ISSF Technical Report 2015-02

Preliminary study of the relative fishery impacts on non-tuna species caught in various tuna fisheries

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February, 2015

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Suggested citation:
Justel-Rubio, A. and V. Restrepo. 2015. Preliminary study of the relative fishery impacts on non-tuna species caught in tuna fisheries. ISSF Technical Report 2015-02. International Seafood Sustainability Foundation, Washington, D.C., USA.

All fishing methods have some type of unintentional environmental impact. One impact that receives a lot of attention is the incidental catch of non-target species, often referred to as "bycatch"[2]. The purpose of this study is to provide descriptions of stock status (if available) and the relative impacts of different fisheries based on their current/recent levels of effort (if known), on non-tuna species[3] caught incidentally in tuna fisheries (with an emphasis on those species that are caught by purse seine fisheries).

The information used was obtained primarily from the available tuna Regional Fishery Management Organization's (tRFMO) scientific papers and scientific committee reports. In most cases, the available catch data for bycatch species is very sparse. Only in a few cases stock assessments have been conducted or attempted, resulting in a thorough compilation of catch data for different gears, and even in those cases, important data gaps may still exist. This study thus helps to identify data gaps and research required to better characterize tuna fishery impacts on non-tuna species.

As the information available on these species is very sparse, this study should be viewed as an initial attempt to compile all available information so as to better understand overall fishery impacts on non-tuna species. The authors would be grateful to readers of this report who identify any errors or omissions so that they can be addressed in a subsequent update.

METHODOLOGY

Catch data were compiled for a selection of species commonly reported as tuna fisheries bycatch. The sources consulted were stock assessment and other reports and catch databases from tuna RFMOs, as well as additional studies on tuna fisheries bycatch presented to tuna RFMOs or published in scientific journals. When possible, catch data in weight (tonnes) were used, although in some cases the only available information was presented as numbers of specimens.

Average annual catch for recent years were obtained from the literature for each species-region-gear combination (see Appendix 1 and Appendix 2). In cases where more than one source of information was relevant for a specific species-region-gear combination, an average annual catch was calculated for each source and included in the tables. For a given species-region-gear combination, the average annual catches from the different sources may differ substantially from each other. This can be due to several reasons, including: The overall sparseness of the data, the estimation methods used in the different sources, and whether data available were estimated or reported catches. This report makes no inference about the relative quality of the various sources available in the literature.

The most recent stock assessments for the species included in this report (when available), as well as the related conservation and management measures adopted by tRFMOs, are reported here in combination with the calculated annual catches in order to provide a summary description for each species. The data gaps and any other relevant issues encountered in the course of this study were also included in each species description.

[2] There is not a unique definition of what constitutes "bycatch". For some authors this term refers solely to specimens that are discarded dead, while for others it may include specimens released alive, retained non-target species and small-size specimens of target species. For the purposes of this report, "bycatch" refers to retained non-target species, as well as dead discards (when that information is available). Note that it was not always possible to determine whether a given fishery was targeting or not a specific species. In those cases, all catches from those fisheries were included in this study.

[3] Tunas considered "tuna species" for the purposes of this report: bluefin tuna (*Thunnus thynnus thynnus*, *Thunnus orientalis, Thunnus maccoyii),* skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and albacore tuna (*Thunnus alalunga*).

CONTENTS

GLOSSARY

Areas

AO	Atlantic Ocean
EPO	Eastern Pacific Ocean
IO	Indian Ocean
WCPO	Western and central Pacific Ocean

Species

RHN	Whale shark
FAL	Silky shark
OCS	Oceanic whitetip shark
SPN	Hammerhead sharks
BSH	Blue shark
BTH	Bigeye thresher
POR	Porbeagle shark
SMA	Shortfin mako shark
MR	Mantas, rays
PLS	Pelagic stingray
BLM	Black marlin
BUM	Blue marlin
MLS	Striped marlin
WHM	White marlin
SWO	Swordfish
SAI/SFA	Sailfish
MAH	Mahi-mahi
WAH	Wahoo
FRI	Frigate tuna
RR	Rainbow runner
YT	Yellowtail
TRI	Triggerfish

Gears

GN	Gillnet
HL	Handline
LL	Longline
MWTW	Mid-water trawl
PL	Pole and line
PS_FSC	Purse seine-free school set
PS_FAD	Purse seine-object associated set
PS_DOL	Purse seine-dolphin set
PS (or **PS_ALL**)	Purse seine all set types
TR	Troll
TP	Trap
Other	Other

SHARKS

Sharks are caught by fisheries targeting sharks and in other fisheries including those targeting tuna and swordfish. In tuna targeting fisheries, the primary gear types that catch sharks are gillnet, longline and purse seine. Note that on purse seine vessels the potential bias of underreporting sharks would be higher than on longliners given the higher difficulties for the crew/ observers in enumerating shark catches. On the other had, longline fisheries generally have much lower levels of observer coverage than purse seine fisheries do.

Shark finning and fin-trade have been major issues concerning shark catches because, on one hand, catch statistics are compromised as a result of finning; and on the other hand, because the high value of fins can act as an incentive for fishers to increase or not avoid shark bycatch. Tuna RFMOs have adopted management measures that establish limits on the ratio of shark fins to total shark weight that can be retained onboard and encourage the release of live sharks (IOTC Res. 05/05, ICCAT Recs. 04-10 and 05-05, IATTC Res. C-05-03 and WCPFC CMM-2010-07).

In cases where a stock assessment was available, it was used as the main data source to estimate the species' annual average catch rate. Otherwise, data were obtained from the corresponding RFMO's catch database or from additional studies. In particular, estimations by Murua *et al*. (2013) based on the ratio of shark catch over total target catch were frequently consulted. Source data used by Murua *et al*. (2013) include tuna RFMO available catch databases, observer datasets, literature and personal communications. Note that figures included in this document taken from Murua *et al*. (2013) correspond to their upper estimates.

WHALE SHARK (*Rhincodon typus*) - RHN

Indian Ocean:

Status: Not assessed.
Impact by gear: PSFSC ~ GN. Only one case of observed whale shark mortality (purse seine) reported in the IO in 1999 out of 38 records of known fate (Capietto *et al.* 2014). Estimated average annual catches by gillnet fisheries in the IO could reach 13 tonnes according to Murua *et al.* 2013 (the average weight of adult whale sharks is estimated to be in the 10-20 tonnes range, so this corresponds to one individual).
Management: IOTC Res. 13/05 prohibits intentional sets by purse seine vessels on tunas associated with whale sharks.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: PS ~ MWTW. Only one case of whale shark mortality (purse seine) reported in the AO in 1998 from 107 records of known fate (Capietto *et al.* 2014). ICCAT´s Nominal Catch Information database registers very low levels of RHN catches in mid water trawl fisheries in recent years.
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PS. In the EPO, the average purse seine catches of whale sharks, between 2008 and 2010, from observer data are low for all PS types (Murua *et al.* 2013), with catches of whale sharks from sets on floating objects higher than those from free school sets.
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.

Impact by gear: PS. Whale shark mortality has been observed as a result of purse seine interactions in the WCPO (SPC-OFP 2012, Hall *et al.* 2013).

Management: WCPFC CMM-2012-04 prohibits deliberate purse seine sets around whale sharks.

Main data Gaps: Published documents on global whale shark fishery-induced mortality is scarce. Tunas and other species commonly associate with whale sharks when they are near the surface, since they are large and swim slowly. For this reason, purse seine sets on whale sharks are usually classified as "associated" or "floating object" (FAD) sets in databases of RFMOs, because the whale shark acts as a floating object. This does not mean that the whale shark was associated with a log or a FAD. There is generally good observer coverage for the purse seine fishery in the EPO and WCPO. Whale sharks caught in tuna purse seine fisheries are almost always released alive; however, post-release survival rates, by region, have not been well estimated because of the low sample sizes and limited geographic range in studies conducted. Nonetheless, studies by Escalle *et al*. (2014) and Murua *et al*. (2014) have indicated that whale sharks released using generally accepted standards for safe release have a high probability of survival as verified with popup satellite archival tags (PSATs). There is no officially-agreed global standard for the safe release of whale sharks, but Poisson *et al*. (2014) and ISSF (ISSF guidebooks) provide guidelines. The Scientific Committee of WCPFC is also developing guidelines for the safe release of whale sharks (WCPFC, 2014), which could be adopted by the Commission, and a study on post-release condition of whale sharks released in the WCPO purse seine fishery will commence in 2015 (Clarke pers. comm.).

An important consideration regarding fishery impacts on whale sharks is the significant fishing mortality from non-tuna fisheries, including targeting that is likely to have occurred historically, for instance in the coastal waters of the northwest Pacific Ocean (Rice and Harley, 2012b).

Other notes: A study by Harley *et al*. (2013) examined the spatial and temporal distribution of whale sharks in the western and central Pacific Ocean based on observer data and other data sources.

Information available suggests that whale shark mortality by tuna fisheries is minimal. Even though whale shark interactions and catches occur in tuna fisheries (mostly purse seine), whale sharks appear to survive after being released from the net. Nevertheless, further research on post-release mortality is necessary. On the other hand, while there is a paucity of biological studies, it is concluded that whale sharks are likely to be a species with low population growth (estimates of age at maturity around 30 years (Pauly 2002)) and therefore vulnerable to fishing-related mortality (Rice and Harley 2012b).

SILKY SHARK (*Carcharhinus falciformis*) - FAL

Indian Ocean:

Status: Not assessed. However, available information suggests large declines in abundance over the past decades (IOTC 2014).
Impact by gear: GN ~ LL >> PSFAD > PSFSC. Silky sharks are often targeted by semi-industrial and artisanal fisheries and are a bycatch of industrial tuna fisheries. Data reported to IOTC is suspected to underestimate real silky shark catches (IOTC Species Executive Summaries). Murua *et al.* (2013) estimated that gillnet and longline catches are much higher than those of other gears. Amande *et al*. (2012) provides estimates of European purse seiners cumulative bycatch weight in the IO (2003-2009) which suggests that FAL bycatch is more than five times higher in PS sets on floating objects than it is in sets on free swimming schools.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: LL ~ PSFAD > PSFSC (other gears unknown). Estimates by Murua *et al.* (2013) suggest that the magnitude of silky shark catches in longline and purse seine fisheries is similar. Observer data from European purse seine fisheries for the period 2003-2007 taken from Amandè et al. (2010) indicate that silky sharks are more often caught in floating object-associated purse seine sets. Catches reported to ICCAT for longline fisheries are four times lower than Murua *et al*'s estimates. Catches reported for other gears are very small and probably highly uncertain.
Management: ICCAT Rec 11-08 prohibits the retention on-board of silky sharks.

Eastern Pacific Ocean:

Status: Not assessed. An attempt to assess the northern and southern stocks was unsuccessful due to uncertainty in historical data. Trends in relative abundance for both stocks show large declines in the 1990s, followed by relative stability at lower levels (IATTC 2014c).
Impact by gear: LL >> PSFAD > PSDOL. Silky sharks are caught in large numbers in coastal and high-seas longline fisheries that target a mix of sharks, billfishes, and tunas (Aires-da-Silva *et al*. 2013). High seas purse seine and longline fisheries targeting tunas take a small proportion of the total silky shark catch compared to the other fisheries.
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Stock assessment indicates stock is overfished and overfishing is occurring (Rice and Harley, 2013). Estimated spawning biomass has considerably declined over the model period (1995 to 2009) and current catches exceed MSY.
Impact by gear: LL >> PSFAD > PSFSC. The greatest impact on the stock is attributed to bycatch from the longline fishery in the tropical and subtropical areas, but there are also significant impacts from the purse seine fishery on floating objects, which catches predominantly juvenile sharks (Rice and Harley, 2013; Hutchinson et al. 2014).
Management: WCPFC CMM 2013-08 prohibits the retention onboard of silky sharks.

Main data Gaps: Compilation of catch data from all fishery sectors has been done only in the EPO and WCPO. The magnitude of catches by non-tuna fisheries in the AO and IO is highly uncertain. ICCAT and WCPFC prohibit the retention on-board of silky sharks. Poisson *et al*. (2014b) estimated a post-capture survival of about 20% in purse seine fisheries. Hutchinson *et al*. (2013; 2014) estimated similar levels of impact of total mortality estimates for WCPO associated purse seine effort in excess of 84%. Results from PSAT tagging indicate that pelagic shark species can have high survival rates when released alive from longline fishing gear (Musyl *et al*. 2011), however, an assessment of at-vessel hooking survival for 12 shark species encountered as bycatch in the US Atlantic pelagic tuna and swordfish longline fishery from 1995 to 2012 estimated a significantly low survival rate for silky sharks in swordfish-targeting sets (Gallagher *et al*. 2014). No estimates of post-release survival are available from other fisheries such as gillnet.

Other notes: Analyses of longline observer data from the WCPO have identified the use of shark lines, shark bait, and the time at which sets are made and their durations as significant factors resulting in the capture of silky sharks (Caneco *et al*. 2014).

Based on research in the Indian Ocean, Filmalter *et al.* (2013) estimated that unobserved silky shark mortality from entanglement in the hanging aprons used in FAD construction could be much higher (5-10 times) than the observed purse seine catches. No similar estimation was done in the other oceans. Guidelines for the design of non-entangling FADs have been developed by ISSF (ISSF-Guide for non-entangling FADs). IOTC, ICCAT and IATTC have adopted measures that require a transition to non-entangling FADs (IATTC 13-04; IOTC 13/08; ICCAT 14-01).

OCEANIC WHITETIP SHARK (*Carcharhinus longimanus*) - OCS

Indian Ocean:

Status: Not assessed. Nevertheless, available information suggests that oceanic whitetip shark abundance has declined significantly over recent decades (IOTC 2014).
Impact by gear: GN ~ LL > PSFAD > PSFSC. OCS catches in the IO estimated by Murua *et al.* 2013 indicate higher quantities for gillnet and longline fisheries, and purse seine catches much lower in comparison (Murua *et al.* 2013, Ardill *et al.* 2011).
Management: IOTC Res. 13/06 prohibits the retention of oceanic whitetip sharks.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: LL > PSFSC ~PSFAD (other gears unknown). According to estimates by Murua *et al.* (2013), OCS mortality is mainly caused by longline fleets (mostly shark-targeting), followed by purse seine fisheries (Amande *et al*. 2010). Catches reported to ICCAT for longline fisheries are considerably lower than Murua *et al*'s estimates. Catches reported for other gears are very small and probably highly uncertain.
Management: ICCAT Rec 10-07 prohibits the retention on-board of oceanic whitetip sharks.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFAD ~ PSFSC. LL. (Other gears unknown). Estimates from IATTC and Murua *et al.* 2013 of OCS catches indicate relatively low levels occur in purse seine fisheries (except in dolphin associated sets) (IATTC 2013, IATTC 2014b, Murua *et al.* 2013). Data from an observer program that assessed the impact of the Costa Rican longline fishery between 1999 and 2010 indicate that low OCS catches

have occurred in LL fisheries, although the actual magnitude is unknown (Dapp *et al*. 2013).
Management: IATTC Res C-11-10 prohibits the retention of oceanic whitetip sharks and requires the release of specimens that are alive when caught.

Western Pacific Ocean:

Status: Stock assessment indicates stock is overfished and overfishing is occurring (Rice and Harley, 2012). Estimated spawning biomass has declined considerably over the model period (1995 to 2009) and current catches are slightly lower than MSY.
Impact by gear: LL > PSFAD > PSFSC. The greatest impact on the stock is attributed to bycatch from the longline fishery, with lesser impacts from target longline activities and purse seining (Rice and Harley 2012). I
Management: WCPFC CMM 2011-04 prohibits the retention on-board of oceanic whitetip sharks.

