restrictions on potential harvest of hammerheads. There are no limits of catch or possession of the five shark species. |
| **Risk assessment** | An ERA has been completed for this fishery [8], and considers the Smooth Hammerhead along with other Sharks, skates and rays (page 69). The take of other sharks, skates and rays (which includes Smooth Hammerhead) was considered by the ERA to be negligible compared to the overall population sizes and | |

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| | that this level of take is likely to continue into the future. The risk rating assigned was NEGLIGIBLE. |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for Smooth Hammerhead and Porbeagle Shark could be implemented.<br>2.19 Improve reporting of sharks to species level in commercial logbooks and record any discards.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature population. |
| **References** | 1. Primary Industries and Resources South Australia. 2006. Management Plan for the South Australian Marine Scalefish Fishery. The South Australian Fisheries Management Series, Paper No 45, Adelaide.<br>2. Primary Industries and Resources South Australia. 2011. Ecological Assessment of the South Australian Marine Scalefish Fishery: Reassessment Report. The South Australian Fisheries Management Series, September 2011, Adelaide.<br>3. http://www.environment.sa.gov.au/marineparks/About (Accessed June 2013)<br>4. Ward, T.M., Burch, P., Gorman, D. and Begg, G.A. (2012). Estimates of historical commercial fishery catches/effort in final sanctuary and habitat protection ones in South Australia's Marine Parks. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000307-8. SARDI Research Report Series No. 670. 77pp.<br>5. Anon. 2005. Assessment of the South Australian Marine Scalefish Fishery. Department of Environment and Heritage. Canberra.<br>6. Department of Environment, Water and Natural Resources. 2012. Far West Coast Marine Park Management Plan 2012. Government of South Australia.<br>7. Fowler AJ, Lloyd M, Schmarr D (2009). A preliminary consideration of by-catch in the Marine Scalefish fishery of South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, F2009/000097-1. SARDI Research Report Series No. 365. 79 pp.<br>8. Primary Industries and Resources South Australia. 2011. Ecologically sustainable development (ESD) risk assessment of the South Australian commercial Marine Scalefish Fishery. Government of South Australia. July 2011.<br>9. Fisheries Management (General) Regulations 2007. (Version: 24.5.2013) |

| **Victorian – Ocean Access Fishery (OAF)** | | |
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| **Harvest management** | 2.10 Illegal harvest or trade: | Illegal catch of hammerheads is unquantified, but likely to be small.<br>Estimates of compliance rates for the OAF were not found, however information on enforcement outcomes for commercial fishers (all Victorian Fisheries) covering 1 July 2012–31 March 2013 reported 633 inspections, resulting in 57 offenders detected. [5] |
| | 2.11 Management history: | Management arrangements are in place, however there is no management plan specifically for this fishery. The fishery is managed under the Fisheries Act 1995 and Fisheries Regulations 2009. [6] |
| | 2.12 Management plan or equivalent: | There is no management plan or equivalent in place for this fishery, but the fishery is managed under the Fisheries Act 1995 and Fisheries Regulations 2009. [6] |
| | 2.13 Aim of harvest regime in management planning: | The objectives of the Fisheries Act 1995 are (a) to provide for the management, development and use of Victoria's fisheries, aquaculture industries and associated aquatic biological resources in an efficient, effective and ecologically sustainable manner; (b) to protect and conserve fisheries resources, habitats and ecosystems including the maintenance of aquatic ecological processes and genetic diversity; (c) to promote sustainable commercial fishing and viable aquaculture industries and quality recreational fishing opportunities for the benefit of present and future generations; (d) to facilitate access to fisheries resources for commercial, recreational, traditional and non-consumptive uses; (e) to promote the commercial fishing industry and to facilitate the rationalisation and restructuring of the industry; (f) to encourage the participation of resource users and the community in fisheries management. [7]<br>This objective does not match any of the options for this factor, however it could be considered to be more conservative than "Maximise economic yield", but less conservative than "Generate conservation benefit". |

