Australian Government

Department of the Environment

2011 Assessment Period – *Alopias vulpinus*

Section 1 - Legal Status, Distribution, Biological, Ecological

Conservation Theme

1. Not applicable - there is no conservation theme for the 2011 assessment period.	**N/A**

Taxonomy

2. *What are the **currently accepted scientific and common name/s** for the species (please include Indigenous names, where known)?* *Note any other scientific names that have been used recently. Note the species authority and the Order and Family to which the species belongs (Family name alone is sufficient for plants, however, both Order and Family name are required for insects).*	Scientific name: ***Alopias vulpinus*** (Bonnaterre, 1788) Common names: **Thresher shark** (English) **Common thresher** (English) **Thintail Thresher** (English) **Fox shark** (English) **Sea fox** (English) **Pez Zorro** (Spanish) **Pesce Pavone** (Italian) **Pesce Volpe** (Italian) **Renard** (French) **La faux** (French)
3. *Is this **species conventionally accepted**? If not, explain why. Is there any controversy about the taxonomy?*	This species is conventionally accepted.
4. *If **the species** is **NOT conventionally accepted**, please provide:* *(i) a taxonomic description of the species in a form suitable for publication in conventional scientific literature; **OR*** *(ii) evidence that a scientific institution has a specimen of the species and a written statement signed by a person who has relevant taxonomic expertise (has worked, or is a published author, on the class of species nominated), that the person thinks the species is a new species.*	***Not applicable***
5. *Is this species **taxonomically distinct** (Taxonomic distinctiveness – a measure of how unique a species is relative to other species)?*	The species is taxonomically distinct. However, it may be confused with other sharks within the same family *(Alopiidae)* of which there is only one genus (*Alopias*) and three species (*A. vulpinus, A. pelagicus* and *A. superciliosus*). Goldman et al (2007) report that a recent study indicated that an unrecognized fourth species of *Alopias* may exist, however recent work investigating the population structure of all three *Alopias* species found no evidence that a fourth species of thresher shark exists.

Legal Status

6. *What is the species' **current conservation status** under Australian and State/Territory Government legislation?*	The thresher shark is not listed under any Australian Federal or State/Territory Government legislation.
7. *Does the species **have specific protection** (e.g. listed on an annex or appendix) under other legislation or intergovernmental arrangements, e.g. Convention on International Trade in Endangered Fauna and Flora (CITES), Convention on Migratory Species (CMS).*	The thresher shark is listed under Annex I of the United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS states in Part V, "Exclusive Economic Zone", article 64, paragraph 1 that "*the coastal State and other States whose nationals fish in the region for the highly migratory species listed in Annex I shall cooperate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone. In regions for which no appropriate international organisation exists, the coastal State and other States whose nationals harvest these species in the region shall cooperate to establish such an organization and participate in its work*". Indirectly, this species is protected under the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA–Sharks). This plan of action recommends shark population assessments and regional shark management plans to be developed by the Regional Fisheries Organisations (IUCN, 2006). The thresher shark is not listed under any appendix in CITES. However, the report of the working group on biological and trade status of sharks to the CITES Animal Committee meeting in 2004 identified the three species of the *Alopias* genus in a provisional first list of key species requiring special management attention from Parties. The thresher shark is listed as vulnerable to extinction by IUCN, together with all members of the genus *Alopias* due to their declining populations (Goldman et al, 2007). IUCN (2007) has identified all three species of thresher shark as species that may potentially benefit from a listing on the Convention for the Conservation of Migratory Species (CMS).

Description

8. *Give a brief description of the species' **appearance**, including size and/or weight, and sex and age variation if appropriate; social structure and dispersion (e.g. solitary/clumped/flocks).*	Appearance: The Thresher Shark is a large shark, named for and easily recognisable by its extremely long tail, the upper lobe of which can be as long as the rest of the shark with the terminal lobe over twice the length of second dorsal fin base. The first dorsal fin and pectoral fins are large with narrow tips. The second dorsal fin and anal fins are tiny. The snout is sharply pointed with a small mouth containing 29 rows of small teeth in each jaw. The mouth has labial furrows. Another distinguishing feature of *A. vulpinus* is its coloration: it is blue-grey above with a metallic lustre, and has a conspicuous pale white abdomen, extending above the pelvic and pectoral fin bases. Pectoral, pelvic and dorsal fins blackish Sometimes white dots on pectoral, pelvic, and caudal fin tips. Last and Stevens (2009) further describe the species as being characterised by a fusiform, moderately stout body with a relatively short, conical and pointed snout. The free rear tip of first dorsal fin is well in advance of pelvic-fin origin. (Last And Stevens, 2009; Shark Trust, 2010; Fishbase 2011). This photo has been removed Figure 1: *Alopias vulpinus,* Thresher shark Source: Shark Trust 2010 Born between 115 and 150 cm, the thresher shark attains about 570cm (Last and Stephens, 2009). Its total length ranges between 549 cm and 609 cm, with adult males 319 to at least 420 cm and adult females 376 to 549 cm. At birth, the total size is between 114 to 150 cm (Compagno, 1984; Doyle et al., 1993). In Australia, males mature at about 340 cm and females mature between 350 and 400 cm (Last and Stevens 2009). The teeth are relatively small and similar in both jaws. They are smooth edged and narrowly triangular, usually without lateral cusplets. The first 3 teeth near the centre of the jaw are erect, all other teeth are oblique. The tooth count is 38-40/35-41 [32-52/25-50], and total vertebrae is 343-356 [322-364] (Last and Stevens, 2009). Social Structure and dispersion: Threshers are coastal over the continental and insular shelves and epipelagic species far from land in temperate to tropical waters. However, populations in the north western Indian Ocean have shown spatial and depth segregation by sex. (Fishbase 2011) Last and Stevens (2009) note that tracking studies in Australia have shown that thresher sharks undertake daily vertical migrations with most of the night spent in the top 50m while during the day most time was spent at 300 – 400m. Young threshers are often found close inshore and in shallow bays. They seem to swim in depth range from the surface to 366m.
9. *Give a brief description of the species' **ecological role** (for example, is it a 'keystone' or 'foundation' species, does it play a role in processes such as seed*	Thresher sharks are expected to play an important role in the structure and functioning of marine ecosystems (Dulvy et al. 2008). Like the majority of sharks, the thresher shark is a top-order predator feeding on a variety of prey items including small fish, squid (Preti et al., 2004). Last and Stevens (2009) note that

dispersal or pollination).	their diet consists mainly of small schooling fishes, which are herded and stunned with its long tail. They also feed on bottom fishes and cephalopods. It is considered a high trophic level apex predator with a trophic level of 4.5 (out of 5) based on diet studies in coastal and open ocean ecosystems (Fishbase 2011). Little is known of the thresher shark predators however they have been identified as prey for killer whales around New Zealand (Visser, 2005). In 2007, the decline of shark populations triggered a trophic cascade that collapsed a century-old fishery for bay scallops in the northwest Atlantic (Ferretti et al., 2008).