Main data Gaps: There remains considerable uncertainty about total OCS catches over the last decade. The magnitude of catches by non-tuna fisheries is highly uncertain. Results from PSAT tagging indicate that pelagic shark species can have high survival rates when released alive from longline fishing gear (Musyl *et al*. 2011). An assessment of at-vessel hooking survival for 12 shark species encountered as bycatch in the US Atlantic pelagic tuna and swordfish longline fishery from 1995 to 2012 estimated a high survival rate for oceanic whitetip sharks, especially in swordfish-targeting sets (Gallagher *et al*. 2014). Estimates of post-release survival are not available for purse seine fisheries.

Other notes: The analyses of longline observer data from the WCPO have identified the use of shark lines as well as set duration as significant factors resulting in the capture of oceanic whitetip sharks (Caneco *et al*. 2014).

HAMMERHEAD SHARKS (*Sphyrna Spp.*) - SPN

Indian Ocean:

Status: Not assessed.
Impact by gear: GN ~ LL ~ HL. In the IO, catch numbers from gillnet, handline and longline fisheries are similar (Murua *et al.* 2013, IOTC database).
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: GN > LL >> Oth. Hammerhead sharks in the Atlantic Ocean are mainly caught by gillnet fisheries, followed by longline and other gears (Murua *et al.* 2013, ICCAT database, Amande *et al*. 2010).
Management: ICCAT Rec 10-08 prohibits the retention on-board of several species of hammerhead sharks.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFAD > PSFSC > PSDOL. LL. (Other gears unknown). Catches of hammerhead sharks in the EPO are primarily from purse seine sets (Murua *et al.* 2013), especially those on floating objects (Hall 2014). Data from an observer

program that assessed the impact of the Costa Rican longline fishery between 1999 and 2010 indicate that some hammerhead sharks catches have occurred in LL fisheries, although the actual magnitude is unknown (Dapp *et al*. 2013).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: ? - No catch estimates available.
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: There is a paucity of catch data for hammerhead sharks, especially in the WCPO. The magnitude of catches by non-tuna fisheries is highly uncertain. Estimates of post-release survival are not available, but an assessment of at-vessel hooking survival for 12 shark species encountered as bycatch in the US Atlantic pelagic tuna and swordfish longline fishery (1995-2012) resulted in scalloped hammerhead sharks being one of the species with the lowest estimated survival rates (Gallagher *et al*. 2014).

Other notes: The U.S. National Marine Fisheries Service recently assessed scalloped hammerhead shark (*Sphyrna lewini*) status in relation to criteria for listing under the U.S. Endangered Species Act. The determination supported distinct population segments (DPS) for Scalloped Hammerhead in the Central & SW Atlantic, Eastern Atlantic, Indo-West Pacific and Eastern Pacific. Significant stock depletion and negative stock condition was assessed for the Eastern Atlantic, Eastern Pacific, Central & SW Atlantic and Indo-West Pacific scalloped hammerhead DPS (Federal Register/Vol. 79, No 128/July 3, 2014).

BLUE SHARK (*Prionace glauca*) - BSH

Indian Ocean:

Status: Not assessed.
Impact by gear: LL > HL > GN. Blue sharks are often targeted by some semi-industrial and artisanal fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries). However, in recent years longliners are occasionally targeting this species, due to an increase in its commercial value worldwide. Reported handline catches in this region are also significant (IOTC Species Executive Summaries, Murua *et al.* 2013, IOTC database). BSH is considered as not being vulnerable to purse seine gear (IOTC 2012), however, low blue shark catches during purse seine fishing operations have been reported in other oceans.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: In 2008, ICCAT assessed the status of North Atlantic and South Atlantic blue sharks and estimated that the stocks were not overfished and that overfishing was not occurring (ICCAT 2008, ICCAT 2013).
Impact by gear: LL >> PL > GN > Oth. Catches by longline fisheries are substantially greater than other gear types in the Atlantic Ocean (ICCAT database).
Management: No direct measures have been adopted by ICCAT.

Pacific Ocean:

Status: The status of North Pacific blue shark was assessed by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) and the Secretariat of the Pacific Community (SPC) in 2014 (Rice *et al*. 2014,

ISC 2014). Upon reviewing the results of the assessments, the WCPFC Scientific Committee (SC) determined that the North Pacific blue shark stock is not overfished and overfishing is not occurring (WCPFC 2014). Nevertheless, uncertainty was noted in the assessment.
The stock is estimated to be 76% of the unfished level and 162% of B_{MSY}.
Status has not been assessed in the South Pacific.
Impact by gear: LL >> Oth. While a variety of fishing gears catch BSH, in the North Pacific most are caught in longline fisheries.
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: The magnitude of catches by non-tuna fisheries is highly uncertain. In the assessment of North Pacific blue shark, uncertainties in a number of inputs to the assessments, such as the time series for estimated catch, the quality (observer versus logbook) and time spans of abundance indices, the size composition data and many life history parameters such as growth and maturity schedules were noted to influence the assessment (WCPFC 2014).

Other notes: Murua *et al*. 2013 estimates, from observer data and from target/shark catch ratios, suggest that BSH is encountered in low quantities as purse seine bycatch in the Eastern Pacific Ocean.

The analyses of longline observer data from the WCPO has identified the use of wire trace and shark lines as significant variables resulting in the capture of blue shark (Caneco *et al*. 2014). In addition, according to Coelho *et al*. (2013), blue shark sizes are important predictors for estimating at-haulback mortality rates, with the probabilities of dying at-haulback decreasing with increasing specimen sizes.

BIGEYE THRESHER (*Alopias superciliosus*) - BTH

Indian Ocean:

Status: Not assessed.

Impact by gear: GN > LL (Other gears unknown). This species is a known catch of some longline and gillnet fisheries in the Indian Ocean, both as target and as bycatch.

Management: IOTC Res. 12/09 prohibits retention on-board of all species of thresher sharks.

Atlantic Ocean:

Stock status: Not assessed.

Impact by gear: LL > GN. ICCAT's task I nominal catch database shows slightly higher BTH catches from longline than from gillnet fisheries in the AO. A high proportion of LL catches of BTH occur in fisheries targeting sharks and swordfish (Murua *et al*. 2013).

Management: ICCAT Rec 09-07 prohibits the retention on-board of bigeye thresher sharks.

Eastern Pacific Ocean:

Status: Not assessed.

Impact by gear: PS. LL. (Other gears unknown). Murua *et al*. 2013 estimates from observer data and from target/shark catch ratios suggest that BTH is sometimes encountered as a significant PS bycatch in the EPO. Data from an observer program that assessed the impact of the Costa Rican longline fishery between 1999 and 2010 indicate that some thresher sharks catches have occurred in LL fisheries, although the actual magnitude is unknown (Dapp *et al*. 2013).

Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.

Impact by gear: LL, PS. (Other gears unknown). According to available data, longline is the gear responsible for the majority of thresher shark catches in this region. Estimations based on observer data and from target/shark catch ratios indicate that thresher sharks are also caught by purse seine fisheries (SPC 2014).
Thresher sharks, mainly bigeye thresher, were most often observed from deep longline sets in east-central areas of the tropical WCPO (Clarke et al. 2011, 2011b). Catch estimates indicate removals have been stable in the past decade (Lawson 2011) with median estimates for 2006 ranging from ~65,000 to 750,000 individuals (Lawson 2011; Clarke 2009).

Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Bigeye thresher catch data is scarce in all regions and are often reported aggregated at the thresher shark family level. The magnitude of catches by non-tuna fisheries is highly uncertain. Estimates of bigeye thresher sharks post-release survival are not available, but an assessment of at-vessel hooking survival for 12 shark species encountered as bycatch in the US Atlantic pelagic tuna and swordfish longline fishery (1995-2012) resulted in bigeye thresher sharks being one of the species with the lowest estimated survival rates (Gallagher *et al*. 2014).In addition, some studies on the post-release survival of other thresher sharks have been conducted, such as the study by Heberer *et al*. (2010) that estimated a 26% mortality rate of common thresher sharks tailed-hooked during trolling activities of the southern California recreational fishery. When the results of the study were segregated by size, over 41% of the larger sharks (≥180cm Fork Length) did not survive.

<u>Other notes</u>: In the WCPO high proportions of juveniles were found near the estimated center of abundance (15°N, 170°E) (Lawson 2011, Clarke et al. 2011). Few adults were identified in tropical waters (Clarke et al. 2011, 2011b) but in the Japan training vessel dataset most bigeye threshers found north of 20°N exceeded the length at maturity. Mature bigeye thresher are taken in the Hawaii-based longline fishery with trunks retained and marketed while trade in fins is prohibited.

PORBEAGLE (*Lamna nasus*) - POR

Indian Ocean:

Status: Not assessed.
Impact by gear: HL > LL. Available data from the IOTC database shows that handline catches of POR are greater than those of longline fisheries. However, Murua *et al*. (2013) estimated higher LL annual catches.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Exploratory assessments of the North Atlantic stocks indicate that the stock is overfished and that overfishing may be occurring, although uncertainty was noted in both cases.
Stock assessments of South Atlantic stocks were inconclusive (ICCAT 2009).
Impact by gear: LL > GN > Oth. Fisheries with the highest catches of porbeagle use LL, especially those targeting sharks, but porbeagle is also caught with gillnets, pelagic trawl and bottom trawl, and handlines (FAO Fact Sheets, ICCAT database).
Management: ICCAT Recommendation 07-06 limits mortality on porbeagle.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: ? - No catch estimates available.
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: LL (Other gears unknown). Catches reported in the SW Pacific are significant and correspond primarily to Japan and New Zealand´s longline fleets (WCPFC Data Catalogue).
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Unreported longline catches for the Southern Hemisphere are probable and they may be substantial in the SW Atlantic region given the large and increasing longline effort in this area (ICCAT 2009). The magnitude of catches by non-tuna fisheries is highly uncertain.

SHORTFIN MAKO (*Isurus oxyrinchus*) - SMA

Indian Ocean:

Status: Not assessed.

Impact by gear: GN > LL > Oth. Shortfin mako sharks are most frequently caught in the Indian Ocean by gillnet and longline fisheries (Murua *et al.* 2013, IOTC DB). SMA was estimated as the third most vulnerable shark species to purse seine gear (IOTC Species Executive Summaries).

Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Stock assessment indicates that North and South Atlantic stocks are not overfished, and overfishing is not occurring. Nevertheless, uncertainty was noted in the assessment of both Atlantic Ocean stocks (ICCAT 2012b).

Impact by gear: LL >> Oth. The fishing gear type primarily responsible for shortfin mako catches in the Atlantic Ocean is the pelagic longline, by a large margin (ICCAT database, Amande *et al*. 2010).

Management: ICCAT Recommendation 07-06 limits mortality on North Atlantic shortfin mako. ICCAT Recommendation 10-06 prohibits the retention of shortfin mako on-board vessels flagged to countries that do not report catches for this species. ICCAT Rec 14-06 aims to improve data collection and reporting for SMA.

Eastern Pacific Ocean:

Status: Not assessed.

Impact by gear: LL >> PS. Murua *et al*. 2013 estimates from observer data and from target/shark catch ratios suggest that SMA is sometimes a significant PS bycatch in the EPO. More importantly, target/ shark ratio estimates also suggest substantial longline catches of SMA in this region.

Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.

Impact by gear: LL >> PS (other gears unknown). According to available data, longline is the gear responsible for the majority of mako shark catches in this region (WCPFC data catalogue, SPC 2014). Combined catch estimates, by number, based on observer data of shortfin and longfin makos indicate removals have dropped by approximately 50% in the past decade (Lawson 2011), with median estimates for 2006 ranging from ~50,000 to 250,000 individuals (Lawson 2011; Clarke 2009).

Management: No direct measures have been adopted by WCPFC.

Main data Gaps: The only available data in the WCPO are LL catches at the mako shark family level. The magnitude of catches by non-tuna fisheries is highly uncertain.

Other notes: In the WCPO shortfin mako is found over a similar range as the blue shark but at much lower abundances (Compagno et al. 2005). The shortfin mako was categorized as being at "medium" ecological risk for both deep and shallow longline sets (Kirby and Hobday 2007). Few adult makos were identified in the North Pacific, and few adult females were identified in the South Pacific (Clarke et al. 2011b). High proportions of juveniles were found in the Tasman Sea (Clarke et al. 2011b) with a center of abundance for the species identified off northeast New Zealand (Lawson 2011).

RAYS (*Mobulidae*) - MR

Catches of rays are usually reported as aggregated species, which is problematic for conducting single species assessments. Furthermore, since not all grouped data include information for the same species, aggregated data from different regions may not be comparable. The category includes the giant manta ray (*Manta birostris*) and several species of devil rays (*Mobula spp.*) but may include smaller species such as the pelagic stingray (*Pteroplatytrygon violacea*) which is a common bycatch in pelagic longline fisheries.

Indian Ocean:

Status: Not assessed.
Impact by gear: GN > PSFSC > PSFAD. According to the study by Murua *et al*. (2013), estimated annual catches for rays in the IO are predominant in gillnet fisheries, followed by some purse seine catches. Estimates by Amande *et al*. (2012) based on ray bycatch observations on-board European purse seiners show that rays are encountered slightly more frequently in sets on free swimming schools.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: PSFSC > PSFAD > LL. Rays are reported in catches from the AO purse seine fishery (Murua *et al*. 2013, Amande *et al*. 2010). Mas *et al*. (2014) describe mobulid bycatch from observer data in longline fleets operating in the SW Atlantic and points out that the low catches by LL of mobulids is probably due to the use of squid and small fish as bait, and those not being common prey items.
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFSC > PSDOL > PSFAD. LL. Hall *et al*. (2013) estimated annual catches of the manta ray in the EPO tuna purse seine fisheries. That study indicates that average bycatch rates (2007-2009) are greatest in unassociated sets, followed by dolphin sets and, at a much lower level, in sets on floating objects. Data from an observer program that assessed the impact of the Costa Rican longline fishery between 1999 and 2010 indicate that some catches of pelagic stingray and other rays have occurred in LL fisheries, although the actual magnitude is unknown (Dapp *et al*. 2013).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: PS. Estimates of the annual average PS catch of rays in the WCPO are available for the period 2005-2007 (Hall *et al*. 2013).
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Catches of rays have historically been underreported. In some cases where purse seine catches are known, the distinction between different set types is not available. The magnitude of catches by non-tuna fisheries is highly uncertain.

Other notes: Pelagic stingray catches should receive some special attention since they occur in pelagic oceanic waters, and may be a common bycatch in tuna and swordfish longline fisheries. Post-discard survival rates of pelagic stingrays caught in LL fisheries are thought to be low in some areas because the fish are often discarded with serious mouth and jaw damage (www.iucnredlist.org). Murua *et al*. (2013) also present an estimation of pelagic stingray longline catches in the Indian Ocean, while PS bycatch rates in the EPO in 2013 are available from Hall (2014). Guidelines to handling and release of mantas and rays have been developed by ISSF (ISSF-shark and ray handling and release) and Poisson *et al*. (2014).

BILLFISHES

Billfishes are target species of some longline vessels worldwide, but they are also a common by-catch of longline fisheries targeting tuna, and of purse seine tuna fisheries. Billfishes are also a priced target of sport fisheries in some regions of the world, but commonly released after capture. Commercial catches have frequently been reported in aggregated form for more than one billfish species, increasing uncertainty in historical single species catch statistics and stock assessments. Additional studies on the post-release condition and survival of longline caught billfish by species is a general data gap that should be addressed.

