Possible ETP Interactions
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Introduction

The FIP is made up of a fleet of 21 tuna purse seine vessels, flagged to Taiwan, Republic of Korea, the United States, Kiribati, Nauru and the Federated States of Micronesia (FSM). The vessels fish in the WCPO for the three tropical tuna species (with most of the catch being made up of skipjack). They deploy Fish Aggregation Devices (FADs), and fish on FADs and other floating objects, as well as setting on free schools.

The free-school composite of the fishery generally scored well against the P2 Performance Indicators (PIs), which reviews the interactions/impacts of the UoA with the marine ecosystem including associated species, endangered, threatened and protected (ETP) species and the habitat. The majority of scores align with the Public Certification Report (PCR) from the most recent re-assessment of the PNA free-school fishery (Blyth-Skyrme et al., 2018). Although the pre-assessment perceived an issue with whale shark interactions in both the free-school (and FAD-associated fisheries), which was not shared by the PNA free-school assessment. This could be attributed to lack of fishery-specific data, so the scoring applied was in the pre-assessment was precautionary.

For the FAD-portion of the fishery, scorings are aligned with the OPAGAC FIP and includes unobserved mortality of ETP species due to FAD entanglement and ecosystem impacts of FADs. The former only applies if entangling FADs are used, but it is thought that this may be the case in this fishery. Entanglement in FADs is an issue for a range of species, but principally, it is thought, silky sharks (Filmalter et al., 2013) and turtles.

To enable us to understand this better, this document collates best scientific information on ETP species from a number of sources; the IUCN Red List, country submissions to RFMOs and overlapping MSC certified fisheries. These will then lead to a list of recommended ETP species designations. This data will then be able to be used to build relevant management plans.

The MSC definition of an ETP species is:

- Any species that is recognised by national ETP legislation;
- Species listed in the binding international agreements given below:
    - Appendix 1 of the Convention on International Trade in Endangered Species (CITES), unless it can be shown that the particular stock of the CITES listed species impacts by the UoA under assessment is not endangered;
    - Binding agreements concluded under the Convention on Migratory Species (CMS), including:
        - Annex 1 of the Agreement on Conversation of Albatross and Petrels (ACAP);
        - Table 1 Column A of the African-Eurasian Migratory Waterbird Agreement (AEWA);
        - Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea (ASCOBANS);
        - Annex 1, Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS);
        - Wadden Sea Seals Agreement;
        - Any other binding agreements that list relevant ETP species concluded under this Convention.
- Species classified as ‘out of scope’ (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE).

Country Submissions

Country submissions to the WCPFC provide a snapshot of interactions reported by the fisheries. These are listed below where they could be found.

United States of America

According to the Annual Reports to the Commission, part 1, National Oceanic and Atmospheric Administration National's (NOAA) Marine Fisheries Service report that US flagged purse seine vessels interacted with the following protected species in 2018.

Table 1. ETP species recorded in US's Annual Report to the Commission, part 1, 2019.

Category	Common name	Scientific name	Number released alive	Number released dead
Cetaceans	False killer whale	*Pseudorca crassidens*	19	10
	Pantropical spotted dolphin	*Stenella attenuata*	10	5
	Minke whale	*Balaenoptera acutorostrata*	4	0
	Sei whale	*Balaenoptera borealis*	2	0
	Unidentified baleen whale	-	1	0
	Unidentified dolphin	-	7	0
Sharks	Oceanic whitetip shark	*Carcharhinus longimanus*	92	79
	Silky shark	*Carcharhinus falciformis*	2,885	4,327
	Whale shark	*Rhinocodon typus*	26	0

Federated States of Micronesia

Within FSM flagged vessels the total estimated species of shark caught by gear by purse seine in 2018 can be seen in Table 2below. Worryingly, silky shark was retained in a small amount, despite being a prohibited species under its own CMM 2013-08.

Table 2. ETP shark species reported in FSM's Annual Report the Commission, part 1, 2019.

Category	Common name	Scientific name	Weight retained (mt)	Weight discarded (mt)
Sharks	Oceanic whitetip shark	*Carcharhinus longimanus*	0	0.4
	Silky shark	*Carcharhinus falciformis*	0.2	63.9
	Whale shark	*Rhinocodon typus*	0	1

The most prolifically caught species is the silky shark (this is observed in the longline fishery too) of all the recorded shark species being caught by purse seine.

Table 3. Other ETP species (species of special interest) reported in FSM's Annual Report the Commission, part 1, 2019.

No	Gear	Category	Species	Number	No. Alive	No. Dead
1	Purse Seine	Whale Shark	Whale Shark	21	17	0
2	Purse Seine	Marine Mammals	False Killer Whale	60	28	2
3	Purse Seine	Marine Mammals	Spinner Dolphin	12	11	0
4	Purse Seine	Marine Mammals	Rough-toothed Dolphin	6	5	1
5	Purse Seine	Marine Mammals	Toothed Whales Nei	4	4	0
6	Purse Seine	Marine Mammals	Sei Whale	3	2	0
7	Purse Seine	Marine Mammals	Short-finned Pilot Whale	3	3	0
8	Purse Seine	Marine Mammals	Bottlenose Dolphin	1	1	0
9	Purse Seine	Marine Mammals	Fin Whale	1	1	0
10	Purse Seine	Marine Reptiles	Green Turtle	10	9	0
11	Purse Seine	Marine Reptiles	Olive Ridley Turtle	9	5	0
12	Purse Seine	Marine Reptiles	Hawksbill Turtle	2	2	0
13	Purse Seine	Marine Reptiles	Leatherback Turtle	1	1	0
14	Purse Seine	Marine Reptiles	Loggerhead Turtle	1	0	0

Republic of Korea

Korea has reported well on its interactions with species of special interest. Table 4 below shows the most commonly encountered species of special interest in the Korean purse seine fishery. The most commonly encountered every year is the whale shark, a species identified as a possible issue within the pre-assessment.

Although neither false killer whales nor pygmy killer whales are listed as vulnerable or worse on the IUCN Red List, they are still classed as ETP species in the WCPO, as they are protected under CMM 2011-03 for cetaceans in purse seine operations. Since the requirement to report the fate of the individual, the vast majority are released successfully alive.

Table 4 - Annual estimated catch or encounter of species of special interest by Korean fisheries in the WCPFC Convention Area (2014-2018) as reported in the Annual Report to the Commission, part 1, 2019

Fishery	Year	Number by species									
		Whale shark	Leather-back turtle	Olive ridley turtle	Logger-head turtle	Green turtle	Other marine turtles	False killer whale	Hump-back whale	Pygmy killer whale	Other whales
PS	2014	8	-	-	5	-	-	-	-	-	-
	2015	21	-	-	12	-	-	-	-	-	-
	2016	D:0, A:1	-	-	-	D:0, A:1	D:1, A:7	D:0, A:1[1)]	-	-	-
	2017	D:0, A:11	-	D:0, A:1	D:0, A:1	-	D:1, A:1	D:0, A:3[2)]	D:1, A:2[3)]	D:0, A:1[4)]	D:0, A:6[5)]
	2018	D:0, A:9	-	-	-	D:0, A:1	D:0, A:10	-	-	D:0, A:7[6)]	D:0, A:12[7)]

As can be seen incidental catch of shark species is considerably lower in the purse seine fishery than the longline one, however, the majority of those are classified as "other". Those that are identified are not species specific and enabled further analysis, however it can be assumed the thresher and mako sharks are vulnerable.

Table 5 - Annual discard catch by key shark species in Korean purse seine fishery in the WCPFC Convention Area (2016-2018) as reported in the Annual Report to the Commission, part 1, 2019.

Fishery	Year	Discard catch (number) by key shark species				
		Blue shark	Thresher sharks	Hammerhead sharks	Mako sharks	Others
Purse seine	2016	0	0	2	0	36
	2017	0	2	3	1	769
	2018	0	0	2	0	69
Longline	2016	1,000	423	8	39	2,556
	2017	2,826	1,050	1	13	4,323
	2018	3,121	1,839	6	263	3,695

Survival rates in 2016 of oceanic whitetip are high at 93%, whereas the majority of silky sharks encountered die, with a live release rate of 11% (Table 6) in 2018. Post-release mortality is still to be evaluated. Both of these species are vulnerable and considerable work needs to be done to improve the rates of releasing silky sharks alive in the Korean purse seine fishery.

Table 6 - Annual number of releases of oceanic whitetip and silky shark by the Korean fishery in the WCPFC Convention Area (2014 - 2018) as reported in the Annual Report to the Commission, part 1, 2019

Fishery	Year	Number of releases	
		Oceanic whitetip shark	Silky shark
Purse seine	2014	2	5.7*
	2015	-	13*
	2016	D: 7, A: 96	D: 977, A: 327
	2017	D: 6, A: 1	D: 1,683, A: 332
	2018	D: 8, A: 14	D: 1,704, A: 625
Longline	2014	173	58
	2015	356	942
	2016	D: 44, A: 65	D: 897, A: 1,095
	2017	D: 48, A: 137	D: 675, A: 615
	2018	D: 19, A: 12	D: 726, A: 43

Taiwan

The DWPS vessels mainly operate in the tropical waters close to the equator area targeting on skipjack. Since most of the fishing grounds are located in the EEZs of PICs, these vessels acquire fishing permits through access agreements with PICs, including PNG, FSM, Nauru, Marshall Islands, Solomon Islands, Tuvalu and Kiribati. In early 1980s, logs were used as fish aggregation objects and sets were made on schools associated with these floating objects. This practice continued throughout the 80s and early 90s. Successful exploitation on free-swimming schools in mid 1990s has made free school setting to be the most prevailing fishing method.

According to
Table 7, 224 silky sharks were released in 2018 in the distant water purse seine fishery and three oceanic whitetip sharks. According to the report, no sharks are retained in the purse seine fishery. The numbers of other sharks discarded in the fishery can be seen in

Table 7 with the aid of Table 8. Note no interactions with whale sharks have been included due to "the domestic law had banned all fisheries from catching whale sharks since 2008". There is no data on the fate of the animals discarded.

*Table 7 - Annual estimated catch of shark species by Taiwanese fisheries in the WCPFC Convention Area in 2018 as reported in the Annual Report to the Commission, 2019. ** in the table refers to discards*

	BSH	FAL	MAK		OCS	PTH	BTH	ALV	SPZ	SPL	SPK	EUB	POR	SHK	RMB	RMV
			SMA	LMA												
LTLL	4350	0	481	15	0	6	74	0	19	0	0	0	0	3	0	0
STLL	9703	0	634		0	176	347	9	96	194	0	0	0	2787	0	0
DWPS**	0	224	0	1	3	0	0	0	0	0	0	0	0	63	3	12

Table 8 - Species codes for

Table 7 above.

Species code	Common name	Scientific name
BSH	Blue shark	*Prionace glauca*
FAL	Silky shark	*Carcharhinus falciformis*
SMA	Shortfin mako shark	*Isurus oxyrinchus*
LMA	Longfin mako shark	*Isurus paucus*
OCS	Oceanic whitetip shark	*Carcharhinus longimanus*
PTH	Pelagic thresher shark	*Alopias pelagicus*
BTH	Bigeye thresher shark	*Alopias supercilious*
ALV	Common thresher shark	*Alopias vulpinus*
SPZ	Smooth hammerhead shark	*Sphyrna zygaena*
SPL	Scalloped hammerhead shark	*Sphyrna lewinii*
SPK	Great hammerhead	*Sphyrna mokarran*
EUB	Winghead shark	*Eusphyra blochii*
POR	Porbeagle shark	*Lamna nasus*
SHK	Shark unidentified	-
RMB	Giant manta ray	*Mobula birostris*
RMV	Mobula spp.	*Mobula* nei

Interactions with cetaceans, as expected, occurred most frequently with whale sharks (55%), none of these were deliberately encircled and all were released alive after implementing measures for safe release such as stopping operating and hauling. The other identified species was the near threatened listed false killer whale (*Pseudorca crassidens*). Once again misidentification accounts for 29% of all cetacean interactions in the Taiwanese fishery. This unidentified data could have large impacts on endangered species.