Australian Distribution

10. *Describe the species' **current and past distribution in the Australian distribution** and, if available, attach a maps noting the source and the datasets used to create these.*	The thresher shark is an oceanic species occurring in all tropical and warm temperate seas from the surface to at least 700 m deep (Last and Stevens, 2009), although it is most commonly found between 0 – 200m (Fishbase 2011). In Australia it is found in more temperate waters, occurring off southern Australia from Brisbane (QLD) to the North West Shelf (WA) including Tasmania and coastal and oceanic from the surface to 650m (Last and Stevens, 2009). Cosmopolitan in temperate and tropical seas, thresher sharks are mainly pelagic, from the coast to the open ocean (Last and Stevens, 2009). Small juveniles are found in nursery areas inshore (Last and Stevens, 2009), and sharks of the thresher family are regularly caught in low numbers in the shark control nets on coastal beaches in New South Wales. *Map deleted due to copyright* **Figure 2:** Global distribution of the thresher shark, *A. vulpinus* Source: Fishbase
11. *What is the **extent of occurrence** (in km^2) for the species (described in Attachment A); explain how it was calculated and provide information on data sources.*	
a. *What is the **current** extent of occurrence?*	The species occurs in all temperate and tropical seas, from the coast to the open ocean. In Australia, they occur off southern Australia from Brisbane (QLD) to the North West Shelf (WA) including Tasmania and coastal and oceanic from the surface to 650m (Last and Stevens, 2009). The extent of occurrence has not been determined for this species in terms of square kilometres.
b. *What data are there to indicate **past declines** in extent of occurrence (if available, include data that indicates the percentage decline over the past 10 years or 3 generations whichever is longer)?*	There is not sufficient data available to enable reliable estimates to be inferred on past declines in extent of occurrence in Australia's EEZ due to the lack of data establishing baseline abundances of naturally occurring populations of the thresher shark (and other large sharks) in Australia's waters prior to the onset of industrialized commercial fishing (Baum and Myers 2004). However, severe declines in thresher shark populations have been recorded in the Mediterranean and in North America (Ferretti *et al.,* 2008; Dulvy *et al.,* 2008; Stevens *et al.,* 2000).

c. *What data are there to indicate **future changes** in extent of occurrence (if available, include data that indicates the percentage decline over 10 years or 3 generations whichever is longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)*?	There is no data available that specifically indicate future changes in geographical extent of occurrence, as noted above. It is reasonable to conclude that declines in population density of the thresher shark will certainly continue and worsen if fishing pressure does not ease. This is particularly applicable to the thresher shark due to the value of its fins.
12. *What is the **area of occupancy** (in km^2) for the species (described in Attachment A); explain how it was calculated and provide information on data sources*	
a. *What is the **current** area of occupancy?*	The species occurs in all temperate and tropical seas, from the coast to the open ocean. In Australia, they occur off southern Australia from Brisbane (QLD) to the North West Shelf (WA) including Tasmania and coastal and oceanic from the surface to 650m (Last and Stevens, 2009). Thresher sharks are active, strong swimmers and believed to move throughout their distribution in Australia; however the area of occupancy has not been determined for this species in terms of square kilometres.
b. *What data are there to indicate **past declines** in area of occupancy (if available, include data that indicates the percentage decline over the past 10 years or 3 generations whichever is longer)?*	No data is available to indicate past declines in area of occupancy of thresher sharks either in Australia or in waters overseas.

c. *What data are there to indicate **future changes** in area of occupancy (if available, include data that indicates the percentage decline over 10 years or 3 generations whichever is longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)?*	No data is available that may indicate future changes in area of occupancy in Australia.
13. *How many **natural locations** do you consider the species occurs in and why? Where are these located? Provide latitude, longitude, map datum and location name, where available, in an attached table.* *The term 'location' defines a geographically or ecologically distinct area.*	The species occurs in all temperate and tropical seas, from the coast to the open ocean. In Australia, they occur off southern Australia from Brisbane (QLD) to the North West Shelf (WA) including Tasmania and coastal and oceanic from the surface to 650m (Last and Stevens, 2009). *A. vulpinus* is a pelagic and highly migratory species which is believed to move throughout their distribution in Australia. Small juveniles are found in nursery areas inshore (Last and Stevens, 2009). No further data is available to indicate any natural locations it may occupy.
14. *Give **locations of other populations**: captive/propagated populations; populations recently re-introduced to the wild; and sites for proposed population re-introductions. Note if these sites have been identified in recovery plans. Provide latitude, longitude, map datum and location name, where available, in an attached table.*	There is no evidence of either captive / propagated populations in the scientific literature. As such, there are not likely to be any populations that have been re-introduced into the wild, or any sites that are proposed for population re-introductions.
15. *Is the species' **distribution severely fragmented?** What is the cause of this fragmentation? Describe any biological, geographic, human-induced or other barriers causing this species' populations to be fragmented.* *Severely fragmented refers to the situation in which increased extinction risk to the taxon results from most individuals being found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonisation.*	The lack of population data for the species makes it difficult to determine the degree of fragmentation of the species' distribution. However, it is noted that the species is a migratory marine species and is unlikely to experience barriers to movement within its range.
16. *Departmental Use Only:*	

