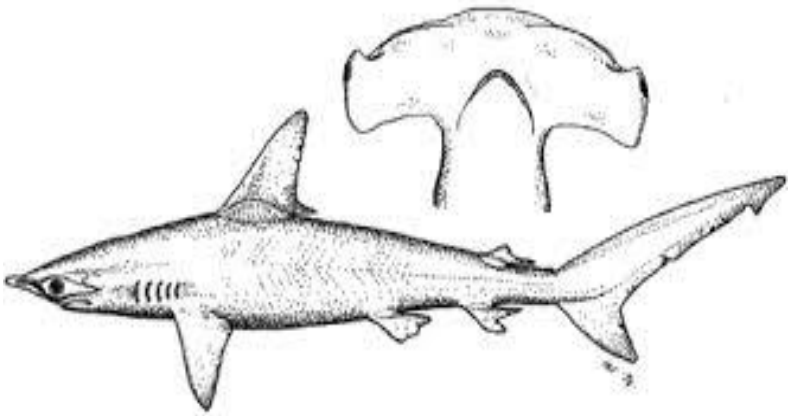
New Zealand non-detriment finding for smooth hammerhead shark

Sphyrna zygaena



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1. Introduction

In March 2013, the 16th Conference of the Parties (CoP16) of the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) listed seven commercially-important species of sharks and rays on Appendix II of the Convention: porbeagle shark *Lamna nasus*, oceanic whitetip shark *Carcharhinus longimanus*, scalloped hammerhead shark *Sphyrna lewini*, great hammerhead shark *Sphyrna mokarran*, smooth hammerhead shark *Sphyrna zygaena*, giant manta ray *Manta birostris* and reef manta ray *Manta alfredi*. Because these new listings were likely to require considerable work before the listings could be implemented, the date of entry onto CITES Appendix II was delayed by 18 months until 14 September 2014.

The CITES convention has three Appendices (I, II and III), based largely on the level of risk that international trade could have on the viability of wild populations of the species. Trade in plant or animal species listed in Appendix II has three requirements that must be fulfilled before permits are issued:

1. The CITES Management Authority of the exporting country (or equivalent recognised authority in the case of countries that are not Parties to the CITES Convention) must verify that the species was obtained legally;

2. In the case of live specimens, the CITES Management Authority must verify that specimens will be transported in a humane manner, and

3. The CITES Scientific Authority of the exporting country must advise that such export will not be detrimental to the survival of the species (known as a non-detriment finding (NDF)).

Also at the CITES CoP16, Parties adopted Resolution 14.6 (Rev. CoP16) which specifies procedures associated with trade in CITES-listed species obtained on the high seas (i.e. marine areas beyond national jurisdiction and outside the 200 nautical mile jurisdiction of any State). In the case of specimens of Appendix II species, the Scientific Authority (usually from the State where the specimen will be landed, but this can vary depending on particular chartering arrangements) must issue an NDF before the specimens are actually taken (i.e. collected at sea).

The listing of smooth hammerhead shark on Appendix II of CITES therefore requires an NDF to be issued in three situations:

- before the export of smooth hammerhead shark products that were obtained within the New Zealand Exclusive Economic Zone (EEZ),

- before the take of smooth hammerhead shark on the high seas by a New Zealand vessel and landed at a New Zealand port, and