Table 9 - The summary on cetaceans/whale sharks encircled incidentally in purse seine fishing operation in 2018 in the Annual Report to the Commission, 2019.

Date	Longitude	Latitude	Species	Number	Reason	Measure for ensure safe release	Status on release
2018/1/8	E148°15'	N07°12'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/1/12	E141°39'	N04°55'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/1/15	E148°17'	N00°19'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/1/18	E148°03'	S00°12'	Whale shark	2	not deliberately encircled	stop operating	Alive
2018/1/21	E149°35'	S00°10'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/1/23	E151°30'	S01°26'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/1/23	E149°19'	S00°15'	Sei whale	2	not deliberately encircled	stop operating	Alive
2018/2/16	E145°21'	N02°16'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/2/16	E145°18'	N02°16'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/2/19	E142°50'	N04°10'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/2/26	E154°04'	S01°06'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/3/9	E162°44'	S07°02'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/3/9	E149°58'	S07°45'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/3/13	E168°06'	N00°07'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/3/16	E167°20'	N00°14'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/3/21	E167°46'	N00°33'	Dolphins nei	4	not deliberately encircled	stop operating	Alive
2018/3/22	E168°27'	S00°34'	Pygmy killer whale	9	not deliberately encircled	stop operating	Alive
2018/3/24	E169°13'	N00°32'	Pygmy killer whale	1	not deliberately encircled	stop hauling	Alive
2018/4/1	E150°09'	S01°11'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/4/5	E169°02'	S02°33'	Whale shark	1	not deliberately encircled	stop hauling and operating	Alive
2018/4/9	E169°19'	S02°10'	False killer whale	3	not deliberately encircled	stop operating	Alive
2018/4/23	E147°27'	N01°30'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/4/26	E168°46'	N01°43'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/4/29	E153°43'	S00°44'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/5/4	E167°50'	N01°01'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/5/9	E155°05'	S02°06'	Dolphins nei	4	not deliberately encircled	stop operating	Alive
2018/5/21	E168°18'	S00°36'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/5/27	E157°25'	N03°02'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/5/31	E156°04'	N03°37'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/5/31	E156°01'	N03°39'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/6/3	E165°10'	S00°54'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/6/4	E165°30'	S02°11'	False killer whale	4	not deliberately encircled	stop operating	Alive
2018/6/14	E155°59'	N01°06'	Short-finned pilot whale	1	not deliberately encircled	stop operating	Alive
2018/6/18	E156°10'	N01°28'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/6/21	E154°35'	N00°17'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/6/30	E154°57'	S00°18'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/7/6	E144°55'	N01°17'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/7/27	E164°42'	N05°00'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/8/7	W167°17'	S03°25'	Aquatic mammals nei	1	not deliberately encircled	stop operating	Alive
2018/8/28	E166°58'	S03°05'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/8/31	E169°12'	N01°40'	Bryde's whale	1	not deliberately encircled	stop operating	Alive
2018/8/31	E169°10'	N01°41'	Aquatic mammals nei	1	not deliberately encircled	stop hauling	Alive
2018/8/31	E169°12'	N01°38'	Aquatic mammals nei	1	not deliberately encircled	stop hauling	Alive
2018/9/12	E171°05'	N02°40'	False killer whale	1	not deliberately encircled	stop hauling	Alive
2018/10/3	E169°22'	S02°06'	Risso's dolphin	7	not deliberately encircled	stop operating	Alive
2018/10/13	E156°39'	N01°12'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/10/17	E149°08'	N00°44'	Whale shark	1	not deliberately encircled	stop hauling	Alive
2018/10/18	E144°02'	S00°34'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/10/27	E152°52'	S00°54'	Whale shark	1	not deliberately encircled	stop hauling and operating	Alive
2018/11/3	E153°28'	N00°30'	False killer whale	4	not deliberately encircled	stop operating	Alive
2018/12/3	E145°04'	N02°02'	Whale shark	1	not deliberately encircled	stop operating	Alive
2018/12/6	N175°49'	E01°37'	Dolphins nei	6	not deliberately encircled	stop operating	Alive
2018/12/6	N175°49'	E01°37'	Dolphins nei	9	not deliberately encircled	stop operating	Dead
2018/12/9	E146°52'	N00°25'	Whale shark	1	not deliberately encircled	stop hauling and operating	Alive
2018/12/15	E154°27'	S08°39'	Whale shark	1	not deliberately encircled	stop hauling and operating	Alive
2018/12/16	E179°28'	S01°39'	Spotted dolphins nei	15	not deliberately encircled	stop operating	Dead
2018/12/26	E156°06'	N00°23'	False killer whale	2	not deliberately encircled	stop operating	Alive
2018/12/28	E174°21'	S03°34'	Long-beaked common dolphin	12	not deliberately encircled	stop operating	Alive

Nauru

As with other purse seine fleets covered in this document, the most commonly encountered ETP shark species in 2018 was the silky shark. The one whale shark recorded in the fishery was injured upon release. Please note the 'number' refers to the observed number and 'discarded' the upscaled number due to 78% observer coverage.

Table 10. Regional ETP shark species by Nauru flagged purse seine fishery in 2018, as reported in the Annual Report to the Commission, 2019.

Gear	Species	Number	Discarded	Retained
PS	OCS	2	3	0
PS	FAL	51	65	0
PS	RHN	1	2	0

One pygmy killer whale was also recorded by the fleet, but it's status upon release was unknown. Improvements to the observer programme are needed for Nauru flagged vessels for better reporting but also better handling practices are needed to ensure the safe release of ETP and other non-target species.

MSC Fishery Assessments

Currently these are the following fisheries engaged in the MSC process with a similar scope as the WCPO PS Tuna FIP all found within the Western Central Pacific (FAO Area 71) fishing using purse seine gear:

Fishery	Target Species	Status	Link
Tropical Pacific yellowfin and skipjack free-school purse seine fishery	Skipjack and Yellowfin	Certified	https://fisheries.msc.org/en/fisheries/tropical-pacific-yellowfin-and-skipjack-free-school-purse-seine-fishery/@@view
Solomon Islands skipjack and yellowfin tuna purse seine and pole and line	Skipjack and Yellowfin	Certified	https://fisheries.msc.org/en/fisheries/solomon-islands-skipjack-and-yellowfin-tuna-purse-seine-and-pole-and-line/@@view
WPSTA Western and Central Pacific skipjack and yellowfin free school purse seine	Skipjack and Yellowfin	Certified with component(s) in assessment	https://fisheries.msc.org/en/fisheries/wpsta-western-and-central-pacific-skipjack-and-yellowfin-free-school-purse-seine/@@view
PNG Fishing Industry Association's purse seine Skipjack & Yellowfin Tuna Fishery	Skipjack and Yellowfin	In Assessment	https://fisheries.msc.org/en/fisheries/png-fishing-industry-associations-purse-seine-skipjack-yellowfin-tuna-fishery/@@view
PNA Western and Central Pacific skipjack and yellowfin, unassociated / non-FAD set, tuna purse seine	Skipjack and Yellowfin	Certified	https://fisheries.msc.org/en/fisheries/pna-western-and-central-pacific-skipjack-and-yellowfin-unassociated-non-fad-set-tuna-purse-seine/@@view
Tri Marine Western and Central Pacific Skipjack and Yellowfin Tuna	Skipjack and Yellowfin	Certified	https://fisheries.msc.org/en/fisheries/tri-marine-western-and-central-pacific-skipjack-and-yellowfin-tuna/@@view

For each of these fisheries the ETP species assigned are designated below.

Tropical Pacific yellowfin and skipjack free-school purse seine fishery

The ETP designated species classified are as below:

Common Name	Scientific name	Justification
Olive ridley turtle	*Lepidochelys olivacea*	CMM 2008-03; CMS Appendix I; CITES Appendix I
Flatback turtle	*Natator depressus*	CMM 2008-03; CITES Appendix I
Hawksbill turtle	*Eretmochelys imbricata*	CMM 2008-03; CMS Appendix I; CITES Appendix I
Loggerhead turtle	*Caretta caretta*	CMM 2008-03; CMS Appendix I; CITES Appendix I
Green turtle	*Chelonia mydas*	CMM 2008-03; CMS Appendix I; CITES Appendix I
Silky shark	*Carcharhinus falciformis*	CMM 2013-08; CMS MoU species
Oceanic whitetip shark	*Carcharhinus longimanus*	CMM 2011-03
Pelagic thresher shark	*Alopias pelagicus*	CMS MoU species; Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau

Blue shark	*Prionace glauca*	CMS MoU species; Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Common thresher shark	*Alopias vulpinus*	CMS MoU species; Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Scalloped hammerhead shark	*Sphyrna lewini*	CMS MoU species; Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Great hammerhead shark	*Sphyrna mokarran*	CMS MoU species; Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Blacktip Shark	*Carcharhinus limbatus*	Minor secondary or ETP if in shark sanctuary Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Copper shark	*Carcharhinus brachyurus*	Minor secondary or ETP if in shark sanctuary Shark sanctuary - Cook Islands, Kiribati, Marshall Islands, Tokelau
Giant manta	*Manta birostris*	CMS Appendix I; CITES Appendix II; CMS MoU species
Mobula nei	*Mobula spp.*	CMS Appendix I; CITES Appendix II; CMS MoU species
Whale shark	*Rhincodon typus*	CMM 2012-04; CMS Appendix I; Cook Islands, Kiribati, Marshall Islands, Tokelau
False killer whale	*Pseudorca crassidens*	CMM 2011-03
Rough-toothed dolphin	*Steno bredanensis*	CMM 2011-03

Solomon Islands skipjack and yellowfin tuna purse seine and pole and line

The ETP designated species classified are as below:

Common Name	Scientific name	Justification
Marine Mammals	N/A	CMM 2011-03
Turtles	N/A	CMM 2008-03

WPSTA Western and Central Pacific skipjack and yellowfin free school purse seine

The ETP designated species classified are as below:

Common Name	Scientific name	Justification
Risso's Dolphin	*Grampus griseus*	CMM 2011-0
False killer whale	*Pseudorca crassidens*	CMM 2011-03
Spinner dolphin	*Stenella longirostris*	CMM 2011-03
Rough-toothed dolphin	*Steno bredanensis*	CMM 2011-03
Long-Beaked common dolphin	*Delphinus capensis*	CMM 2011-03
Green turtle	*Chelonia mydas*	CMM 2008-03
Loggerhead turtle	*Caretta caretta*	CMM 2008-03
Olive Ridley turtle	*Lepidochelys olivacea*	CMM 2008-03
Flatback turtle	*Natator depressus*	CMM 2008-03
Hawksbill turtle	*Eretmochelys imbricata*	CMM 2008-03
Whale shark	*Rhincodon typus*	CMM 2012-04
Silky shark	*Carcharhinus falciformis*	CMM 2013-08
Oceanic whitetip shark	*Carcharhinus longimanus*	CMM 2011-03

PNG Fishing Industry Association's purse seine Skipjack & Yellowfin Tuna Fishery

Currently, this fishery is in assessment, so no reports are available.