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| | 2.14 Quotas: | There are no limits of catch or possession of the five shark species in this fishery. |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | There are no multi-use MPAs in Victorian that allow fishing by the OAF. [2] |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | Despite the lack of a management plan, Fisheries Victoria operates a compliance program, and there is confidence in the effective implementation of the management controls that are in place. There are no limits of catch or possession of the five shark species. |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing returns. [1] Fishers report whole weights. Numbers of sharks are not required or reported. There is no requirement for fishers to report to species level. Population estimates are not made for Smooth Hammerhead in this fishery. There is no observer data available for this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is low confidence in the monitoring of retained catches in this fishery, as all of the reported catches of hammerheads were recorded as the group "Shark, Hammerheads", non-retained catch has not been recorded in logbooks, and there has been no observer program for this fishery. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | The reported catch of hammerheads by this fishery is relatively low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | 5-15%. A total of 5. % of Victoria's marine waters (out to 3 nm) are protected by Marine National Parks and Marine Sanctuaries. All of that area is no-take. [2] |
| | 2.25 Effectiveness of strict protection measures: | DEPI (previously DPI and DSE) are responsible for enforcement of no-take zones. While an enforcement program is in place, a recent review reported that "Neither DPI nor DSE has a comprehensive whole-of-organisation, risk-based approach to managing their compliance responsibilities" and that "as a consequence, DPI and DSE cannot be sure that their compliance activities contribute to protecting natural resources, primary industries and the environment as the legislation intended". [8] |
| | 2.26 Regulation of harvest effort: | The fishery is managed through input controls including limited entry, gear (type and size) restrictions. [3] There is uncertainty as to the effectiveness of restrictions on potential harvest of hammerheads. There are no limits of catch or possession of the five shark species. |
| **Risk assessment** | The E A for this fishery did not consider any of the five listed shark species specifically but "other sharks" were included in the group "Other retained species". The risk of an effect on the population resulting from harvesting for sale was assessed as Low. It was highlighted, however, that slow breeding and low productivity of sharks could heighten the risks associated with harvest. | |
| **Recommendations** | 2.14 Quotas are not appropriate for infrequently caught byproduct/ bycatch species, but trip limits or catch triggers for Smooth Hammerhead and Porbeagle Shark could be implemented.<br>2.19 Improve identification of shark catches in commercial logbooks.<br>2.20 An observer program should be implemented and data on retained and discarded shark species should be identified down the species level.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature shark population. | |
| **References** | 1. Department of Primary Industries. 2008. Fishery Status Report 2008. Fisheries Management Report Series No 63, Melbourne.<br>2. Department of Environment and Primary Industries http://www.dse.vic.gov.au/coasts-and-marine/marine/marine-national-parks-and-sanctuaries (Accessed June 2013)<br>3. Fisheries Regulations 2009 http://www.austlii.edu.au/au/legis/vic/consol_reg/fr2009219/ (Accessed 15/5/2013) | |

