The Minister approved this conservation advice and included this species in the Conservation Dependent category, effective from 15/03/2018

Listing Advice

Sphyrna lewini

scalloped hammerhead

Taxonomy

Conventionally accepted as *Sphyrna lewini* (Griffith & Smith 1834).

Summary of assessment

Conservation status

Conservation Dependent

Endangered: Criterion 1 A2(a),(b),(d)

The Committee also considers that the *Sphyrna lewini* meets the requirements of paragraph 179(6)(b) of the EPBC Act to be eligible for listing as Conservation Dependent.

The highest category for which *Sphyrna lewini* is eligible to be listed is Endangered.

Sphyrna lewini has been found to be eligible for listing under the following categories:
Criterion 1: A2(a),(b),(d): Endangered.
Paragraph 179(6)(b) of the EPBC Act: Conservation Dependent.

The Committee recommends that *Sphyrna lewini* be listed in the Conservation Dependent category.

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by a nomination from the public to list *Sphyrna lewini* as a threatened species under the EPBC Act.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 32 business days between 22 May 2014 and 7 July 2014. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species Information

Description

The scalloped hammerhead is a relatively large, fusiform-bodied, moderately slender shark; olive, bronze or brownish grey dorsally and pale on its underside. The ventral surface of the pectoral fin tips are dusky in adults, dark in juveniles, the lower caudal and second dorsal tips are also dark in juveniles. Its first dorsal fin is broad, relatively erect, semi-falcate, and originates over or slightly behind pectoral fin insertion. The second dorsal fin originates over about the midpoint of the anal fin base. Body width is around 24–30 per cent of total body length (TBL)

(Last & Stevens 2009). The scalloped hammerhead is somewhat sexually dimorphic in that females are slightly larger than males.

TBL measures:

- birth – 45–50 cm
- maturity – at 140–160 cm (males) and 200–220 cm (females)
- maximum – 350 cm (Last & Stevens 2009).

All species in the family Sphyrnidae have evolved a laterally expanded skull shaped like a hammer, known as a cephalofoil. This increases the surface area allowing for the expansion of many sensory systems which detect chemical, physical and thermal changes in the environment as well as electrical fields of their prey. The front margin of the scalloped hammerhead's head is curved forward anteriorly and has lateral and median indentations, giving it its "scalloped" appearance; cephalofoil width reaches a maximum of around four per cent of TBL (Last & Stevens 2009).

Distribution

The scalloped hammerhead has a circum-global distribution in tropical and sub-tropical waters. The scalloped hammerhead shows strong genetic population structuring across ocean basins as it rarely ventures into or across deep ocean waters, but ranges quite widely over shallow coastal shelf waters. Consequently, there is very little structuring from the eastern to western extents within Australia and it is likely to be a shared stock with Indonesia (Chin et al. 2017).

Within Australian waters the scalloped hammerhead extends from New South Wales (approximately from Wollongong, where it is less abundant), around the north of the continent and then south into Western Australia to approximately Geographe Bay, though it is rarely recorded south of the Houtman Abrolhos Islands.

International-scale assessments group the Australian stocks/regional populations in different ways:

- The IUCN (2007) assessment treats Australia as part of the Western Pacific subpopulation, but provides status information separately. No specific assessment is given for the Western Pacific subpopulation (Baum et al. 2007)
- The CITES (2013) assessment includes Australia in a Western Pacific Ocean subpopulation but separate from an Eastern Indian Ocean stock which includes the island of Lombok, directly to the north of Western Australia (Food and Agriculture Organisation 2013)
- The United States status assessment of the scalloped hammerhead identified several Distinct Population Segments, including an Indo-West Pacific stock extending from the east coast of Africa, north to India and Japan, through South East Asia to approximately Fiji (Miller et al. 2013).

With regard to the assessment of the scalloped hammerhead under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), subsection 5(2) of the Act stipulates that it "… applies to acts, omissions, matters and things in the Australian jurisdiction, and does not apply to acts, omissions, matters and things outside the Australian jurisdiction." However, it is open to the Minister and the Committee to take account of the abundance or otherwise of a species outside Australia to the extent that this may influence the abundance or otherwise of the species within Australia. Therefore, it is not possible to use such expansive stock definitions as those cited above, and necessary to estimate the appropriate scale for the "Australian" stock using data on habitat use and movements of hammerhead sharks (addressed below in "Relevant Biology").

Cultural significance

Sharks are significant both as totemic symbols and as food resources to northern Australian Indigenous communities, and hammerheads are considered important amongst other shark species (McDavitt 2005).

Relevant biology/ecology

The age and size at maturity for scalloped hammerheads vary between temperate and tropical waters. In tropical waters males mature at 5.7 years and 147 cm, while in temperate waters they mature at 8.9 years and 204 cm (Harry et al. 2011a). There are no direct estimates of the age at maturity of female hammerheads in Australian waters, however an approximation is possible. The size at maturity in tropical Australia is estimated at 200 cm (Stevens & Lyle 1989). On the general growth curve for the species produced by Harry et al. (2011) this corresponds to approximately 12 years. Similarly, applying the estimated length for maturity in Brazil to a von Bertalanffy growth curve for females (Kotas et al. 2011), produces an estimate of approximately 15 years to maturity. Maximum age for scalloped hammerheads is estimated at between 30 years (Harry et al. 2011a) and 55 years (Kotas et al. 2011). More recently, estimates have been made for scalloped hammerheads in Indonesia (Drew et al. 2015). Female sharks in Indonesia mature at 13.2 years and live to approximately 35 years old (Drew et al. 2015). These data correspond to generation time estimates of approximately 21 years (Australian data), 24 years (Indonesian) and 35 years (Brazilian data). These were estimated using the formula: age of first reproduction+ z*(length of reproductive period) with z=0.5 (IUCN Standards and Petitions Subcommittee 2013). The IUCN guidance notes that z is usually less than 0.5 and the higher values are where the relative fecundity is skewed towards older age classes, as is the case for scalloped hammerheads (next paragraph). For comparison, a value 0.4 for z, produces generation lengths of 19 years (Australian) and 22 years (Indonesian). An alternative method, using an age-based matrix model of the Queensland scalloped hammerhead population provided an estimate of generation time of 19 years (Harry 2011). The recent US assessment estimated three generations, averaged across all stocks, to be approximately 50 years (Miller et al. 2013). For the purposes of this assessment a generation time of approximately 20 years is assumed.

Along the east coast of Australia the scalloped hammerhead gives birth to live young (pups) year round, but with a peak in births between November and December (Harry et al. 2011a). Across the north (in the Arafura Sea) the peak of the pupping season spans October to January, with a gestation period of between nine and 10 months (Stevens & Lyle 1989). Litter size is highly variable: 14–41 in Indonesia (White et al. 2008) and 13–23 in northern Australia/Arafura Sea. There is a linear relationship between litter size and female body length (Stevens & Lyle 1989; Harry 2011; Noriega et al. 2011), which demonstrates the importance of large females to population growth.

The life history of the scalloped hammerhead renders the species susceptible to threats such as overfishing. Even in comparison to other shark species the scalloped hammerhead is considered to have low potential to recover from increased mortality (Smith et al. 1998; Harry 2011). Harry (2011) estimated population growth rates for an unfished population of between 0.99 and 1.22 yr^{-1}, with a mean of 1.11 yr^{-1} and showed that population growth was similarly sensitive to adult and juvenile survivorship. The age classes between 18 and 23 years are most valuable in terms of future reproductive output (Harry 2011).