PNA Western and Central Pacific skipjack and yellowfin, unassociated / non-FAD set, tuna purse seine

The ETP designated species classified are as below:

Common Name	Scientific name	Justification
Silky shark	*Carcharhinus falciformis*	CMM 2013-08
Whale shark	*Rhincodon typus*	CMM 2012-04
Giant manta	*Manta birostris*	CMS Appendix I
Devil manta ray	*Mobula mobular*	CMS Appendix I
False killer whale	*Pseudorca crassidens*	CMM 2011-03
Oceanic whitetip shark	*Carcharhinus longimanus*	CMM 2011-04
Risso's dolphin	*Grampus griseus*	CMM 2011-03
Pygmy sperm whale	*Kogia breviceps*	CMM 2011-03
Olive Ridley turtle	*Lepidochelys olivacea*	CMS Appendix I (CMS 2015) / CITES Appendix I
Green turtle	*Chelonia mydas*	CMS Appendix I (CMS 2015) / CITES Appendix I
Bottlenose dolphin	*Tursiops truncatus*	CMM 2011-03
Rough-toothed dolphin	*Steno bredanensis*	CMM 2011-03
Leatherback turtle	*Dermochelys coriacea*	CMS Appendix I (CMS 2015) / CITES Appendix I
Melon-headed whale	*Peponocephala electra*	CMM 2011-03
Loggerhead turtle	*Caretta caretta*	CMS Appendix I (CMS 2015) / CITES Appendix I
Hawksbill turtle	*Eretmochelys imbricata*	CMS Appendix I (CMS 2015) / CITES Appendix I

Tri Marine Western and Central Pacific Skipjack and Yellowfin Tuna

The ETP designated species classified are as below:

Common Name	Scientific name	Justification
Oceanic whitetip shark	*Carcharhinus longimanus*	CMM 2011-03
Mobula (Devil ray)	*Mobula spp.*	None given
Giant manta	*Manta birostris*	None given
Whale shark	*Rhincodon typus*	CMM 2012-04
Short finned mako	*Isurus oxyrinchus*	None given
Great hammerhead	*Sphyrna mokarran*	None given
Scalloped hammerhead	*Sphyrna lewini*	None given
Smooth hammerhead	*Sphyrna zygaena*	None given
False Killer whale	*Pseudorca crassidens*	CMM 2011-03
Rough-toothed dolphin	*Steno bredanensis*	CMM 2011-03
Indo-pacific bottlenose dolphin	*Tursiops aduncus*	CMM 2011-03
Bottlenose dolphin	*Tursiops truncatus*	CMM 2011-03
Short-finned pilot whale	*Globicephala macrorhynchus*	CMM 2011-03
Spinner dolphin	*Stenella longirostris*	CMM 2011-03
Spotted dolphin	*Stenella attenuata*	CMM 2011-03
Sei whale	*Balaenoptera borealis*	CMM 2011-03
Striped dolphin	*Stenella coeruleoalba*	CMM 2011-03
Olive Ridley turtle	*Lepidochelys olivacea*	CMM 2008-03
Green turtle	*Chelonia mydas*	CMM 2008-03
Loggerhead turtle	*Caretta caretta*	CMM 2008-03
Hawksbill turtle	*Eretmochelys imbricata*	CMM 2008-03
Flatback turtle	*Natator depressus*	CMM 2008-03
Leatherback turtle	*Dermochelys coriacea*	CMM 2008-03

Final Recommendations

Overall after drawing on all available evidence the following species need to be included when assessing the WCPO PS Tuna FIP, this includes species identified by the IUCN Red List when out of scope and listed as either 'vulnerable', 'endangered', or 'critically endangered', country submissions to RFMOs and designated ETP species in MSC certified fisheries:

Table 11. List of potential WCPO ETP species and their designations.

Genus	Species	Common Name	CMS appendices	CITES Appendix I?	IUCN Red List Status	RFMO CMMs
Alopias	*pelagicus*	Pelagic thresher shark	Appendix II	No	Vulnerable	N/A
Alopias	*superciliosus*	Bigeye thresher shark	Appendix II	No	Vulnerable	N/A
Alopias	*vulpinus*	Common thresher shark	Appendix II	No	Vulnerable	N/A
Eubalaena	*japonica*	North Pacific right whale	Appendix I	Yes	Endangered	CMM 2011-03
Balaenoptera	*musculus*	Blue whale	Appendix I	Yes	Endangered	CMM 2011-03
Balaenoptera	*physalus*	Fin whale	Appendix I	Yes	Vulnerable	CMM 2011-03
Balaenoptera	*borealis*	Sei whale	Appendix II	Yes	Endangered	CMM 2011-03
Balaenoptera	*acutorostrata*	Minke whale	N/A	Yes	Least concern	CMM 2011-03
Feresa	*attenuata*	Pygmy killer whale	N/A	No	Least concern	CMM 2011-03
Peponocephala	*electra*	Melon-headed whale	N/A	No	Least concern	CMM 2011-03
Carcharhinus	*obscurus*	Dusky shark	Appendix II	No	Vulnerable	N/A
Carcharhinus	*longimanus*	Oceanic whitetip shark	N/A	No	Vulnerable	CMM 2011-04
Carcharhinus	*falciformis*	Silky shark	Appendix II	No	Vulnerable	CMM 2013-08
Cetorhinus	*maximus*	Basking shark	Appendix I; Appendix II	No	Vulnerable	N/A
Lepidochelys	*olivacea*	Olive ridley turtle	Appendix I	Yes	Vulnerable	CMM 2008-03
Chelonia	*mydas*	Green turtle	Appendix I	No	Endangered	CMM 2008-03
Eretmochelys	*imbricata*	Hawksbill turtle	Appendix I	No	Critically endangered	CMM 2008-03
Caretta	*caretta*	Loggerhead turtle	Appendix I	No	Vulnerable	CMM 2008-03
Natator	*depressus*	Flatback turtle	N/A	Yes	Data deficient	CMM 2008-03
Dermochelys	*coriacea*	Leatherback turtle	Appendix I	No	Vulnerable	CMM 2008-03
Isurus	*oxyrinchus*	Shortfin mako shark	Appendix II	No	Endangered	N/A
Isurus	*paucus*	Longfin mako shark	Appendix II	No	Endangered	N/A
Lamna	*nasus*	Porbeagle shark	Appendix II	No	Vulnerable	N/A
Carcharodon	*carcharias*	Great white shark	Appendix I	No	Vulnerable	N/A

Mobula	*birostris*	Pelagic manta ray	Appendix I	No	Vulnerable	N/A
Mobula	*alfredi*	Reef manta ray	Appendix II	No	Vulnerable	N/A
Mobula	*mobular*	Giant devil ray	Appendix II	No	Endangered	N/A
Mobula	*japanica*	Spinetail mobula ray	Appendix II	No	Near threatened	N/A
Mobula	*kuhlii*	Shortfin devil ray	Appendix II	No	Data deficient	N/A
Mobula	*tarapacana*	Sicklefin devil ray	Appendix II	No	Vulnerable	N/A
Mobula	*eregoodootenkee*	Longhorn devil ray	Appendix II	No	Near threatened	N/A
Prionace	*glauca*	Blue shark	Appendix II	No	Near threatened	N/A
Phocarctos	*hookeri*	New Zealand sea lion	N/A	No	Endangered	N/A
Pseudorca	*crassidens*	False killer whale	N/A	No	Near threatened	CMM 2011-03
Stenella	*attenuata*	Pantropical spotted dolphin	N/A	No	Least concern	CMM 2011-03
Delphinus	*capensis*	Long-beaked common dolphin	N/A	No	Data deficient	CMM 2011-03
Stenella	*attenuata*	Spotted dolphin	N/A	No	Least concern	CMM 2011-03
Stenella	*coeruleoalba*	Striped dolphin	N/A	No	Least concern	CMM 2011-03
Stenella	*longirostris*	Spinner dolphin	N/A	No	Least concern	CMM 2011-03
Steno	*bredanensis*	Rough-toothed Dolphin	N/A	No	Least concern	CMM 2011-03
Tursiops	*aduncus*	Indo-pacific bottlenose dolphin	N/A	No	Data deficient	CMM 2011-03
Tursiops	*truncatus*	Bottlenose dolphin	N/A	No	Least concern	CMM 2011-03
Globicephala	*macrorhynchus*	Short-finned pilot whale	N/A	No	Least concern	CMM 2011-03
Globicephala	*melas*	Long-finned pilot whale	N/A	No	Least concern	CMM 2011-03
Arctocephalus	*galapagoensis*	Galapagos Islands fur seal	N/A	No	Endangered	N/A
Callorhinus	*ursinus*	Northern fur seal	N/A	No	Vulnerable	N/A
Zalophus	*wollebaeki*	Galapagos sea Lion	N/A	No	Endangered	N/A
Neomonachus	*schauinslandi*	Hawaiian monk seal	N/A	No	Endangered	N/A
Physeter	*macrocephalus*	Sperm whale	Appendix II	Yes	Vulnerable	CMM 2011-03
Kogia	*breviceps*	Pygmy sperm whale	N/A	No	Data deficient	CMM 2011-03
Megaptera	*novaeangliae*	Humpback whale	N/A	Yes	Endangered	CMM 2011-03
Rhincodon	*typus*	Whale shark	Appendix I, II	No	Endangered	CMM 2012-04
Sphyrna	*lewini*	Scalloped hammerhead shark	Appendix II	No	Endangered	N/A
Sphyrna	*mokarran*	Great hammerhead shark	Appendix II	No	Endangered	N/A

As can be seen in the Figure 1 and Figure 2, the majority of ETP species are cetaceans then elasmobranchs (sharks and rays)(39%). Out of all the species the largest percentage are listed as vulnerable, 36%, followed by endangered at 30%.