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| | 4. Anon. 2008. Ocean Access (& Coastal Waters Recreational) Fishery Risk Assessment Reporting Table October 2008 Review. Fisheries Victoria, Melbourne.<br>5. http://www.dpi.vic.gov.au/fisheries/enforcement/about-education-and-enforcement (Accessed July 2013)<br>6. http://www.dpi.vic.gov.au/fisheries/about-fisheries/legislation-and-regulation (Accessed July 2013)<br>7. Fisheries Act 1995 No. 92 of 1995 (Version No 070 incorporating amendments as at 18 March 2013)<br>8. VAG. 2012. Effectiveness of Compliance Activities: Departments of Primary Industries and Sustainability and Environment. Victorian Auditor-General's eport October 2012, Melbourne. | |
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| **Tasmanian – Scalefish Fishery (SF)** | | |
| **Harvest management** | 2.10 Illegal harvest or trade: | Unquantified, likely to be small. Estimates of compliance rates for the SF were not found |
| | 2.11 Management history: | The SF is managed under the Scalefish Management Plan which has been periodically revised (2001, 2004, 2009) with performance indicators and reference points [1] |
| | 2.12 Management plan or equivalent: | The SF is managed under the Scalefish Management Plan [1] |
| | 2.13 Aim of harvest regime in management planning: | One major objective is *To optimise yield and/or value per recruit* [1] |
| | 2.14 Quotas: | There is a trip limit of 5 sharks (other than Elephant Fish) in the SF. [3] |
| **Control of harvest** | 2.15 Harvesting in Protected Areas: | In total 7.9% of Tasmania's State coastal waters is reserved, however only 4.2% is in no-take areas and the majority of this is concentrated around subantarctic Macquarie Island. Only 1.1% of Tasmania's immediate coastal waters are fully protected in no-take areas. [2] Reported catches are outside of Marine Protected Areas. |
| | 2.16 Harvesting in areas with strong resource tenure or ownership: | The fishery is managed which could be considered to have high resource tenure or ownership. |
| | 2.17 Harvesting in areas with open access: | The legal harvest by this fishery is managed and could not be described as 'open access'. |
| | 2.18 Confidence in harvest management: | There is a trip limit of 5 sharks (other than Elephant Fish) in the SF. [3]<br>A person must not, in State waters, be in possession of shark fins without the trunks or bodies from which they came. [3] |
| **Monitoring of harvest** | 2.19 Methods used to monitor the harvest: | Catch is monitored through fishing returns. [1] Populations estimates are not made for Smooth Hammerhead in this fishery. There is no observer program for this fishery. |
| | 2.20 Confidence in harvest monitoring: | There is low confidence in the monitoring of retained catches in this fishery, as each of the small number of reported catches of hammerheads were recorded as the group code "CAAB Code 7 019000", non-retained catch has not been recorded, and there has been no observer program for this fishery. |
| **Incentives and benefits from harvesting:** | 2.21 Utilization compared to other threats: | The reported catch of hammerheads by this fishery is extremely low. |
| | 2.22 Incentives for species conservation: | There is no species conservation benefit to this species accruing from harvesting. |
| | 2.23 Incentives for habitat conservation: | There is no habitat conservation benefit to this species accruing from harvesting. |
| **Protection from harvest:** | 2.24 Proportion strictly protected: | <5%. Only 1.1% of Tasmania's immediate coastal waters are fully protected in no-take areas. There are additional no-take zones around Macquarie Island, however the fishery does not operate in those waters [2] |
| | 2.25 Effectiveness of strict protection measures: | Information on the effectiveness of strict protection measures could not be found. |
| | 2.26 Regulation of harvest effort: | The fishery is managed through input controls such as limited entry, gear (type and size) restrictions. [1] There is a trip limit of 5 sharks (other than Elephant Fish) in the SF. [3] |

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| **Risk assessment** | An ERA is currently being conducted for this fishery and is expected to be available during August 2013. |
| **Recommendations** | 2.19 Improve identification of shark catches in commercial logbooks.<br>2.20 An observer program should be implemented and data on retained and discarded shark species should be identified down the species level.<br>2.26 A maximum size limit could be implemented to ensure stricter protection of a portion of the mature shark population. |
| **References** | 1. Hartmann, K. and Lyle, J.M. 2011. Tasmanian Scalefish Fishery – 2009/10. Institute for Marine and Antarctic Studies. University of Tasmania. Hobart, March 2011.<br>2. Parks and Wildlife Service Tasmania http://www.parks.tas.gov.au/?base=397 (Accessed June 2013)<br>3. Fisheries (Scalefish) Amendment Rules 2009. Statutory Rules 2009. |

# Appendix 6: Guidance for Domestic Implementation of CITES in Commercial Fisheries – Non-Detriment Findings Fact Sheet

## Guidance for Domestic Implementation of CITES in Commercial Fisheries – Non-Detriment Findings

The Convention on International Trade in Endangered Species (CITES) is a binding international agreement, which was ratified by Australia in 1976. The purpose of CITES is to prevent international trade from driving unsustainable population decline in species listed on the Convention's appendices. CITES requires the exporting Party's Scientific Authority to make a positive non-detriment finding (NDF) prior to export of CITES specimens.

A positive NDF is made when *"the sum of all harvests is sustainable in that it does not result in unplanned range reduction, or long term population decline, or otherwise change the population in a way that might be expected to lead to the species being eligible for inclusion in Appendix I".*

CITES is not prescriptive regarding the process Parties (i.e. countries which are signatories to CITES) should follow in arriving at a NDF, however at the 16th meeting of the Conference of the Parties, a Resolution was adopted, http://www.cites.org/common/cop/16/com/E-CoP16-Com-I-07.pdf, that provides a guide to how Parties may consider developing science based NDFs that would satisfy CITES requirements. This Resolution should lead to a more consistent approach, so that both Parties involved in permitting an import/export transaction can be satisfied that CITES requirements have been met.