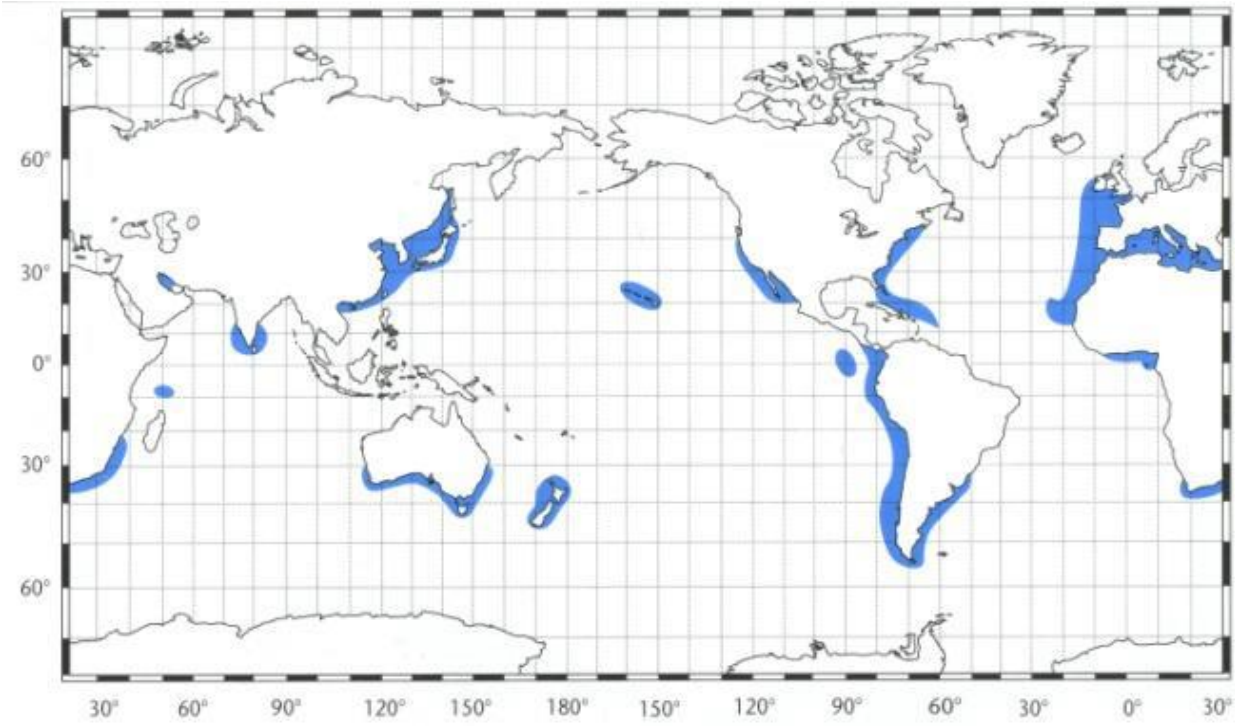
- before the take of smooth hammerhead shark on the high seas by a New Zealand vessel and landed at a foreign port.

2. Smooth hammerhead shark ecology

2.1 Global distribution

The smooth hammerhead shark is primarily a coastal species using inshore and continental shelf waters and some large estuaries. It is found in subtropical and temperate waters round the world between latitudes 55°N and 55°S (Figure 1). Its mainly anti-tropical distribution contrasts with the more tropical distribution of the other two hammerhead shark species listed by CITES (scalloped hammerhead *S. lewini* and great hammerhead *S. mokarran*). Some large hammerheads seen to the north of New Zealand may belong to these two species, but it seems that some older/ larger smooth hammerheads are semi-oceanic. In the South Pacific Ocean, smooth hammerheads are primarily found south of 30°S, but have been widely reported, including from the EEZ of Australia, Federated States of Micronesia, Fiji, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands, Tonga, and Vanuatu (Lack & Meere 2009, Clarke et al. 2014 and Malcolm Francis, NIWA, pers. comm.) .

Figure 1: Global distribution of smooth hammerhead shark; from Last & Stevens (2009).