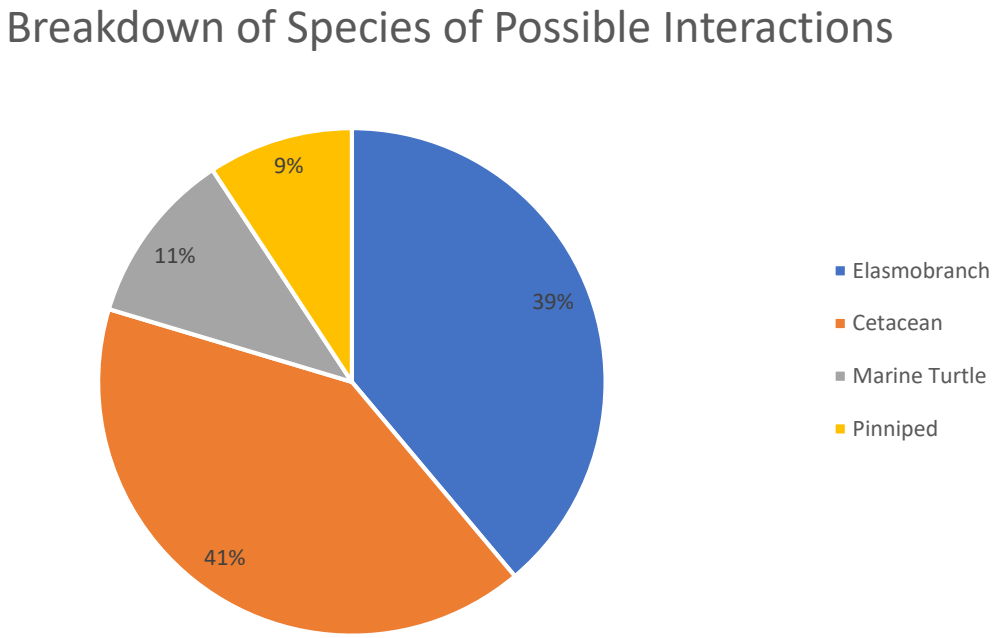

Figure 1. Breakdown of possible species interactions

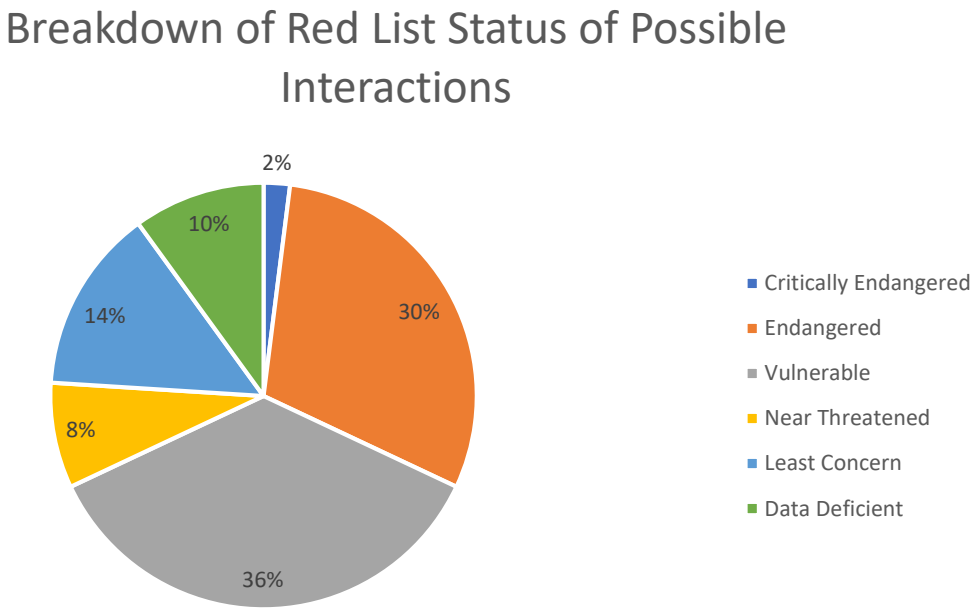

Figure 2. Breakdown of possible species interactions by IUCN Red List status

Cetaceans

Sei whale

Balaenoptera borealis is an endangered whale species. Little is known about its life history and biological characteristics. In the North Pacific, sei whales in summer are distributed mainly north of 40°N, including the Gulf of Alaska and Aleutian Islands (US), and to some extent into the Bering Sea, but not into the Okhotsk Sea. The wintering grounds are poorly known, but Sei Whales were formerly caught in winter off the Bonin Islands (Japan) (IWC 2006); animals tagged there have been recaptured throughout the summer range (Masaki 1977).

Of 21,713 stomachs examined in the North Pacific, 82.7% contained copepods only, and 12.6% contained *euphausiids* only; of 31,494 stomachs examined in the southern hemisphere, 54.3% contained *euphausiids* only, 30.5% contained copepods only, and 14.4% contained amphipods only (Nemoto and Kawamura 1977).

Reports of other human-caused deaths of sei whales are rare. Two fatal ship strikes (sei hales found dead on the bows of ships) were reported on the US East Coast during 2000 – 2004 (Cole et al. 2006). It is hard to extrapolate from known cases to an estimated total, but sei whales appear to be at relatively low risk of human impacts, probably because of their largely offshore distribution.

Blue whale

The blue whale (*Balaenoptera musculus*) is a cosmopolitan species, found in all oceans except the Arctic, but absent from some regional seas such as the Mediterranean, Okhotsk and Bering seas. Blue whales occur in the eastern Pacific from around 44°S in southern Chile (Hucke-Gaete et al. 2005) as far as the Costa Rica Dome where they are present year-round (Reilly and Thayer 1990). There may be a gap from there to Baja California where they are quite common as also off the Californian coast (Calambokidis and Barlow 2004) but tracking of a tagged whale suggests that some of the Californian whales may migrate to the Costa Rica Dome in winter (Mate et al. 1999). North of 40°N, blue whales occur across the North Pacific from the coast of Oregon to the Kurile Islands (Russian Federation), and north to the Aleutian Islands (US -Alaska) but not far into the Bering Sea. In the past blue whales were caught off southern Japan and the Korean peninsula, but none have been seen there in recent years.

Blue whales feed almost exclusively on *euphausiids* (krill), with a variety of species being taken by different blue whale populations. They feed both at the surface and also at depth, following the diurnal vertical migrations of their prey to at least 100 metres (Sears 2002).

Blue whales are subject to some ship strikes and entanglements (NMFS 1998) but reported cases are few. The remote distribution of some blue whale populations probably makes them less vulnerable to human impacts than some other cetacean species, but local populations that inhabit waters with significant levels of human activity may be subject to some threat, such as disturbance from vessel traffic, including ship noise (e.g. Gulf of St Lawrence population, NMFS 1998). Globally, there appear to be no major threats to blue whales at present.

Fin whale

Otherwise known as the finback whale (*Balaenoptera physalus*) are listed as an endangered species. In the eastern North Pacific, fin whales occur year-round off the central and southern California coast (Anon, 2003). They occur in summer off the entire coast of western North America from California into the Gulf of Alaska. Fin whales tagged off California in winter were recaptured in summer by whaling operations along the entire coast, suggesting migration. Offshore, fin whales occur across the North Pacific north of 40°N, at least from May to September in summer, with some tendency for a northward shift in distribution in high summer, when they also enter the Okhotsk Sea (Miyashita et al. 1995). They occur in the Bering Sea and some have been seen in the Chuckchi Sea, but rarely in the Beaufort Sea (Angliss and Outlaw 2004).

Fin whales occur, albeit in small numbers, in Hawaiian waters in both summer and winter (Anon, 2005). They are rare or absent throughout the tropical North Pacific. While there appears to be some migration, acoustic data suggests that overall there is no marked seasonality in distribution in the North Pacific (Watkins et al., 2000), in contrast to the traditional view of the fin whale as a migratory species.

The available quantitative evidence suggests that the fin whale is a catholic feeder, sometimes preying heavily on fish but mostly on crustaceans.

Fin whales are one of the more commonly recorded species of large whale reported in vessel collisions (Laist et al., 2001). Five fatal collisions were recorded off the US east coast during 2000-04 (Cole et al. 2006). Collisions with vessels appear to be a significant, but not necessarily unsustainable, source of mortality for the Mediterranean population (Panigada et al. 2006, Reeves and Notarbartolo di Sciara 2006).

Fin whales are occasionally caught in fishing gear as a bycatch. Four deaths and serious injuries from this source were reported from the eastern US coast during 2000 - 04 (Cole et al. 2006); recent Japanese Progress Reports to the IWC reported about one Fin Whale by-caught per year on average.

North Pacific right whale

Eubalaena japonica is an endangered whale species that occur during the summer in the Okhotsk Sea, the north western North Pacific (west of 170°W and north of 35°N, including the coast of Kamchatka and the Commander Islands) (Matsuoka et al., 2017, Ovsyanikova et al., 2015), the south-eastern Bering Sea, the Aleutian Islands, and the northern Gulf of Alaska (Brownell et al., 2001). During the winter, they occur (or at least occurred historically) southward to the Sea of Japan. There are rare recent records from the Taiwan Strait and the Ogasawara Gunto (Bonin Islands, Japan) in the west, and to Hawaii, California, and Baja California Sur (Mexico) in the east (Brownell et al. 2001). The same uncertainty pertains to right whale sightings off Ogasawara, Taiwan, California, and Baja California. In 2015, one right whale was found entangled off the south coast of Korea and was released, the first record there since the last catch by whalers in 1974 (Kim et al. 2015). Little is known about habitat use by north Pacific right whales. By analogy with its congeners *(E. glacialis and E. australis),* a diet of mainly copepods is presumed.

There is currently no directed hunting but there have been cases of known and suspected entanglements and ship strikes in the Okhotsk Sea and Kuril Islands, involving at least four whales including one dead (Burdin et al., 2004). Effort is needed to ascertain the frequency of such occurrences, since the low observer effort may mean that most deaths pass unrecorded.

Sperm whale

Physeter microcephalus is a vulnerable whale species with a large geographic range (Rice, 1989). It can be seen in nearly all marine regions, from the equator to high latitudes, but is generally found in continental slope or deeper water.

The habitat of the sperm whale is the open sea. More specifically, sperm whales can be found in almost all marine waters deeper than 1,000 metres.

Entanglement in fishing gear, particularly gillnets, has been a particular problem in the Mediterranean Sea (Reeves and Notarbartolo di Sciara, 2006), but sperm whales die from entanglement in nets and lines in many other areas and in a variety of fisheries as well (Haase and Félix 1994; Barlow and Cameron 2003). Considering the widespread distribution of sperm whales, observations of occasional takes in relatively small-scale gillnet fisheries (Barlow and Cameron 2003) suggest much larger takes in unobserved, unregulated high seas driftnet fisheries such as were common before the 1989 adoption of resolution 44/225 of the UN General Assembly. concerning large-scale pelagic drift-net fishing and its impact on the living marine resources of the world's oceans and seas.

Sperm whales sometimes take fish off fishing gear (most often demersal long-line gear), an activity known as “depredation.” Depredation of longline catches appears to be a recent and increasing phenomenon, and now occurs in many regions (e.g., South East Alaska, Chile, South Georgia and several other Southern Ocean island areas and North Atlantic). This interaction has resulted in a few reported entanglements and deaths (Salas 1987; Hucke-Gaete et al. 2004) and has incurred hostility from some fishers (National Marine Fisheries Service 1998; Donoghue et al. 2003), including shooting of whales (González and Olivarría 2002).

Humpback whale

Humpback whales have a global distribution. Individual humpbacks have been observed to travel more than 8,000 kilometres between their high-latitude summer feeding grounds and winter mating and calving range in tropical waters (Rasmussen et al., 2007). The Oceania subpopulation is delineated by its breeding range, with approximate boundaries in the west at 145°E (eastern Australia), in the east at 120°W (between French Polynesia and South America), in the north at the equator at 0°S, and in the south to approximately 30°S.

Mortality of humpback whales due to entanglements in fishing gear and collisions with ships have been reported in the Southern Hemisphere (IWC, 2001). Entanglement of humpback whales in pot lines occurs in both New Zealand and Australia. There is little information from around the rest of the South Pacific, but a humpback mother (with calf) was reported entangled in a longline in 2007 (N. Hauser, reported in SPWRC, 2008) and another humpback was struck and killed by a vessel in 1999 in Tonga (Diver, 2004). The range of possible outcomes spans both the 'endangered' and 'vulnerable' IUCN Red List categories. However, in line with the Red List Guidelines calling for both precaution and credibility, the median outcome places this subpopulation in the 'endangered' category.