Global Distribution

17. *Describe the species' **global distribution**.*	*Alopias vulpinus* is globally distributed (IUCN, 2007). It is cosmopolitan in temperate and tropical seas (Last and Stevens, 2009). See Figure 2 above for the full global distribution. The migrations of thresher sharks are not well studied, but all are likely to be migratory within at least parts of their range. IUCN (2007) describes what is known of the species migratory behaviour as follows: In the north western Indian Ocean and off the west coast of North America they show spatial and depth segregation by sex. Off the west coast of North America (and probably elsewhere) the species is seasonally migratory, and moves northwards from Baja California into California waters

	during the spring, with adult males tending to travel farther northwards than females and reaching the coast of British Columbia. Juveniles are mostly found in shallow warm-temperate inshore waters, particularly off southern California where an important nursery area occurs. Juveniles may be less cold-tolerant than adults, and seldom range north of Central California. Both adults and juveniles congregate in inshore waters of southern California, primarily during spring and summer. There have also been infrequent records in inshore waters off Ireland (Quigley et al, 2008).
18. *Give an overview of the **global population**'s size, trends, threats and security of the species outside Australia.*	Due to the absence of population estimates for the thresher shark, there is insufficient data available to provide an indication of the global population size of the thresher shark, however the population trend is one of decreasing numbers, with the thresher shark listed as vulnerable under IUCN (Goldman et al, 2007). Fisheries pose the greatest threat to thresher shark populations. Due to the thresher shark's life history characteristics, the species is slow to recover from moderate levels of exploitation and high levels of largely unmanaged and unreported mortality in target and bycatch fisheries (Goldman et al, 2007). Serious declines in thresher shark populations can therefore be said to have been caused by target and bycatch fisheries in coastal waters and on the high seas (IUCN, 2007). Thresher shark populations are among those that have declined in the northwest Atlantic with Baum *et al* (2003) reporting a decline in thresher sharks of over 75%. Last and Stevens (2009) also report a target gillnet fishery for this species off southern California started in the late 1970s but ended in 1990 due to declining catches. Data from logbooks of pelagic longline fisheries in the northwest and western central Atlantic suggest that thresher stocks declined between 63-80% from 1986-2000 (Goldman et al, 2007). The main threat to thresher sharks is mortality in longline fisheries primarily targeting pelagic species such as tuna and billfish. Like many sharks, threshers have low growth rate and low fecundity and are highly vulnerable to the significant fishing pressure (Dulvy et al., 2008), so when shark species are a bycatch of fishing methods targeting teleost species their population will inevitably be depleted (Walker, 1998). Due to the high quality of the meat and fins (Last and Stevens (2009) it is a commercial by-product of many fisheries. There is strong international trade for its meat and fins. The practice of shark finning (removal of the fin only) and discarding trunks makes it difficult to determine the quantity of threshers caught in longline fisheries (Ward *et al.*, 2004). The common thresher has also been identified as part of the fish leather trade in the US (Grey et al., 2006). While globally the threat to thresher sharks by recreational fishing is not as big as by the commercial fishing industry, Cortes (2008) note this is not always the case locally, pointing out that significantly more thresher sharks are caught by US anglers than by the US commercial pelagic longline fleet in the Atlantic. There is no data available for the Australian component of this but it is likely to be significant. Last and Stephens (2009) report that the thresher shark is known to leap out of the water, making it a popular angling species.

While overall the species is considered Vulnerable, IUCN (2007) has also assessed the conservation status for the species in some regions. The North East Atlantic population is classified as near threatened and the North West Atlantic population is classified as endangered. The Mediterranean and East Indian Ocean populations are vulnerable, while the North East Pacific is near threatened.

IUCN (2007) identifies harvest mortality as the major threat to this species as a primary and secondary target in fisheries. Very few range States and regional fisheries management organisations (RFMOs) appear to have introduced management measures for the thresher shark (IUCN, 2007), although IOTC, ICCAT, WCPFC and IATTC are increasingly addressing this issue.

In 2010 The Western and Central Pacific Fisheries Commission (WCPFC) approved a shark assessment and research program recommended by its Scientific Committee which aims to determine the stock status of key Commission-managed shark species in the WCPO – the Shark Assessment and Research Program. The program is unique among tuna RFMOs in its scope which covers data collection and improvement, research and assessment and will be led by one of the world's leading shark researchers, Dr. Shelley Clarke. The program will focus on blue, mako, silky, oceanic whitetip and thresher sharks and can be extended to other shark species, such as porbeagle and hammerheads, as the program matures.
The program is operating in the Convention Area under Conservation and Management Measure (CMM) 2009-04. This measure also contains several operational provisions applicable to fisheries catching sharks which, *inter alia*:

- call for minimising waste and discards;
- encourage live release;
- define key shark species, and shark catch and discard reporting requirements for WCPFC CCMs;
- support research on avoidance of unwanted bycatch;
- prohibit retention on board, transhipment, landing or trading shark fins which total more than 5% of retained shark carcasses; and
- allow alternative measures for conserving and managing sharks within areas of coastal States' national jurisdiction.

WCPFC (2010).

In 2010 the Indian Ocean Tuna Commission (IOTC) adopted a resolution which prohibits the retention onboard, transhipment, landing, storing, selling or offering for sale any part or whole carcass of the three species of Thresher sharks (family Alopiidae) by all vessels on the IOTC record of authorized vessels. (IOTC, 2010)

These measures should increasingly prevent the fishing of thresher sharks for their fins alone (Goldman et al, 2007).

Thresher sharks certainly warrant a much higher priority for collaborative management by range States than is currently the case (IUCN, 2007). IUCN (2007) summarises known management measures for this species as being a bycatch and recreational bag limit in South Africa and a pelagic species on the United States Highly Migratory Species Fishery Management Plan.

A provisional list of some of the shark species identified by the 20th Meeting of the CITES Animals Committee under Resolution Conference 12.6 lists the three species of thresher shark as being in decline and in need of management attention from the

	Parties.