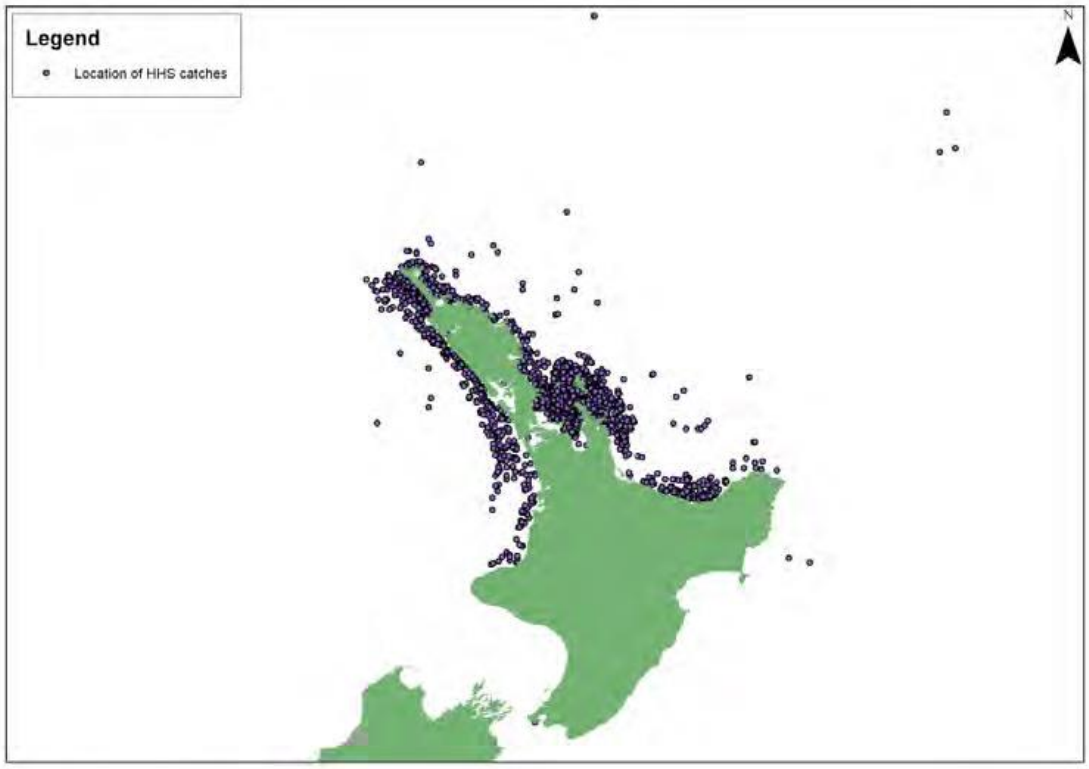
There is some evidence that adult smooth hammerheads that visit and give birth in New Zealand waters in summer move into the tropics in winter; a 250 cm shark tagged by a game-fisher off Cuvier Island (northeast of the Coromandel Peninsula) was recaptured east of Vava'u, northern Tonga, 2200 km away, at about 19°S (Malcolm Francis, NIWA, pers. comm.). Simpfendorfer (2014) reported that genetic analyses had shown significant differences between Atlantic and Indo-Pacific stocks. Comparisons of eastern Australia and New Zealand with mitochondrial DNA markers showed separation; however nuclear markers showed no difference. This finding can arise if males are highly mobile, but females (that pass on the mitochondrial DNA) are less mobile, or at least regularly return to close to their natal site to breed. The nuclear data suggest that there is some linkage between New Zealand and Australian populations, and the very limited tagging data shows linkages into tropical Pacific waters.

2.2 Spatial distribution within New Zealand waters

In the New Zealand EEZ, small smooth hammerheads are mainly caught in inshore set-nets and in bottom longline fisheries, but they are occasionally taken as accidental bycatch on tuna surface longlines (Figure 2). The known distribution is based on commercial catch records and research trawls, supplemented with records at sea by fisheries observers, recreational fishermen and scientists, shark patrolling aircraft, and during aerial surveys of marine mammals (Clinton Duffy, DOC, pers. comm.)

According to Francis (2010) and Ministry for Primary Industries (2014), most captures are of juveniles caught in set-nets in the seas off the north-eastern North Island from East Cape to North Cape, but especially in the Firth of Thames and Hauraki Gulf (statistical areas 005, 006 and 007). Catches of smooth hammerheads are also high in the area off Ninety Mile Beach (area 047), with smaller

Figure 2: Distribution of New Zealand catches of smooth hammerhead sharks derived from Ministry for Primary Industries' Catch Effort Database from 1 December 1989 to 30 June 2013 (Ministry for Primary Industries 2014).



catches of mainly larger subadults down the west coast of the North Island to Taranaki, in Cook Strait and off the Wairarapa coast. The distribution of captures on longlines (MPI 2014) is similar, with the peak capture rate being in the inner Hauraki Gulf (statistical area 006), but some are caught off the west coast of the South Island (area 034) associated with the southern bluefin tuna fishery there, and a few are caught as bycatch in the surface longline industry targeting other highly migratory species, mainly from distant waters near the Kermadec Islands (area 094).