BLACK MARLIN (*Istiompax indica*) – BLM

Indian Ocean:

Status: According to the latest stock assessment conducted, the stock is not overfished but is subject to overfishing (IOTC Scientific Committee 2014).
Impact by gear: GN > LL > HL >> PSFAD > PSFSC. Black marlins are mainly caught by gillnets and drifting longlines. Remaining catches are taken by other gears such as handline and purse seine (IOTC database, Ardill *et al*. 2011).
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed. Black marlins are found primarily in the Pacific and Indian oceans.
Impact by gear: LL. According to available data from ICCAT's nominal task I database, BLM in the Atlantic Ocean, while rare, are mostly caught by longline fisheries.
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: LL >> PSFAD > PSDOL > PSFSC. Black marlins are mainly caught in longline fisheries, although they are also captured in purse seine fisheries (IATTC 2014). BLM are more susceptible to capture in purse seine sets on floating objects than in sets on free schools or dolphin associated (Hall 2014).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: LL >> PSFSC ~ PSFAD > HL. According to data from WCPFC yearbook, the largest annual catches come from longline gear; while purse seine and handline fisheries also account for a portion of BLM catches (WCPFC Yearbook, Pilling *et al*. 2013).
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: In the IO, limited data are being reported for coastal gillnet and sport fisheries (IOTC 2013). Overall, little data is available in the tRFMOs.

BLUE MARLIN (*Makaira nigricans*) – BUM

Indian Ocean:

Status: Most recent stock assessment indicates the stock is overfished but not subject to overfishing (IOTC 2014).
Impact by gear: LL >> GN > HL > PSFAD > PSFSC. Blue marlin are mainly caught by drifting longlines and gillnets. Other gears contributing to BUM catches at lower levels are handline and purse seine (IOTC Scientific Committee 2014). Amande *et al*. (2012) estimates of European purse seiner bycatch in the IO (2003-2009) suggest that BUM bycatch is slightly higher in purse seine sets on floating objects.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Most recent stock assessment indicates the stock is overfished and subject to overfishing (ICCAT 2011).
Impact by gear: LL >> GN > TR > PS > HL. Available information on BUM catches in the AO suggest that the majority of catches are from longline fisheries, while other gears such as gillnets and, at a much lower level, traps, purse seines and handlines also contribute to BUM mortality (ICCAT DB).
Management: ICCAT Rec. 12-04 placed catch restrictions for blue marlin.

Eastern Pacific Ocean:

Status: Most recent stock assessment indicates the stock is not overfished and not being overfished (ISC 2013).
Impact by gear: LL >> PSFAD > PSFSC > PSDOL. Although longline fisheries are responsible for most BUM catches (IATTC 2014), some purse seine catches also occur, especially in sets on floating objects (Hall 2014).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Most recent stock assessment indicates the stock is not overfished and not being overfished (ISC 2013).
Impact by gear: LL >> HL > PSFSC ~ PSFAD. Longline fisheries have the highest catches of BUM, followed by handline and purse seine fisheries (WCPFC yearbook, Pilling *et al*., 2013).
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: In the IO, limited data are being reported for coastal gillnet and sport fisheries (IOTC 2013).

STRIPED MARLIN (*Kajikia audax*) – MLS

Indian Ocean:

Status: Most recent stock assessment indicates the stock is overfished and subject to overfishing (IOTC 2014).
Impact by gear: LL >> GN > HL >> PSFAD > PSFSC. Striped marlin are caught predominantly by drifting longlines, but also by gillnets and handlines. Very small catches are attributed to other fisheries, such as purse seiner (IOTC Scientific Committee 2014, Ardill *et al*. 2011).
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed. Striped marlin are found primarily in the Pacific and Indian oceans, with a few apparent stray specimens reported in the SE AO.
Impact by gear: LL. MLS are occasionally caught by longline fisheries in the south eastern Atlantic Ocean.
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean (North):

Status: Most recent stock assessment indicates the stock is not overfished and not subject to overfishing (Hinton and Maunder 2010).
Impact by gear: LL >> PS. Longline is, undoubtedly, the fishing gear that captures the highest numbers of MLS. Gear responsible for lower catches are purse seiners and recreational fisheries (IATTC 2014, Hall 2014, Hinton and Maunder 2010).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status:
North: Most recent stock assessment indicates overfishing is currently occurring and the stock is in an overfished state (ISC 2013b).
South-West: Most recent stock assessment indicates the stock is approaching an overfished state and overfishing is not occurring (Davies et al. 2012). It is estimated that spawning potential (2011) is at ~46% of the unfished level. Recent catches are 5%-20% below the MSY level.
Impact by gear:
North: LL > Oth >> PS. Most of the catch of striped marlin is taken by longline, driftnet and harpoon fisheries (OFP-SPC 2013, WCPFC Yearbook). Purse seine catches of MLS are low (Pilling *et al.* 2013).
South-West: LL >> Oth. MLS are captured mainly by longline fisheries and to a lesser extent by sport fisheries throughout their range in the south western Pacific Ocean (Davies et al. 2012).
Management: WCPFC CMM 2006-04 limits mortality on striped marlin in the SW Pacific. WCPFC CMM 2010-01 limits mortality on North Pacific striped marlin.

WHITE MARLIN (*Kajikia albida*) – WHM

Atlantic Ocean:

Status: Most recent stock assessment indicates the stock is overfished but most likely not undergoing overfishing. However, there was considerable uncertainty in the assessment (ICCAT 2012c).
Impact by gear: LL > PL >> PS_{FAD} > PS_{FSC} > TR > Oth. This species is primarily taken by longline fisheries, but also by pole and line, purse seiner, and by some artisanal fisheries which are targeting marlins, as well as by various sport fisheries located on both sides of the Atlantic. Over 90% of the catches are attributed to bycatch in longline fisheries (ICCAT database, Amande *et al*. 2010).
Management: ICCAT Rec. 12-04 establishes annual landing limits for WHM.

Main data Gaps: Improvements are needed in the monitoring of the fate and amount of dead and live releases, with verification from scientific observer programs; as well as verification of current and historical landings from some artisanal and industrial fleets (ICCAT 2012c).

Other notes: White marlins are distributed in the Atlantic Ocean.

SWORDFISH (*Xiphias gladius*) – SWO

Indian Ocean:

Status: Most recent stock assessment indicates the stock is not overfished and not subject to overfishing, except in the South West IO, where it is overfished (IOTC 2014).

Impact by gear: LL >> GN > HL > PSFAD > PSFSC. Most SWO are caught using drifting longlines, in longline fisheries directed at tunas or swordfish; while the remaining catches are taken by other fisheries, in particular drifting gillnets and handlines (IOTC Scientific Committee 2014). Catches of SWO in purse seine fisheries are low and generally occur in sets on floating objects (Amande *et al*. 2012).

Management: IOTC Resolution 12/11 put a stop to any increase in fishing capacity for fleets targeting swordfish in the Indian Ocean.

Atlantic Ocean:

Status:

Atlantic (North and South): Most recent stock assessment indicates the stock is not overfished and not subject to overfishing (ICCAT 2013b).

Mediterranean: Most recent stock assessment indicates the stock is overfished and subject to overfishing; however, there is considerable uncertainty about the stock status (ICCAT 2014).

Impact by gear: LL >> GN > HL. The main fishing gears having the greatest impact are surface longline and gillnet. SWO are also caught with other gears such as handlines, harpoons, trolls and traps. It is often found as bycatch of longlines and driftnets targeting albacore, purse seines, etc. (ICCAT database, Amande *et al*. 2010).

Management:

ICCAT Rec. 94-14: For the management of Atlantic Swordfish

ICCAT Rec. 01-04: For evaluating alternatives to reduce catches of juveniles or dead discards of swordfish.

ICCAT Rec. 03-04: Relating to Mediterranean swordfish.

ICCAT Rec. 11-02: For the conservation of North Atlantic swordfish

ICCAT Rec. 11-03: For management measures for Mediterranean swordfish in the framework of ICCAT.

ICCAT Rec. 12-01: On South Atlantic swordfish catch limits.

Eastern Pacific Ocean:

Status:

North: Most recent stock assessment indicates the stock is not overfished but may be experiencing overfishing (ISC 2014b).

South: Most recent stock assessment indicates the stock is not overfished and not experiencing overfishing (Hinton and Maunder 2011).

Impact by gear: LL >> Oth. The vast majority of SWO catches are taken in longline fisheries, a portion of which are taken as bycatch in tuna targeting fisheries. Some artisanal fisheries also exist which use predominantly harpoon and gillnet gear (IATTC 2014, IATTC database).

Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status:
North: Most recent stock assessment indicates the stock is not overfished and not subject to overfishing (ISC 2014b).
South: Most recent stock assessment indicates the stock is not overfished and not subject to overfishing (Davies *et al*. 2013). It is estimated that spawning potential is at ~26-60% of the unfished level. Recent catches are between 82% and 102% of the MSY level.
Impact by gear: LL >> GN > Oth. Longline fleets dominate the catches of swordfish, a portion of which are taken as bycatch in tuna targeting fisheries (OFP-SPC 2013, WCPFC Yearbook).
Management: WCPFC CMM 2009-03 limits mortality on swordfish.

SAILFISH (*Istiophorus albicans, Istiophorus platypterus*) – SAI/SFA

Indian Ocean:

Status: Uncertain. However, data poor-methods for stock assessment using Stock reduction analysis (SRA) techniques indicate that the stock is not overfished and is close to or exceeding maximum sustainable yield levels (IOTC 2014).
Impact by gear: GN >> HL > LL > PSFAD > PSFSC. Indo-Pacific sailfish is caught mainly by gillnets, while it is also caught by other gears such as handline, longline and purse seine (IOTC Scientific Committee 2014, Ardill *et al*. 2011).
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Most recent stock assessment indicates that both the East and West Atlantic stocks may be overfished and subject to overfishing, with the results for the eastern stock more pessimistic than those for the western stock (ICCAT 2009b).
Impact by gear: LL >> GN > HL > PSFSC > PSFAD. According to catches registered in ICCAT's task I nominal catch database, annual catches by longline gear of Atlantic sailfish (*Istiophorus albicans*) predominate over all other fishing gear, followed by gillnet fisheries (ICCAT database, Amande *et al*. 2010).
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Uncertain. An attempt to assess the northern and southern stocks provided unreliable results (Hinton and Maunder 2013).
Impact by gear: LL >> PSDOL > PSFSC > PSFAD. The principal fisheries that capture sailfish in the EPO are longline fleets targeting tuna and non-tuna species. Sailfish are also taken occasionally in the purse seine fisheries targeting tropical tunas (IATTC 2014). Dolphin associated purse seine sets have a slightly higher catch of sailfish than sets on free schools and sets on floating objects (Hall 2014).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: LL >> PSFSC ~ PSFAD. WCPFC Data Catalogue catch information reflects a predominance of longline catches of sailfish in the WCPO. The impact of purse seine catches compared to that of longline is low in this region (Pilling *et al.* 2013)
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Reported catches from gillnet and sport fisheries in the IO are incomplete (IOTC 2013). Reporting of sailfish catches in the Atlantic Ocean is thought to be incomplete, particularly for the most recent years. Besides, historical catches of unclassified billfish continue to be reported to ICCAT, making the estimation of sailfish catch difficult (ICCAT 2012c). It should be noted also that artisanal fishermen harvest a large part of the sailfish catch along the African coast (ICCAT 2012c).

BONY FISHES

Some bony fishes frequently caught in tuna purse seine fisheries are commonly targeted by a range of fisheries that include artisanal, recreational and subsistence fisheries; which have a significant cultural and economic value. Bony fishes that are commonly captured in tuna fisheries by gear types other than purse seine are not listed here.

MAHI MAHI (*Coryphaena hippurus and equiselis*) – MAH

Indian Ocean:

Status: Not assessed.
Impact by gear: GN > LL > PSFAD > PSFSC > HL. Available data suggests that longline catches are lower than gillnet catches, but higher than catches in purse seine and handline fisheries (IOTC database). Purse seine catches in the IO reached more than 350 tonnes in 2010 (Ardill *et al*. 2011). MAH bycatch estimates by Amande *et al*. (2012) suggest that purse seine sets on floating objects have a significantly higher impact on MAH compared to sets on free swimming schools of tuna.
Management: IOTC Res. 13/11 recommends purse seine vessels to retain on board and land non-targeted species such as dolphinfish.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: LL > HL ~ PSFAD > PSFSC > Oth. In the AO this species is predominantly caught by longline vessels, but also by other fisheries such as handline, purse seine, trolling, baitboat and gillnet (ICCAT database, Amande *et al*. 2010).
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: LL >> PSFAD > PSFSC. Annual dolphinfish catch in the EPO by longline fisheries amount to a much higher number than purse seine catches and some dolphinfish targeted longline fisheries exist in Central and South America (IATTC 2014). An estimate of the average annual dolphinfish bycatch for the different purse seine set types in 2013 shows that FAD sets represent the highest proportion of dolphinfish bycatch (Hall 2014).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: LL > PSFAD > PSFSC (Other gears unknown). No information on dolphinfish catches in the WCPO is currently being reported by WCPFC. Nevertheless, aggregates of estimates of longline and purse seine catches based on observer data are available (SPC 2014), Pilling *et al*. (2013) provided estimates of annual catches by free school and floating object purse seine sets in the WCPO (2008-2010) and an estimate of all purse seine catches in the WCPO is given by Hall *et al*. (2013) for the period 2003-2005. Catches in purse seine sets on FADs appear substantially higher than those from free school sets.
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Data on dolphinfish catches in the Indian and West Pacific oceans are scarce.

Other notes: Dolphinfish is caught occasionally by driftnets and it is an important target species in artisanal and semi-industrial fisheries. Small quantities are taken as bycatch in longline and driftnet fisheries; however, its overall catch is increasing due to increases in the numbers of sets on FADs (www.iucnredlist.org).

WAHOO (*Acanthocybium solandri*) – WAH

Indian Ocean:

Status: Not assessed.

Impact by gear: GN > HL >> LL > PSFAD > PSFSC. In the IO the predominant fishery catching wahoo is gillnet. Other fisheries contributing to WAH catches at a lower level are handline, longline and purse seine (IOTC database). According to Amande *et al*. (2012) WAH are more commonly encountered in purse seine sets on floating objects.

Management: IOTC Res. 13/11 recommends purse seine vessels to retain on-board and land non-targeted species such as wahoo.

Atlantic Ocean:

Status: Not assessed.

Impact by gear: LL > HL > TR > PSFAD > Oth. In the AO wahoo are exploited mainly by coastal fisheries and often by artisanal fisheries, although substantial catches are also made, either as target species or as bycatch, by purse seiners, mid-water trawlers, handlines, troll lines, driftnets, surface drifting long-lines and small scale gillnets. Several recreational fisheries also catch wahoo. In the southwest Atlantic this species is caught by artisanal handline and trolling in the northeast and central Brazil, as bycatch in industrial longliners and in game fisheries (www.iucnredlist.org, Amande *et al*. 2010). According to ICCAT´s nominal catch database, the highest annual average catch in the AO relies on handline, troll and longline fisheries.

Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.

Impact by gear: PSFAD > PSFSC. LL. WAH is often caught as bycatch in purse seines, especially in sets on floating objects (IATTC 2013, IATTC 2014b, www.iucnredlist.org). Data from an observer program that assessed the impact of the Costa Rican longline fishery between 1999 and 2010 indicate that some wahoo catches have occurred in LL fisheries, although the actual magnitude is unknown (Dapp *et al*. 2013).

Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.

Impact by gear: LL > PSFAD > PSFSC. This species is primarily caught by longline and purse seine fisheries in the WCPO, especially in sets on floating objects (Hall *et al.* 2013, Pilling *et al.* 2013, SPC 2014, www.iucnredlist.org).

Management: No direct measures have been adopted by WCPFC.

FRIGATE TUNA (*Auxis thazard*) – FRI

Indian Ocean:

Status: Not assessed.