Long-Beaked Common Dolphin

Although the species is widespread and its aggregate abundance probably numbers in the high tens or low hundreds of thousands, in several areas (most notably West Africa, the east and west coasts of South America and East Asia), there are known incidental and directed takes of unknown, but possibly large, magnitude, making it difficult to make a reliable assessment of the impact on the species. Therefore, the long-beaked common dolphin is listed as 'data deficient' by the IUCN Red List.

Long-beaked common dolphin are known to be taken in bottom-set gillnets and purse seine fisheries off southern California, but potential impacts are uncertain. Some bycatch has also been documented in drift gillnets off California (Carretta et al., 2005). They are only occasionally involved as bycatch in the eastern tropical Pacific tuna fishery. They are present off Japan, and some have been taken in drive fisheries there. There are anecdotal reports of potentially large numbers of dolphins, including long-beaked common dolphins, killed for bait in some coastal fisheries off Baja California, Mexico (K. Forney pers. comm.).

Pygmy killer whale

This species (*Feresa attenuatais*) is widely distributed in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. Although pygmy killer whales occur worldwide, they appear to be naturally uncommon everywhere. The sum of existing abundance estimates is approximately 40,000 animals however, surveys have covered only a very small portion of its range and therefore total abundance is likely much higher. They are killed incidentally in low numbers in longline fisheries and probably in gillnet fisheries and they are occasionally targeted in direct hunts.

Pygmy killer whales were listed as 'data deficient' in 2008 by IUCN and the data remains extremely poor across the majority of its range. However, they appear to be naturally rare and no threats are considered significant or pervasive. There is no indication of large-scale mortality or population declines and therefore the species is listed on the IUCN Red List as 'least concern'. Significant threats may exist and declines in abundance may have gone undetected. Relatively little human-caused mortality could cause population decline in a species with such low abundance and declines would be difficult to detect given the low density. Therefore, this listing should be considered provisional pending more information.

Short-finned pilot whale

The short-finned pilot whale is a highly social species with a wide distribution in tropical and temperate waters around the globe. It is relatively common and abundant in some areas. The difficulty of distinguishing this species from the long-finned pilot whale (*Globicephala melas*) at sea in areas where the two species' ranges overlap compounds the problem of obtaining reliable estimates for such areas. The total of all available abundance estimates for short-finned pilot whales is approximately 700,000 but large parts of the species range have not been surveyed and therefore actual abundance must be considerably greater than this. Information on trends in abundance at the global scale is lacking but a lack of threats over much of the range does not suggest declining trends.

Short-finned pilot whales are known to be incidentally taken in a deep-set longline fishery that targets primarily tunas in Hawaiian waters (Bradford and Forney 2014, Carretta et al. 2014) and also in a drift gillnet fishery off California (Carretta et al. 2017). Bycatch of short-finned pilot whales is more significant on the east coast of the United States where the estimated mean annual total estimated fisheries-related serious injury and mortality in the period of 2010-2014 was estimated at 233 (CV 0.24) and is cause for concern under provisions of the U.S. Marine Mammal Protection Act (Hayes et al., 2017). The most common human-related cause of death observed in waters off Puerto Rico and the U.S. and British Virgin Islands was 'entanglement and accidental captures', followed by gunshots and spear wounds (Mignucci-Giannoni et al., 1999).

Risso's dolphin

Risso's dolphin (*Grampus griseus*) is a widely distributed species that occurs throughout tropical and temperate waters in the Atlantic, Pacific, and Indian Oceans. These dolphins appear to favour continental slope habitats but also occur at lower densities in oceanic and continental shelf waters. The sum of existing abundance estimates is about 350,000 individuals, but as these estimates are from only a small fraction of the total distribution range of the species, actual abundance is likely much higher. Threats that may be causing declines include bycatch in offshore gillnets, pelagic longlines, and other fishing gear. There is little quantitative information on bycatch rates, but it is clear that this species is taken in small or moderate numbers in several countries throughout its range. However, given its wide distribution and considerable abundance, and in the absence of evidence that threats are significant throughout the species' extensive range, Risso's dolphin is assessed on the IUCN Red List as 'least concern'. There is not enough information to rule out the possibility that the global population has declined by 30% or more over three generations (60 years; Taylor et al. 2007) and if that were the case it would qualify for listing as 'vulnerable'. Therefore, further monitoring is encouraged and this assessment should be regarded as provisional, pending better information particularly regarding incidental mortality in fisheries.

Pygmy sperm whale

There is considerable uncertainty about the status of this species (*Kogia breviceps*), which may span a range from 'least concern' to a 'threatened' IUCN Red List category. There is no information on abundance or on trends in global abundance. As a relatively uncommon species it is potentially vulnerable to low-level threats and a 30% global reduction over three generations (36 years; Taylor et al. 2007) cannot be ruled out

A few have been killed in gillnet fisheries of Sri Lanka, Taiwan and California, and it is likely they are killed in gillnets elsewhere as well (Jefferson et al. 1993; Barlow et al. 1997). Perez et al. (2001) reported on occasional bycatch in fisheries in the northeast Atlantic (mostly gillnet and purse seine operations). However, although it is taken in small numbers both directly and incidentally in fisheries, Baird et al. (1996) found no serious threats to its status.

Melon-headed whale

The melon-headed whale (*Peponocephala electra*) is a tropical and subtropical delphinid species that occurs in large groups in deep oceanic waters worldwide. Global trends in abundance are not available, however, worldwide abundance is at least 180,000 based on the sum of estimates from the eastern tropical Pacific, the Gulf of Mexico, Hawaii, and the southwestern Indian Ocean. Since these estimates refer to only a small proportion of the range of the species, the actual total abundance is likely considerably greater. Threats that could cause declines include high levels of anthropogenic sound, especially military sonar and bathymetric surveys, and localised interactions with drift gillnet and pelagic longline fisheries.

The melon-headed whale was assessed as 'least concern' in 2008. The species has a moderate global abundance and a widespread tropical distribution, and while there is little information available on trends in abundance, no major threats have been identified that are likely to be causing a global decline of the species. It was therefore reassessed in 2019 as 'least concern'.

False killer whale

False killer whales (*Pseudorca crassidens*) are widely distributed in tropical, subtropical, and warm temperate waters of the Atlantic, Pacific, and Indian Oceans, but they are not common anywhere. They occur at highest densities in tropical areas, but even there are generally among the less common delphinids.

Based on observer reports, false killer whales were the most frequently reported species of cetacean killed in the tropical western and central Pacific purse seine fishery in 2009, with an estimated mortality of 281 (SPC-OFP 2010). Interactions with this fishery were observed within the EEZs of Papua New Guinea, Kiribati, the Federated States of Micronesia, and Nauru, and in international waters. Mortality of false killer whales has been documented in Chinese purse seine fisheries in the western Pacific (Dai et al. 2017). By contrast, the only mortality documented in the eastern tropical Pacific purse seine fishery since 2001 was in 2010 (IATTC 2011).

False killer whales were listed as 'data deficient' on the IUCN Red List in 2008, and the species remains data-poor for most of its range.

Pantropical spotted dolphin

The pantropical spotted dolphin (*Stenella attenuata*) is one of the most abundant cetaceans in tropical and subtropical waters around the globe. The sum of available abundance estimates totals more than 2.3 million individuals. Estimates are unavailable for most of the species range, particularly in the eastern Atlantic, Indian Ocean, and large portions of the tropical Pacific and therefore total abundance is likely much higher.

The northeastern offshore population of pantropical spotted dolphins in the eastern tropical Pacific Ocean (ETPO) bore the brunt of the massive dolphin kill by tuna purse seiners from the late 1950s to the 1980s. For example, in the period 1959 to 1972, nearly five million dolphins were killed, and of this number, about three million were Spotted Dolphins from the northeastern offshore population (Wade, 1995). Since the Inter-American Tropical Tuna Commission (IATTC) implemented per-vessel mortality limits on the international fleet, the combined annual mortality for all pantropical spotted dolphins in the ETPO has decreased greatly, to only 238 in 2016 (IATTC, 2017). Mortality of all spotted dolphins has been <1,000 since 1998 (IATTC, 2017). Although current mortality is greatly reduced, the northeastern stock appears to be recovering very slowly (Gerrodette et al., 2008) and potential factors such as fishery-related stress, unobserved mortality due to calf separation and orphaning during fishing operations (Archer et al. 2001), possible mortality caused by small vessels that do not carry observers, under-reporting of mortality, and ecosystem change, have been suggested as possible reasons for the species' slow recovery in this region (Gerrodette and Forcada 2005).

In the eastern tropical Atlantic and western Indian Ocean, a combination of logbook (1980-2011) and observer (1995-2011) data from purse seine fisheries show that pantropical spotted dolphin bycatch has been recorded but suggest that numbers are relatively low (Escalle et al. 2015). However, mortality is suspected to occur more frequently in other fisheries, particularly in gillnets.

It was classified as 'least concern' on the IUCN Red List in 2008, and although it is data-poor in much of its range, given its generally high abundance and pantropical distribution, and in the absence of evidence that threats are significant throughout the species' extensive range, the pantropical spotted dolphin is again assessed as 'least concern'.

Striped dolphin

The striped dolphin (*Stenella coeruloalba*) is one of the most abundant cetaceans in tropical, subtropical, and temperate waters around the globe. The sum of available abundance estimates totals more than two million individuals. Estimates are unavailable for most of the species range, particularly in the eastern Atlantic, Indian Ocean, and large portions of the tropical Pacific and therefore total abundance is likely much higher.

Striped dolphins are killed accidentally in fishing gear throughout their range, however data are limited for most range states. Mortality occurs in purse seines and gillnets, large mesh pelagic driftnets, and pelagic longline fisheries, and has been documented in the northeastern Indian Ocean, the eastern tropical Pacific, the northeastern Atlantic, the Mediterranean, and in the North Pacific off the coast of Japan (Archer and Perrin, 1999). Although rare, striped dolphins have been caught in shark nets at Natal, South Africa (Perrin et al., 1994). Between 1985 and 1988 striped dolphins comprised 14% of the cetaceans brought into fish landing sites in Sri Lanka (Ilangakoon, 1997).

Globally, the species remains widely distributed and abundant and it is unlikely that the global population has been, or will be, reduced by as much as 30% over three generations. Striped dolphins were classified as 'least concern' on the Red List in 2008, and although the species is data-poor in much of its range, given its generally

high abundance and pantropical distribution, and in the absence of evidence that threats are significant throughout its extensive range, the striped dolphin was again re-assessed as 'least concern'.

Spinner dolphin

The spinner dolphin (*Stenella longirostris*) is one of the most abundant cetaceans globally (Perrin, 2018). The sum of existing abundance estimates is more than one million dolphins, and as these estimates are from only a small fraction of the total distribution range of the species, total abundance is presumably much higher.

Throughout much of their range, spinner dolphins are taken as bycatch in purse seine, gillnet, and trawl fisheries (Perrin et al., 1994, Donahue and Edwards 1996), often in high numbers. Spinner dolphins are the most abundant dolphins in the Indian Ocean (Ballance and Pitman, 1998) and are taken throughout that region in numbers that are largely unknown but may be substantial, especially as there is evidence that dolphins associate with tuna in this region (Anderson, 2014). Annual bycatch levels of hundreds of spinner dolphins were reported in the few fisheries examined in India in the 1980s and early 1990s (Mohan, 1994), and annual takes in the thousands were reported in Sri Lanka in the 1980s (Leatherwood and Reeves, 1989). They were reported to be the most frequently bycaught cetaceans in the Union of the Comoros (Kiszka et al., 2008), and amongst the most commonly taken in Madagascar (Razafindrakoto et al. 2004), Mayotte, and other countries in the western Indian Ocean (Kiszka et al., 2008). Unknown numbers have been taken in the tuna purse seine fishery in the eastern Atlantic (Donahue and Edwards, 1996) and in small-scale gillnet fisheries in the western Atlantic (Siciliano, 1994). They have been reported as bycatch in the Caribbean Sea (Vidal et al., 1994).