Scalloped hammerhead pups are born in shallow intertidal habitats and they remain in shallow inshore habitats for the first few years of their lives (Harry 2011). Females leave this habitat at approximately 3 years or 100 cm, presumably having migrated to deeper water (Branstetter

1987; Stevens & Lyle 1989; Harry 2011). More large, mature females are caught in deeper water fisheries (but still on the continental shelf) (Stevens & Lyle 1989; Hazin et al. 2001; Harry 2011) although the proportion is still low (Macbeth et al. 2009) and does not account for sufficient females to explain the inshore pup production. Males may stay resident in shallow habitats for considerably longer, with many males up to 10 years found in this habitat on the Queensland coast, while older males are rarely encountered (Harry et al. 2011a). Harry et al. (2011) suggest that male scalloped hammerheads may employ one of two strategies, a coastal or a pelagic adulthood with pelagic strategists maturing later and at larger size.

Scalloped hammerhead are mobile animals that range widely over shallow coastal shelf waters, but rarely venture into or across deep ocean waters. Tagging and tracking studies have demonstrated straight line movements of up to 1680 km (Kohler & Turner 2001), although movements in excess of 200 to 300 km are relatively uncommon in such studies (Kohler & Turner 2001; Bessudo et al. 2011; Diemer et al. 2011); see also Los Angeles Department of Wildlife and Fisheries (http://www.wildlifetracking.org/index.shtml?project_id=780).

The nature of such movements is reflected in the genetic structuring of hammerhead populations. There is strong genetic structure between ocean basins (Duncan et al. 2006), but little structure evident within basins, particularly areas connected by contiguous continental shelves (Duncan et al. 2006). There is some support for an isolation by distance model (Nance et al. 2011). There is no evidence for genetic population structure between Indonesian and Australian populations of scalloped hammerheads, in either mitochondrial or microsatellite DNA, suggesting that they are the same stock (Ovenden et al. 2009; Ovenden et al. 2011). However, microchemical analyses of the vertebrae of juveniles and small males show that there is population structuring over distances of tens to hundreds of kilometres within shorter timescales (within a generation) (Welch et al. 2011). Nevertheless, Welch et al. (2011) suggest movement of adult females (and possibly of large males) between these sub-stocks facilitates genetic exchange. A recent synthesis of all the available data on connectivity of Australia's hammerhead stock with Indonesia and Papua New Guinea concluded that a shared, panmictic population was the most sound and precautionary conclusion (Chin et al. 2017). Other models of movement might also fit the available data, but Chin et al. (2017) found limited support for Australia's hammerhead stock being restricted to Australian waters.

For the purposes of this assessment of the scalloped hammerhead's status in Australia, it is appropriate to consider the status of the hammerhead stock extending at least as far as Indonesia. This is particularly so given the importance of adult females to population dynamics and their relatively low contribution to catches in Australian fisheries and higher contribution to Indonesian fisheries (see below in "Threats"). In this context, it should be noted that:

1. Hammerheads are likely to be more heavily reduced in South East Asia than in Australia, and

2. If individuals rarely swim more than 1000km, processes operating at substantially greater distances will have little influence on the Australian status over relevant timeframes (e.g. the three generation timeframe of Criterion 1).

With respect to the first of these caveats, if the status of hammerheads in South East Asia is substantially poorer than in Australia, to broaden the spatial extent of the shared stock will have the effect of exaggerating declines in Australia. Additionally, with respect to the frequency of large scale (>1000km) movements, it has been noted that at regional scales the capacity for hammerheads to recover is more likely to be driven by localised reproduction, and not quickly through immigration (Duncan et al. 2006). This assessment therefore has considered the status of the Australian/Indonesian stock under a range of scenarios of relative original sizes of the

Australian and Indonesian components of the shark stock (see Criterion 1, Tables 2a-2d). A low Indonesian:Australian ratio represents little exchange of scalloped hammerheads between the two countries' waters, while a high ratio suggests extensive exchange.

Threats

The principal threat to the scalloped hammerhead is historic and ongoing fishing. In Australia, scalloped hammerheads are caught in recreational and commercial line fisheries, gillnets, trawls and bather protection programs (note that these are treated here functionally as a fishery despite the different intent). Because of their unique head shape, hammerheads are particularly vulnerable to capture by gillnets. Hammerhead sharks have recently been shown to be particularly susceptible to capture mortality, both immediately (before being brought to the boat) and subsequent to being released alive due to a strong stress response (Gallagher et al., 2014; Dapp et al., 2015; Eddy et al., 2016). Immediate mortality is especially high when captured in gillnets (Dapp et al., 2015) which are the principal method of capture of hammerheads in Australian fisheries (Table 1).

The clearest example of local scale effects of fishing on shark populations is a study of shark abundance in reefs off north-western Australia using Baited Remote Underwater Video Systems (Meekan et al. 2006). Some of these reefs are open to fishing by Indonesian fishers under a Memorandum of Understanding between the Australian and Indonesian governments; two previously fished reefs were declared Marine Protected Areas, one in 1988 and one in 2000, and; a reef system to the south has not been fished. The abundance of hammerhead sharks on fished reefs was approximately a quarter of that on unfished reefs, while in deeper water beyond the reefs, hammerheads were absent from fished reefs. These are the areas where Indonesian fishers typically deploy longlines. It was also notable that some shark species had recovered in the Marine Protected Areas, but that hammerheads and tiger sharks had not.

Australia

Scalloped hammerheads are found across northern and temperate Australian waters and are caught in a range of fisheries (Table 1). All life-stages are caught by Australian fisheries, although adult females are significantly under-represented, suggesting that they principally reside in waters outside areas fished by Australian fishers (see Relevant Biology/Ecology above) and are thus important in replenishing populations (Welch et al. 2011). The total take of scalloped hammerheads is difficult to estimate because several fisheries report only at the level of "hammerhead" and do not distinguish between the species. Koopman & Knuckey (2013) collated fishery catch data from across Australia between 2001 and 2012 and were able to disaggregate the pooled data to provide estimates for scalloped hammerhead alone (Figure 1), although no detail is given on the method of disaggregation. Total catch of scalloped hammerheads rose rapidly from 2001 to a peak of 214 t in 2008 before declining to 89 t in 2012 (Figure 1) (Koopman & Knuckey 2014).

Given the concentration of fishing effort in coastal and shallow waters, this catch is mostly made up of juveniles (both males and females) and small adult males (Stevens & Lyle 1989; Harry et al. 2011a; Simpfendorfer et al. 2011). A minor exception to this is the targeted shark fishery of the New South Wales Ocean Trap and Line fishery, which catches more large sharks, but very few adult females (Macbeth et al. 2009). While the coastal fisheries may constitute a "gauntlet" fishery and thus be able to sustain higher mortality (Harry et al. 2011b), if the adult females are subjected to high mortality elsewhere, the combined effect is likely to be unsustainable.

The Taiwanese gillnet fishery in Australian waters (1974–1986) is also relevant because of the long generation time of scalloped hammerheads. The annual shark catches in the early to mid-

1980s ranged from 2300–4500 t (all species) (Stevens 1999). Data specifically for sharks are not available prior to 1979, but the total catch (including tuna and mackerel) peaked at nearly 10 000 t in 1977. Hammerhead sharks (all species) made up approximately seven per cent of the catch by number and nearly three quarters of the catch was scalloped hammerhead (Stevens & Lyle 1989). Catch per unit effort (CPUE) estimates suggest that the Taiwanese fishery reduced the Northern Territory/Arafura Sea component of the stock by about 60–70 per cent and the Gulf of Carpentaria stock by approximately 30 per cent during this period (Stevens 1999). No estimate specific to hammerhead sharks is available.

Table 1: Summary of main fisheries that capture scalloped hammerhead within Australian waters.