Impact by gear: HL > GN > PSFAD > PSFSC >> LL ~ PL. Catches available from the IOTC database present very high catches for several gears such as handline, gillnet and purse seine. Purse seine catches include industrial PS bycatch and some targeting ring net fisheries. Frigate tunas are also caught in longline, pole and line and other fisheries (IOTC Scientific Committee 2014). Estimates by Amande *et al*. (2012) based on FRI bycatch observations on-board European purse seiners indicate that frigate tunas are more frequently encountered in sets on floating objects.

Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:

Status: Not assessed.

Impact by gear: PSFAD > PSFSC >> PL > GN > MWTW > HL ~ LL > Oth. Catches reported in the AO show a predominance of catches by purse seiners (mainly as bycatch), although this species is caught by several other gears such as pole and line, gillnet, mid-water trawls, handline and longline (ICCAT database, Amande *et al*. 2010).

Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.

Impact by gear: PSFAD > PSFSC > PSDOL. Estimated bycatch of PS fisheries in the EPO in recent years are higher for sets on floating objects than for sets on free swimming schools, while estimates for dolphin associated sets are much lower in comparison (IATTC 2013, IATTC 2014b). These rates include aggregated data for both *Auxis thazard* and *Auxis rochei*.

Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.

Impact by gear: PS. *Auxis* spp. are targeted by small scale purse seine and ringnet in the far western Pacific region and also appear as bycatch in industrial purse seine fisheries. Catch estimates are poorly documented and bycatch estimates are not available.

Management: No direct measures have been adopted by WCPFC.

Main data Gaps: Catch estimates for frigate tunas in the Indian Ocean were derived from very small amounts of information and are therefore highly uncertain (IOTC Species Executive Summary). It is important to note that both in the Indian and in the Atlantic Ocean catches are highly uncertain and may refer to *Auxis* spp. Information of catches in the WCPO are scant.

RAINBOW RUNNER – RR (*Elagatis bipinnulata*)

Indian Ocean:

Status: Not assessed.
Impact by gear: PSFAD > PSFSC. Rainbow runners are commonly caught as bycatch in tuna-targeting purse seine fisheries. According to Ardill et al. (2011), catches of rainbow runners in purse seine fisheries in the IO are relatively high. Rainbow runner bycatch estimates by Amande *et al*. (2012) suggest that purse seine sets on floating objects have a significantly higher impact on RR compared to sets on free swimming schools.
Management: IOTC Res. 13/11 recommends purse seine vessels to retain on board and land non-targeted species such as rainbow runner.

Atlantic Ocean:
Status: Not assessed.
Impact by gear: PSFAD > PSFSC. Purse seine fisheries are responsible for most RR catches in the AO (Hall *et al.* 2013, Amande *et al*. 2010).
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:
Status: Not assessed.
Impact by gear: PSFAD > PSFSC >> GN ~ LL. According to Hall *et al.* (2013) annual average PS catches in the EPO were lower in sets on free schools than in sets on floating objects. Low quantities in catches of *carangid* spp. are reported from gillnet and longline fisheries (IATTC 2014).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:
Status: Not assessed.
Impact by gear: PSFAD > PSFSC >> LL. Rainbow runner catches reported in Hall *et al.* 2013 for the WCPO purse seine fishery are higher than those estimated by WCPFC's Scientific Committee in 2013 (Pilling *et al.* 2013). The difference may be caused by the earlier time period of Hall´s data. According to Pilling *et al*. (2013), sets by purse seine vessels on floating objects are the predominant set type in which RR are caught. Aggregates of estimates of longline and purse seine catches based on observer data suggest that catches of rainbow runner by longline fisheries are much lower those by purse seine (SPC 2014).
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: There is a general lack of information on the mortality of this species following capture by purse seine vessels.

YELLOWTAIL – YT (*Seriola* spp.)

Indian Ocean:
Status: Not assessed.
Impact by gear: LL > HL (other gears unknown). Available data on yellowtail catches in the Indian Ocean are highly scarce.
Management: No direct measures have been adopted by IOTC.

Atlantic Ocean:
Status: Not assessed.
Impact by gear: PS >> PL ~ LL. Although some yellowtail are found as bycatch in pole and line and longline fisheries in the Atlantic Ocean, the vast majority of incidental catch of yellowtail are caught by purse seine fleets (ICCAT database).

Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFAD > PSDOL > PSFSC (Other gears unknown). Purse seine sets on floating objects, commonly kelp paddies in the northern coastal areas off Baja CA, Mexico, cause the highest mortality of yellowtail, followed by dolphin-associated sets; whereas sets on free schools of tuna have a negligible impact on this species (Hall 2014). *Seriola lalandi* is a very popular target of sport fisheries off Baja CA, Mexico.
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: PS. No specific data available.
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: There is a general lack of information on the mortality of this species as by-catch. Data on yellowtail catches is often included in a higher category (carangids) or reported jointly with rainbow runner catches. Very few sources provide data at the species level.

OCEANIC TRIGGERFISH – TRI (*Canthidermis maculatus*)

Indian Ocean:

Status: Not assessed.
Impact by gear: PS. In the Indian Ocean, triggerfish have a significant presence in purse seine fisheries (Ardill *et al*. 2011).
Management: IOTC Res. 13/11 recommends purse seine vessels to retain on board and land non-targeted species such as triggerfish.

Atlantic Ocean:

Status: Not assessed.
Impact by gear: PSFAD > PSFSC. In the Atlantic, significant quantities of triggerfish are captured in purse seine fisheries, particularly in sets on floating objects (Amande *et al*. 2010)
Management: No direct measures have been adopted by ICCAT.

Eastern Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFAD. Triggerfish are predominantly captured in sets on floating objects in the Eastern Pacific Ocean purse seine fisheries (IATTC 2013, IATTC 2014b).
Management: No direct measures have been adopted by IATTC.

Western Pacific Ocean:

Status: Not assessed.
Impact by gear: PSFAD > PSFSC. Although reliable catch estimates are not available, triggerfish have been frequently observed in purse seine sets (Bailey et al. 1996; Hall *et al*. 2013). See *Other notes*.
Management: No direct measures have been adopted by WCPFC.

Main data Gaps: There is a lack of information regarding the mortality rates and post-release survivorship of triggerfish following capture by purse seine vessels. Besides, problems of estimation, identification, escape through the meshes in unknown condition, retention enmeshed in the net or inconsistent treatment by observers and researchers make the data on this group of the smaller species very uncertain, and hard to compare among regions and observer programmes (Hall *et al*. 2013).

Other notes: Observer data from purse seine fisheries in the WCPO (1994-2009) held by the Oceanic Fisheries Programme (OFP) describe the proportions of triggerfish in different purse seine fishing methods: 12% in log associated sets, 5% in anchored FAD sets, 8% in drifting FAD sets and 1% in unassociated sets (OFP – SPC 2010).

SEA TURTLES

The status of the global population of a marine turtle species in a given ocean region does not always reflect the real status of some of its subpopulations. Marine turtle subpopulations may vary widely in population size, geographic range and population trends, which makes it necessary to study marine turtles at a subpopulation level.

Threats to marine turtles vary across regions, but general categories include fisheries bycatch (i.e. incidental capture by marine fisheries operations targeting other species), take (e.g. utilization of eggs, meat or other turtle products), coastal development, pollution and pathogens, and climate change (Wallace *et al*. 2011).

Fisheries bycatch occurs because the long oceanic migration of most marine turtles leads them to interact with coastal and open ocean fisheries worldwide (Bourjea *et al*. 2014). Incidental capture in fishing gear such as trawls, longlines and gillnets, as well as the ingestion or entanglement in discarded or lost fishing gear, are all cited as major sources of mortality for sea turtles (IAC 2006). Fisheries with turtle interaction comprise tuna and non-tuna targeting fleets, but published literature does not always facilitate the distinction between the two.

Indian Ocean:

Status/abundance:

- Leatherback: The North East subpopulation is relatively data poor. Nesting beach monitoring is limited because of the remoteness of nesting beaches and unavailability of sufficient infrastructure and resources. Therefore, continuous long-term datasets are not available. Additionally, since the 2004 tsunami, access to many key nesting sites has become more logistically challenging. The Western Indian population is currently stable; it has substantially recovered over the last 40 years because egg exploitation is no longer a threat (Saba *et al*. 2008).
- Loggerhead: North and South East populations are at risk, in particular, the North IO subpopulation is considered by Wallace *et al*. (2011) as one of the world's most endangered Regional Management Units (RMUs) (Wallace *et al*. 2011). These turtles are under high threat, mostly because of fisheries bycatch in trawls and nets, as well as ongoing development of coastal areas where they nest (SWOT 2011). The South West population, although currently it is not likely at immediate risk; according to Conant *et al*. (2009) its status is likely to worsen in the foreseeable future. The North West population, despite being the largest loggerhead nesting population in the world, has had its monitoring efforts become consistent only recently, which means that relatively little is known about this population. Threats from fisheries bycatch appear to be severe, but the sheer abundance of nesting loggerheads in this region seems to counteract those impacts (SWOT 2011).
- Green turtle: Information from the North Indian Ocean subpopulation is deficient (Wallace *et al*. 2011). Although green turtles in the South Western IO have not been monitored for long, they are considered as one of the healthiest turtle populations. These turtles are abundant and fairly isolated, they nest along the rugged and remote coast of Western Australia; and although consumption of eggs and turtles by humans poses a threat to them on beaches and in the water, the risk to this subpopulation is minimal (SWOT 2011).
- Hawksbill: Trade statistics going back more than 100 years indicate massive declines of up to 95 percent in hawksbill populations, specifically in Madagascar, Seychelles, and Sri Lanka (SWOT 2006). According to Wallace *et al.* (2011), the North East IO RMU is one of the world's most endangered. The

size and status of this population is poorly known, making monitoring and conservation work very important for its continued survival (SWOT 2011). On the contrary, the South East IO subpopulation is one of the healthiest. Nesting in isolated places gives these hawksbills an advantage that allows them to thrive. Although monitoring has been occurring only in recent years, threats to this population appear mild (SWOT 2011). In the South West, these hawksbills benefit from solid long-term monitoring and good protection at major nesting sites and in their coral reef habitats. As with all hawksbills, exploitation of their shells for handicrafts and jewellery is a constant threat. Although this population is historically depleted as a result, it is healthy and recovering at present (SWOT 2011).

- Olive Ridley: Despite the massive numbers of olive ridleys that nest in a few locations in India each year, extremely intense pressures from trawl bycatch, development of major shipping ports along the coast of India and consumption of turtle eggs and meat have made the seemingly abundant ridleys decline dramatically regionwide (SWOT 2011). The West Indian Ocean RMU is considered by Wallace et al. (2011) as one of the world's most endangered (Wallace *et al*. 2011).
- Flatback: Northern Australia subpopulation is believed to be at low risk and under high threats (Wallace *et al*. 2011), such as direct harvest for meat and eggs, incidental capture in fishing gear, feral predators, destruction of nesting beaches from coastal development, pollution and destruction of feeding habitats (http://www.environment.gov.au/). It must be noted that flatback turtles are one of the most poorly understood marine turtle species and are therefore classified as *Data Deficient* by the IUCN (www.iucnredlist.org).

Fisheries interaction: In the IO, trawls and longlines present a similar impact on sea turtles populations. According to Waugh *et al*. (2013), South Asia is one of the areas where turtles are most affected by gillnet fishing. The marine turtle species most affected in the IO according to Wallace *et al*. (2013) and Amande *et al*. (2012) are Olive Ridley turtles.
Nel *et al*. 2013 estimated relative catches by fishing gear and turtle species (**Table 1**). Note that these figures do not necessarily represent cases of turtle mortality.

Table 1. Relative impact of each gear type per species caught. *(Species are Cc= Caretta caretta, Cm= Chelonia mydas, Dc= Dermochelys coriacea, Ei= Eretmochelys imbricata, Lo= Lepidochelys olivacea, Nd= Natator depressus, Ui= Unidentified)*.

Fishery	Cc	Cm	Dc	Ei	Lo	Nd	Ui (unidentified)
Longline (LL) (10%)	13%	0%	69%	0%	7%	0%	89%
Purse seine (PS) (1%)	0%	0%	0%	2%	2%	0%	11%
Gillnet (GN) (89%)	87%	99%	31%	98%	91%	100%	0%

Amande *et al.* (2012) provide bycatch information based on observer data from European purse seiners (2003-2009) which indicates that Olive Ridley, Green and Loggerhead turtles were only observed in purse seine sets on free swimming schools, whereas Kemp's Ridley turtles were only observed in sets on floating objects.

Management: IOTC Resolution 12/04 (which supersedes various prior measures) requires IOTC members to mitigate sea turtle mortality and to provide data on turtle bycatch to the SC. The measure has specific requirements for longline and purse seine operators to facilitate the appropriate handling and release of live turtles. Resolution 13/08 calls for a transition to non-entangling FADs in purse seine fisheries starting in 2014.

Atlantic Ocean:

Status/abundance:

- Leatherback: Subpopulation in the NW is large and increasing due to conservation efforts to maintain beach protection and to address significant bycatch issues (SWOT 2011). Nevertheless, leatherbacks are at risk from longline, gillnet, trawl and pot fisheries throughout the north Atlantic (NFWF 2009). The subpopulation in the SE is the largest and healthiest subpopulation of leatherback in the world. The existence of these large subpopulations provides a conservation buffer for the species globally (www.iucnredlist.org). Nevertheless, leatherback turtles from Atlantic African nesting beaches face great pressure from fisheries off the coasts of Brazil, Argentina, and Uruguay (SWOT 2006).
- Loggerhead: North Atlantic and Mediterranean populations are currently at risk. The risk is higher in the Eastern North Atlantic due to the ongoing directed lethal take of nesting females and low hatching and emergence success. In the South Atlantic, although the risk is not immediate, it is likely to increase substantially in the foreseeable future, mainly due to the mortality of juvenile loggerheads from fishery bycatch (longline fleets operating in the SW coast of Africa that target both swordfish and tuna, among other gears) (Conant *et al*. 2009). At the major rookery at Archie Carr Refuge in Florida, USA, nesting has declined by more than 50 percent in the past five years (SWOT 2006).
- Green Turtle: In the major rookeries, located in Turkey, populations have declined by 60–90 percent in 17 years (SWOT 2006). Green turtles in the Caribbean have declined by more than 95 percent in the past 400 years. The loss of a number of rookeries has significantly reduced genetic diversity of green, and current take of adult green turtles is greater than 11,000 per year in Nicaragua (SWOT 2006). However, green turtles in the South West are on the rise. Although coastal net bycatch is still a threat, collaborative conservation efforts throughout the region are ensuring a positive outlook for this population (SWOT 2011).
- Hawksbill: Nesting in the Caribbean has declined by more than 60 percent at the largest rookery, located in Mexico, in the past five years (SWOT 2006). However, Caribbean stocks have stabilized and some have begun to increase. Hawksbills are still hunted in some areas of the Caribbean, but the single greatest threat to the species may be accidental capture in artisanal fisheries, especially gillnet fisheries (NFWF 2009). According to Wallace *et al*. (2011) the East Atlantic Ocean is one of the most endangered RMUs in the world.
- Kemp's Ridley: Kemp's Ridleys' small population size has declined more than 95 percent in less than 50 years, and they live within a limited range (SWOT 2006). Although the Kemp's ridley has become increasingly secure, threats remain. While the adoption of Turtle Excluder Devices (TEDs) in Mexican and U.S. shrimp fisheries has greatly reduced bycatch, Kemp's ridleys continue to be captured, injured and killed by numerous fisheries in the Gulf of Mexico and along the Atlantic seashore (NFWF 2009).
- Olive Ridley: In the Eastern Atlantic, the subpopulation is at low risk but under high threats. The Western Atlantic subpopulation is at high risk and under high threats (Wallace *et al*. 2011). The main threats faced by this species are egg and meat harvest and fisheries bycatch. The highest number of incidental

captures occurs in the shrimp trawl fisheries in the Western Atlantic, but this is not the only fishery in the Atlantic where olive ridleys are caught. For instance, bycatch in commercial fisheries in the Eastern Atlantic is thought to be a significant threat as well, but very little data is available (www.iucnredlist.org).