Juvenile smooth hammerheads (up to 150 cm long) are common in shallow coastal waters off the northern North Island, especially in the Firth of Thames, Hauraki Gulf, eastern Bay of Plenty and off 90-Mile Beach, but are apparently absent south of New Plymouth and Cape Kidnappers. Juveniles also use large harbours and estuaries such as the Bay of Islands and the Kaipara and Manukau harbours. Subadults are occasionally caught in trawl nets off the west coast of the North Island, but the ban on set-netting (as part of the management of the West Coast North Island Marine Mammal Sanctuary) in coastal waters out to 7 nautical miles (nm) offshore between Maunganui Bluff in Northland and New Plymouth, and out to 2 nm offshore from New Plymouth to Hawera will limit the numbers caught. Many subadult hammerhead sharks of 150-200 cm total length are seen during aerial surveys of Maui's dolphins off the west coast of the North Island (Clinton Duffy, DOC, pers. comm.). A small number of adult smooth hammerheads (>200 cm TL), including pregnant females, are occasionally seen and caught in coastal waters around northern New Zealand, including Hauraki Gulf and Hawkes Bay (Francis 2010). Adults are sometimes taken as bycatch on surface longlines targeting tuna and swordfish well offshore at ocean depths often exceeding 1000 m, especially near the Kermadecs (Francis 2010). A 250 cm adult game-tagged off Cuvier Island in 2011 was recovered east of Vava'u, northern Tonga, 2200 kilometres and two and a half years later (M. Francis, NIWA, pers. comm.). It is possible that adults spend most of their time in subtropical oceanic waters or

tropical waters to the north of the New Zealand mainland, but at least females move into shallow coastal waters of northern New Zealand to give birth to their young.

The whole of the New Zealand EEZ is treated as a single fishery stock with some apparent differences in the spatial distribution of the age classes.

2.3 Habitat and food

Smooth hammerheads are an active-swimming predator, feeding predominantly on squid and fish (Casper et al. 2005). There are no specific data available from New Zealand, but off New South Wales they fed mainly on cephalopods (squids and octopuses) and to a lesser extent on bony fish; 76% of sharks with food in their stomach had eaten squid, while 54% had eaten bony fish (Stevens 1984).

2.4 Biological characteristics

The smooth hammerhead shark is a medium-sized hammerhead shark (family Sphyrnidae) growing to a maximum length of c.400 cm total length or c.310 cm fork length. Few adult smooth hammerheads have been measured in waters around New Zealand, but one of nine measured from surface longliners was 280 cm fork length or about 360 cm total length (Francis 2010). Of 25 weighed from trawl captures, the heaviest was 400 kg greenweight, and the game fishing record in New Zealand waters is 212 kg (www.nzsportfishing.co.nz).

The gestation period of smooth hammerheads is about 10-11 months off eastern Australia, and mean litter size is 32 pups (range 20-49) (Stevens 1984). The sex ratio of embryos is 1:1 (Stevens 1984) and the sex ratio of a sample of 176 juveniles caught in New Zealand waters was also 1:1 (Francis 2010). Parturition off eastern Australia occurs between January and March, with ovulation at about the same time (Stevens 1984). The timing of parturition is similar in New Zealand because the size classes of smooth hammerheads caught increased from a distinct mode centred at the normal length at birth of about 60 cm total length in January-March, and this mode progressed through to about 70 cm by October-December, and to around 70-80 cm the following January-March (Francis 2010). Stevens (1984) found that off the east coast of Australia males mature at about 250-260 cm total length and females at about 265 cm total length, and so most smooth hammerheads caught in New Zealand waters are juveniles or subadults. The age at maturity is not clear, but could be c.10 years old judging by the slow growth rates in their early years, and would be similar to that of the similar-sized great hammerhead shark (*S. mokarran*). Maximum lifespan has yet to be determined for the species, but it is thought to be 20 years or longer (Casper et al. 2005).

This combination of low productivity (compared with most fish), slow growth and long time to reach sexual maturity makes the species intrinsically vulnerable to over-exploitation and population depletion.

2.5 Global conservation status

In 2005, the global status of smooth hammerhead shark was assessed by IUCN as being “Vulnerable” based on the assumption that it was as biologically vulnerable as other large hammerhead species and it was caught in a variety of fisheries as target or bycatch and its fins are highly sought-after (Casper et al. 2005). A problem for managing smooth hammerheads at a global

scale is that species-specific capture data are rarely available because much of its distribution overlaps that of the great hammerhead (*S. mokarran*) and scalloped hammerhead (*S. lewini*), and captures of these three hammerheads are usually aggregated rather than reported at the species level. The other two species, not known to occur in New Zealand waters, are classified as "Endangered" based on known and projected declines. Some of the declines in hammerhead populations have been catastrophic, with an estimated >99% decline reported in the Mediterranean Sea, and over 80% decline in fisheries in parts of the North Atlantic Ocean (Casper et al. 2005).