Jurisdiction	Fishery	Reporting
Northern Territory	Barramundi Fishery (gillnets)	All sharks
Northern Territory	Offshore Net and Line Fishery	Now reporting species separately (*S. lewini*, *S. mokarran* and *Eusphyra blochii* (winghead sharks)).
WA	Northern Shark Fisheries[a]	Hammerheads (*Sphyrna* spp.)
WA	Pilbara Fish Trawl Fishery[b]	Hammerheads (*S. lewini, S. zygaena, S. mokarran*)
Qld	East Coast Inshore Fin Fish Fishery	Now reporting species separately (*S. lewini*, *S. mokarran* and *Eusphyra blochii* (winghead sharks)).
Qld	Gulf of Carpentaria Inshore Fin Fish Fishery	Now reporting species separately (*S. lewini*, *S. mokarran* and *Eusphyra blochii* (winghead sharks)).
Qld	Shark Control Program	Hammerheads identified to species since the early 1990s
New South Wales	Ocean Trap and Line Fishery[c]	Now reporting species separately (*S. lewini, S. zygaena, S. mokarran*).
New South Wales	Recreational	Hammerheads (*S. lewini, S. zygaena, S. mokarran*)
New South Wales	Shark Meshing (Bather Protection) Program	Hammerheads identified to species since 1998
Commonwealth	Eastern Tuna and Billfish Fishery	Hammerhead sharks

[a] The Northern Shark Fisheries are currently closed.

[b] The Pilbara Fish Trawl Fishery now uses bycatch reduction devices that may reduce the catch of hammerheads.

[c] In 2012, both scalloped and great hammerheads were listed as threatened species under the NSW *Threatened Species Conservation Act 1995*. Offences apply for buying, selling, possessing or harming either species or for damaging their habitat without a specific permit, licence or other appropriate approval. Any incidentally caught scalloped or great hammerhead sharks must be immediately released with least possible harm, or if deceased, must be discarded. There is mandatory reporting of such interactions.

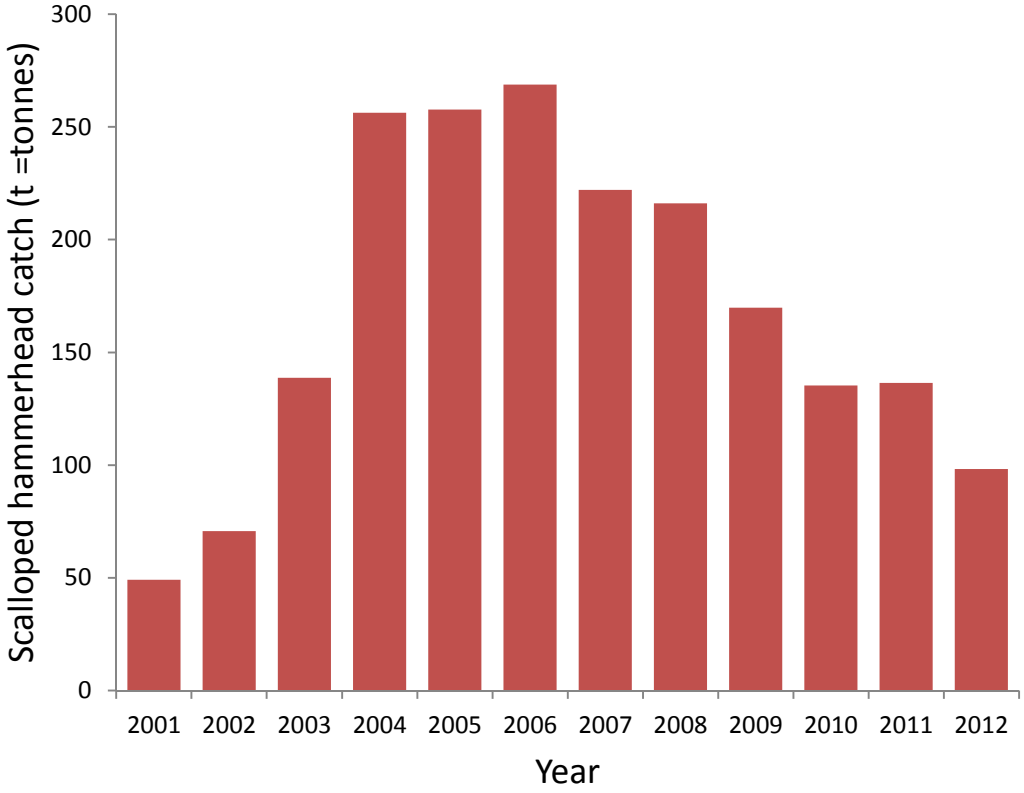

Figure 1: Retained harvest of scalloped hammerheads in Australian fisheries (Source: Koopman and Knuckey (2013)).

International (Indonesia and Papua New Guinea)

Indonesia has the largest chondrichthyan fishery in the world, with annual reported catches of approximately 110 000 t (White et al. 2006; Lack & Sant 2009) in 27 distinct fisheries (Blaber et al. 2009). There is likely to be a large unreported additional catch due to illegal, unregulated, and unreported (IUU) fishing, including foreign vessels (White & Kyne 2010). Such fishing pressure has led to coastal fisheries throughout South East Asia being depleted to 10–20 per cent of earlier estimates (Stobutski et al. 2006). It is noteworthy that the total catch of sharks in Indonesia has increased since the early 1990s but the catch rate in the Java Sea has decreased by at least an order of magnitude between 1976 and 1997 (Blaber et al. 2009). This problem is worsening with fishing capacity growing larger while stocks decline (Stobutski et al. 2006). Fishers are continually moving further afield to find suitable fishing areas and localised depletions are becoming more apparent (White & Kyne 2010).

While it is clear that shark stocks overall have been severely depleted, it is difficult to determine the specific trend for scalloped hammerheads. Where data are available, scalloped hammerheads constitute a relatively small but consistent proportion of the catch. They are considered a key species in four of the 27 shark and ray fisheries identified by Blaber et al. (2009), although in only one of those, at Tanjung Luar, are they a target species. Annual landings at Tanjung Luar (Lombok) were estimated at c. 1700 individuals and 68 200 kg. This was 3.3/12.5 per cent of the total number/weight of landed sharks at this site (White et al. 2008). The contribution of scalloped hammerheads to the Indonesian shark longline group overall was approximately 6.8 per cent.

With respect to the potential impact of Indonesian fisheries on the component of the stock that is shared with Australia, the abundance of large females in the Indonesian take (White et al. 2008) is in stark contrast to the Australian fisheries. Longlining caught much larger sharks than the

gillnet fisheries and females outnumbered males by approximately 4.8:1. For example, the average weight of sharks at Tanjung Luar, cited above (White et al. 2008), was approximately twice that of the New South Wales Ocean Trap and Line Fishery (Macbeth et al. 2009). Similarly, in a study of IUU fishing in northern Australia, the scalloped hammerhead size frequency distribution was much more skewed towards large sharks than, for example, the Queensland East Coast Inshore Fin Fish Fishery (Harry et al. 2011a; Marshall 2011). Given the connection between the Indonesian and Australian stocks (Ovenden et al. 2011), and the lack of large female scalloped hammerheads in most Australian fisheries, the Indonesian take has particular significance for this assessment.

The available data on scalloped hammerhead status in Papua New Guinea are more sparse, but many of the conservation concerns for this region are similar to those of Indonesia (White & Kyne 2010). Papua New Guinea has a dedicated shark fishery with between 7 and 9 vessels operating since 2002 (Usu et al. 2012). Catches of hammerheads (not identified to species level) has ranged between 18–42 t since 2007 (Usu et al. 2012). White & Kyne (2010) suggest that a decline in sharks similar to that in Indonesia is likely to have occurred, although there is no stock assessment for this fishery.

Illegal, unregulated and unreported (IUU) fishing

IUU shark fishing has been significant in Northern Australian waters (Stevens 1999). Population modelling of the stock remaining at the cessation of the Taiwanese gillnet fishery suggested the stock should have been increasing by 5–10 per cent per year. However, Northern Territory gillnet fishery CPUE data showed an ongoing decline, suggestive of up to 1500 t annually (all shark species) of unreported catches (Stevens 1999). While it is reported that domestic compliance issues are relatively minor, illegal foreign fishing increased substantially between approximately 2001 and 2005/06 as Indonesian vessels depleted local resources and moved further afield to increase catch rates (Figure 2). The displacement of small scale Indonesian vessels is exacerbated by large, industrial IUU fishing vessels of mainly Chinese and Taiwanese origin having become common in Indonesian waters (Field et al. 2009). In a recent attempt to estimate the scale of this harvest, the catch by small scale Indonesian vessels in 2006 was estimated at between 300–1100 t for all shark species (Marshall 2011). The same study estimated that illegal Taiwanese industrial scale vessels each harvest approximately 100 times the amount taken by an average small scale Indonesian vessel. In recent years, the number of foreign fishing vessels apprehended in Australian waters has declined markedly, from 367 in 2005/06 to only seven in 2012/13 (Australian Fish Management Authority 2013).