Fisheries interaction: A study of fisheries bycatch in marine turtle populations conducted by Wallace *et al.* (2013) concluded that the highest impact rates occurred in the Atlantic. The RMU-gear combination that resulted on the highest bycatch per unit of effort was the trawl fishery (e.g., shrimp trawls) in the SW Atlantic, affecting primarily loggerhead turtles, as well as green sea turtles.
As concerns purse seine fisheries, some species of sea turtles, such as the olive ridley, are attracted to floating objects, perhaps searching for food or shelter, and are captured in sets on FADs or logs. As the FADs usually have webbing hanging below them, the turtle may become entangled in the FAD, and if it is not released it may die (Hall *et al*. 2013). The frequency of turtle capture in the Atlantic Ocean by different purse seine types is summarised in **Table 2**. Olive ridleys are the most frequently encountered turtles, in sets on both free schools and floating objects (Hall *et al*. 2013). Note that data included in **Table 2** reflect captures, not necessarily turtle mortality.

Table 2.Turtle capture frequency in the Atlantic, 2001-06. (Original source: Sarralde *et al.* 2006)

	FSC (%)	FAD (%)
Olive Ridley	1.3	1.8
Kemps Ridley	0.1	0.8
Loggerhead	0.1	0.6
Green	0.4	0.4
Hawksbill	–	0.4
Leatherback	1.1	0.1

According to the Ecological Risk Assessment by Angel *et al*. (2013), purse seine fishing poses negligible threats to turtles relative to longline fishing in the Atlantic Ocean. Longline fisheries targeting swordfish are generally more dangerous to sea turtles than those targeting tuna because hooks in the former fishing mode are shallower in the water column and light sticks are used, which turtles are attracted to.

Management: ICCAT Recommendations 10-09 and 13-11 set up reporting requirements for sea turtle interactions and mandates its scientific committee to assess, by 2014, the impact of tuna fisheries on sea turtle populations. The measure has specific requirements for longline operators to be trained on appropriate handling and release of live turtles so as to maximize their survival. ICCAT Recommendation 13-01 states that ICCAT contracting parties should promote FADs whose design can reduce the entanglement of marine turtles (among other species).

Eastern Pacific Ocean:

Status/abundance:

- Leatherback: The East Pacific Ocean RMU was identified by Wallace et al. (2011) as one of the world's most endangered RMUs. This population is one of the best studied in the world, so its 90 percent decline in the past 20 years is very well known. However, despite decades of conservation efforts at key nesting sites, leatherbacks remain scarce in the East Pacific. Historic egg consumption, as well as coastal and high-seas bycatch (mainly Chilean longline fisheries targeting swordfish and Peruvian artisanal fisheries targeting sharks, rays, bonitos and dolphinfish; but also other fisheries like driftnets in the North Pacific targeting squid and tuna in the 80's and 90's), caused this population's decline (Eckert 1997, Alfaro-Shigueto 2010).Now coastal development looms as the newest threat to its survival (SWOT 2011). Bycatch in Chilean and Peruvian fisheries is still considered the major obstacle to population recovery (NFWF 2013)

- Loggerhead: Pacific Ocean populations are currently at risk. In the US Pacific, LL fisheries targeting swordfish and tuna and drift gillnet fisheries targeting swordfish have been identified as the primary fisheries of concern for loggerheads, although bycatch in these fisheries has been significantly reduced as a result of conservation measures implemented (Conant *et al*. 2009).
- Green turtle: This population underwent a perilous decrease in numbers in past decades because of substantial turtle harvest for their meat and eggs throughout the region, especially in Mexico. However, because stricter controls on trade of turtle products were enforced, green turtles have made a remarkable comeback in this region. Although still at a fraction of their historic population size, green turtles in the East Pacific are no longer in immediate risk (SWOT 2011).
- Hawksbill: Wallace et al. (2011) identified the East Pacific Ocean RMU as one of the world's most endangered RMUs. The main reasons for this categorization are their use of habitats previously unknown to scientists (mangrove estuaries), extremely low numbers, and severe threats of coastal bycatch and egg consumption (SWOT 2011).
- Olive's Ridley: Harvest for meat, eggs, and skin was rampant in the past and resulted in steep declines in the abundance of olive ridleys in the East Pacific. Although some mass nesting sites have not recovered, others have resisted these impacts and remained considerably abundant. The biggest rookery in the world hosts hundreds of thousands of nesting females each year. Serious threats still exist in this region, especially because of bycatch in shrimp trawl fisheries, longline fisheries (tuna and non-tuna), tuna purse seine fisheries (mainly on FAD sets) and other smaller fisheries. Nevertheless, bycatch information is in many cases incomplete and there are no reliable estimates of post-release survival when specimens are captured alive and released back to the sea (Frazier *et al*. 2007). Despite these threats, this population of sea turtles is presently one of the most abundant on the planet (SWOT 2011).

Fisheries interaction: Marine turtles are extensively threatened by fisheries bycatch in the EPO. Some of the gears with a highest impact are trawls (principally those targeting shrimp), longlines and drift gillnets. Hall *et al*. (2013) concluded that, in the EPO, olive ridley turtles are those most affected by tuna purse seine fisheries, especially when FADs are involved (**Table 3**).

Table 3. Average number of marine turtles caught in large PS fisheries in the EPO (2007-2009)

EPO	FSC	FAD	DOL
Olive Ridley	0.7	12	3.3
Unid. Turtle	0.7	6.7	2
Green	0.7	0.7	0
Loggerhead	0	1.3	0
Hawksbill	1.3	0.7	0
Leatherback	0	0	0

Management: IATTC Resolution C-07-03 requires fishermen to release sea turtles entangled in FADs or caught in longlines and to avoid encircling them with purse seine nets. The resolution also calls for research to mitigate sea turtle bycatch, especially with gear modifications. Resolution C-13-04 calls for a transition to non-entangling FADs in purse seine fisheries.

Western Pacific Ocean:

Status/abundance:

- Leatherback: The West Pacific subpopulation has declined >80% over three generations and is projected to decline further in coming decades. Because the threats to this subpopulation (e.g. human take of females and eggs, low hatching success, fisheries bycatch) have not ceased, the West Pacific Leatherback subpopulation is considered *Critically Endangered* according to IUCN Red List Criterion A2 and A4 (www.iucnredlist.org).
- Loggerhead: Pacific Ocean populations are currently at risk, one of the main reasons being bycatch by tuna longliners in the Western Pacific and South China Sea (Conant *et al*. 2009). Nesting in the Pacific (principally Japan and Australia) has declined by more than 90 percent over the past 25 years (SWOT 2006).
- Green turtle: This species have suffered substantial declines in nesting in this region (SWOT 2006). South and Central Pacific subpopulations seem to be healthy, but better assessments of their status are necessary to help future conservation efforts (SWOT 2011). The Hawaiian subpopulation has demonstrated a strong recovery pattern following 30 years of harvest prohibition (Balazs et al. 2004).
- Hawksbill: Nesting of hawksbills in this region has suffered important declines (SWOT 2006). The West Pacific RMU is considered by Wallace et al. (2011) as one of the world's most endangered, although the South West subpopulation seems to be healthy in spite of the current exploitation of their shells and impacts from future climate changes (SWOT 2011).
- Olive Ridley: This species have suffered substantial declines in nesting in the Western Pacific (SWOT 2006). Olive Ridleys are found as bycatch in longline, gillnet and trawl fisheries; but there is little systematic information on their incidental capture and mortality in the Western Pacific ocean (Frazier et al. 2007).
- Flatback: Eastern Australia subpopulation is believed to be at high risk and under high threats (Wallace *et al*. 2011), which include direct harvest for meat and eggs, incidental capture in fishing gear, feral predators, destruction of nesting beaches from coastal development, pollution and destruction of feeding habitats (http://www.environment.gov.au/). It must be noted that

flatback turtles are one of the most poorly understood marine turtle species and are therefore classified as *Data Deficient* by the IUCN (www.iucnredlist.org).

Fisheries interaction: In the Pacific Ocean, longlines seem to be the most harmful gear for turtles. South-East and East Asia are some of the areas where turtles are most affected by gillnet fishing according to the study published by Waugh *et al*. (2013). The marine turtle species most affected according to Wallace *et al*. (2013) are Olive Ridley turtles.

Table 4 shows nominal purse seine CPUEs (turtles/ 100 sets) of marine turtles from different studies realized in the past decades. Animal association sets (live whales and whale sharks) are those with the highest CPUE, but these sets represent only a small proportion of the total. Hall *et al.* (2013) also state that the total estimated mortality of marine turtles in purse seine fisheries in the WCPO is probably fewer than 20 individuals per year, given that the majority of marine turtle encounters result in a live capture and release.

Table 4.Estimated nominal CPUE (turtles/ 100 sets) in the WCPO

Nominal CPUE (turtles/100 sets)	1993–1994	1995–2000	1995–2007
School	1.34	0.11	0.61
Log	1.92	0.81	0.78
FAD		0.07	0.28
Payao (anchored FAD)		0.62	0.78
Animal association		1.11	1.61

Original sources: Bailey, Williams and Itano (1996) and OFP (2001) for 1995–2000; Williams, Kirby and Beverly (2009) for 1995-2007

Management: WCPFC CMM 2008-03 instructs WCPFC members to implement the FAO (2009) guidelines for reducing sea turtle mortality, and requires longline operators to use line cutters and de-hookers to handle and promptly release sea turtles caught or entangled. The measure also requires purse seine operators to avoid setting on turtles if possible and to disentangle/release them when caught alive.

Main data Gaps: There is a general scarcity of data from small-scale and coastal fisheries (Lewison 2014). Wallace *et al.* (2010) states that the distribution of putative RMUs illustrates gaps in scientific understanding of marine turtle biogeography in much of the Indian Ocean, and biogeography of hawksbill and leatherback turtles in particular. The Green turtle North Indian Ocean RMU was classified as data deficient by Wallace et al. (2011). In spite of the Olive Ridley being the most abundant sea turtle, available quantitative information is extremely scarce and unevenly distributed across regions (www.iucnredlist.org).

Other notes: Most RFMOs require the release of marine turtles alive. Although turtles in purse seine fisheries are almost always released without any visual signs of damage, there are poor estimates of post-release survival: with low observer coverage, as is the case in most oceans, and the infrequent encounters of marine turtles during purse seine sets; it is difficult to produce solid estimates of sea turtle mortality (Hall *et al*. 2013).

The result from a recent study by Bourjea *et al*. (2014) suggests that the number of incidental captures of marine turtles in purse seine fisheries in the Atlantic Ocean is similar in drifting FADs (DFAD) sets and in free school sets. However, in the Indian Ocean, higher turtle catches are observed in sets on DFADs than on free schools.

Skipper's Guidebooks were released by ISSF in 2014 with guidelines on how to release marine turtles caught in purse seine nets (ISSF- PS Skipper's Guidebook) and longline (ISSF- LL Skipper's Guidebook) sets, as well as bycatch mitigation methods such as the use of circle hooks in longline fisheries.

In order to reduce by-catch of marine turtles in FADs, non-entangling FADs need to be designed and adopted by the fishing industry. IOTC, ICCAT and IATTC have adopted measures that require a transition to non-entangling FADs (IATTC 13-04; IOTC 13/08; ICCAT 13-01). The *ISSF Guide for Non-Entangling FADs* presents recommendations on FAD designs and selection of materials that can help reduce bycatch (ISSF Guide for Non-Entangling FADs).

Nevertheless, direct bycatch mitigation methods are not the only means of conserving sea turtle populations. For instance, the analyses conducted by Gjertsen *et al.* (2013) concluded that protecting nesting beaches can be much more cost-effective than other mitigation activities. For that reason, conservation action on nesting beaches is an essential part of the worldwide sea turtle research and educational projects that ISSF supports on an ongoing basis (ISSF-Sea turtle conservation).

SEABIRDS

All Oceans:

Status: Seabird populations are subject to various human-related impacts. The principal current threats at sea are posed by commercial fisheries (through competition and mortality on fishing gear) and pollution; whereas on land, alien invasive predators, habitat degradation and human disturbance are the main threats. Seabird bycatch (especially in longline fisheries) is the most pervasive and immediate threat to many seabird species in both coastal waters and on the High Seas (Croxall 2012).

A comprehensive global assessment on the impact of longline fisheries on seabirds (Anderson *et al.* 2011) estimated the annual number of seabirds killed by LL fisheries in all the locations for which data were available.

The results of the work conducted showed that the species most frequently caught are albatrosses, petrels and shearwaters, with current levels of mortality liable to be unsustainable for some species and populations. The authors also highlight the existence of important data gaps on LL fisheries data that hinder the assessment of seabird bycatch. As a consequence, the authors state that despite the many inadequacies and assumptions contained in the data used, they estimated that at least 160,000 (and potentially more than 320,000) seabirds are killed annually by this type of fisheries.

Zydelis *et al*. (2013) reviewed available data on seabird bycatch in gillnet fisheries, estimated the global magnitude of this type of bycatch, identified the main species susceptible to and impacted by GN fisheries, reviewed bycatch mitigation methods and identified areas where conservation actions are most needed. The authors estimate that although reports of seabird bycatch in gillnets are relatively numerous, the magnitude of this phenomenon is poorly known for all regions and emphasize the need for more comprehensive data.

Impact by gear: LL >> TW ~ GN >>> PS. Seabirds are vulnerable to mortality in longline, trawl and gillnet (including driftnet) fisheries (Clarke *et al.* 2015. The global assessment of seabird bycatch in gillnet fisheries by Zydelis *et al*. (2013) estimated that at least 400,000 birds are killed per year. No global estimate has been done for trawl fisheries, but it is known to number at least several tens of thousands. In terms of impact on threatened seabird populations, longline fisheries (demersal and pelagic) are the most harmful (Anderson *et al*. 2011, Zydelis *et al*. 2013). On the contrary, seabirds are not usually caught by purse seine fisheries, or any other non-shallow fisheries, although there are indications that coastal purse seine vessels impact shearwater species (Oliveira et al. 2014)

Seabirds incidental mortality caused by longline fishing operations happens primarily during line setting, when foraging birds are attracted to the bait, become hooked or entangled, and are then dragged underwater and drown (Clarke *et al.* 2015). They may also be hooked during line hauling.

Diving seabirds are susceptible to capture in gillnets as they may become entangled in the net when diving to forage for food and drown before the net is retrieved. Seabirds might also be entangled in lost gillnets or discarded pieces of gillnets as this material is opportunistically collected by seabirds for the construction of their nest (Waugh *et al*. 2013).

Management:

IOTC:

- Resolution 12/06 (which supersedes various prior measures) requires longliners operating south of 25°S to use at least two of several mitigation measures such as weighted branch lines, night-setting, or tori (bird-scaring) lines. The measure also requires IOTC members to provide data on interactions between fisheries and sea birds to the SC.

ICCAT:

- Recommendation 07-07 required longliners operating south of 20°S to use at least two of several mitigation measures such as weighted branch lines, night-setting, or tori (bird-scaring) lines. The measure also required ICCAT members to collect and report data on interactions between fisheries and sea birds.
- Recommendation 11-09 strengthened the mitigation measures in 07-07, especially for longliners fishing south of 25°S, and in the Mediterranean.

IATTC:

- The IATTC Resolution C-11-02 requires longline vessels operating in high latitudes (North of 23°N, South of 30°S and around the Galapagos Islands) to employ at least two sea bird mitigation techniques such as weighted branch lines, night-setting or tori (bird-scaring) lines.