The species was classified as 'data deficient' on the IUCN Red List in 2008 and it remains data-poor in much of its range. However, given its generally high abundance and pantropical distribution, and in the absence of evidence that threats are significant throughout the species' extensive range, the spinner dolphin is assessed as 'least concern'. There is not enough information to determine whether the global population has declined by 30% or more over three generations (therefore qualifying for listing as 'vulnerable') but this is possible.

Rough-toothed dolphin

The rough-toothed dolphin (*Steno bredanensis*) is widely distributed in tropical, subtropical and warm temperate waters. They are generally not common or highly abundant but can be common around oceanic islands and archipelagos. The sum of existing abundance estimates for rough-toothed dolphins is approximately 220,000 individuals. Since estimates are available for only a small proportion of the range of the species, the total abundance is likely considerably greater than this. The species was assessed as 'least concern' in 2008 (Hammond et al., 2012). While there is little information available on trends, no major threats have been identified, thus the species was re-assessed in 2019 as 'least concern'.

Rough-toothed dolphins are killed incidentally in tuna purse seines in the eastern tropical Pacific: 21 were estimated to have been killed during the period 1971-75 and 36 died in a single net haul in 1982.

Indo-pacific bottlenose dolphin

Although the species (*Tursiops aduncus*) is widespread in Indo-pacific coastal waters and its aggregate abundance is probably in the tens of thousands in multiple local populations, habitat destruction and incidental takes (of unknown but possibly large magnitude) may have a significant impact on this species. However, the lack of available information precludes an assessment of this impact.

Incidental catches occur in a number of fisheries throughout the range, including gillnets and purse seines. A Taiwanese shark gillnet fishery operated in northern Australian waters during the early 1980s and took up to 2,000 per year (Harwood and Hembree, 1987). Incidental catch in Taiwan continues to be a serious problem. For example, multiple individuals have been seen observed in single catches there and throughout most of the species' range (J.Y. Wang, pers. comm.).

Bottlenose dolphin

The common bottlenose dolphin (*Tursiops truncatus*) is among the most common cetacean species globally. These dolphins are distributed worldwide in all three major ocean basins and the Mediterranean Sea. They occur in tropical and temperate inshore, coastal, shelf, and oceanic waters. The sum of available abundance estimates

is around 750,000, however the vast majority of the species' range has not been surveyed therefore actual abundance is considerably higher.

Incidental mortality of common bottlenose dolphins is known to occur throughout the species' range in set gillnets, drift gillnets, purse seines, trawls, and longlines, and on hook-and-line gear used in commercial and recreational fisheries, but the level of mortality is poorly documented from most range states (Wells and Scott, 1999, Wells et al., 2008). Set gillnet, purse seine and drift gillnet fisheries off Peru continue to take an unknown but potentially large number annually (Van Waerebeek et al. 2017, Alfaro-Shigueto et al. 2010), and some of those taken as bycatch or directly were being sold in fish markets at least through 2007, as determined by molecular evidence (Tzika et al., 2010). Prior to 2001, the estimated annual incidental mortality of common bottlenose dolphins in the eastern tropical Pacific purse seine fishery for tuna ranged up to almost 200 per year, but during 2001-2016, the average mortality declined to 2.9 per year (IATTC data, M. Scott pers. comm.). Incidental catches in Chinese fisheries reached several hundred per year in the 1990s (Yang et al., 1999).

This species was listed as 'least concern' on the Red List in 2008 and it remains 'least concern' in the updated assessment in 2019.

Turtles

Loggerhead Turtle

The *Caretta caretta* is listed as 'vulnerable' on the IUCN Red List, with its population decreasing. The loggerhead turtle is globally distributed throughout the subtropical and temperate regions of the Mediterranean Sea and Pacific, Indian, and Atlantic Oceans (Wallace et al., 2010).

Like most sea turtles, loggerhead turtles are highly migratory and use a wide range of broadly separated localities and habitats during their lifetimes (Bolten and Witherington, 2003). Upon leaving the nesting beach, hatchlings begin an oceanic phase in major current systems (gyres) that serve as open-ocean developmental grounds (Bolten and Witherington, 2003; Putman and Mansfield, 2015). After 4-19 years in the oceanic zone, loggerheads recruit to neritic developmental areas rich in benthic prey or epipelagic prey where they forage and grow until maturity at 10–39 years (Avens and Snover, 2013).

Threats to loggerheads vary in time and space, and in relative impact to populations. Threat categories affecting marine turtles, including loggerheads, were described by Wallace et al. (2011) as including fisheries bycatch, incidental capture in fishing gear targeting other species, for example bycatch mortality of large post-hatchlings in the long line fisheries of Peru and Chile (Alfaro-Shigueto et al., 2011).

Green Turtle

The green turtle (*Chelonia mydas*) is an endangered species and has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters (Atlantic Ocean – eastern central, northeast, northwest, southeast, southwest, western central; Indian Ocean – eastern, western; Mediterranean Sea; Pacific Ocean – eastern central, northwest, southwest, western central). Green turtles are highly migratory and they undertake complex movements and migrations through geographically disparate habitats. Nesting occurs in more than 80 countries worldwide (Hirth, 1997).

A number of incidental threats impact green turtles around the world. These threats affect both terrestrial and marine environments, and include bycatch in marine fisheries, habitat degradation at nesting beaches and feeding areas, and disease. Mortality associated with entanglement in marine fisheries is the primary incidental threat; the responsible fishing techniques include drift netting, shrimp trawling, dynamite fishing, and long-lining.

Leatherback Turtle

Dermochelys coriacea is a vulnerable species distributed circumglobally, with nesting sites on tropical sandy beaches and foraging ranges that extend into temperate and sub-polar latitudes. *D. coriacea* is an oceanic, deep-diving marine turtle inhabiting tropical, subtropical, and subpolar seas. Leatherbacks make extensive migrations between different feeding areas at different seasons, and to and from nesting areas. Leatherbacks feed predominantly on jellyfishes, salps and siphonophores.

Threats to leatherbacks vary in time and space, and in relative impact to populations. Threat categories affecting marine turtles, including leatherbacks, were described by Wallace et al. (2011) as including fisheries bycatch and incidental capture in fishing gear targeting other species.

Hawksbill Turtle

Eretmochelys imbricate is critically endangered. The hawksbill has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic Ocean, Indian Ocean, and Pacific Ocean. Hawksbills are migratory and individuals undertake complex movements through geographically disparate habitats during their lifetimes. They are highly migratory and use a wide range of broadly separated localities and habitats during their lifetimes (Witzell, 1983).

Hawkbills are particularly susceptible to entanglement in gillnets (see IND-Table 5, PAC-Table 5 and ATL-Table 7 in Supplementary Material) and capture on fishing hooks (Mortimer, 1998). Juvenile hawksbills comprised 47% of all turtles entangled in derelict fishing nets and other debris in northern Australian waters (Kiessling, 2003; White 2004). Ingestion of marine debris by hawksbills is also significant (White, 2004).

Olive Ridley Turtle

Otherwise known as the Pacific Ridley turtle (*Lepidochelys olivacea*) is listed as 'vulnerable' on the IUCN Red List. The Olive Ridley sea turtle has a circumtropical distribution, with nesting occurring throughout tropical waters (except the Gulf of Mexico) and migratory circuits in tropical and some subtropical areas (Atlantic Ocean – eastern central, northeast, northwest, southeast, southwest, western central; Indian Ocean – eastern, western; Pacific Ocean – eastern central, northwest, southwest, western central) (Pritchard, 1969). Like most other sea turtles, olive Ridleys display a complex life cycle, which requires a range of geographically separated localities and multiple habitats (Márquez, 1990). Like other long-lived species, olive Ridleys are prone to population declines because of slow intrinsic growth rate in combination with anthropogenic impacts. The incidental capture of olive Ridleys occurs worldwide in trawl fisheries, longline fisheries, purse seines, gillnet and other net fisheries and hook and line fisheries (Frazier et al., 2007). The impact of the incidental capture of olive Ridleys in fisheries has been well-documented for some regions but not for others. In some locations where bycatch statistics are unavailable from fisheries, cause and effect has been used to implicate a fishery in the decline of the species. The incidental capture of olive Ridleys in the shrimp trawl fishery in the western Atlantic, is believed to be the main cause of the significant population decline observed there since the 1970s and currently the number of olive Ridleys caught as bycatch in trawl fisheries off the coasts of Surinam and French Guiana is believed to be approximately a couple of thousand turtles annually (Godfrey and Chevalier, 2004; Frazier et al., 2007). Gillnets and other fishing methods in this region also capture olive Ridleys incidentally but to a lesser extent than shrimp trawl fishery (Frazier et al., 2007). Bycatch in trawl fisheries off Sergipe State in Brazil is considered the most pressing threat to that population (Thomé et al., 2003). In the eastern Atlantic, the incidental capture of olive Ridleys by commercial fisheries is thought to be a significant threat but very little systematic data is available (Frazier et al., 2007). Incidental mortality of olive Ridleys is worst along the coast of Orissa, India with arribada olive Ridleys gathering to nest were fishing effort is high. Every year since the early 1980s, thousands or tens of thousands of olive Ridleys have stranded dead on the Orissa beaches, presumably as a result of incidental capture in shrimp trawls (Pandav, 2000). A gillnet fishery also operates in the region and contributes to the ridley mortality along this coastline. Incidental capture in fisheries is also believed to be a serious threat in the eastern Pacific (Frazier et al. 2007) where these turtles aggregate in large numbers offshore from nesting beaches (Kalb et al., 1995; Kalb, 1999), but the information available is incomplete (Pritchard and Plotkin 1995; NMFS/USFWS, 1998). Incidental capture of olive Ridleys in this region has been documented in shrimp trawl fisheries, longline fisheries, purse seine fishery and gillnet fisheries (Frazier et al., 2007). Incidental capture of sea turtles in shrimp trawls is a serious threat along the coast of Central America, with an estimated annual capture for all species of marine turtle exceeding 60,000 turtles, most of which are olive Ridleys (Arauz, 1996). Recent growth in the longline fisheries of this region are also a serious and growing threat to this species and have the potential to capture hundreds of thousands annually (Frazier et al., 2007). Bycatch of olive Ridleys is high in Indonesian tuna long-lines and shrimp trawls although mortality appears to be low (WWF Indonesia, unpublished data).

Flatback Turtle

The flatback sea turtle (*Natator depressus*) is a species of sea turtle in the family Cheloniidae. The species is endemic to the sandy beaches and shallow coastal waters of the Australian continental shelf. This turtle gets its common name from the fact that its shell has a flattened or lower dome than the other sea turtles. The flatback turtle is listed by the IUCN Red List as 'data Deficient'.

Elasmobranchs

Whale Shark

The whale shark (*Rhincodon typus*), the world's largest living fish, is a cosmopolitan tropical and warm temperate species. Genetic results indicate that two major subpopulations exist, in the Atlantic Ocean and Indo-Pacific, respectively. Based on count data, modelled population estimates and habitat availability, 75% of the global whale shark population is inferred to occur in the Indo-Pacific, and 25% in the Atlantic. Given the bulk of the global population occurs in the Indo-Pacific, the overall global decline is inferred to be ≥50%. Globally, this species is therefore assessed as 'endangered' by the IUCN Red List.