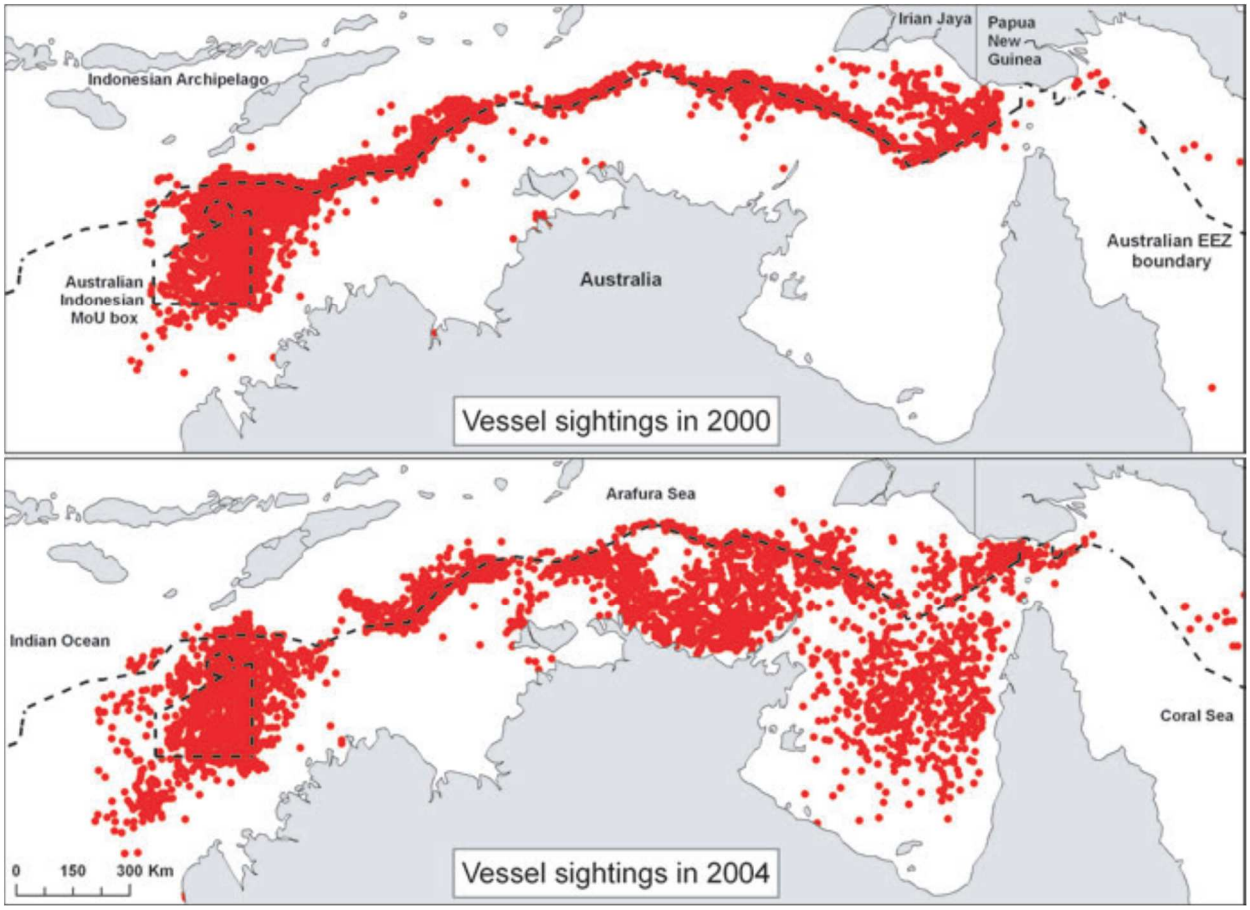

Figure 2: Coastwatch sightings of foreign fishing vessels bordering and within the Australian Economic Exclusive Zone (EEZ) in 2000 (top) and 2004 (bottom) showing the southward progression of illegal, unreported and unregulated (IUU) fishing effort (Source: (Field et al. 2009).

IUU fishing is considered to be a major concern in Indonesia but is poorly defined and largely unknown. The fisheries in Indonesia are largely unregulated and catches are likely to be largely unreported. Illegal fishing is a considerable issue with many foreign vessels entering Indonesian waters illegally, and at present, there is little or no capability for policing, especially considering the extensive marine area of Indonesia (White & Kyne 2010).

The development of IUU fishing in Indonesia has been driven principally by the shark fin trade (Suzuki 2002), including in Australian waters (Lack & Sant 2008). Scalloped hammerhead fins are sought after for their high fin ray count and hammerheads are one of the more common shark types found in the world's largest market in Hong Kong (Lack & Sant 2008). While the species caught by illegal vessels are similar to those in Australian fishery catches, the proportional representation in the catch differs. Scalloped hammerhead fins were a significant component of fins (8.8 per cent) confiscated from illegal fishing vessels, although the data are sparse (Lack & Sant 2008). It should be noted that the trend in illegal fishing in northern Australian waters has generally been downward, however the ongoing pressure on depleted stocks may be expected to at least impede recovery and possibly to continue the decline. Despite the widespread introduction of shark finning bans, the Food and Agriculture Organisation noted concerns about low levels of compliance and high levels of post-capture mortality, particularly where gillnets are used (Food and Agriculture Organisation 2013).

How judged by the Committee in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers)
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Eligible under Criterion 1 A2(a),(b),(d) for listing as Endangered

In this instance, the scalloped hammerhead has been assessed against Criterion 1 A2. As the threat of fishing has not ceased for this species at the time of assessment, Criterion 1 A1 is inappropriate. Criteria 1 A3 and A4 also have not been used. Both these criteria require projection of likely population trends into the future, for up to three generations. As the generation time of the scalloped hammerhead is long (approximately 20 years), the Committee considers that there are too many inherent uncertainties to project the population trend with sufficient confidence to address Criteria 1 A3 and A4. The assessment below is based on the historical decline in the species that the Committee considers to have occurred to date.

Australia

While there is an abundance of information on harvests from a range of Australian fisheries, there are fewer data from which to discern the trend in population numbers or density. With respect to the three generation time span of this criterion, the estimates may extend back to the early 1950s. However, fishing impact was relatively low at that time, and the development of the Taiwanese fishery in the 1970s was the beginning of significant fishing of scalloped hammerheads. The available data are not specific to hammerheads, but suggest a decline of the target stocks (of blacktip sharks) of 60–70 per cent and the Gulf of Carpentaria stock by approximately 30 per cent (Stevens 1999). Further declines were noted in CPUE from the Northern Territory gillnet fishery until at least 1995 (Northern Territory Government 2012). It is not possible to quantify the decline in scalloped hammerhead from these data, but they are strongly suggestive that the species has declined in response to the development of commercial fisheries across the north of Australia throughout the 1980s and 1990s.