WCPFC:

- WCPFC CMM 2012-07 requires longliners operating north of 23°N and south of 23°S to use at least two of several mitigation measures such as weighted branch lines, night-setting or tori (bird-scaring) lines. The measure also encourages mitigation research to be conducted by WCPFC members.

CCSBT:

- Non-binding Recommendation to Mitigate the Impact on Ecologically Related Species - ERS - of Fishing for Southern Bluefin Tuna (updated 2011) strongly encourages CCSBT members to comply with mitigation measures on sea birds, sharks and sea turtles adopted by ICCAT, IOTC and WCPFC.
- Mandatory use of Tori poles is required by all members in all southern bluefin longline fisheries South of 30°S.
- CCSBT members are required to exchange information concerning new or refined techniques to reduce incidental catch of seabirds and cooperate in developing and assessing the effectiveness of such techniques. Most CCSBT Members and Cooperating Non-Members have achieved 10% scientific coverage (in catch and effort) for their fisheries; the 10% level is a non-binding target.

Main data gaps: Major data gaps remain for artisanal fleets, such as those in the Mediterranean, West Africa and Northwest Pacific, and many industrial fleets (Anderson *et al*. 2011).

Post-release survival is poorly known. The extent to which handling mortality, which can be substantially affected by human behaviour, determines overall mortality rates as opposed to hooking mortality, should be the subject of further research (Clarke *et al*. 2014)

Other notes: Various mitigation techniques exist to reduce seabird bycatch. The ISSF Longline Skipper's Guide (ISSF – LL Guide) provides a list of commonly encountered sea birds as well as an extensive description of seabird bycatch mitigation methods. There are other sources of mitigation advice available, such as the reviews of mitigation measures published by the Agreement on the Conservation of Albatrosses and Petrels (ACAP), or the Mitigation Fact Sheets published by the Royal Society for the Protection of Birds (RSPB).

MARINE MAMMALS

All Oceans:

Status: The results of a study on population trends of different categories of marine mammals conducted by Magera *et al*. (2013) indicated that, overall, 42% of marine mammal populations are Significantly Increasing, 10% are Significantly Decreasing, 28% have not suffered a significant change and 20% could not be classified due to insufficient data.

As regards the categories studied, proportionally, more populations of sirenian, polar bear and sea otter populations (71%) and pinnipeds (50%) are *Significantly Increasing*, than marine mammals overall (42%) or cetaceans (31%). In contrast, toothed whales, and dolphins and porpoises, seem to have the highest proportions of *Significantly Decreasing* populations.

Global bycatch levels suggest that over 300,000 marine mammals per year are killed in fishing operations globally (Read *et al.* 2006). Most species of marine mammal that occur in places that are heavily fished have been recorded caught in at least one type of fishing gear.

A significant issue in marine mammals bycatch is that there does not need to be a very large number of bycatch kills for the total effect to be significant. Most of the numerically significant bycatches of marine mammals tend to be in static fishing gear, mainly gillnets. Typically in European and North American coastal gillnet fisheries, a capture event only occurs in one or two out of every hundred fishing operations. Such low levels may remain unnoticed, although the aggregate effect over a large number of vessels and operations may be significant to the status of the population (Northridge 2009).

Impact by gear: GN > PS ~ MWTW ~ LL. Most types of fishing gear have been reported to ensnare marine mammals at one time or another (Northridge 2009). Fixed and drift gillnets cause the greatest bycatch of small marine mammals, although small cetaceans and pinnipeds also can be caught in purse seines and midwater trawl nets (Lewison 2004). Pelagic longline fisheries are a concern especially for cetaceans, mainly toothed cetaceans (odontocetes) (Clarke *et al*. 2015). Pelagic longline fishing grounds overlap with the distributions of most cetacean species but available data are too limited to estimate current or historical interaction or mortality rates by species (Hamer *et al*. 2012)

Information regarding marine mammal interactions in gillnet, trap, and harpoon fisheries for tuna is generally lacking.

The only example of comprehensive abundance data on marine mammals are the population estimates derived from the IATTC observer program for offshore dolphin stocks, though those estimates are largely limited to species that frequently associate with tunas in the Eastern Pacific and have historically been set on by tuna purse seine vessels including spotted, spinner and common dolphins (Anonymous 2010).

Management:

IOTC:

- IOTC Res. 13/04 prohibits deliberate purse seine sets around cetaceans and requires reporting of interactions.

ICCAT:

No direct measures have been adopted by ICCAT.

IATTC:

- The AIDCP establishes total per-stock and per-year limits on incidental dolphin mortality (DMLs), with a structured protocol for allocating and keeping track of DMLs (using observers). A vessel must stop setting on dolphin associations for the rest of the year once its DML has been reached.

WCPFC:

- WCPFC CMM-2011-03 prohibits deliberate purse seine sets around cetaceans and requires reporting of interactions.

Main data Gaps: Low levels of capture make monitoring rather difficult. The lack of data is especially significant in drift net fisheries, given that when a drift net escapes, it will continue to trap fish and marine life long after it has been abandoned.

Detailed information on fishing effort in tuna RFMOs relative to marine mammal distribution and to bycatch events is largely unavailable. In addition, marine mammals can also be subject to mortality from other human activities (ship strikes, directed harvest, marine debris, contaminants, bycatch in recreational and artisanal fisheries, etc.). Therefore, a comprehensive assessment of the relative effects of fishery bycatch requires considerable demographic data and complementary information about other mortality sources (Anonymous 2010).

Other notes: Several mitigation methods have been studied to reduce marine mammal bycatch. Extensive effort has been made to modify gillnets to warn cetaceans away from them by using acoustic devices ("pingers") and deterrent materials such as barium sulphate, with varying success (http://cetaceanbycatch.org/, Waugh *et al.* 2013). As regards longline fisheries, Gilman (2006) presents some potential strategies to reduce interactions with cetaceans.

ACKNOWLEDGEMENTS

The authors are grateful to S. Clarke, L. Dagorn, D. Itano, S. Nicol, K. Schaefer, C. Small and O. Yates for their valuable comments and suggestions on earlier drafts of this document.

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APPENDIX 1 - CATCH TABLES BY SPECIES

Note that shaded cells represent NUMBER of specimens, not catch weight in tonnes.

RHN		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	0.8	2008-2010	Murua et al. 2013_Observer
	PS_FAD	3	2008-2010	Murua et al. 2013_Observer
	PS_DOL	0	2008-2010	Murua et al. 2013_Observer
	PS_ALL			
	Other			
AO	GN			
	HL			
	LL			
	MWTW	0.2	2010-2011	ICCAT DB
	PS	1	1998	Capietto et al. 2014
	Other			
IO	GN	13	2000-2010	Murua et al. 2013
	HL			
	LL			
	PS	1	1999	Capietto et al. 2014
	Other			
WCPO	GN			
	HL			
	LL			
	PS	38 723	2009-2010 2005-2007	SPC-OFP 2012 Hall et al. 2013
	Other			

FAL		Catch (mt)	Reference	
			Years	Ref
EPO	GN	20	2008-2010	Aires-da-Silva et al. 2013
	HL			
	LL	14000	2008-2010	Aires-da-Silva et al. 2013
	PS_FSC	44	2012-2013	IATTC 2013 & IATTC 2014
	PS_FAD	206	2012-2013	IATTC 2013 & IATTC 2014
	PS_DOL	45	2012-2013	IATTC 2013 & IATTC 2014
	PS_ALL	650	2008-2010	Aires-da-Silva et al. 2013
	Other			
AO	GN	1	2012	ICCAT DB
	HL	<0.1	2010	ICCAT DB
	LL	49 240	2010-2013 2000-2010	ICCAT DB Murua et al. 2013
	PS_FSC	<1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	5.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	210	2000-2010	Murua et al. 2013
	Other	0.4	2010-2013	ICCAT DB
IO	GN	20153	2000-2010	Murua et al. 2013
	HL	112	2010-2013	IOTC DB
	LL	26	2000-2010	Murua et al. 2013
	GN-LL	11880	2000-2010	Murua et al. 2013
	PS_FSC	4	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	22	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	1157	2000-2010	Murua et al. 2013
	Other			
WCPO	GN			
	HL			
	LL	180333	2007-2009	Rice and Harley 2013
	PS_FSC	8980	2009	Rice and Harley 2013
	PS_FAD	90110	2009	Rice and Harley 2013
	PS_ALL	58826	2009-2010	Rice and Harley 2013
	Other			

OCS		Catch (mt)	Reference Years	Reference Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	<1	2012-2013	IATTC 2013 & IATTC 2014
	PS_FAD	<1	2012-2013	IATTC 2013 & IATTC 2014
	PS_DOL	0	2012-2013	IATTC 2013 & IATTC 2014
	PS_ALL	3	2009-2011	Murua et al. 2013
	Other			
AO	GN			
	HL			
	LL	36 240	2010-2013 2000-2010	ICCAT DB Murua et al. 2013
	PS_FSC	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	11	2000-2010	Murua et al. 2013
	Other	2	2010-2013	ICCAT DB
IO	GN	13301	2000-2010	Murua et al. 2013
	HL			
	LL	599	2000-2010	Murua et al. 2013
	GN-LL	3267	2000-2010	Murua et al. 2013
	PS_FSC	4	**(EU PS)** 2003-2007	Ardill et al. 2011
	PS_FAD	139	**(EU PS)** 2003-2007	Ardill et al. 2011
	PS_ALL	216	2000-2010	Murua et al. 2013
	Other			
WCPO	GN			
	HL			
	LL	98340	2009	Rice 2012
	PS_FSC	1170	2009	Rice and Harley 2012
	PS_FAD	3410	2009	Rice and Harley 2012
	PS_ALL	788	2009-2010	Rice and Harley 2012
	Other			

SPN		Catch (mt)	Reference Years	Reference Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	0.7	**(SPL only)** 2013	Hall 2014
	PS_FAD	16	**(SPL only)** 2013	Hall 2014
	PS_DOL	0.5	**(SPL only)** 2013	Hall 2014
	PS_ALL	20	**(SPL only)** 2009-2011	Murua et al. 2013
	Other			
AO	GN	5755	2000-2010	Murua et al. 2013
	HL	85	**(SPY)** 2010-2013	ICCAT DB
	LL	1058	2000-2010	Murua et al. 2013
	MWTW			
	PL	<0.1	**(SPY)** 2010-2013	ICCAT DB
	PS_FSC	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	3	2000-2010	Murua et al. 2013
	TR	28	**(SPY)** 2010-2013	ICCAT DB
	Other	221	2010-2013	ICCAT DB
IO	GN	3225	2000-2010	Murua et al. 2013
	HL	2979	**(SPY)** 2010-2013	IOTC DB
	LL	113	2000-2010	Murua et al. 2013
	GN-LL	3267	2000-2010	Murua et al. 2013
	PS			
	Other	2845	**(OTH-Shark)** 2000-2010	Murua et al. 2013
WCPO	GN			
	HL			
	LL			
	PS			
	Other			

BSH		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	1	2008-2010	Murua et al. 2013_Observer
	PS_FAD	0.2	2008-2010	Murua et al. 2013_Observer
	PS_DOL	0.4	2008-2010	Murua et al. 2013_Observer
	PS_ALL	2	2009-2011	Murua et al. 2013
	Other			
AO	GN	22	2010-2013	ICCAT DB
	HL	4	2010-2013	ICCAT DB
	LL	63894	2010-2013	ICCAT DB
	MWTW	3	2010-2013	ICCAT DB
	PL	147	2010-2013	ICCAT DB
	PS	2	2010-2013	ICCAT DB
	TR	0.4	2010-2013	ICCAT DB
	TP	3	2010-2013	ICCAT DB
	Other	424	2010-2013	ICCAT DB
IO	GN	1339	2010-2013	IOTC DB
	HL	12653	2010-2013	IOTC DB
	LL	27340	2000-2010	Murua et al. 2013
	GN-LL	6534	2000-2010	Murua et al. 2013
	PS			
	Other	16880	2000-2010	Murua et al. 2013
North Pacific	GN	800	2009-2011	ISC 2013 (**NPac**)
	HL			
	LL	32968	2009-2011	ISC 2013 (**NPac**)
	PS			
	Other	4743	2009-2011	ISC 2013 (**NPac**)

BTH		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	2	2008-2010	Murua et al. 2013_Observer
	PS_FAD	1	2008-2010	Murua et al. 2013_Observer
	PS_DOL	1	2008-2010	Murua et al. 2013_Observer
	PS_ALL	4	2009-2011	Murua et al. 2013
	Other			
AO	GN	43	2012	ICCAT DB
	HL			
	LL	43 81	2010-2013 (**THR**) 2000-2010	ICCAT DB Murua et al. 2013
	PS			
	Other	1	2010-2013	ICCAT DB
IO	GN	66	2010-2013	IOTC DB
	HL			
	LL	54	2010-2013	IOTC DB
	PS			
	Other			
WCPO	GN			
	HL			
	LL	1089 154	(**THR**) 2010-2013 (**THR**) 2010-2013	WCPFC Data catalogue SPC Data 2014
	PS	24	(**THR**) 2010-2013	SPC Data 2014
	Other			

POR		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	PS			
	Other			
AO	GN	9	2010-2013	ICCAT DB
	HL	0.1	2010-2013	ICCAT DB
	LL	108	2010-2013	ICCAT DB
	MWTW	1	2010-2013	ICCAT DB
	PL	0.2	2010	ICCAT DB
	PS	<0.1	2010-2013	ICCAT DB
	TR			ICCAT DB
	TP			ICCAT DB
	Other	23	2010-2013	ICCAT DB
IO	GN			
	HL	22	2010-2013	IOTC DB
	LL	10 26	2010-2013 2000-2010	IOTC DB Murua et al. 2013
	PS			
	Other			
WCPO	GN			
	HL			
	LL	391	2010-2013	WCPFC Data catalogue
	PS			
	Other			

SMA		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL	2900	2000-2010	Murua et al. 2013
	PS_FSC	1	2008-2010	Murua et al. 2013_Observer
	PS_FAD	1	2008-2010	Murua et al. 2013_Observer
	PS_DOL	0.1	2008-2010	Murua et al. 2013_Observer
	PS_ALL	3	2009-2011	Murua et al. 2013
	Other			
AO	GN	19	2010-2013	ICCAT DB
	HL	2	2010-2013	ICCAT DB
	LL	6149	2010-2013	ICCAT DB
	MWTW	0.1	2011	ICCAT DB
	PL	20	2010-2013	ICCAT DB
	PS_FSC	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	0	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	28	2010-2013	ICCAT DB
	TP	0.1	2012	ICCAT DB
	Other	428	2010-2013	ICCAT DB
IO	GN	9405	2000-2010	Murua et al. 2013
	HL	0.1	2010-2013	IOTC DB
	LL	3318	2000-2010	Murua et al. 2013
	GN-LL	659	2000-2010	Murua et al. 2013
	PS			
	Other	2917	2000-2010	Murua et al. 2013
WCPO	GN			
	HL			
	LL	4207 1213	(**MAK**) 2010-2013 (**MAK**) 2010-2013	WCPFC Data catalogue SPC Data 2014
	PS	5	(**MAK**) 2010-2013	SPC Data 2014
	Other			