To ensure that fisheries declared as approved Wildlife Trade Operations (WTO) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) continue to be able to trade internationally in CITES-listed marine species, Australia's CITES Scientific Authority for Marine Species needs to make NDFs based on a level of information that meets these standards.

Australia's CITES Scientific Authority for Marine Species has taken a risk-based approach to the information requirements for making NDFs which closely follows the guidance included in the Resolution. Under this approach, the level of information required to inform a NDF will vary depending on the biological vulnerability of the species, its global and national status, the risks posed to the species, and the degree of certainty associated with these factors.

The standard information fields for NDFs include:

- species biology;
- species life history characteristics;
- species range – historic and current;
- population structure, status and trends (nationally and in the harvest area);
- threats;
- species specific (or in some instances genus specific[1]) levels of harvest/ mortality from the fishery (historic and current);
- estimates of species specific (or in some instances genus specific[1]) levels of harvest/mortality from <u>*all sources*</u> combined;
- results of population modelling;
- management measures currently in place and proposed, including consideration of rates of compliance;

[1] Genus-level reporting is acceptable for some coral species.

- a *scientific* assessment of the level of harvest that is considered sustainable under the management regime taking into account all sources of mortality;
- trade information relating to the species.

**International CITES Implications**

Australia, in preparation for the adoption of this Resolution undertook to review and where appropriate modify the approach for determining NDFs for marine species over the past 18 months. This improved process is intended to ensure that all exports from Australia are rigorously assessed and meet CITES requirements before an export permit is issued.

Some CITES Parties also require CITES exporting parties to provide their NDF or the information forming the basis for their NDFs prior to allowing imports of CITES listed species into their country. A number of countries including the European Union (EU) have chosen this avenue in order to be confident that the Convention is being applied properly by all Parties and international trade of CITES specimens into their country is not contributing to unsustainable utilisation in other parts of the world. This means that Australia (as an exporting party) has to be able to provide appropriate evidence that our harvest regimes and management measures are sustainable. The CITES Scientific Authority for Marine Species has received an increasing number of such requests over the past 12 months.

Running parallel to the increased scrutiny from importing Parties, there has been an increase in the number of marine species being examined through the formal CITES process to check that Parties are meeting their CITES NDF obligations. In recent years, Australia has been included in this process, known as the 'Review of Significant Trade'. The purpose of these reviews is to examine species of concern and determine if Parties are upholding their obligations under the Convention and determine if there are any significant problems with the implementation of NDFs. The outcome of these assessments can be international trade bans if countries are found to be breaching their obligations. During recent years, Australia's CITES Scientific Authority for Marine Species has been required to provide advice to the CITES Secretariat on our trade and NDFs for 4 seahorse species, 20 coral species and 1 species of giant clams.

**CITES Precautionary Principle**

Adopted at the 11th meeting of the CITES Conference of the Parties (Gigiri, 2000), the CITES Strategic Vision states that "*Where uncertainty remains as to whether trade is sustainable, the precautionary principle will be the ultimate safeguard*". Australia's CITES Scientific Authority for Marine Species interprets the precautionary principle under CITES as the definition of the precautionary approach set out in Principle 15 of the Rio declaration (United Nations Conference on Environment and Development, 1992). It states: *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".*

Further, during the 14th meeting of the Conference of the Parties (The Hague), an objective was set that the *"best available scientific information should be the basis for non-detriment findings".* Where species are considered particularly vulnerable or rare and have a relatively high level of harvest, the burden of proof in a NDF will be high. As such, if information is limited, the level of harvest of the species should be limited accordingly, and the basis for the harvest limit must be scientifically justified. If the burden of proof is unable to be met, the harvest of the species must be considered detrimental until it can be demonstrated otherwise.