2.6 Population status in New Zealand

Little is known about the population status of smooth hammerheads in New Zealand waters. There are no target fisheries for hammerheads in New Zealand waters from which to monitor trends in catch rate. Juveniles and subadults are common in waters off northern New Zealand, and there is no suggestion that their numbers have declined in recent decades.

There has been no analysis of changing bycatch per unit effort in any of the major fisheries; hammerhead sharks do not appear in the 30 common bycatch fish species in the New Zealand tuna longline fishery (e.g., Griggs & Baird 2013), and what little data that has been collected has not been analysed. Many catches of smooth hammerheads are in inshore set-nets and on bottom long lines, with some also taken by recreational fishers on surface lines. It is likely that much of the set-net catch goes unreported because the species is not managed under the Quota Management System (QMS). NIWA observers posted on set-net fishing vessels have recorded large catches of hammerhead sharks in the Hauraki Gulf and Raglan regions (Ministry for Primary Industries 2014), but no time-series data are available. Ministry for Primary Industries (2014) considers that there may be considerable unreported bycatch of juveniles in recreational set-nets.

3. Pressures on smooth hammerheads

3.1 Fishing pressures

Juveniles and subadults are likely to be vulnerable to predation by orca, great white sharks and other large sharks. The main threat to smooth hammerheads worldwide is over-exploitation in targeted and bycatch fisheries, as shown by the collapse of Mediterranean and some North Atlantic stocks. Hammerheads are particularly sought after because their fins have a high fin ray count compared with many other shark species. Between the two species combined, smooth and scalloped hammerhead fins comprised about 4-5% of the total fins traded in Hong Kong in 1999-2001 (Clarke et al. 2006a) and this represented 1.3 – 2.7 million sharks weighing 49,000 – 90,000 tonnes (Clarke et al. 2006b). At the time, at least 50% of shark fins were traded through Hong Kong, but the total global trade was probably considerably greater than these figures (Clarke et al. 2006a).

Hammerheads are particularly vulnerable to capture in nets because of their unique head shape; they can become entangled in much smaller meshed nets than sharks or other fish of similar total body length. Being obligate ram ventilators, like most sharks, hammerheads must maintain constant movement to obtain oxygen, and this means that many caught accidentally in set-nets die of asphyxiation before the net is cleared (Gallagher et al. 2014).

Hammerheads are used for a variety of purposes apart from the use of their fins in shark-fin soup; their meat is frozen, dried, smoked or consumed fresh, skin is used for leather, and oil is extracted

from their livers. No targeted fishing of smooth hammerheads has ever taken place in New Zealand, and little information is available about the use of smooth hammerheads in New Zealand. It is likely that most juveniles are discarded dead after entanglement in set-nets, with no parts retained. A few adults are caught as bycatch on tuna long-lines; for example, only six hammerheads were observed to be taken in the four-year period, 2006-10, and four were retained (Griggs & Baird 2013).

No catch statistics have been published by the Ministry of Fisheries or Ministry for Primary Industries since 2010, but reported landings of smooth hammerheads in New Zealand before then were relatively steady at about 10 tonnes per year, and consistently less than 15 tonnes per year. Almost all of the 2500 hammerheads landed in a 5-year period to 2013 were dressed, with only 25 (1%) landed as fins only.

There is very little information on the level of recreational or customary fisheries in New Zealand waters. It is suspected that many juveniles are caught and drowned in recreational or customary inshore set-nets targeting flatfish, mullet and other inshore species. Both recreational and customary line fishing impacts are thought to be negligible because many are returned alive to the sea. There is no known illegal targeted catch of smooth hammerhead sharks.

3.2 Trade pressures

There are no quantitative historical trade data because before 2010 all global trade from New Zealand was reported under general Customs commodity codes for 'shark species', and so smooth hammerhead trade could not be differentiated from that in other shark species.

Because exports from New Zealand of most shark products have not been recorded to species level, there are no data on the trade of smooth hammerhead products. Since 14 September 2014, when smooth hammerhead was listed in Appendix II of CITES, and all exported smooth hammerhead products were supposed to be CITES certified as being legally obtained in New Zealand or landed in New Zealand from the high seas, there has been no certified international trade into or out of New Zealand.