MR		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	PS_FSC	25 0.2	2007-2009 (**PLS**) 2013	Hall et al. 2013 Hall 2014
	PS_FAD	2 0.2	2007-2009 (**PLS**) 2013	Hall et al. 2013 Hall 2014
	PS_DOL	13 0.7	2007-2009 (**PLS**) 2013	Hall et al. 2013 Hall 2014
	PS_ALL			
	Other			
AO	GN			
	HL			
	LL	23	2010-2013	Mas et al. 2014
	PS_FSC	1	(**EU-PS**) 2003-2007	Amande et al. 2010
	PS_FAD	<1	(**EU-PS**) 2003-2007	Amande et al. 2010
	PS_ALL	226	(**MAN**) 2000-2010	Murua et al. 2013
	Other			
IO	GN	3225	(**MAN**) 2000-2010	Murua et al. 2013
	HL			
	LL	232	(**PLS**) 2000-2010	Murua et al. 2013
	PS_FSC	2	(**EU-PS**) 2003-2009	Amande et al. 2012
	PS_FAD	1	(**EU-PS**) 2003-2009	Amande et al. 2012
	PS_ALL	73	(**MAN**) 2000-2010	Murua et al. 2013
	Other			
WCPO	GN			
	HL			
	LL			
	PS	2245	**Mantas & devil rays** 2005-2007	Hall et al. 2013
	Other			

BLM		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL	230	2010-2013	IATTC DB
	MWTW			
	PL			
	PS_FSC	0.1	2013	Hall 2014
	PS_FAD	4	2013	Hall 2014
	PS_DOL	0.3	2013	Hall 2014
	PS_ALL	72	2010-2013	IATTC DB
	TR			
	TP			
	Other	0	2010	IATTC DB
AO	GN	1	2010	ICCAT DB
	HL			
	LL	18	2010-2013	ICCAT DB
	MWTW			
	PL			
	PS_FSC	0	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	TR			
	TP			
	Other	0.2	2011	ICCAT DB
IO	GN	6019	2010-2013	IOTC DB (SC)
	HL	2144	2010-2013	IOTC DB (SC)
	LL	3438	2010-2013	IOTC DB (SC)
	MWTW			
	PL			
	PS_FSC	125	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
	PS_FAD	320	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
	TR			
	TP			
	Other	71	2010-2013	IOTC DB (SC)
WCPO	GN	12	2010-2013	WCPFC Yearbook (WCP_CA)
	HL	66	2010-2013	WCPFC Yearbook (WCP_CA)
	LL	1753	2010-2013	WCPFC Yearbook (WCP_CA)
	MWTW			
	PL			
	PS_FSC	76	2008-2010	Pilling et al. 2013
	PS_FAD	64	2008-2010	Pilling et al. 2013
	PS_ALL	505	2010-2013	WCPFC Yearbook (WCP_CA)
	TR	2	2010-2013	WCPFC Yearbook (WCP_CA)
	TP			
	Other	60	2010-2013	WCPFC Yearbook (WCP_CA)

BUM		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL	5426	2010-2013	IATTC DB
	MWTW			
	PL			
	PS_FSC	0.6	2013	Hall 2014
	PS_FAD	14	2013	Hall 2014
	PS_DOL	0.2	2013	Hall 2014
	PS_ALL	169	2010-2013	IATTC DB
	TR			
	TP			
	Other	112	2010-2013	IATTC DB
AO	GN	417	2010-2013	ICCAT DB
	HL	38	2010-2013	ICCAT DB
	LL	1470	2010-2013	ICCAT DB
	MWTW			
	PL	0.3	2010	ICCAT DB
	PS	59	2010-2013	ICCAT DB
	TR	120	2010-2013	ICCAT DB
	TP			
	Other	177	2010-2013	ICCAT DB
IO	GN	3001	2010-2013	IOTC DB (SC)
	HL	272	2010-2013	IOTC DB (SC)
	LL	8928	2010-2013	IOTC DB (SC)
	MWTW			
	PL			
	PS_FSC	0.4	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	1	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	15	2010-2013	IOTC DB (SC)
	TR			
	TP			
	Other	0.1	2010-2013	IOTC DB (SC)
WCPO	GN	328	2010-2013	WCPFC Yearbook (WCP_CA)
	HL	1882	2010-2013	WCPFC Yearbook (WCP_CA)
	LL	15071	2010-2013	WCPFC Yearbook (WCP_CA)
	MWTW			
	PL	23	2010-2013	WCPFC Yearbook (WCP_CA)
	PS_FSC	149	2008-2010	Pilling et al. 2013
	PS_FAD	136	2008-2010	Pilling et al. 2013
	PS_ALL	740	2010-2013	WCPFC Yearbook (WCP_CA)
	TR	389	2010-2013	WCPFC Yearbook (WCP_CA)
	TP			
	Other	396	2010-2013	WCPFC Yearbook (WCP_CA)

MLS		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL	2393	2010-2013	IATTC DB
	MWTW			
	PL			
	PS_FSC	0	2013	Hall 2014
	PS_FAD	0.5	2013	Hall 2014
	PS_DOL	0.2	2013	Hall 2014
	PS_ALL	24	2010-2013	IATTC DB
	TR			
	TP			
	Other	11	2010-2013	IATTC DB
AO	GN			
	HL			
	LL	23	2010-2013	ICCAT DB
	MWTW			
	PL			
	PS			
	TR			
	TP			
	Other			
IO	GN	743	2010-2013	IOTC DB (SC)
	HL	284	2010-2013	IOTC DB (SC)
	LL	2873	2010-2013	IOTC DB (SC)
	MWTW			
	PL			
	PS_FSC	10	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
	PS_FAD	25	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
	TR			
	TP			
	Other	7	2010-2013	IOTC DB (SC)
WCPO	GN	599	2010-2013	WCPFC Yearbook (WCP_CA)
	HL			
	LL	3296	2010-2013	WCPFC Yearbook (WCP_CA)
	MWTW			
	PL			
	PS_FSC	26	2008-2010	Pilling et al. 2013
	PS_FAD	24	2008-2010	Pilling et al. 2013
	PS_ALL			
	TR	14	2010-2013	WCPFC Yearbook (WCP_CA)
	TP			
	Other	1373	2009-2012	OFP-SPC 2013

WHM		Catch (mt)	Reference	
			Years	Ref
AO	GN	11	2010-2013	ICCAT DB
	HL	3	2010-2013	ICCAT DB
	LL	321	2010-2013	ICCAT DB
	MWTW			
	PL	30	2010-2013	ICCAT DB
	PS_FSC	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	12	2010-2013	ICCAT DB
	TR	10	2010-2013	ICCAT DB
	TP	<0.1	2010-2013	ICCAT DB
	Other	4	2010-2013	ICCAT DB

SWO		Catch (mt)	Reference	
			Years	Ref
EPO	GN	101	2010-2013	IATTC DB
EPO	HL			
EPO	LL	20510	2010-2013	IATTC DB
EPO	MWTW			
EPO	PL			
EPO	PS_FSC			
EPO	PS_FAD			
EPO	PS_DOL			
EPO	PS_ALL	3	2010-2013	IATTC DB
EPO	TR			
EPO	TP			
EPO	Other	3945	2010-2013	IATTC DB
AO	GN	401	2010-2013	ICCAT DB
AO	HL	170	2010-2013	ICCAT DB
AO	LL	32307	2010-2013	ICCAT DB
AO	MWTW	26	2010-2013	ICCAT DB
AO	PL	31	2010-2013	ICCAT DB
AO	PS_FSC	0	**(EU-PS)** 2003-2007	Amande et al. 2010
AO	PS_FAD	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
AO	PS_ALL	19	2010-2013	ICCAT DB
AO	TR	44	2010-2013	ICCAT DB
AO	TP	4	2010-2013	ICCAT DB
AO	Other	1027	2010-2013	ICCAT DB
IO	GN	2324	2010-2013	IOTC DB (SC)
IO	HL	1645	2010-2013	IOTC DB (SC)
IO	LL	22862	2010-2013	IOTC DB (SC)
IO	MWTW			
IO	PL			
IO	PS_FSC	0.2	**(EU-PS)** 2003-2009	Amande et al. 2012
IO	PS_FAD	1	**(EU-PS)** 2003-2009	Amande et al. 2012
IO	PS_ALL	83	2010-2013	IOTC DB (SC)
IO	TR			
IO	TP			
IO	Other	9	2010-2013	IOTC DB (SC)
WCPO	GN	1180	2010-2013	WCPFC Yearbook (WCP_CA)
WCPO	HL	25	2010-2013	WCPFC Yearbook (WCP_CA)
WCPO	LL	18145	2010-2013	WCPFC Yearbook (WCP_CA)
WCPO	MWTW			
WCPO	PL			
WCPO	PS_FSC			
WCPO	PS_FAD			
WCPO	PS_ALL			
WCPO	TR	1	2010-2013	WCPFC Yearbook (WCP_CA)
WCPO	TP			
WCPO	Other	1263	2009-2012	OFP-SPC 2013

SFA/ SAI		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
EPO	HL			
EPO	LL	615	2010-2013	IATTC DB
EPO	MWTW			
EPO	PL			
EPO	PS_FSC	0.5	2013	Hall 2014
EPO	PS_FAD	<0.1	2013	Hall 2014
EPO	PS_DOL	1	2013	Hall 2014
EPO	PS_ALL	18	2010-2013	IATTC DB
EPO	TR			
EPO	TP			
EPO	Other	12	2010-2013	IATTC DB
AO	GN	526	2010-2013	ICCAT DB
AO	HL	165	2010-2013	ICCAT DB
AO	LL	1117	2010-2013	ICCAT DB
AO	MWTW			
AO	PL			
AO	PS_FSC	2	**(EU-PS)** 2003-2007	Amande et al. 2010
AO	PS_FAD	0.2	**(EU-PS)** 2003-2007	Amande et al. 2010
AO	PS_ALL	134	2010-2013	ICCAT DB
AO	TR	39	2010-2013	ICCAT DB
AO	TP			
AO	Other	55	2010-2013	ICCAT DB
IO	GN	21125	2010-2013	IOTC DB (SC)
IO	HL	5575	2010-2013	IOTC DB (SC)
IO	LL	1896	2010-2013	IOTC DB (SC)
IO	MWTW			
IO	PL	20	2010-2013	IOTC DB (SC)
IO	PS_FSC	53	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
IO	PS_FAD	135	2010-2013	IOTC DB (SC)/ Ardill et al. 2011
IO	TR			
IO	TP			
IO	Other	9	2010-2013	IOTC DB (SC)
WCPO	GN			
WCPO	HL			
WCPO	LL	1883	2009-2012	WCPFC Data catalogue
WCPO	MWTW			
WCPO	PL			
WCPO	PS_FSC	7	2008-2010	Pilling et al. 2013
WCPO	PS_FAD	6	2008-2010	Pilling et al. 2013
WCPO	PS_ALL			
WCPO	TR			
WCPO	TP			
WCPO	Other	1263	2009-2012	OFP-SPC 2013

MAH		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL	12395	2010-2013	IATTC DB
	MWTW			
	PL			
	PS_FSC	2	2013	Hall 2014
	PS_FAD	489	2013	Hall 2014
	PS_DOL	0	2013	Hall 2014
	PS_ALL	1446	2010-2013	IATTC DB
	TR			
	TP			
	Other	17486	2010-2013	IATTC DB
AO	GN	11	2010-2013	ICCAT DB
	HL	336	2010-2013	ICCAT DB
	LL	2477	2010-2013	ICCAT DB
	MWTW			
	PL	60	2010-2013	ICCAT DB
	PS_FSC	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	461	2010-2013	ICCAT DB
	TR	85	2010-2013	ICCAT DB
	TP	0.2	2010-2013	ICCAT DB
	Other	1267	2010-2013	ICCAT DB
IO	GN	1268	2010-2013	IOTC DB
	HL	87	2010-2013	IOTC DB
	LL	405	2010-2013	IOTC DB
	MWTW			
	PL			
	PS_FSC	2	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	37	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	356	2010	Ardill et al. 2011
	TR			
	TP			
	Other			
WCPO	GN			
	HL			
	LL	2061	2010-2013	SPC Data 2014
	MWTW			
	PL			
	PS_FSC	46	2008-2010	Pilling et al. 2013
	PS_FAD	725	2008-2010	Pilling et al. 2013
	PS_ALL	750 476	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	TR			
	TP			
	Other			

WAH		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	1	2012-2013	IATTC 2013 & IATTC 2014
	PS_FAD	590	2012-2013	IATTC 2013 & IATTC 2014
	PS_DOL	<1	2012-2013	IATTC 2013 & IATTC 2014
	PS_ALL			
	TR			
	TP			
	Other			
AO	GN	38	2010-2013	ICCAT DB
	HL	559	2010-2013	ICCAT DB
	LL	612	2010-2013	ICCAT DB
	MWTW	4	2011	ICCAT DB
	PL	13	2010-2013	ICCAT DB
	PS_FSC	0	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	2	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	52	2010-2013	ICCAT DB
	TR	468	2010-2013	ICCAT DB
	TP	<0.1	2010-2013	ICCAT DB
	Other	385	2010-2013	ICCAT DB
IO	GN	517	2010-2013	IOTC DB
	HL	164	2010-2013	IOTC DB
	LL	20	2010-2013	IOTC DB
	MWTW			
	PL			
	PS_FSC	1	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	9	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	2	2010-2013	IOTC DB
	TR			
	TP			
	Other	20	2010-2013	IOTC DB
WCPO	GN			
	HL			
	LL	2611	2010-2013	SPC Data 2014
	MWTW			
	PL			
	PS_FSC	5	2008-2010	Pilling et al. 2013
	PS_FAD	65	2008-2010	Pilling et al. 2013
	PS_ALL	260 250	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	TR			
	TP			
	Other			

FRI		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	128	**(FRZ)** 2012-2013	IATTC 2013 & IATTC 2014
	PS_FAD	280	**(FRZ)** 2012-2013	IATTC 2013 & IATTC 2014
	PS_DOL	1	**(FRZ)** 2012-2013	IATTC 2013 & IATTC 2014
	PS_ALL			
	TR			
	TP			
	Other			
AO	GN	889	2010-2013	ICCAT DB
	HL	136	2010-2013	ICCAT DB
	LL	123	2010-2013	ICCAT DB
	MWTW	440	2010-2013	ICCAT DB
	PL	1119	2010-2013	ICCAT DB
	PS_FSC	1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	7	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	6930	2010-2013	ICCAT DB
	TR	11	2010-2013	ICCAT DB
	TP	45	2010-2013	ICCAT DB
	Other	309	2010-2013	ICCAT DB
IO	GN	28704	2010-2013	IOTC DB (SC)
	HL	36422	2010-2013	IOTC DB (SC)
	LL	3268	2010-2013	IOTC DB (SC)
	MWTW			
	PL	1383	2010-2013	IOTC DB (SC)
	PS_FSC	17	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	80	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	10301	2010-2013	IOTC DB (SC)
	TR			
	TP			
	Other	13274	2010-2013	IOTC DB (SC)
WCPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC			
	PS_FAD			
	PS_ALL			
	TR			
	TP			
	Other			

RR		Catch (mt)	Reference	
			Years	Ref
EPO	GN	6	**(Carangids)** 2010-2013	IATTC DB
	HL			
	LL	4	**(Carangids)** 2010-2013	IATTC DB
	MWTW			
	PL			
	PS_FSC	137	2007-2009	Hall et al. 2013
	PS_FAD	191	2007-2009	Hall et al. 2013
	PS_DOL	0	2007-2009	Hall et al. 2013
	PS_ALL	55	**(Carangids)** 2010-2013	IATTC DB
	TR			
	TP			
	Other			
AO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	4	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_ALL	193	2010	Hall et al. 2013
	TR			
	TP			
	Other			
IO	GN			
	HL	0.2	2010-2013	IOTC DB
	LL			
	MWTW			
	PL			
	PS_FSC	7	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_FAD	39	**(EU-PS)** 2003-2009	Amande et al. 2012
	PS_ALL	1200	2010	Ardill et al. 2011
	TR			
	TP			
	Other			
WCPO	GN			
	HL			
	LL	8	2010-2013	SPC Data 2014
	MWTW			
	PL			
	PS_FSC	82	2008-2010	Pilling et al. 2013
	PS_FAD	2191	2008-2010	Pilling et al. 2013
	PS_ALL	8200 2717	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	TR			
	TP			
	Other			

YT		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	0.4	2013	Hall 2014
	PS_FAD	5	2013	Hall 2014
	PS_DOL	1	2013	Hall 2014
	PS_ALL			
	TR			
	TP			
	Other			
AO	GN			
	HL			
	LL	<0.01	2011	ICCAT DB
	MWTW			
	PL	<0.01	2011	ICCAT DB
	PS	26	2011	ICCAT DB
	TR			
	TP			
	Other			
IO	GN			
	HL	<0.1	2010-2013	IOTC DB
	LL	16	2010-2013	IOTC DB
	MWTW			
	PL			
	PS			
	TR			
	TP			
	Other			
WCPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC			
	PS_FAD			
	PS_ALL			
	TR			
	TP			
	Other			

TRI		Catch (mt)	Reference	
			Years	Ref
EPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	<1	2012-2013	IATTC 2013 & IATTC 2014
	PS_FAD	169	2012-2013	IATTC 2013 & IATTC 2014
	PS_DOL	1	2012-2013	IATTC 2013 & IATTC 2014
	PS_ALL			
	TR			
	TP			
	Other			
AO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	PS_FAD	4	**(EU-PS)** 2003-2007	Amande et al. 2010
	TR			
	TP			
	Other			
IO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS	776	2010	Ardill et al. 2011
	TR			
	TP			
	Other			
WCPO	GN			
	HL			
	LL			
	MWTW			
	PL			
	PS_FSC			
	PS_FAD			
	PS_ALL			
	TR			
	TP			
	Other			

APPENDIX 2 - CATCH TABLES BY GEAR

Note that shaded cells represent NUMBER of specimens, not catch weight in tonnes.