19. *Explain the **relationship** between the Australian population and the global population, including:*	
a. *What **percentage** of the global population occurs **in Australia**;*	Due to the lack of population data available worldwide, it is not possible to quantify the proportion of the population which occurs within Australian waters.
b. *Is the Australian population **distinct**, geographically **separate** or does part or all of the population move in/out of Australia's jurisdiction (give an overview; details in Movements section);*	Due to the ambiguity surrounding the species' transoceanic migratory movements, the lack of definitive data concerning the existence and locations of specific subpopulations, and the degree to which these populations naturally interact, it is unknown whether there are any populations which occur entirely within Australia's EEZ for any given period of time. As threshers are active and strong swimmers, they are likely to leave Australian waters. However, data is not available to confirm this. As a member of the *Alopias* family, *A. vulpinus* is considered a 'highly migratory species' under Annex I of teh 1982 United National Convention on the Law of the Sea (UNCLOS), and the species occurs regularly in pelagic habitat within international waters, as can be seen in Figure 1.
c. *Do **global threats** affect the Australian population*?	The Thresher Shark is an important economic species in many areas and is taken in large numbers, including the Mediterranean Sea and northeast Atlantic. Regularly landed as bycatch in long-line and trawl fisheries, its meat is highly prized fresh but can also be salted/ dried and the fins are used for sharkfin soup in much of Asia. The oil from its liver can be processed for vitamins and its hide is usable for leather. (Shark Trust 2010). The migratory nature of this species makes it vulnerable to fishing pressure on the high seas, particularly from industrial longline fleets. Ward & Curran (2004) found thresher sharks were among the top 20 species most frequently caught in long-line fishing for tuna and swordfish off Western Australia. Approximately 40% of the thresher sharks caught were dead when the long lines were retrieved. Fisheries therefore pose the principal threat to the species, as thresher sharks are caught as bycatch in pelagic longline fisheries and commercially traded due to the high value of the meat and fins. The species is commonly traded on the Hong Kong fin market (Lack and Sant, 2008). Lack and Sant (2008) report that *Alopias* spp are taken in Illegal Unreported and Unregulated (IUU) fishing according to literature and media reports. Recreational fishing on thresher sharks is also popular in Australia (Last and Stephens, 2009), which means that the thresher shark is also exposed to these threats in Australian waters. In light of the global distribution of the species, it is expected that the thresher shark is subject to all the same threats in Australia that it is globally.

Surveys and Monitoring

20. *Has the species been **reasonably well surveyed**? Provide an overview of surveys to date and the likelihood of the species' its current known distribution and/or population size being its actual distribution and/or population size. Include references documenting the current known distribution and location records and survey methodology where available.*	There are many ongoing surveys (e.g. WCPFC, 2010) that are now underway to further investigate the biology and distribution of the thresher sharks, and ongoing calls within tuna RFMOs for more data to be collected on sharks. Last and Stevens (2009) report that tagging studies in Australia have identified vertical movements of thresher sharks. From a search of the literature, the species does not appear to have been reasonably well surveyed in Australia however.
21. *For species nominated as extinct or extinct in the wild, please provide details of the **most recent** known **collection**, or authenticated **sighting** of the species, and whether additional populations are likely to exist and the basis for this assertion. Provide latitude, longitude, map datum and location name, where available.*	***Not applicable***
22. *Is there an ongoing **monitoring programme**? If so, please describe the extent and length of the programme.*	There is no ongoing monitoring program for the thresher shark in Australia that the nominee is aware of. However internationally tuna RFMOs are starting to instigate programs, e.g. WCPFC Shark Research Program (WCPFC 2010). The Australian Fisheries Management Authority has underway Ecological Risk Assessments to identify species whose conservation is at risk in Australian fisheries but the information is not yet public. HSI recommends the TSSC seek information on this species from all relevant fisheries assessed in the ERA process. The IOTC recommended in 2009 to add thresher shark to IOTC Resolution 08/04 "*Concerning the recording of the catch by longline fishing vessels in the IOTC area*" in order to improve collection of data on shark bycatch in the Indian Ocean. Bycatch of thresher sharks now has to be reported to the IOTC, as per IOTC Resolution 2010/12 (IOTC, 2010).

Life Cycle and Population

23. *What is the species' total population size in terms of **number of mature individuals**? How were population estimates derived and are they reliable? Are there other useful measures of population size and what are they?* In the absence of figures, terms such as common, abundant, scarce can be of value.	The migratory nature of the species makes it difficult to give a reliable population estimate for this species. It has also been poorly studied. Therefore, the population size of thresher sharks remains unknown.
24. *Does the species occur in a **number of smaller populations**? How many? For each population give the locality, numbers and trends in numbers and tenure of land (include extinct populations). Can these be considered to be subpopulations and why?* **Subpopulations** are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange.	Thresher sharks appear to exhibit little to no immigration and emigration between geographic areas. The California drift gill net fishery provided insight into the population dynamics of this species, indicating that numerous isolated subpopulations or stocks exist globally. An ongoing global population genetic study using DNA sequences from the mitochondrial control region indicates significant structuring of *A. vulpinus* populations within the Pacific Ocean, and significant structure between Pacific and northwest Atlantic populations. Differences in length at maturity and fecundity of specimens examined from different regions of the world also provides evidence for isolated subpopulations or stocks. The nominee is not aware of any ongoing work or research in this regard on Australian stocks of *A.vulpinus*.

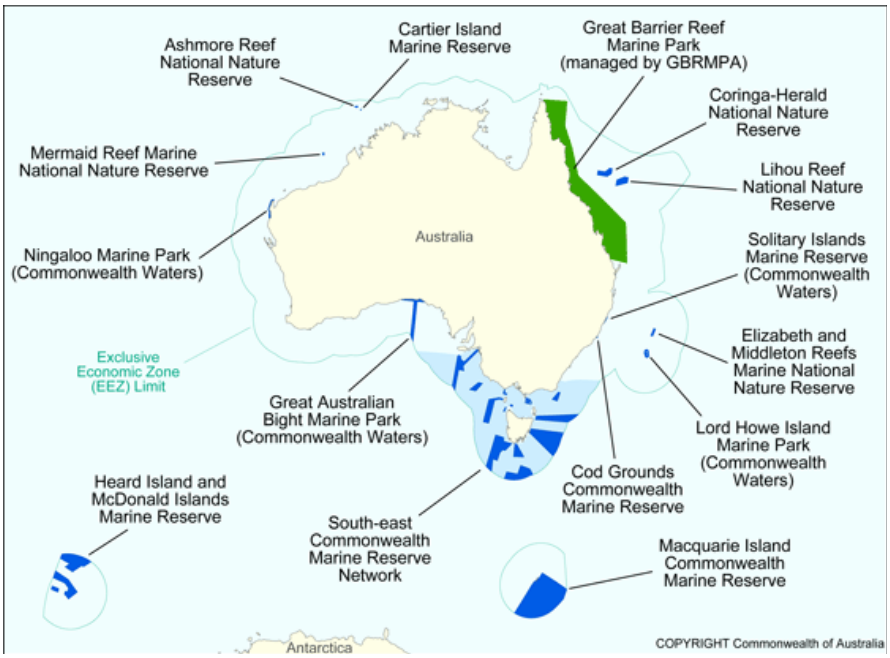
	(Goldman et al, 2007)