There is more specific data available via state-based assessments. In an assessment of shark fisheries of the North West Marine Region of Western Australia, CPUE data showed a decline of between 58–76 per cent from 1998/99 to 2005/06 (Heupel & McAuley 2007). This decline is likely additional to that described in the previous paragraph. Simpfendorfer et al. (2011) analysed the catch rates of hammerheads (mostly scalloped) from the Queensland Shark Control Program (QSCP) for beaches around Townsville and Cairns. They found a decline of between 67–84 per cent from 1966 to the early 1990s (later data could not be analysed due to a change from nets to drumlines, which caught too few hammerheads). However, mean size of sharks caught did not decrease, as might be expected for a declining population, and the commercial fishery operating on adjacent coastlines maintained a significant hammerhead catch (Simpfendorfer et al. 2011). A potential explanation for the lack of decrease in mean size is that the commercial fishery takes a disproportionate amount of small individuals, which may have counteracted the effect expected due to overall depletion. There are no comparable estimates of decline for the Gulf of Carpentaria or Northern Territory but given the decline reported due to the Taiwanese fishery and the current presence of both domestic fisheries and high exposure to IUU fishing along the northern coast, a decline can be inferred.

A notable caveat to these declines is the caution of Simpfendorfer et al. (2011) that the data were indicative only of a decline in captures of males, as females were rarely caught. The only location where adult females were not rare was Mackay, on the Queensland coast, where the QSCP data recorded large and small females in similar numbers to males (Noriega et al. 2011). Noriega et al. (2011) also found a significant decline in overall length of females in the QSCP which may be indicative of population depletion. Overall, the low proportion of females in most Australian catch data, and almost absence of mature females (Stevens & Lyle 1989; Macbeth et al. 2009; Harry et al. 2011b; Simpfendorfer et al. 2011), is a significant impediment to assessing the status of the species in Australian waters. It is necessary then to address the exposure to fishing of those females that pup in Australian waters but may reside elsewhere.

It is well recognised that scalloped hammerheads do not significantly occupy the deep ocean, and confine the majority of their movements to the continental shelf. There is sufficient fishing activity in ocean waters adjacent to the Australian coast, both on the shelf and beyond it, that it is unlikely (but not impossible (Chin et al. 2017)) that substantial aggregations of mature females occur in these waters. Analysis of both maternally inherited mitochondrial DNA and microsatellites showed no differentiation between Australian and Indonesian scalloped hammerhead stocks (Ovenden et al. 2011). It is thus reasonable to conclude that the mature females contributing to the recruitment of the Australian scalloped hammerhead stock are significantly exposed to the high fishing pressure in Indonesian waters.

Indonesia and Papua New Guinea

The evidence cited above demonstrates that the fishing pressure on scalloped hammerheads in Indonesia is stronger than in Australian waters, but data to quantify the actual decline are lacking. The only estimate available, for all sharks grouped, is that cited by Blaber et al. (2009) showing differences in the catch rates of sharks from research cruises across the Java Sea. Between 1976 and 1997 the catch rate for sharks declined by an order of magnitude. Additional data demonstrate that mature females are caught far more commonly in Indonesian than Australian waters. Given the ongoing high levels of both legal and illegal fishing, and continual displacement of fishing effort due to local depletions, it is reasonable to infer that the decline in the shared scalloped hammerhead population in Indonesia is of a similar magnitude to that for sharks overall.

Synthesis

There are multiple uncertainties in the assessment of the scalloped hammerhead's status in Australian waters. Chief amongst these are:

1. The relative original sizes of the Australian and Indonesian components of that population;
2. The decline in the Australian component of the population;
3. The decline in the Indonesian component of the population.

Despite these uncertainties, it is possible to infer approximate estimates for these values and examine the sensitivity of the overall assessment to their variability. That is, does this uncertainty prevent a conclusion of whether or not the decline is above the relevant threshold?

The relative sizes of the original populations, three generations (60 years) ago, are a function of population density and the extent to which the Australian stock extends into Indonesia. Given that sharks collected in Bali were genetically indistinguishable from those of eastern Queensland, and that the Arafura and Java seas are both shallow, offering extensive potential habitat to scalloped hammerheads, it is likely that the Australian and Indonesian components of the shared stock were initially similar in size. The sensitivity of the estimated decline to variation in the relative sizes of the components of the stock is modelled below, with a range from the Indonesian component being one quarter of the size of the Australian, through to the Indonesian being twice the size of the Australian (rows within Table 2 to Table 4). A low Indonesian: Australian ratio represents little exchange of scalloped hammerheads between the two countries' waters, while a high ratio suggests extensive exchange.

The Australian component of the shared stock has very likely declined, but by somewhat less than the Indonesian component. Given the declines cited above (northern Queensland 67–84 per cent, North West Marine Region 58–76 per cent, NT 60–70 per cent (inferred from blacktip shark declines)), the Australian decline may plausibly be estimated to exceed 60 per cent and thus has been modelled across a range from 40 to 80 per cent decline (columns within Table 2 to Table 4). In contrast, the evidence suggests a much stronger decline in the Indonesian component, thus it has been modelled from 60 per cent (Table 2) to 90 per cent (Table 4).

The tables below show the overall decline of the combined Australian/Indonesian stock across the range of possible values of the relative sizes of the stock components and the declines within each.

Table 2 shows the declines expected if the Indonesian decline is 60 per cent. At this relatively conservative estimated Indonesian decline, the overall shared stock decline is greater than 50 per cent for all plausible levels of decline in Australia, unless the exchange between the Australian and Indonesian components of the stock is low.

Under increasing levels of Indonesian decline, the circumstances under which the overall decline is less than the threshold for Endangered become even more constrained. If the Indonesian decline is considered to be a plausible 75 per cent (Table 3) or greater (90 per cent Table 4) then an overall decline of at least enough to meet the criteria for Endangered is the outcome.

Therefore, despite the considerable uncertainty in the precise magnitude of declines in both components of the stock, it is possible to infer that the overall decline is most plausibly between 50–80 per cent, and that the scalloped hammerhead is **eligible** for the listing in the **Endangered** category.

Table 2: Estimated decline in the scalloped hammerhead population shared between Australian and Indonesia, assuming that the decline in scalloped hammerheads in Indonesia is approximately 60 per cent.

Decline in Australian component	40%	50%	60%	70%	80%
Indonesian component / Australian component	Rate of decline				
0.25	0.44	0.52	0.60	0.68	0.76
0.50	0.47	0.53	0.60	0.67	0.73
0.75	0.49	0.54	0.60	0.66	0.71
1.00	0.50	0.55	0.60	0.65	0.70
1.25	0.51	0.56	0.60	0.64	0.69
1.50	0.52	0.56	0.60	0.64	0.68
1.75	0.53	0.56	0.60	0.64	0.67
2.00	0.53	0.57	0.60	0.63	0.67

Vulnerable: Criterion 1A2-4, Endangered Criterion 1A2-4, Critically Endangered: Criterion 1A2-4

Table 3: Estimated decline in the scalloped hammerhead population shared between Australian and Indonesia, assuming that the decline in scalloped hammerheads in Indonesia is approximately 75 per cent.

Decline in Australian component	40%	50%	60%	70%	80%
Indonesian component / Australian component	Rate of decline				
0.25	0.47	0.55	0.63	0.71	0.79
0.50	0.52	0.58	0.65	0.72	0.78
0.75	0.55	0.61	0.66	0.72	0.78
1.00	0.58	0.63	0.68	0.73	0.78
1.25	0.59	0.64	0.68	0.73	0.77
1.50	0.61	0.65	0.69	0.73	0.77
1.75	0.62	0.66	0.70	0.73	0.77
2.00	0.63	0.67	0.70	0.73	0.77

Vulnerable: Criterion 1A2-4, Endangered Criterion 1A2-4, Critically Endangered: Criterion 1A2-4

Table 4: Estimated decline in the scalloped hammerhead population shared between Australian and Indonesia, assuming that the decline in scalloped hammerheads in Indonesia is approximately 90 per cent.