4. Existing management

4.1 National Plan of Action for Sharks and associated legislation

In 1998, to address global concerns about the conservation and management of sharks, the Food and Agriculture Organisation of the United Nations (FAO) developed an International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). The overarching goal of the IPOA- Sharks is *"to ensure the conservation and management of sharks and their long-term sustainable use"*. To fulfil its obligations under the international plan, in 2008 New Zealand developed its own National Plan of Action (NPOA) for the Conservation and Management of Sharks (Ministry of Fisheries 2008) to ensure that management strategies for sharks are implemented in New Zealand in order to meet the international goals. The NPOA was reviewed and revised in 2013 (Ministry for Primary Industries 2013). Probably the most significant objective in the 2013 plan, subsequently achieved on 1 October 2014, was to eliminate all shark-finning. Most non-QMS shark species, including smooth hammerhead, now have to be landed with their fins naturally attached,

4.2 Quota Management System (QMS)

The smooth hammerhead is not managed as part of the QMS, but because they have been listed on Appendix II of CITES Appendix II, the Ministry for Primary Industries has started to carry out an annual assessment as part of their Fisheries Assessment Plenary process.

4.3 Fisheries Act 1996

No specific provisions are made for smooth hammerhead shark under this legislation, but see 4.4 below.

4.4 Other legislative protection

It seems likely that smooth hammerhead sharks in New Zealand benefit from the protection measures devised for Maui's dolphins (*Cephalorhynchus hectori maui*),especially the creation of the West Coast North Island Marine Mammal Sanctuary established in 2008 under the Marine Mammal Protection Act 1978). Within the sanctuary, the Fisheries Act 1996 has been used to restrict commercial and recreational trawling out to 2-4 nm offshore in the 400 km of coastline between Maunganui Bluff (Northland) and Pariokariwa Point (North Taranaki), as well as restrictions on commercial and recreational set-netting out to 7 nm offshore over the same coastline, and to 2 nm offshore over the 150 km of coast from Pariokariwa Point to Hawera, and restrictions to commercial set-netting to 7 nm on this coast. In 2013, the Marine Mammals Protection Act 1978 was used to provide a complete ban on commercial and recreational set-netting 2 to 7 nm offshore along a 40 km section of the coast north of New Plymouth.

Because smooth hammerhead sharks are especially vulnerable to accidental capture in set-nets and trawl nets, it is likely that the huge reduction in fishing effort along this 550 km section of coast has been beneficial to the species. Indeed, many subadult hammerhead sharks, in the 1.5-2 m length class, are seen along this coast during aerial surveys for Maui's dolphins (Clinton Duffy, DOC, pers. comm.).

4.4 Observer programme

Since the early 1990s, there has been an independent fishery observer programme in place within the New Zealand EEZ. There is good coverage of chartered Japanese tuna longline vessels, but a low coverage of domestic tuna longline vessels and midwater trawl vessels. Smooth hammerhead shark are rarely observed on tuna longlines. There were 19 captures observed in the 22 years, 1998 to 2010, when 5-10% of fishing effort was observed, and most were discarded dead or released alive.

4.4 Regional Fisheries Management

In December 2010, hammerhead sharks were listed as a group as a 'key shark species' for the Western and Central Pacific Fisheries Commission (WCPFC), which covers most of the New Zealand EEZ, and the management of hammerhead sharks in the western and central Pacific Ocean is now the responsibility of WCPFC (Clarke et al. 2014, Ministry for Primary Industries 2014). As a signatory to the WCPFC, New Zealand has obligations for recording, reporting and undertaking research on species listed as 'key shark species', and for ensuring that the management measures applied within New Zealand fisheries waters are compatible with or better than those of the WCPFC (Ministry for Primary Industries 2014).

4.5 Regional context

In 2014, the Department of the Environment in Australia assessed their hammerhead fisheries as part of the development of their NDFs under CITES. Simpfendorfer (2014) determined that there was no evidence to suggest that the population is at a level where the current harvest of about 70 tonnes per year would be detrimental to the species, and there was some evidence from the temperate gillnet and longline fishery off Western Australia that catch per unit effort has increased between 1989 and 2011. The Department of the Environment set the harvest levels for their NDF at 70 tonnes taken in the Australian EEZ and adjacent Eastern and Western Tuna and Billfish Fisheries, but declined to issue NDFs for Introductions from the Sea from the Australian High Seas Fishery which operates away from the EEZ (Australian Department of the Environment 2014).