25. *Provide details on ages of the following:*	
a. *sexual maturity;*	Age at sexual maturity has been estimated at between 3 and 8 years old (Cailliet et al., 1983) and approximately 5 years old (Frisk et al., 2001). In Australia males mature at about 340cm although this may be 300cm in other regions. Females mature between 350 and 400cm. (Last and Stephens, 2009). Fishbase (2011) estimates that maturity occurs at between 226 and 400cm.
b. *life expectancy;*	Unknown. It is estimated that maximum age may range between 45 to 50 years (Cailliet et al., 1983; Doyle et al., 1993), although Fishbase (2011) reports the maximum age as being 25 years.
c. *natural mortality.*	Unknown, However, due to the long life of threshers and their advanced stage and condition of newborn pups, natural mortality is presumed low (Doyle et al. 1993).
26. Reproduction	
For plants*: When does the species flower and set fruit? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, cleared ground) in order to reproduce?*	***Not applicable***
For animals*: provide overview of breeding system and of breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?*	Pups are born between 115-150cm and can attain about 570cm (Last and Stephens, 2009). Thresher sharks have low fecundity making them vulnerable to over-fishing. They mature late and produce few young at a time. Thresher sharks are ovoviviparous. After absorption of the yolk sac, developing foetuses obtain nourishment by feeding on the yolk sac and other ova produced by the mother whilst still developing in the uterus (Fishbase 2011). Mating is thought to occur in summer and gestation lasts 9 months (Last and Stephens, 2009), with female common threshers giving birth between March and June to an average of four fully developed pups (Doyle *et al.,* 1993) although the litter size can vary between 2 and 7 pups Last and Stephens, 2009).
27. *What is the* ***population trend*** *for the entire species?*	
a. What data are there to indicate ***past decline*** *in size (if available, include data on rate of decline over past 10 years or 3 generations whichever is longer)?*	According to IUCN (Goldman et al, 2007) the global population trend for *A. vulpinus* is decreasing, and the species is listed as vulnerable to extinction. Data are available from studies in the North Atlantic and Mediterranean Sea. Ferretti *et al.* (2008) used a diverse set of records dating back to the early 19th and mid 20th century to reconstruct long-term population trends of large predatory sharks (including threshers) in the northwestern Mediterranean Sea and found that thresher shark's population declined between 96 and 99.99% relative to their former abundance. Baum et al. (2003) has used a large dataset in the northwestern Atlantic (Gulf of Mexico) to indicate a decline in thresher sharks

	of over 75% in the past 15 years. "*We estimate that thresher sharks – a group comprised of the common thresher (Alopias vulpinus) and big eye thresher (A. superciliousus) – have declined by 80% (95% CI: 76 to 86%) and the area examined for the thresher sharks encompasses the known distribution of their Northwest Atlantic populations. Observed declines suggest that these populations have collapsed*" (Baum *et al,* 2003). No data on population declines for this species is available for Australia.
b. *What data are there to indicate **future changes** in size (if available, include data which will indicate the percentage of decline over 10 years or 3 generations whichever in longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)?*	No data is available to determine possible future changes in size. However, because of the low fecundity and long life, threshers are particularly vulnerable to population decline due to fishing pressure. If pressure from fisheries activities is not reduced and improvement in management processes and implementation of mitigation measures undertaken, then declines of *A. vulpinus* can only be expected to worsen.
28. *Does the species undergo **extreme natural fluctuations** in population numbers, extent of occurrence or area of occupancy? To what extent and why?* **Extreme fluctuations** can be said to occur in a number of taxa when population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e. a tenfold increase or decrease).	Extreme natural fluctuations in population numbers, extent of occurrence or area of occupancy have not been recorded for thresher sharks. However as stated in Q26a the population of threshers is in decline.
29. *What is the **generation length** and how it is calculated?* **Generation length** is the average age of parents of the current cohort (i.e. newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used.	The generation length is estimated using parameters of age of first reproduction and natural mortality rate into the following formula (COSEWIC 2006): GL = age of first reproduction + (1/natural mortality rate) Because the natural mortality rate for threshers is unknown, it is not currently possible to estimate the generation length by using the formula.

30. *Identify **important populations** necessary for the species' long-term survival and recovery? This may include: key breeding populations, those near the edge of the species' range or those needed to maintain genetic diversity.*	There is currently insufficient data available to identify populations of importance for this species.
31. *Describe any **cross-breeding** with other species in the wild, indicating how frequently and where this occurs.*	There is no evidence to suggest the occurrence of cross-breeding with any other species in the wild in the available literature.
32. *Departmental Use only:*	

Populations In Reserve

33. *Which **populations** are **in reserve systems**? Which of these are actively managed for this species? Give details.*	Because threshers are a highly migratory species, they are more likely to swim through reserve systems and use these locations only temporarily. No species specific mechanisms are currently in place to manage particular populations of *A. vulpinus*. Nonetheless, enforcement is difficult and high levels of fishing intensity continue illegally. In Australian waters, all reserve systems in the species range may have *A. vulpinus* either permanently or occasionally. The map in Figure 3 shows Commonwealth marine protected areas of 2009.  **Figure 3:** Commonwealth marine protected areas (source: SEWPaC)

Habitat

34. *Describe the **species' habitat** (e.g. aspect, topography, substrate, climate, forest type, associated species, sympatric species). If the species uses different habitats for different activities (e.g. breeding, feeding, roosting, dispersing, basking), then describe each habitat.*	Thresher sharks are a pelagic species living in tropical and temperate oceans. Coastal over continental and insular shelves and epipelagic far from land (Fishbase 2011) they have greater apparent abundance within 40 miles of shore. They are strong swimmers, although transoceanic migrations are undocumented in the Pacific. Threshers are abundant over the continental and insular shelves (Doyle et al. 1993). Small juveniles are found in nursery areas inshore. Tracking studies in Australia have shown that they undertake daily vertical migrations with most of the night spent in the top 50m while during the day most time was spent at 300-400m (Last and Stevens, 2009). Spatial and depth segregation by sex has also been observed in northwestern Indian Ocean populations (Fishbase 2011).