Decline in Australian component	40%	50%	60%	70%	80%
Indonesian component / Australian component	Rate of decline				
0.25	0.50	0.58	0.66	0.74	0.82
0.50	0.57	0.63	0.70	0.77	0.83
0.75	0.61	0.67	0.73	0.79	0.84
1.00	0.65	0.70	0.75	0.80	0.85
1.25	0.68	0.72	0.77	0.81	0.86
1.50	0.70	0.74	0.78	0.82	0.86
1.75	0.72	0.75	0.79	0.83	0.86
2.00	0.73	0.77	0.80	0.83	0.87

Vulnerable: Criterion 1A2-4, Endangered Criterion 1A2-4, Critically Endangered: Criterion 1A2-4

Criterion 2.	Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
		Critically Endangered Very restricted	**Endangered Restricted**	**Vulnerable Limited**
B1.	Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2.	Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions:				
(a)	Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b)	Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c)	Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Not eligible

The scalloped hammerhead has a circum-global distribution in tropical and sub-tropical waters. Within Australian waters its distribution is too large to meet this criterion and thus the Committee finds the scalloped hammerhead ineligible for listing in any category under this criterion.

Criterion 3.	Population size and decline			
		Critically Endangered Very low	**Endangered Low**	**Vulnerable Limited**
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Not eligible

The estimated total number of mature individuals within Australian waters is likely to be much larger than 10 000 individuals which is too large to meet this criterion and thus the Committee finds the scalloped hammerhead ineligible for listing in any category under this criterion.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	**Endangered Very Low**	**Vulnerable Low**
Number of mature individuals	**< 50**	**< 250**	**< 1,000**

Evidence:

Not eligible

The total number of mature individuals within Australian waters is likely to be in excess of 10 000 which is not considered extremely low, very low or low. Therefore, the species has not been demonstrated to have met this required element of this criterion.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	**Endangered Near future**	**Vulnerable Medium-term future**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% in 100 years**

Evidence:

Not eligible

Population viability analysis has not been undertaken.

How judged by the Committee in relation to the Conservation Dependent listing criteria of the EPBC Act and Regulations

To be eligible for listing as Conservation Dependent a species must, at the time, satisfy the statement at paragraph 179(6)(a) of the EPBC Act or satisfy all four of the subparagraphs of paragraph 179(6)(b).

The Committee judges that scalloped hammerhead is eligible for listing as Conservation Dependent under the EPBC Act. The assessment against the criteria is as follows:

At the time of the Committee's assessment, Fisheries Queensland (Queensland Department of Agriculture and Fisheries) and Northern Territory Fisheries (Northern Territory Department of Primary Industry and Resources) had informed members of the Committee and the Department of the Environment and Energy that the full range of management arrangements described below aimed at halting decline, and supporting recovery, of scalloped hammerhead would be implemented under law by late 2017/early 2018. The advice of the Committee contained herein is therefore based on the understanding that these measures will be implemented, without alteration, and in force under law, prior to the Minister for the Environment and Energy's listing decision under the EPBC Act being made.

Furthermore, these management arrangements complement Australia's Convention on International Trade in Endangered Species (CITES) non-detriment finding for the international export of sharks (http://www.environment.gov.au/biodiversity/wildlife-trade/publications/non-detriment-finding-five-shark-species) and are/will be embedded as Conditions of the EPBC Act Wildlife Trade Operation (WTO) approvals for each relevant fishery, as appropriate (under section 303FN of the EPBC Act).

Paragraph 179(6)(a) – the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered:

Evidence:

Not applicable

The Committee considers that scalloped hammerhead is eligible for listing in the Endangered category. Therefore, the Committee does not consider the current management arrangements implemented by the Queensland and Northern Territory governments under law to constitute a 'conservation program' for the purposes of paragraph 179(6)(a) of the EPBC Act, or the cessation of which would result in the scalloped hammerhead becoming Vulnerable, Endangered or Critically Endangered because the species has been found eligible for listing as Endangered. The species has, therefore, not been demonstrated to have met the required element of paragraph 179(6)(a).

Paragraph 179(6)(b) – the following four subparagraphs are satisfied (*see below*):

Subparagraph 179(6)(b)(i) – the species is a species of fish:

Scalloped hammered (*Sphyrna lewini*) is a species of 'shark' for the purposes of the definition of **fish** under subsection 179(7) of the EPBC Act, therefore satisfies subparagraph 179(6)(b)(i).

Subparagraph 179(b)(ii) – The fish species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised:

The Committee considers that a set of fisheries management arrangements implemented under Commonwealth, state or territory law can constitute, if sufficiently focused on the species concerned, a 'plan of management' under law for the purposes of paragraph 179(6)(b) of the EPBC Act.

Australian Government Arrangements

Non Detriment Finding for CITES listed hammerhead sharks (2014)

Scalloped, great and smooth hammerhead sharks are listed on Appendix II of CITES. The listing came into effect on 14 September 2014. CITES Parties deemed the scalloped hammerhead met the requirements for listing on Appendix II and included both great hammerhead and smooth hammerhead on Appendix II as "look-alike species", i.e. species whose specimens in trade look like those of species listed for conservation reasons.

To enable the export of CITES listed species, Australia must ensure that the export will not be detrimental to the survival of the species in the wild. A non-detriment finding assessment was undertaken by the Australian CITES Scientific Authority for the three CITES listed species of hammerhead in September 2014. The assessment found that while data are limited with regards to global stock sizes of these shark species, the findings and harvest levels in Australia's non-detriment finding have been determined using the best available scientific information, by analysing Australian harvest against global harvest and by assessing the risks associated with the management arrangements currently in place in Australian fisheries.

Australian national harvest levels set by the non-detriment finding for the hammerhead shark species are:

- Scalloped hammerhead (*Sphyrna lewini*) – 200 t per year.
- Great hammerhead (*Sphyrna mokarran*) – 100 t per year.
- Smooth hammerhead (*Sphyrna zygaena*) – 70 t per year.

The Australian CITES Scientific Authority also made a number of recommendations to state and Northern Territory fisheries management agencies, including:

- Species level reporting in log books;
- Further measures to reduce incidental capture and post release mortality as practically appropriate to specific fisheries and gear types;
- Landing of sharks with fins naturally attached;
- Mandatory discard reporting to species level;
- Maximum size limits;
- Trip limits;
- An improved understanding and management focus on illegal, unreported and unregulated harvest (IUU).

Information on the 2014 Non-Detriment Finding assessment is available on the Department's webpage (https://www.environment.gov.au/biodiversity/wildlife-trade/publications/non-detriment-finding-five-shark-species) and includes a copy of the assessment, the scientific information that formed the basis of the assessment and advice on CITES Appendix II shark listings.

The Committee is of the understanding that the 2014 Non-Detriment Finding assessment will be reviewed by the Australian CITES Scientific Authority once greater information becomes available following the implementation of management arrangements by the Queensland and Northern Territory Governments for hammerhead sharks. It is expected that the current management arrangements are being implemented in a manner which allows flexibility to change if the non-detriment finding changes in future.

The Committee recommends that 2014 Non-Detriment Finding be fully reviewed and updated in 2019, taking into consideration all relevant available data, including that collected between September 2014 and June 2019.

Commercial permit requirements for CITES listed hammerhead sharks

CITES permits are required under the EPBC Act to internationally export or import any part or derivative (e.g. fillets, fins) for the three listed hammerhead shark species. CITES export permits are issued under section 303CG of the EPBC Act. In order for an exporter to be issued a permit they must provide evidence that the specimen(s) to be exported were sourced from a fishery which has been assessed as an approved wildlife trade operation (for the purposes of paragraph 303FN of the EPBC Act).

Fisheries that interact with hammerhead sharks

Hammerhead sharks are taken incidentally in some Australian commercial fisheries when fishing for other species. Five fisheries account for approximately 90 per cent of the Australian hammerhead catch: the Northern Territory Offshore Net and Line Fishery, Queensland's East Coast and Gulf of Carpentaria Inshore Fin Fish Fisheries, the Western Australian Temperate Shark Fisheries and the South Australian Marine Scalefish Fishery. Scalloped hammerheads specifically are principally taken by the Queensland and Northern Territory fisheries. Scalloped hammerheads were also taken by the Western Australian North Coast Shark Fishery, however that fishery is currently closed.