Major contemporary threats to whale sharks include fisheries catches, bycatch in nets, and vessel strikes. Other threats affect whale shark on local or regional scales. Tuna are often associated with whale sharks, and tuna purse-seine fisheries often use whale sharks as an indicator of tuna presence, even setting nets around the sharks (Capietto et al., 2014). Direct mortality in purse seine fisheries appears to generally be low, recorded as 0.91% (one of 107) and 2.56% (one of 38) of sharks where fate was reported by observers in the Atlantic and Indian Oceans, respectively (Capietto et al. 2014). However, estimated mortality rates in the western and central Pacific purse seine fishery were higher: 12% for 2007–2009 and 5% in 2010. This extrapolated to a total mortality of 56 sharks in 2009 and 19 in 2010 (Harley et al., 2013). Observer reports on release condition from this region from 2010–2014 were generally consistent, with 50–60% of encircled sharks released alive, 5–10% dying and 30–40% of status unknown (Clarke, 2015). Assuming a poor outcome for the latter category, potential mortalities in 2014 range from a minimum of 11 to 42, with a higher number possible depending on longer-term survival of the sharks released alive (Clarke, 2015). Available data on the number of whale sharks caught are likely to underestimate total catch (Clarke, 2015). The longer-term survivorship of whale sharks released from nets has not been examined at this stage. Common release practices, such as being lifted or towed by the caudal peduncle, are likely to cause stress, injury and possibly death to the sharks.

It is listed, along with six other species of sharks, under the CMS Memorandum of Understanding on the Conservation of Migratory Sharks. In 1998, the Philippines banned all fishing, selling, importing, and exporting of whale sharks for commercial purposes, followed by India in May 2001, and Taiwan in May 2007.

Pelagic manta ray

The giant manta ray (*Mobula birostris*), the largest living ray, has a circumtropical and also semi-temperate distribution throughout the world's major oceans, however within this broad range, actual populations appear to be sparsely distributed and highly fragmented. This is likely due to the specific resource and habitat needs of this species. Overall population size is unknown, but subpopulations appear to be small (about 100–1,000 individuals). Only recently separated from the reef manta ray (*M. alfredi),* little is currently known about this ray except that it is elusive and potentially highly migratory.
This species is not regularly encountered in large numbers and, unlike the reef manta, do not often appear in large schools (>30 individuals) when feeding. Overall, they are encountered with far less frequency than the *Mobula alfredi*, despite having a larger distribution across the globe. Overall, the rate of population reduction appears to be high in several regions, up to as much as 80% over the last three generations (approximately 75 years), and globally a decline of >30% is strongly suspected.

The main threat to both *Mobula birostris* and *M. alfredi* is fishing, whether targeted or incidental. Manta rays are currently killed or captured by a variety of methods including harpooning, netting and trawling. These rays are easy to target because of their large size, slow swimming speed, aggregative behaviour, predictable habitat use, and lack of human avoidance. Manta rays are caught in gillnet and purse seine fisheries as well as netting programs throughout their distribution.

Basking Shark

The basking shark (*Cetorhinus maximus*) is a very large, filter-feeding cold-water pelagic species that is migratory and widely distributed, but only regularly seen in a few favoured coastal locations and probably never abundant. Most documented fisheries have been characterised by marked, long lasting declines in landings after the removal of hundreds to low thousands of individuals. Its fins are among the most valuable in international trade. The global status of the basking shark is assessed as 'vulnerable', with the North Pacific and Northeast Atlantic stocks, which have been subject to target fisheries, assessed as Endangered. These assessments are based

primarily on past records of rapidly declining local populations of basking sharks as a result of short-term fisheries exploitation and very slow population recovery rates.

Shortfin mako shark

The shortfin mako (*Isurus oxyrinchus*) is a large (to 445 cm total length) pelagic shark, widespread in temperate and tropical oceans to depths of 888 metres. The species has low biological productivity with a triennial reproductive cycle and late age at maturity. It is caught globally as target and bycatch in coastal and pelagic commercial and small-scale longline, purse seine, and gillnet fisheries, and is generally retained for the high-value meat as well as its fins. Steep population declines have occurred in the north and south Atlantic, with declines also evident, though not as steep in the north Pacific and Indian Oceans. The south Pacific population appears to be increasing but with fluctuating catch rates. The weighted global population trend estimated a median decline of 46.6%, with the highest probability of 50–79% reduction over three generation lengths (72–75 years), and therefore the shortfin mako is assessed as 'endangered'.

The shortfin mako is caught globally as target and bycatch in pelagic commercial and small-scale longline, purse seine, and gillnet fisheries. The majority of the catch is taken as bycatch of industrial pelagic fleets in offshore and high-seas waters (Camhi et al., 2008). It is also captured in coastal longlines, gillnets, trammel nets, and sometimes trawls, particularly in areas with narrow continental shelves (Camhi et al., 2008, Martínez-Ortiz et al., 2015).

Longfin Mako Shark

The longfin mako (*Isurus paucus*) is a large (to 427 cm total length), widely distributed but infrequently encountered, pelagic oceanic shark. It usually occurs to depths of 760 metres but has been reported to 1,752 metres. The species is caught globally as target and bycatch in pelagic commercial and small-scale longline, purse seine, and gillnet fisheries that operate throughout its range. It is caught less frequently than the shortfin mako (*Isurus oxyrinchus*) and is usually retained for the meat and fins. Most catches of the longfin mako are inadequately recorded and likely underestimated in landings data, particularly as it is commonly misidentified as the shortfin mako. The longfin mako is of serious conservation concern due to its apparent rarity, large maximum size, low fecundity, and continued, poorly-documented take in intensive fisheries. The limited available population trend data indicates strong declines and it is suspected to have undergone a population reduction of 50–79% globally over the last three generations (75 years), similar to its congener. The longfin mako is therefore assessed as 'endangered' on the IUCN Red List.

Longfin Makos are caught globally as target and bycatch in pelagic commercial and small-scale longline, purse seine, and gillnet fisheries. The majority of the catch is taken as bycatch of industrial pelagic fleets in offshore and high-seas waters (Camhi et al., 2008). It is also captured in coastal longlines, gillnets, trammel nets, and sometimes trawls, particularly in areas with narrow continental shelves (Camhi et al., 2008; Martínez-Ortiz et al., 2015). The longfin mako is likely less vulnerable to shallow set pelagic longline gear than the shortfin mako, because its preferred depth distribution is deeper.

Porbeagle Shark

The porbeagle (*Lamna nasus*) is a wide-ranging, coastal and oceanic shark, but with apparently little exchange between adjacent populations. Low reproductive capacity and high commercial value (in target and incidental fisheries) of mature and immature age classes makes this species highly vulnerable to over-exploitation and population depletion.

The main threat to the porbeagle shark is unsustainable fisheries (target and bycatch) utilising its very high value meat. It is also a valued target game fish species for recreational fishing in Ireland and UK. The low reproductive capacity and high commercial value of both mature and immature age classes makes this species highly vulnerable to over-exploitation and population depletion. Well documented declines in this extremely valuable species during the past fifty years in the North Atlantic, which is the major reported source of world catches, has taken place during a period of rising fishing effort and market demand, and improved fisheries technology.

Porbeagles are a valuable secondary target of many fisheries, particularly longline fisheries, also gill nets, driftnets, pelagic and bottom trawls, and handlines. Examples include the demersal longlines for Patagonian

toothfish *Dissostichus eleginoides* in the southern Indian Ocean and by the Argentinean fleet (Victoria Lichtstein, CITES Management Authority of Argentina, in litt. to TRAFFIC Europe, 27 October 2003), and longline swordfish and tuna fisheries in international waters off the coasts of Argentina and Uruguay (Domingo undated). Despite the large amount of fishing activity capturing porbeagles in the Southern Hemisphere, New Zealand is the only country that reports landings to FAO, indicating that the southern catch is largely unreported.

The high value of porbeagle shark meat means that most "bycatch" is exploited. The exception is in those high sea tuna and billfish fisheries where vessels' holding space is too limited to enable even valuable shark carcasses to be retained. In these cases, the fins alone may be retained (e.g., the Japanese longline fishery for southern bluefin tuna off Tasmania and New Zealand, the pelagic fishing fleets of other countries in the southern Indian Ocean and probably elsewhere in the Southern Hemisphere (Compagno, 2001).

Great White Shark

Despite the high profile media attention, the great white shark (*Carcharodon carcharias*) receives, relatively little is known about its biology. It appears to be fairly uncommon compared to other widely distributed species, being most frequently reported from South Africa, Australia, California and the northeast United States. World catches of great white sharks from all causes are difficult to estimate, though it is known to have a relatively low intrinsic rebound potential (Smith et al., 1998). Nowhere is the great white shark abundant and productive enough to sustain long-term directed fisheries; the majority of annual captures worldwide being made incidentally through commercial fisheries operating longlines, setlines, gillnets, trawls, fish-traps and other gear. The great white shark is ensnared throughout the water column in nearshore fisheries but, notably, is rarely represented in the elasmobranch bycatch of offshore oceanic pelagic fisheries (unlike shortfin mako (*Isurus oxyrinchus*) and porbeagle (*Lamna nasus*)). The great white shark is vulnerable to capture trauma and may be killed or has limited survivorship after capture. Great white sharks are curious and readily approach boats, scavenge from fishers' nets or longlines and devour hooked fish taken by rod-and-line or swordfish harpoon. This vulnerable propensity often results in either their own accidental entrapment or deliberate killing by commercial fishers.

Scalloped Hammerhead Shark

The scalloped hammerhead (*Sphyrna lewini*) is a coastal and semi oceanic hammerhead shark that is circumglobal in coastal warm temperate and tropical seas, from the surface and intertidal to at least 275 m depth. Although it is wide ranging, there is genetic evidence for multiple subpopulations. All life-stages are vulnerable to capture as both target and bycatch in fisheries: large numbers of juveniles are captured in a variety of fishing gears in near shore coastal waters, and adults are taken in gillnets and longlines along the shelf and offshore in oceanic waters.

In addition to the ‘endangered’ IUCN Red List global assessment, a number of regional assessments have also been designated for this species as follows: ‘endangered’ in the northwest Atlantic and western central Atlantic, ‘vulnerable’ in the southwest Atlantic, ‘endangered’ in the western Indian Ocean, ‘endangered’ in the eastern central and southeast Pacific, ‘vulnerable’ in the eastern central Atlantic and ‘data deficient’ in Australia.

The scalloped hammerhead is taken as both a target and bycatch by trawls, purse seines, gillnets, fixed bottom longlines, pelagic longlines and inshore artisanal fisheries. The latter catch large numbers of pups and juveniles in some regions. The species' aggregating behaviour makes them vulnerable to capture in large schools. This also means that they may appear more abundant in landings, where they are caught in high, localised concentrations. Intense fishing pressure can deplete regional stocks rapidly, and re-colonization of depleted areas from neighbouring regions is expected to be a slow and complex process. This species is expected to have a low resilience to exploitation because of its life-history characteristics (Maguire et al., 2006).