35. *Does the species use **refuge habitat**, e.g. in times of fire, drought or flood? Describe this habitat.*	Thresher sharks are open ocean pelagic shark and there is no evidence available in the literature to indicate they use refuge habitat.
36. *Is the **extent or quality** of the species' habitat **in decline**? If the species uses different habitats, specify which of these are in decline.*	Anthropogenic influences threaten coastal and estuarine habitat utilized by *A. vulpinus* and other coastal species through development, fisheries activities, chemical and nutrient pollution, freshwater diversion from incoming rivers, and dumping of plastic and other manmade substances, endangering marine life (Camhi et al 1998). Marine pollution from agriculture and industry effluents cause algal growths which smother plant life, and leach atmospheric contaminants and heavy metal deposits such as mercury, organochlorines and PCBs which can act as endocrine disruptors, cause neurological complications or interrupt other basic biological functions in sharks (Camhi et al 1998; WildAid 2007). Moreover, climate change and its many associated effects (i.e. ocean acidification, water temperature rise, altered current flows, limited nutrient availability, coral bleaching etc – refer item 45) might potentially result in any number of implications for sharks; however it is inappropriate to speculate about such implications at present, as management of such potential outcomes is far beyond the scope of this document.
37. *Is the species part of, or does it rely on, a **listed threatened ecological community**? Is it associated with any other **listed threatened species**?*	***Not applicable***

Feeding

38. *Summarize the species' **food** items or sources and timing/seasonality.*	Bony fish make up 97% of the thresher shark's diet. They feed mostly on small schooling fish such as manhanden, herring, Atlantic saury, sand lance, and mackerel. Bluefish and butterfish are the most common meal. These small schooling fishes are herded and stunned with the thresher shark's long tail. They are also known to feed on bonito, squid and rarely seabirds. (Last and Stephens, 2009; Fishbase 2011) Bedford (1992) and Preti *et al*. (2001) found that in the eastern Pacific, the northern anchovy *Engraulis mordax* Girard is the most abundant prey item in the diet of both juvenile and adult *A. Vulpinus.* Other prey include squid (Loligo opalescens) , Pacific sardine (Sardinops sagax); Pacific hake (Merluccius productus); and Pacific or chub mackerel (Scomber japonicas, both in warm water and cool water periods. Preti et al (2005) suggest that during cool-water periods the thresher shark subsists on a narrow range of food items (such as anchovy and squid), but the diet becomes more diversified and opportunistic during less-productive warm-water El Nino periods. Research by Cartamil et al (2010) suggests that the common thresher shark is primarily a daytime predator, which prefers deep offshore water and avoids shallower waters over the continental shelf.
39. *Briefly describe the species' **feeding behaviours**, including those that may make the species vulnerable to a threatening process.*	Thresher sharks use their caudal fin to both produce thrust and immobilize prey during feeding (Aalbers et al, 2010). Thresher sharks encircle schools of fish and then stun the prey with their tails used like as a whip. This is often done in groups and/or pairs.

	Aalbers et al (2010) also noted that the use of the caudal fin during feeding probably contributes to the effectiveness of alopiid sharks as a predator of lower trophic level organisms, particularly small schooling fish They have also been known to kill seabirds with their tails. (Fishbase 2011)

Movement Patterns (fauna species only)

40. *Describe any relevant **daily and seasonal pattern of movement** for the species, or other irregular patterns of movement, including relevant arrival/departure dates if migratory.*	Threshers are strong swimmers, although transoceanic migrations are undocumented in the Pacific (Doyle et al. 1993). Tracking studies in Australia have shown that they undertake daily vertical migrations with most of the night spent in the top 50m while during the day most time was spent at 300-400m (Last and Stevens, 2009).

41. *Give details of the species' **home ranges/territories**.*	Because threshers are highly migratory, they are a cosmopolitan species occurring in tropical and temperate oceans. Further research is needed on this issue.

Survey Guidelines

42. *Give details of the **distinctiveness and detectability** of the species.*	There are three species within the Family *Alopiidae* all of which occur in Australian waters. *A. vulpinus* is similar to *A. pelagicus* the pelagic thresher and to *A. superciliosus,* the bigeye thresher. However there are main morphological differences: the pelagic shark is pale-grey in coloration and has lateral teeth *with* distinct cusplets and the terminal lobe of the caudal fin is about equal in length to the second dorsal-fin base. The bigeye thresher has a pronounced groove extending on each side of the head from behind the eyes to above the gill slits. In addition, as seen in figure 4, the bigeye thresher has very large eyes extending onto the dorsal head surface. This photo has been removed due to copyright ***Figure 4:*** *Alopias superciliosus*, Bigeye Thresher Shark Source: Shark Trust 2010 (Last and Stephens, 2009; Shark Trust, 2010)
43. *Describe **methods for detecting species** including when to conduct surveys (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide.*	Thresher shark is a rare species, so it is quite difficult to detect it. As reported in Q40, tagging studies have been conducted in Australia (Last and Stevens, 2009). The species could benefit from further studies, as is being attempted through the fora of Regional Fisheries Management Organisations.