Elsewhere in the Oceania region covered by WCPFC, smooth hammerheads are caught in the subtropical and occasionally tropical Pacific (Clarke et al. 2014), as evidenced by the capture of a New Zealand-tagged smooth hammerhead in Tongan waters, but to date most Pacific Forum and Secretariat of the Pacific Community fisheries have recorded their catch simply as “hammerhead shark” rather than at the species level (Ian Freeman, Forum Fishery Agency, pers. comm., and Lindsay Chapman, Secretariat of the Pacific Community, pers. comm.

5 Conclusion

New Zealand stocks of smooth hammerhead sharks have never been specifically targeted as a fishery, but rather they have been caught as a bycatch in set-net, trawl and tuna longline fisheries. There are no good historical data available about the actual capture rates because it is likely that many juveniles caught in commercial set-net operations are discarded without recording details due to the omission of the species from the QMS, and there is no requirement for recreational or customary catches to be recorded. The population status of smooth hammerheads in the New Zealand EEZ is not known, but at least juveniles and subadults appear to be common in suitable inshore habitats, and their stock does not seem to have collapsed as the over-exploited Mediterranean and Atlantic stocks have done.

The reported capture of about 10 tonnes per annum is about one-seventh of the 70 tonnes taken each year in Australia, from a fish stock which appears to be stable or perhaps slowly increasing.

Overall, it appears that the amount of smooth hammerhead reported landed in New Zealand in recent years is probably sustainable. At this stage, the evidence suggests it is reasonable to **allow exports of smooth hammerhead products that were legally obtained within the New Zealand EEZ as long as the reported capture remains at less than 15 tonnes per annum and that captures remain entirely from accidental bycatch, and that no targeted hammerhead fishery is developed.**

The high seas take of smooth hammerheads which is landed in New Zealand is understood to be very small, but likely to be mainly of adults of breeding age, which represent an important part of the population in long-lived species. Given that so little is known of the biology, movements, and numbers of adult smooth hammerheads, it is not possible to allow imports from the high seas of any take that is from a targeted hammerhead fishery. A modest importation of up to 20 whole carcasses per annum (similar to the level of capture estimated from observer coverage of tuna longlining in the EEZ) will be permitted as long as good records are provided to Ministry for Primary Industries of the capture effort, and the number, weight and lengths of smooth hammerheads caught, the number released alive

(preferably with tags), and the number discarded dead, so that some assessment of population trends and status can be obtained in exchange for a modest level of landings.

6. Recommendations to improve the NDF process

1. Ministry for Primary Industries seriously consider the merits and costs of including smooth hammerhead in the Quota Management System to better manage stocks of this 'key shark species' as required as a signatory of the WCPFC, and to make the NDF process of CITES more defendable. Even though the apparent annual take is very low compared with many commercial fish species, there is a high level of public interest, nationally and internationally, in the population trends and conservation of sharks.

2. Ministry for Primary Industries should publish annual catch statistics for smooth hammerheads as they do for many other QMS and non-QMS species in their annual "Stock Status" or "Species" tables.

3. Increase observer coverage on vessels using set-nets and trawling in inshore waters of the northern North Island, to better assess the true capture statistics, and the percentage released alive and well. Ensure that observer effort over all fisheries encountering smooth hammerheads is applied to collect and analyse data on the number, weight, sex, age, total fork length, and total length of all smooth hammerheads landed, and those discarded alive or dead. An eye should be kept out for other hammerhead species at the same time.

4. Actively promote and expand a tagging programme on commercial and recreational vessels so that, wherever possible, large samples of juveniles, subadults and adults being released alive are tagged so that we can learn more about the movements, growth and survival of this under-studied species.

5. Research, develop and implement specific methods for successful handling, tagging and release of smooth hammerheads.

6. The recreational and customary take of smooth hammerheads must be estimated through survey of recreational and customary fishers.

7. The volumes of smooth hammerhead product introduced from the high seas to New Zealand be monitored very closely, and if necessary fins and carcases should be checked to see that the shark species claimed is accurately recorded, and that smooth hammerhead products are not being imported as another species.

8. New Zealand collaborates with Oceania neighbours, and especially with WCPFC, to better understand the movements and population dynamics of smooth hammerheads moving in and out of the New Zealand EEZ, and especially into other national fishing jurisdictions. At present there is clearly a regional link as far as Tonga, and hence probably to Fiji, and also probably with Australia.

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