**Type of Information Required**

In general, if the CITES Scientific Authority for Marine Species has access to the following information, a rigorous NDF assessment will be able to be conducted:

- relevant scientific literature concerning species biology, life history, distribution and population trends;
- details of any ecological risk assessments conducted;
- scientific surveys conducted at harvest locations and related sites that the species could recruit from (i.e. demonstrated important habitat that has been protected from harvest and other impacts);
- relevant knowledge and expertise of local and Indigenous communities;
- stock assessments;
- data on historical harvest, catch distribution, and catch per unit effort, including explanations of any change in these over time (e.g. reduced effort, or became harder to find);
- information on all sources of mortality, including activities such as recreational or Indigenous fishing, and any important ecological disturbances that affect the CITES listed species; and
- the management arrangements for the species, including harvest levels, and justification as to why this is considered sustainable within the relevant context.

It is important to note that where harvest levels are shown to be increasing, either on a national or regional scale, there may need be a higher burden of proof to inform the NDF and ensure that the proposed level of harvest is sustainable.

Where insufficient scientific evidence is available, the Australian CITES Scientific Authority for Marine Species will take into account all available information and apply the precautionary approach in making its non-detriment assessment. It is possible that harvest of CITES listed species will be restricted until such time as adequate scientific information can be considered.

**Key issues regarding NDF for CITES specimens harvested from commercial fisheries**

Currently, in many Australian commercial fisheries, there appears to be limited information available on the majority of CITES listed species in relation to species biology, life history, and population distribution, status and trends. Research that would allow the level of detail required to conduct a rigorous NDF has often not been undertaken.

Australia's CITES Scientific Authority for Marine Species understands that this information will take time to gather, however, in the interim, precautionary management measures may need to be applied to ensure Australia meets its CITES obligations.

**Where to from here?**

Prior to submitting information to DSEWPaC for assessment of fisheries for export approval, fisheries management agencies are encouraged to analyse the amount of information already available on CITES species within their fishery, assess its accuracy, recency, completeness and determine any significant gaps in information that may limit the preparation of a NDF for each species. In doing this, questions to consider are:

**Historical Catch Information**

- Is the information species specific?
- Does it indicate whether harvest is localised or widespread?
- Does it indicate stable, increasing, decreasing or alternating harvest levels, and is the spatial distribution of harvest consistent?

**Population Surveys & Stock Assessments**

- Have any population surveys been undertaken?
- Have stock assessments been conducted?
- How long ago were these population surveys or stock assessments conducted?

- Have harvest levels been stable since the stock assessments were conducted? If not, an assessment of the reasons for change (demand; catchability) needs to be made.
- Are there any stock assessments or population data in the region or throughout the world that give an indication of local or global status?

**Species-Specific Information**

- Is there information available on species biology and life history characteristics?
- Is this information relevant to wild populations in Australia?
- Is there research to indicate how species life history characteristics relate to its ability to support and recover from harvest?
- Is there any research on the impact of disturbances and other threats on species, e.g. disease, invasive species, coral bleaching?

If any of these questions represent information gaps, then these uncertainties should be recognised within the submission for export approval.

**Additional Information**

- Has there been any anecdotal evidence of population declines in Australia?

**Recreational and Indigenous Fishing and sources of mortality**

- Is there any evidence of the species being targeted by recreational or Indigenous fishing? If so, what is the scale of this harvest thought to be, and what uncertainties exist?
- Is there evidence of illegal take of the species in the area of the population in question and/or nationally?

If there are information gaps, it may not be possible for the management agency to fill them, but this will have to be accounted for in designing appropriately precautionary management. The design and an explanation of the suitability of these measures should be explained to DSEWPaC in your submission for assessment of the fishery.

**Management Arrangements**

- Are there management arrangements in place specific to CITES species to ensure harvest is controlled and monitored? (E.g. harvest triggers to require collection of additional information, or spatial management of catch)
- What compliance mechanisms are in place, and how effective are they?
- Should more precautionary management (such as limits on harvest) be introduced to ensure future harvest of CITES species is demonstrably controlled and sustainable? This is especially important where there is a significant gap in scientific information for CITES species taken by the fishery.

Where significant data gaps are identified, the fishery is encouraged to commission relevant research to address these gaps, and limit harvest to precautionary levels in the interim.