Section 2 - Threats and Threat Abatement

Threats

44. *Identify **past, current and future threats**, to the species indicating whether they are actual or potential. For <u>each</u> threat, describe:*	The Thresher Shark is an important economic species in many areas and is taken in large numbers, including the Mediterranean Sea and northeast Atlantic. Regularly landed as bycatch in long-line and trawl fisheries, its meat is highly prized fresh but can also be salted/ dried and the fins are used for sharkfin soup in much of Asia. The oil from its liver can be processed for vitamins and its hide is usable for leather. (Shark Trust 2010) Fisheries therefore pose the principal threat to the species, as thresher sharks are caught as bycatch in pelagic longline fisheries and commercially traded due to the high value of the meat and fins. The species is commonly traded on the Hong Kong fin market (Lack and Sant, 2008). Lack and Sant (2008) report that *Alopias* spp are taken in Illegal Unreported and Unregulated (IUU) fishing according to literature and media reports.
a. ***how and where** it impacts on this species;*	Over the last 50 years fishing pressure has increased substantially in the world's oceans, resulting in rapid declines of large predatory fish populations. Large elasmobranchs, which are particularly vulnerable to increased mortality rates because of their slow growth, late age of maturity and low reproductive rate, have been of particular concern. (Goldman et al, 2007) Many coastal fisheries target sharks or land them as bycatch in widespread longline, purse seine, gillnet and driftnet fisheries targeting more productive tuna, swordfish and other billfish, as well as midwater trawl fisheries for small pelagic fish in boundary current systems (Dulvy et al., 2008; Ferretti et al., 2008; Stevens et al., 2000). These fishing practices occur worldwide, in the north west Atlantic (Baum et al., 2003), the south east Atlantic (Basson et al., 2007), the south west Atlantic (Mourato et al., 2008) the Mediterranean (Megalofonou et al., 2005; Tudela et al., 2005; Ferretti et al., 2008), Indonesia (White, 2007). It is therefore acknowledged that thresher sharks are fished commercially throughout their range, with *A. vulpinus* thought to be the most important species of the *Alopias* spp. Although referred to as bycatch of other fisheries, given that the bycatch is normally utilised, it would be more accurate to class this as secondary target catch. (Goldman et al, 2007). Thresher shark fins, as well meat, are traded internationally to meet the demand for a delicacy called 'shark fin soup'. This demand is driven by rapidly growing Asian economies. The fins of sharks are generally worth more than their meat, that's why it's common to retain the fins and discard the carcass at the sea – a practice called finning (Dulvy et al., 2008). Despite this widespread exploitation, oceanic pelagic shark have been poorly reported in fisheries records. This is due to the incidental nature of most catches of this species and their traditionally low value relative to the tuna and billfish with which they are typically caught (Dulvy et al., 2008). Clarke et al (2006a) found that on the world's largest fin market, Hong Kong, 34-45% of fins belong to only 14 species including the *Alopias* spp.

	Lack and Sant (2008) report that fishing for thresher sharks has occurred in a marine protected area in the Philippines in contravention of the regulations. The adoption by IOTC in 2010 of a resolution on thresher sharks (IOTC 2010) and the WCPFC's shark assessment program (WCPFC, 2010) is evidence that efforts are underway within tuna RFMOs to gather further information about shark stocks. The impact of fisheries on the thresher shark is difficult to quantify, however in light of the information above, it is likely that it has been significant. FAO in its recent review regards *Alopias* species as being fully exploited or overexploited globally, unless demonstrated otherwise. (Goldman et al, 2007).
b. *what its **effect** has been **so far** (indicate whether it is known or suspected; present supporting information/research; does it only affect certain populations);*	Thresher shark populations have declined by >75% in Northwest Atlantic in just 15 years and by over 90% in the Mediterranean Sea, both attributed to fishing pressure. In 2007, the decline of shark populations triggered a trophic cascade that collapsed a century-old fishery for bay scallops in the northwest Atlantic (Ferretti *et al.,* 2008). In recognition of the threats posed to sharks by tuna fisheries, in 2009 the Indian Ocean Tuna Commission adopted measures to conserve thresher sharks, including a requirement for commercial fishers to release thresher sharks unharmed (IOTC, 2010). This includes thresher sharks caught within the IOTC area in Australia's waters. In addition the Western and Central Pacific Fisheries Commission has recently begun a shark research program to undertake a shark assessment for the WCPFC area (WCPFC, 2010).
c. *what is its **expected effect in the future** (is there supporting research/information; is the threat only suspected; does it only affect certain populations);*	In the absence of effective conservation measures, it is expected that populations of thresher sharks will continue to decline globally. It is therefore essential that fishing practices are regulated and enforced reductions in effort put in place. In addition, the capture of non-target species such as the thresher shark in pelagic longline and tuna fisheries be better mitigated, and action be taken to improve the biological and ecological data provided on migratory shark species such as the thresher shark be agreed by all parties to tuna Regional Fishery Management Organisations.
d. *what is the **relative importance or magnitude** of the threat to the species.*	Fishing mortality in commercial target and bycatch fisheries is the main cause of the decline of thresher sharks. This is especially emphasized with the species' life history traits of slow growing and low productivity (Walker 1998). It can therefore be said that these threats are severe and likely to escalate unless efforts are taken to address this issue.
45. *If not included above, identify **catastrophic threats**, i.e. threats with a low predictability that are likely to severely affect the species. Identify the threat, explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/cyclone in the area every 100 years).*	As the species is oceanic, it is likely to be less affected by catastrophic events. However, given the lack of information on the thresher shark, and lack of evidence in the literature of how the species uses its environment, it is likely that the impacts of any catastrophic threats cannot be evaluated at this time. The impact of climate change on the thresher shark's habitat and range has not been studied.
46. *Identify and explain any **additional biological characteristics** particular to the species that are threatening to its survival (e.g. low genetic diversity)?*	Members of the genus *Alopias*, thresher sharks, are threatened from a combination of slow life history characteristics, hence low capacity to recover from moderate levels of exploitation, and high levels of largely unmanaged and unreported mortality in target (for fins and their valuable meat) and bycatch fisheries. As a large coastal, slow-growing and late maturing species, the

	thresher shark has a very low resilience, with a minimum population doubling time of 14 years (Fishbase 2011).
47. *Identify and explain any* ***quantitative measures or models*** *that address the probability of the species' extinction in the wild over a particular timeframe.*	Quantitative measures or models addressing the probably of extinction for *A. vulpinus* are not available at this time.
48. *Is there* ***other information*** *that relates to the survival of this species that you would like to address?*	**-**