State and Territory Government Arrangements

Given that the primary sources of scalloped hammerhead harvest are undertaken by Queensland and Northern Territory managed fisheries, the management arrangements implemented by these jurisdictions for the species are those being considered for assessment under paragraph 179(6)(b) of the EPBC Act. If another state jurisdiction intends to commence commercial harvest of scalloped hammerhead in the future, this Listing Advice will need to be revised accordingly and complementary management arrangements agreed and implemented.

The Queensland and Northern Territory governments have committed to introducing a set of management arrangements under the Queensland Fisheries Regulation 2008 and the Northern Territory Offshore Net and Line Fishery Management Plan specifically aimed at hammerhead sharks, particularly scalloped hammerhead. The Committee considers these arrangements to be a plan of management for a fish (shark) for the purposes of assessment under paragraph 179(6)(b) of the EPBC Act.

The management arrangements which relevant state and territory jurisdictions are aiming to introduce are specifically aimed at halting the decline of, and supporting recovery of, scalloped hammerheads in Australian waters. These include:

Queensland

- An annual total allowable commercial catch of 150 t for all hammerhead shark, to be split across the East Coast Inshore Fin Fish Fishery (north and south) and the Gulf of Carpentaria Fin Fish Fishery, to be enforced by law under the Queensland Fisheries Regulation 2008. The total allowable commercial catch will be split regionally as follows:
  - East Coast Inshore Fin Fish Fishery north of latitude 24°30' S – 78 t
  - East Coast Inshore Fin Fish Fishery south of latitude 24°30' S – 22 t
  - Gulf of Carpentaria Fin Fish Fishery – 50 t
- A trigger point of 75 per cent of the total allowable commercial catch to be implemented under the Queensland Fisheries Regulation 2008 regionally as follows:
  - East Coast Inshore Fin Fish Fishery north of latitude 24°30' S – 58.5 t
  - East Coast Inshore Fin Fish Fishery south of latitude 24°30' S – 16.5 t
  - Gulf of Carpentaria Fin Fish Fishery – 37.5 t
- Once a trigger point is reached, it will then require fishers to:
  - Abide by trip limits of 10 hammerhead sharks for net fishers and four for line fishers.
  - Land all hammerhead sharks in whole form (i.e. gilled and gutted with head and fins attached).
- Implementation of data validation measures including prior and unload (at dock) reporting and validation.
- Implementation of an intelligence based approach to compliance activities, including at sea boarding or at wharf inspections where warranted.
- Reporting of catch using the Automated Interactive Voice Reporting (AIVR) system by phone. Data will be collated in Queensland's Quota Reporting System so that catch levels can be monitored and responded to close to real time.
- Cross checking of data sources will occur through phone reporting (AIVR), logbooks, vessel monitoring systems and receipts from buyers.
- Reporting of species-specific catch and discard information in logbooks.
- Requirement of all N4 sector (where longer net lengths are permitted, larger fishing vessels are utilised and fishing is conducted over a wider area than other sectors/symbols) boats to have a vessel monitoring system under the Queensland Fisheries Regulation 2008.

Northern Territory

- An annual total allowable commercial catch of 50 t for scalloped hammerhead (and 50 t for great hammerhead) to be enforced by law under the Northern Territory Offshore Net and Line Fishery Management Plan in force under the Northern Territory *Fisheries Act 1988*. Smooth hammerhead is not considered to occur in Northern Territory waters. Catches of *Eusphyra blochii* (winghead shark), the other hammerhead similar-species which occurs in Northern Territory waters, will be regulated under a total allowable catch of 246 t for a combined shark group including species such as *Galeocerdo cuvier* (tiger shark), *Negaprion acutidens* (lemon shark), *Carcharhinus leucas* (bull shark) and others.
- Once 100 per cent of the catch is reached, under the Northern Territory Offshore Net and Line Fishery Harvest Strategy no further fishing will be permitted that allows the harvest or discard of either scalloped or great hammerhead sharks.
- Once catches reach 40 t for either of scalloped or great hammerhead, harvest controls will be implemented. The harvest control would be based on an increased level of observer coverage to ensure the 50 t catch limit is not breached. Other options could include, but are not limited to, area closures, fishery closure, trip limits, gear restrictions and temporal closures.

- Implementation of data validation techniques under the Northern Territory Offshore Net and Line Fishery Management Plan in force under the Northern Territory *Fisheries Act 1988*, including:
  - Implementation of Vessel Monitoring Systems (VMS) on all of the fishery's vessels.
  - Introduction of electronic logbooks to facilitate efficient and timely access to logbook data. Until this is implemented fishery-wide, weights of scalloped and great hammerhead on the Catch Disposal Records at vessel unload will be regulated.
  - Restriction of product unloads to Darwin or Gove.
  - All sharks landed fins naturally attached (unless exemption granted).
  - Where there is no Fishing Monitoring Equipment (electronic monitoring) installed on a vessel, heads need to remain attached to the body of the hammerhead shark.
  - Species-specific recording of hammerhead sharks on Catch Disposal Records.
  - Random port inspection compliance program.
  - Increased monitoring program of at least 20% coverage where high risk of hammerhead shark interactions exist.
- The Northern Territory Government continues to actively participate in research into hammerhead species, by supplying logbook and observer information to external parties for analysis. It also provides genetic samples to CSIRO for a current stock structure project on hammerhead sharks.

Other management measures implemented as fishery-wide measures in Queensland and the Northern Territory, which may also provide conservation benefit to scalloped hammerhead, are as follows, noting however that these additional measures are not in force under a law:

Queensland

The Queensland Government has released the Sustainable Fisheries Strategy 2017-2027, which outlines the reform agenda for the next 10 years. The strategy outlines 33 actions to be delivered across 10 reform areas and sets targets to be achieved by 2020 and 2027. The strategy will deliver 20 more frontline fisheries compliance officers, increased monitoring, new engagement and communication methods and improved decision-making. Some of the actions in the strategy include harvest strategies for each fishery, satellite tracking (vessel monitoring systems) for all commercial fishing boats, regionally specific fishing rules and novel monitoring techniques (e.g. cameras).

As part of the Sustainable Fisheries Strategy, the Queensland Government has allocated funding towards and drafted an 'operational plan' for a research project validating catch composition of shark species in net fisheries in the Gulf of Carpentaria and the east coast. The project aims to determine species catch composition of harvest by sampling at ports, processors or on-board/on-water. It also aims to develop a profile of discards, by including data gathered from random on-board observations. The project started in July 2017 with a three year- time frame.

Under the Sustainable Fisheries Strategy, all fisheries will have harvest strategies developed with sustainable catch limits based on Maximum Sustainable Yield by 2020. Ecological risk assessments will also be undertaken for all priority fisheries and species by 2020. An additional requirement of the strategy is for all Queensland net and line boats to have a vessel monitoring system by the end of 2018.

The Sustainable Fisheries Strategy proposes the development of partnerships to trial the use of novel technologies for fisheries monitoring, such as apps, robotic vision, spatial interfaces and mapping, social media and citizen science. There also is a commitment to develop and implement a data validation plan.

The Queensland Government will consider adding *Eusphyra blochii* (winghead shark) to the total allowable commercial catch at the next available opportunity for regulatory amendment, but this is unlikely to occur before a decision is made on listing scalloped hammerhead under the EPBC Act.

Queensland's Sustainable Fisheries Strategy 2017-2027 can be accessed at:

https://www.daf.qld.gov.au/fisheries/consultations-and-legislation/sustainable-fisheries-strategy

Northern Territory

The development of a new management framework for the Northern Territory Offshore Net and Line Fishery, which includes the development of a harvest strategy for the fishery.

Summary of assessment against subparagraph 179(6)(b)(ii)

The Committee considers that the suite of management arrangements implemented for scalloped hammerhead classify as a 'plan of management' for the purposes of satisfying the requirements of subparagraph 179(6)(b)(ii) of the EPBC Act.