This species' fins are highly valued, and they are being increasingly targeted in some areas in response to increasing demand for shark fins. Hammerhead shark species *S. zygaena* (smooth hammerhead) and *S. lewini* were found to represent at least 4-5% of the fins auctioned in Hong Kong, the world's largest shark fin trading centre (Clarke et al. 2006a). Hammerhead shark fins are generally high value compared to other species because of their high fin ray count (S. Clarke unpubl. data). It is estimated that between 1.3 and 2.7 million *S. zygaena* or *S. lewini* are represented in the shark fin trade each year or, in biomass, 49,000 to 90,000 mt (Clarke et al. 2006b).

Great Hammerhead Shark

A large, widely distributed, tropical hammerhead shark largely restricted to continental shelves. *Sphyrna mokarran* is highly valued for its fins (in target and incidental fisheries), suffers very high bycatch mortality and only reproduces once every two years, making it vulnerable to over-exploitation and population depletion. Generally regarded as solitary and is therefore unlikely to be abundant wherever it occurs.

The great hammerhead ranges widely throughout the tropical waters of the world, from latitudes 40°N to 35°S (Last and Stevens, 1994). It is apparently nomadic and migratory, with some populations moving polewards in the summer.

Due to the distinctive head shape of this genus, it is typical for catches to be reported at the genus level, *Sphyrna* spp. Therefore, it is rare to find fisheries statistics that are specific to one species of hammerhead shark. Due to the great hammerhead's preference for warmer waters, it can be expected to make up a greater proportion of tropical catches of hammerheads than more temperate fisheries. *Sphyrna mokarran* is taken by target and bycatch, fisheries (Dudley and Simpfendorfer, 2006; Zeeberg et al., 2006) and is regularly caught in the tropics, with longlines, fixed bottom nets, hook-and-line, and possibly with pelagic and bottom trawls (Compagno in prep). Hammerhead sharks, have been noted as a favoured target species due to the size of their fins (R.T. Graham pers. comm). Fin prices are rising, driven by the Asian Fin market (R.T. Graham pers. obs).

There was a directed shark fishery operated by Taiwan around the northern coast of Australia that regularly caught great hammerheads up until 1986 (Stevens and Lyle, 1989). Other possible threats include sport fishing (Pepperell, 1992) and capture in anti-shark measures around the beaches of Australia and South Africa (Paterson, 1990; Cliff, 1995). Bonfil (1994) gives an overview of global shark fisheries. This species is mentioned specifically with reference to fisheries in Brazil, East USA and Mexico, however *Sphyrna* spp. are mentioned in the majority of tropical fisheries cited.

Thresher sharks

All members of genus *Alopias*, the thresher sharks, are listed as 'vulnerable' globally because of their declining populations. These downward trends are the result of 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 and bycatch fisheries.

The pelagic thresher shark (*Alopias pelagicus*) is a large, wide-ranging Indo-Pacific Ocean pelagic shark, apparently highly migratory, with low fecundity (two pups/litter) and a low (2-4%) annual rate of population increase. This species is especially vulnerable to fisheries exploitation (target and by-catch) because its epipelagic habitat occurs within the range of many largely unregulated and under-reported gillnet and longline fisheries, in which it is readily caught. Although this species is reportedly relatively common in some coastal localities, current levels of exploitation in some areas are considered to be unsustainable. Overall, it is considered highly likely that serious depletion of the global population has occurred. It is subject to high levels of bycatch mortality from tuna fisheries and is a target of some smaller shark fisheries. The species is also fished in the central Pacific and is currently an important catch off Taiwan, with about 222 t landed annually. A spawner-per-recruit (SPR) analysis of *A. pelagicus* in eastern Taiwanese waters suggests mean SPR of pelagic thresher for 1990-2004 was below the biological reference point (BRP) of SPR = 35% suggesting that this stock was slightly overexploited.

The common thresher shark (*Alopias vulpinus*) is virtually circumglobal, with a noted tolerance for cold waters. This species is especially vulnerable to fisheries exploitation (target and by-catch) because its epipelagic habitat occurs within the range of many largely unregulated and under-reported gillnet and longline fisheries, in which it is readily caught. It is an important economic species in many areas and is valued highly for its meat and large fins. Its life-history characteristics (2-4 pups per litter; 8-14 year generation period) and high value in both target and bycatch fisheries make it vulnerable to rapid depletion.

Thresher shark species were found to represent at least 2-3% of the fins auctioned in Hong Kong, the world's largest shark fin trading centre (Clarke et al., 2006a). Thresher shark fins are generally low value compared to other species because of their low fin ray count (S. Clarke unpubl. data). It is estimated that between 350,000 and 3.9 million thresher sharks (*Alopias* species) are represented in the shark fin trade each year or, in biomass, 12,000-85,000 mt (Clarke et al., 2006b). These estimates are 1-2 orders of magnitude higher than catches of

Alopiidae reported to FAO, which since the early-1980s have generally been less than 1,600 tonnes, and around 1,000 mt since 1998 (Maguire et al., 2006), Catches of thresher sharks are clearly hugely under reported globally. Although trend data are as a result largely lacking, these fisheries are unlikely to be sustainable. A recent FAO analysis states, "unless demonstrated otherwise, it is prudent to consider these species as being fully exploited or overexploited globally" (Maguire et al. 2006).

Dusky Shark

The dusky shark (*Carcharhinus obscurus*) is a large wide-ranging coastal and pelagic warm water species, which is among the slowest-growing, latest-maturing of known sharks, bearing small litters after a long gestation period. Unfortunately, the dusky shark is difficult to manage or protect because it is taken with other more productive sharks in mixed species fisheries and has a high mortality rate when taken as bycatch. This species' fins are highly valued.

Carcharhinus obscurus is taken as both bycatch and target in commercial shark fisheries using, set nets, longlines, hook and line and trawls (Cramer, 1995; Compagno in prep.) in many areas of its range. The species has among the most sought after fins for shark fin soup because of their large size and high fin needle content (*ceratotrichia*) (TRAFFIC 1996, R. Hudson pers. comm.). Because of its high-value fin, dusky sharks caught incidentally in tuna and swordfish fisheries are now regularly landed rather than released. *Carcharhinus obscurus* was found to represent at least 1.2-1.7% of the fins auctioned in Hong Kong, the world's largest shark fin trading centre (Clarke et al. 2006a). It is estimated that between 144,000 and 767,000 Dusky Sharks are represented in the shark fin trade each year or, in biomass, 6,000 to 30,000 mt (Clarke et al. 2006b). The very low intrinsic rate of increase of the dusky shark renders this species among the most vulnerable of all vertebrates (including great whales and sea turtles) to man-induced mortality (Compagno et al., 2005; Musick, 1999). Furthermore, Compagno et al. (2005) report that the species is difficult to manage or protect because it is taken in mixed species fisheries and has a high mortality rate when taken as bycatch.

Oceanic Whitetip Shark

This is one of the most widespread shark species, ranging across entire oceans in tropical and subtropical waters, usually found far offshore between about 30°N and 35°S in all oceans.

This formerly widespread and abundant, large oceanic shark is subject to fishing pressure throughout its range. It is caught in large numbers as a bycatch in pelagic fisheries, with pelagic longlines, probably pelagic gillnets, handlines and occasionally pelagic and even bottom trawls. Catches, particularly in international waters, are inadequately monitored. Its large fins are highly prized in international trade although the carcass is often discarded. Declines of 90% according to observer data from the Pacific are probably the most reliable available data on this species today, and with the same types of fishery in operation throughout its habitat worldwide.

Oceanic whitetip sharks (*Carcharhinus longimanus*) are primarily taken as bycatch in large pelagic longline and purse seine fisheries targeting tuna and swordfish. It is also caught in pelagic gillnets, hand-lines and occasionally pelagic and even bottom trawls (Ebert and Stehmann, 2013). The lack of reliably reported national landings of this species leads to significant underestimations of catches.

Oceanic whitetip sharks are more likely to be retained by longline fisheries than finned, which implies that recent finning regulations requiring the entire carcass to be landed with fins attached may not even benefit this species (Clarke et al., 2011). Tagging studies have determined that this species has a high chance of surviving capture on pelagic longline fishing gear if carefully released (CITES, 2013), so retention bans could potentially benefit the species more than finning bans.

Cortés et al., (2010) carried out an ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries, concluding that oceanic whitetip sharks are among the species most sensitive to overexploitation

Silky Shark

The silky shark (*Carcharhinus falciformis*) is an oceanic and coastal-pelagic shark with a circumglobal distribution in tropical waters. It is a target or bycatch species in pelagic tuna longline and purse seine fisheries where it is taken in high numbers. Silky shark is one of the three most traded shark species in the global shark fin trade. Estimates of trends in abundance over three generations (45 years) from standardised catch rate and spawning

biomass indices show declines of silky shark in the eastern central and southeast Pacific Ocean, western and central Pacific Ocean and the Atlantic Ocean. Across all three ocean regions, there are the major uncertainties in estimates of catch rate and population changes, and an inability to conclusively attribute any declines solely to fishing mortality as there is some potential for environmental influences on catchability and sampling artefacts. The weighted global population trend estimated a 47-54% decline over three generations. This reflects the proportionate contribution of each region's silky shark population change. The estimated level of decline and the uncertainties in the data warrants a global status of 'vulnerable' on the IUCN Red List. This assessment should be revisited when more definitive catch data and stock assessments become available.

The silky shark is the second most caught species of shark globally, after the blue shark (*Prionace glauca*) (Oliver et al., 2015). The silky shark is both targeted or caught as incidental (bycatch) by longline fisheries and purse seine fisheries (especially those using drifting fish aggregating devices [FADs]) as well as by artisanal fisheries. FADs are made of a floating object and nets that lie vertical in the water column to attract schools of fish. The silky shark, as well as other species, is easily entangled in the nets; and there have been large increases in the use of FADs since 1996 (Leroy et al., 2013). Whether they are targeted or an incidental catch, the silky shark is often either retained for its meat and fins where regulations allow or released with high mortality rates apparent in the tropical purse seine fisheries (Hutchinson et al., 2015). Total catches of the silky shark reported to FAO are mainly from Sri Lanka (western Indian Ocean) with the FAO catch less than 4,000 tonnes (t) from 2005-2009 before doubling in 2010 and 2011. Catches then decreased to ~5,000 t in 2012 and 2013 (FAO, 2015).

The silky shark was found to represent at least 3-4% of the fins auctioned in Hong Kong, the world's largest shark fin trading centre—the third highest after blue shark and hammerhead shark species (Clarke et al. 2006a)—and Hong Kong is thought to make up more than half of the global shark fin trade (Clarke et al. 2004, 2006b). Silky shark fins are valuable to the trade, although they are not one of the highest value fin types (S. Clarke, unpublished. data).

Smooth hammerhead shark

The smooth hammerhead (*Sphyrna zygaena*) is one of the larger hammerhead sharks, found world-wide in temperate and tropical seas, with a wider range than other members of its family. It is semi pelagic and occurs on the continental shelf. The species is currently assessed as 'vulnerable' on the IUCN Red List globally and further investigation into threats, population trends, catches and life-history parameters throughout its range is required to determine whether it may warrant a higher category in the future.

Smooth hammerheads are caught with a variety of gears, including with pelagic longlines, handlines, gillnets, purse seines and pelagic and bottom trawls (Bonfil 1994, Compagno in prep, Maguire et al. 2006).

Birds

Interactions with seabirds are more common in the South Pacific Ocean (OFP, 2010). There are 22 species of albatross, 17 of which are threatened globally with extinction (IUCN 2017). No birds were identified that overlap with the fishery or through RFMO submissions.

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