Threat Abatement and Recovery

49. *Give an overview of how broad-scale* ***threats*** *are* ***being abated****/could be abated and* ***other recovery actions*** *underway/ proposed. Identify who is undertaking these activities and how successful the activities have been to date.*	No recovery action is underway in Australia for this species. The Commission for the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western Central Pacific Ocean (WCPFC, 2008) agreed to endorse a conservation measure to identify and strengthen data collection and research on four key shark species, including thresher shark, and more recently agreed to a further research program to undertake a shark assessment for the WCPFC area (WCPFC, 2010). Additionally, IOTC Resolution 10/12 *On the conservation of Thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence* prohibits the retention onboard, transhipment, landing, storing, selling or offering for sale any part or whole carcass of the three species of Thresher sharks (family *Alopiidae*) by all vessels on the IOTC record of authorized vessels. (IOTC 2010). This resolution requires both recreational and sport fishermen carrying out fishing with high risk of catching thresher sharks are equipped with instruments suitable to release alive thresher sharks. The resolution also requires research to be done to identify potential nursery areas, which will be the basis for conservation measures such as time and area closures, or other suitable conservation measures. The IUCN Shark Specialist Group (SSG) group recommends that governments: • Establish and enforce science-based catch limits for sharks and rays • Ensure an end to shark finning (removing fins and discarding bodies at sea) • Improve the monitoring of fisheries taking sharks and rays • Invest in shark and ray research and population assessment • Minimize incidental catch ('bycatch') of sharks and rays • Cooperate with other countries to conserve shared populations. There is significant scope to tackle the threats via a number of means, including but not limited to: 1. Listing on the Appendices of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) which would provide a means to regulate the trade of fins and other products from *A. vulpinus* 2. A ban on the import and export of products from *A. vulpinus* caught in Australia would curb targeted fishing for the species within Australia's EEZ.

	3.Ratification of the UN agreement on straddling and highly migratory fish stocks and involvement in treaties relevant to sharks and rays would be useful activities. The recent signing by Australia of the Memorandum of Understanding for the Conservation of Migratory Sharks under the Convention for the Conservation of Migratory Species (CMS) is a good step towards this. The adoption of a conservation plan which translates this into action is the next step, and will no doubt assist towards the conservation of migratory shark species such as *A. vulpinus.* 4. the management of bycatch and the implementation of mitigation measures to avoid sharks is essential. This includes shark avoidance. 5. The establishment of marine protected areas, both within Australia's EEZ and outside will likely assist in the conservation of *A. vulpinus* through the provision of sanctuary areas free from extractive use. 6. Research – the funding of research to address research gaps for *A. vulpinus* both within Australia's EEZ and outside is essential to boost knowledge of the species.
50. *For species nominated as extinct in the wild, provide details of the locations in which the* ***species*** *occurs* ***in captivity*** *and the level of human intervention required to sustain the species.*	***Not applicable***

Mitigation Approach

51. *Describe any* ***mitigation measures or approaches*** *that have been developed specifically for the species at identified locations. Identify who is undertaking these activities and how successful the activities have been to date.*	A number of countries including Australia, the US, Mexico, Canada, Brazil, Ecuador, the EU, India and South Africa have some form of legislation preventing the full practice of finning and discarding carcasses at sea, or have management plans dealing with pelagic sharks or elasmobranchs more broadly; however such legislation does not specifically target *A. vulpinus* or even the thresher sharks family in general. Additionally, efforts are being made to encourage new strategies for shark avoidance in the pelagic longline industry. Gilman et al (2007, 2008) found in a study of pelagic longline fisheries from eight countries shows that incentives to avoid sharks vary along a continuum, based on whether sharks represent an economic disadvantage or advantage. They note, "*shark avoidance practices are limited, including avoiding certain areas, moving when shark interaction rates are high, using fish instead of squid for bait and deeper setting*". Some conventionally employed fishing gear and methods used to target non-shark species contribute to shark avoidance. A range of shark deterrents may hold promise, including chemical, magnetic, electropositive rare earth metals and electrical repellents, but more research and development is needed (Gilman et al, 2008). Also the development of new equipment specifically designed to discard sharks could improve shark post release survival rate (Gilman et al, 2007). However the authors note, "[*w]ith expanding exploitation of sharks for fins and meat, improved data collection, monitoring and precautionary shark management measures are needed to ensure shark fishing mortality levels are sustainable*".

	No mitigation measures have as yet been developed to remove the threat of fishing on this species at specific locations, however IOTC Resolution 10/12 *On the conservation of Thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence* requires research to be conducted to locate potential nursery areas. Such research is intended to be used as a basis for conservation measures such as time and area closures or other measures deemed suitable (IOTC 2010).

52. *Departmental use only:*	

Major Studies

53. *Identify major studies on the species that might relate to its taxonomy or management.*	Compagno, L.J.V. (1984), FAO species catalogue. Vol. 4. "Sharks of the world. An annotated and illustrated catalogue of sharks species known to date." Part1. Hexanchiformes to Lamniformes. FAO Fish Synop., (125) Vol. 4, Pt. 1: 249p. Hanan, D.A., D. B. Holt, A. L. Coan (1993) "The California Drift Gill Net Fishery for Sharks and Swordfish, 1981-82 through 1990-91" In: Fish Bulletin 175 Dulvy, N.K., J. Baum, S. Clarke, L.J.V. Compagno, E. Cortes, A. Domingo, S. Fordham, S. Fowler, M.P. Francis, C. Gibson, J. Martinez, J.A. Musick, A. Soldo, J.D. Stevens and S. Valenti (2008) "You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays" Aquatic Conserv: Mar. Freshw. Ecosyst. **18**: 459-482 Stevens, J.D., R. Bonfil, N.K. Dulvy and P.A. Walker (2000) "The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems" JCES Journal of Marine Science **57**: 476-494 WCPFC 2010 Progress Toward Shark Assessments, WCPFC-2010-16, Shelley Clarke, Tim Lawson, Donald Bromhead and Shelton Harley http://www.wcpfc.int/doc/wcpfc7-2010-16/spc-progress-toward-shark-assessments

Management Documentation

54. *Identify **key management documentation** available for the species, e.g. recovery plans, conservation plans, threat abatement plans.*	There is no known documentation available for the species.
55. *Departmental use only:*	

Section 3 — Indigenous Cultural Significance

56. *Is the species known to have Indigenous cultural significance to groups within the Australian jurisdiction and, if so, to which Indigenous groups? Are you able to provide information on the nature of this significance?*	No information is available in the literature which has investigated this or which indicates that the thresher shark has indigenous cultural significance. It is therefore recommended that the relevant groups be contacted directly on this point.

Section 4 – References and Reviewers

Notes:

- The opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below.
- Please provide copies of key documentation/references used in the nomination

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58. *Has this document been reviewed and/or have relevant experts been consulted? If so, indicate by whom (including current professional position).*

This document has been reviewed by staff of Humane Society International.

This nomination was drafted by Kirsten Velthius, Gianluca Maio and Tom Mullaney on behalf of Humane Society International.