The Committee considers the management measures, including the introduction of a total allowable commercial catch for hammerhead shark species which will limit the annual catch of scalloped hammerhead to 200 t or less, the introduction of catch trigger points with control rules, data validation measures (including species level reporting) and the commitment to future research, to be potentially sufficient to halt population decline, and support the recovery of the species in Australian waters over the longer term. Therefore, the species has been demonstrated to have met the relevant elements of subparagraph 179(6)(b)(ii) of the EPBC Act.

Subparagraph 179(6)(b)(iii) – the plan of management is in force under a law of the Commonwealth or of a State or Territory:

To be a plan of management 'in force under a law', the Committee recognises that all management measures specifically aimed at the objective of halting decline and supporting recovery of scalloped hammerhead will be implemented under the respective legislation in Queensland and the Northern Territory. These include:

Queensland

- A hammerhead total allowable commercial catch of 150 t under the Queensland Fisheries Regulation 2008 to be split regionally.
- A trigger limit set at 75 per cent of total allowable commercial catch to trigger control rules under the Queensland Fisheries Regulation 2008 to be applied regionally.

Northern Territory

- A scalloped hammerhead total allowable commercial catch of 50 t under the Northern Territory Offshore Net and Line Fishery Management Plan in force under the Northern Territory *Fisheries Act 1988*. There will be a similar total allowable catch of 50 t set for *S. mokarran* (great hammerhead). *Eusphyra blochii* (winghead shark) will be included as part of a combined shark group total allowable catch of 246 t.
- Once 100 per cent of the catch is reached, under the Northern Territory Offshore Net and Line Fishery Harvest Strategy no further fishing will be permitted that allows the harvest or discard of either of the species.

- A trigger limit set at 40 t total catch to trigger control rules, primarily an increased observer coverage, under the Northern Territory Offshore Net and Line Fishery Management Plan.
- Implementation of data validation techniques under the Northern Territory Offshore Net and Line Fishery Management Plan in force under the Northern Territory *Fisheries Act 1988.*

To meet subparagraph 179(6)(b)(iii), all of the actions that are necessary to stop the decline of, and support the recovery of scalloped hammerhead in Australian waters, so that its chances of long term survival in nature are maximised, need to be legislated. All the management measures listed above will be legislated. As mentioned above, the Committee considers that the suite of management measures implemented by the Queensland and Northern Territory governments constitute a 'plan of management' for the purposes of subparagraph 179(6)(b)(ii) of the EPBC Act, and therefore the suite of management measures meet the relevant elements of being 'in force under a law' of subparagraph 179(6)(b)(iii).

Subparagraph 179(6)(b)(iv) – cessation of the plan of management would adversely affect the conservation status of the species:

Given that the Committee considers that the suite of management arrangements to be implemented by the Queensland and Northern Territory governments under their respective state/territory legislation constitute a 'plan of management' for the purposes of subparagraph 179(6)(b)(ii), the Committee considers that the cessation of any of these management arrangements would adversely affect the conservation status of scalloped hammerhead. Cessation of the management actions providing for the halt of decline and rebuilding of the stocks of the species would cease and this would result in the species being eligible for listing in the Endangered category under Criterion 1. Cessation of the management actions may allow for fishing activities otherwise controlled under law to resume, and the species would no longer be protected from the key threat of overfishing, thereby affecting the species' conservation status.

The Committee accepts that, without the suite of management arrangements to be implemented by the Queensland and Northern Territory governments, further declines in the scalloped hammerhead population that occurs in Australian waters are likely to be exacerbated from its current low level because, if total allowable catch limits were removed, the current stock levels are not likely to be able to tolerate a potentially unlimited annual catch of over 200 t.

Therefore, the Committee considers that scalloped hammerhead has demonstrated to have met the relevant elements of subparagraph 179(6)(b)(iv) of the EPBC Act.

Conclusion

Conservation status

Sphyrna lewini (scalloped hammerhead) was publicly nominated for inclusion in the list of threatened species referred to in section 178 of the EPBC Act.

Despite multiple uncertainties in the assessment of the scalloped hammerhead's status, including the relative share of stocks and declines in Australian and Indonesian waters, the Committee considers that the decline of species throughout its entire Australian distribution is most likely between 50–70 per cent, and the threat of fishing, while managed, has not ceased impacting upon the species completely. Therefore, the Committee considers that the species has been demonstrated to have met sufficient elements of Criterion 1 A2(a),(b),(d) to make it **eligible** for listing as **Endangered**.

The Committee considers the management arrangements to be implemented by the Queensland and Northern Territory governments under their respective state/territory legislation for scalloped hammerhead as a 'plan of management' for the purposes of paragraph 179(6)(b) of the EPBC Act. The Committee has evaluated these management arrangements and considers that they could be effective in halting further decline and supporting recovery of scalloped hammerhead in order to maximise its chance of survival in nature. Therefore, the Committee judges that scalloped hammerhead has been demonstrated to have met the requirements of paragraph 179(6)(b) of the EPBC Act and is **eligible** for listing as **Conservation Dependent**.

The highest category for which scalloped hammerhead is **eligible** to be listed is **Endangered**.

In considering its recommendation, the Committee has also considered paragraph 186(2) of the EPBC Act – 'the effect that including the native species in that category could have on the survival of the species'. The Committee has considered the effect of listing in either the Endangered or the Conservation Dependent categories could have on the survival of scalloped hammerhead and has decided that the Conservation Dependent category is likely to provide the best outcome for the species because:

- management actions for the species' protection and recovery will be implemented immediately under law.
- the management actions will remain in place while the species remains listed as Conservation Dependent.
- monitoring will be required to determine rates of recovery.

While scalloped hammerhead is eligible for both the Endangered and Conservation Dependent categories, in light of the considerations of subsection 186(2), the Committee **recommends listing in the Conservation Dependent category** subject to the management actions identified above by the Committee being implemented under law and the recommendations outlined by the Committee below being put into practice.

Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the **Conservation Dependent** category:

Sphyrna lewini

The Committee also makes the following recommendations relevant to the listing of this species in this category:

- The Department continue to monitor the development of catch validation approaches in both the Northern Territory and Queensland and in the context of the catch data. In particular, the Committee regards the revision of all fisheries management regimes relevant to this assessment to provide for the landing of hammerhead sharks with fins naturally attached (consistent with many shark fisheries in Australia), as essential if this species is to remain listed in the Conservation Dependent category.

- The Department update the Committee on the results of the Queensland Government's scheduled June 2019 review of hammerhead stock status and management arrangements.

- In light of the results of the above review, and any new data available from the Northern Territory, a full review of the Australian CITES non-detriment finding for the international export of sharks be undertaken as soon as possible after the results of the Queensland Review are available, and revision of the total allowable commercial catch limits for hammerheads to reflect recommendations from the revised non-detriment finding. The review of total allowable commercial catch limits should also include estimated levels of discards and catch by the Queensland Shark Control Program.

- In reviewing the catch data for scalloped and great hammerhead, the Department provide the available catch data for winghead shark (*Eusphyra blochii*) to the Committee for consideration. Particular attention will be given to catch levels of winghead shark relative to scalloped and great hammerhead, and the level of confidence in data attained from the various mechanisms proposed to strengthen data validation.

- The Department continue to liaise with the Department of Fisheries, Western Australia to ensure timely notification is provided to the Committee of any intention to re-open the Western Australian North Coast Shark Fishery. The Committee notes that the Department of Fisheries will need to implement management arrangements consistent with s179(6)(b) of the EPBC Act so that the Conservation Dependent listing is not jeopardised.

- The Department report annually to the Committee on the performance of the suite of management arrangements outlined in this listing advice which are to be implemented for scalloped hammerhead as a 'plan of management' for the purposes of satisfying the requirements of subparagraph 179(6)(b)(ii) of the EPBC Act.

- The listing of *Sphyrna lewini* (scalloped hammerhead) as Conservation Dependent will be subject to review five years from the date of listing.

Threatened Species Scientific Committee
12 September 2017

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