GN		Catch (mt)	Reference	
			Years	Ref
EPO	RHN			
	FAL	20	2008-2010	Aires-da-Silva et al. 2013
	OCS			
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR			
	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO	101	2010-2013	IATTC DB
	MAH			
	WAH			
	FRI			
	RR	6	(**Carangids**) 2010-2013	IATTC DB
	YT			
	TRI			
AO	RHN			
	FAL	1	2012	ICCAT DB
	OCS			
	SPN	5755	2000-2010	Murua et al. 2013
	BSH	22	2010-2013	ICCAT DB
	BTH	43	2012	ICCAT DB
	POR	9	2010-2013	ICCAT DB
	SMA	19	2010-2013	ICCAT DB
	MR			
	SAI/SFA	526	2010-2013	ICCAT DB
	BLM	1	2010	ICCAT DB
	BUM	417	2010-2013	ICCAT DB
	MLS			
	WHM	11	2010-2013	ICCAT DB
	SWO	401	2010-2013	ICCAT DB
	MAH	11	2010-2013	ICCAT DB
	WAH	38	2010-2013	ICCAT DB
	FRI	889	2010-2013	ICCAT DB
	RR			
	YT			
	TRI			

GN		Catch (mt)	Reference	
			Years	Ref
IO	RHN	13	2000-2010	Murua et al. 2013
	FAL	20153 (+11880 GN-LL)	2000-2010	Murua et al. 2013
	OCS	13301 (+3267 GN-LL)	2000-2010	Murua et al. 2013
	SPN	3225 (+3267 GN-LL)	2000-2010	Murua et al. 2013
	BSH	1339 (+6534 GN-LL)	2010-2013	IOTC DB Murua et al. 2013
	BTH	66	2010-2013	IOTC DB
	POR			
	SMA	9405 (+659 GN-LL)	2000-2010	Murua et al. 2013
	MR	3225	(**MAN**) 2000-2010	Murua et al. 2013
	SAI/SFA	21125	2010-2013	IOTC DB (SC)
	BLM	6019	2010-2013	IOTC DB (SC)
	BUM	3001	2010-2013	IOTC DB (SC)
	MLS	743	2010-2013	IOTC DB (SC)
	SWO	2324	2010-2013	IOTC DB (SC)
	MAH	1268	2010-2013	IOTC DB
	WAH	517	2010-2013	IOTC DB
	FRI	28704	2010-2013	IOTC DB (SC)
	RR			
	YT			
	TRI			
WCPO	RHN			
	FAL			
	OCS			
	SPN			
	BSH	800	2009-2011	ISC 2013 (**NPac**)
	BTH			
	POR			
	SMA			
	MR			
	SAI/SFA			
	BLM	12	2010-2013	WCPFC Yearbook (WCP_CA)
	BUM	328	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS	599	2010-2013	WCPFC Yearbook (WCP_CA)
	SWO	1180	2010-2013	WCPFC Yearbook (WCP_CA)
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			

HL		Catch (mt)	Reference	
			Years	Ref
EPO	RHN			
	FAL			
	OCS			
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR			
	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
AO	RHN			
	FAL	<0.1	2010	ICCAT DB
	OCS			
	SPN	85	(SPY) 2010-2013	ICCAT DB
	BSH	4	2010-2013	ICCAT DB
	BTH			
	POR	0.1	2010-2013	ICCAT DB
	SMA	2	2010-2013	ICCAT DB
	MR			
	SAI/SFA	165	2010-2013	ICCAT DB
	BLM			
	BUM	38	2010-2013	ICCAT DB
	MLS			
	WHM	3	2010-2013	ICCAT DB
	SWO	170	2010-2013	ICCAT DB
	MAH	336	2010-2013	ICCAT DB
	WAH	559	2010-2013	ICCAT DB
	FRI	136	2010-2013	ICCAT DB
	RR			
	YT			
	TRI			

HL		Catch (mt)	Reference	
			Years	Ref
IO	RHN			
	FAL	112	2010-2013	IOTC DB
	OCS			
	SPN	2979	(SPY) 2010-2013	IOTC DB
	BSH	12653	2010-2013	IOTC DB
	BTH			
	POR	22	2010-2013	IOTC DB
	SMA	0.1	2010-2013	IOTC DB
	MR			
	SAI/SFA	5575	2010-2013	IOTC DB (SC)
	BLM	2144	2010-2013	IOTC DB (SC)
	BUM	272	2010-2013	IOTC DB (SC)
	MLS	284	2010-2013	IOTC DB (SC)
	SWO	1645	2010-2013	IOTC DB (SC)
	MAH	87	2010-2013	IOTC DB
	WAH	164	2010-2013	IOTC DB
	FRI	36422	2010-2013	IOTC DB (SC)
	RR	0.2	2010-2013	IOTC DB
	YT	<0.1	2010-2013	IOTC DB
	TRI			
WCPO	RHN			
	FAL			
	OCS			
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR			
	SAI/SFA			
	BLM	66	2010-2013	WCPFC Yearbook (WCP_CA)
	BUM	1882	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS			
	SWO	25	2010-2013	WCPFC Yearbook (WCP_CA)
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			

LL		Catch (mt)	Reference	
			Years	Ref
EPO	RHN			
	FAL	14000	2008-2010	Aires-da-Silva et al. 2013
	OCS			
	SPN			
	BSH			
	BTH			
	POR			
	SMA	2900	2000-2010	Murua et al. 2013
	MR			
	SAI/SFA	615	2010-2013	IATTC DB
	BLM	230	2010-2013	IATTC DB
	BUM	5426	2010-2013	IATTC DB
	MLS	2393	2010-2013	IATTC DB
	SWO	20510	2010-2013	IATTC DB
	MAH	12395	2010-2013	IATTC DB
	WAH			
	FRI			
	RR	4	(**Carangids**) 2010-2013	IATTC DB
	YT			
	TRI			
AO	RHN			
	FAL	49 240	2010-2013 2000-2010	ICCAT DB Murua et al. 2013
	OCS	36 240	2010-2013 2000-2010	ICCAT DB Murua et al. 2013
	SPN	1058	2000-2010	Murua et al. 2013
	BSH	63894	2010-2013	ICCAT DB
	BTH	43 81	2010-2013 (**THR**) 2000-2010	ICCAT DB Murua et al. 2013
	POR	108	2010-2013	ICCAT DB
	SMA	6149	2010-2013	ICCAT DB
	MR	23	2010-2013	Mas et al. 2014
	SAI/SFA	1117	2010-2013	ICCAT DB
	BLM	18	2010-2013	ICCAT DB
	BUM	1470	2010-2013	ICCAT DB
	MLS	23	2010-2013	ICCAT DB
	WHM	312	2010-2013	ICCAT DB
	SWO	32307	2010-2013	ICCAT DB
	MAH	2477	2010-2013	ICCAT DB
	WAH	612	2010-2013	ICCAT DB
	FRI	123	2010-2013	ICCAT DB
	RR			
	YT	<0.1	2010-2013	ICCAT DB
	TRI			

LL		Catch (mt)	Reference	
			Years	Ref
IO	RHN			
	FAL	26	2000-2010	Murua et al. 2013
	OCS	599	2000-2010	Murua et al. 2013
	SPN	113	2000-2010	Murua et al. 2013
	BSH	27340	2000-2010	Murua et al. 2013
	BTH	54	2010-2013	IOTC DB
	POR	10 26	2010-2013 2000-2010	IOTC DB Murua et al. 2013
	SMA	3318	2000-2010	Murua et al. 2013
	MR	232	(**PLS**) 2000-2010	Murua et al. 2013
	SAI/SFA	1896	2010-2013	IOTC DB (SC)
	BLM	3438	2010-2013	IOTC DB (SC)
	BUM	8928	2010-2013	IOTC DB (SC)
	MLS	2873	2010-2013	IOTC DB (SC)
	SWO	22862	2010-2013	IOTC DB (SC)
	MAH	405	2010-2013	IOTC DB
	WAH	20	2010-2013	IOTC DB
	FRI	3268	2010-2013	IOTC DB (SC)
	RR			
	YT	16	2010-2013	IOTC DB
	TRI			
WCPO	RHN			
	FAL	180333	2007-2009	Rice and Harley 2013
	OCS	98340	2009	Rice 2012
	SPN			
	BSH	32968	2009-2011	ISC 2013 (**NPac**)
	BTH	1089 154	(**THR**) 2010-2013 (**THR**) 2010-2013	WCPFC Data catalogue SPC Data 2014
	POR	391	2010-2013	WCPFC Data catalogue
	SMA	4207 1213	(**MAK**) 2010-2013 (**MAK**) 2010-2013	WCPFC Data catalogue SPC Data 2014
	MR			
	SAI/SFA	1883	2009-2012	WCPFC Data catalogue
	BLM	1753	2010-2013	WCPFC Yearbook (WCP_CA)
	BUM	15071	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS	3296	2010-2013	WCPFC Yearbook (WCP_CA)
	SWO	18145	2010-2013	WCPFC Yearbook (WCP_CA)
	MAH	2061	2010-2013	SPC Data 2014
	WAH	2611	2010-2013	SPC Data 2014
	FRI			
	RR	8	2010-2013	SPC Data 2014
	YT			
	TRI			

MWTW		Catch (mt)	Reference	
			Years	Ref
EPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
AO	RHN	0.2	2010-2011	ICCAT DB
	SPN			
	BSH	3	2010-2013	ICCAT DB
	POR	1	2010-2013	ICCAT DB
	SMA	0.1	2011	ICCAT DB
	SAI/SFA			
	BLM			
	BUM			
	MLS			
	WHM			
	SWO	26	2010-2013	ICCAT DB
	MAH			
	WAH	4	2011	ICCAT DB
	FRI	440	2010-2013	ICCAT DB
	RR			
	YT			
	TRI			

MWTW		Catch (mt)	Reference	
			Years	Ref
IO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
WCPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			

P & L		Catch (mt)	Reference	
			Years	Ref
EPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
AO	SPN	<0.1	(SPY) 2010-2013	ICCAT DB
	BSH	147	2010-2013	ICCAT DB
	POR	0.2	2010	ICCAT DB
	SMA	20	2010-2013	ICCAT DB
	SAI/SFA			
	BLM			
	BUM	0.3	2010	ICCAT DB
	MLS			
	WHM	30	2010-2013	ICCAT DB
	SWO	31	2010-2013	ICCAT DB
	MAH	60	2010-2013	ICCAT DB
	WAH	13	2010-2013	ICCAT DB
	FRI	1119	2010-2013	ICCAT DB
	RR			
	YT	<0.1	2011	ICCAT DB
	TRI			

P & L		Catch (mt)	Reference	
			Years	Ref
IO	SAI/SFA	20	2010-2013	IOTC DB (SC)
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI	1383	2010-2013	IOTC DB (SC)
	RR			
	YT			
	TRI			
WCPO	SAI/SFA			
	BLM			
	BUM	23	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			

PS_FSC		Catch (mt)	Reference	
			Years	Ref
EPO	RHN	0.8	2008-2010	Murua et al. 2013_Observer
EPO	FAL	44	2012-2013	IATTC 2013 & IATTC 2014
EPO	OCS	<1	2012-2013	IATTC 2013 & IATTC 2014
EPO	SPN	0.7	(**SPL only**) 2013	Hall 2014
EPO	BSH	1	2008-2010	Murua et al. 2013_Observer
EPO	BTH	2	2008-2010	Murua et al. 2013_Observer
EPO	POR			
EPO	SMA	1	2008-2010	Murua et al. 2013_Observer
EPO	MR	25 0.2	2007-2009 (**PLS**) 2013	Hall et al. 2013 Hall 2014
EPO	SAI/SFA	0.5	2013	Hall 2014
EPO	BLM	0.1	2013	Hall 2014
EPO	BUM	0.6	2013	Hall 2014
EPO	MLS	0	2013	Hall 2014
EPO	SWO			
EPO	MAH	2	2013	Hall 2014
EPO	WAH	1	2012-2013	IATTC 2013 & IATTC 2014
EPO	FRI	128	(**FRZ**) 2012-2013	IATTC 2013 & IATTC 2014
EPO	RR	137	2007-2009	Hall et al. 2013
EPO	YT	0.4	2013	Hall 2014
EPO	TRI	<1	2012-2013	IATTC 2013 & IATTC 2014
AO	FAL	<1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	OCS	<0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	SPN	0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	BSH			
AO	POR			
AO	SMA	<0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	MR	1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	SAI/SFA	2	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	BLM	0	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	BUM			
AO	MLS			
AO	WHM	<0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	SWO	0	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	MAH	<0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	WAH	0	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	FRI	1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	RR	0.1	(**EU-PS**) 2003-2007	Amande et al. 2010
AO	YT			
AO	TRI	<0.1	(**EU-PS**) 2003-2007	Amande et al. 2010

PS_FSC		Catch (mt)	Reference	
			Years	Ref
IO	RHN			
IO	FAL	4	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	OCS	4	(**EU PS**) 2003-2007	Ardill et al. 2011
IO	SPN			
IO	BSH			
IO	BTH			
IO	POR			
IO	SMA			
IO	MR	2	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	SAI/SFA	53	2010-2013	IOTC DB/ Ardill et al. 2011
IO	BLM	125	2010-2013	IOTC DB/ Ardill et al. 2011
IO	BUM	0.4	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	MLS	10	2010-2013	IOTC DB/ Ardill et al. 2011
IO	SWO	0.2	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	MAH	2	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	WAH	1	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	FRI	17	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	RR	7	(**EU-PS**) 2003-2009	Amande et al. 2012
IO	YT			
IO	TRI			
WCPO	RHN			
WCPO	FAL	8980	2009	Rice and Harley 2013
WCPO	OCS	1170	2009	Rice and Harley 2012
WCPO	SPN			
WCPO	BSH			
WCPO	BTH			
WCPO	POR			
WCPO	SMA			
WCPO	MR			
WCPO	SAI/SFA	7	2008-2010	Pilling et al. 2013
WCPO	BLM	76	2008-2010	Pilling et al. 2013
WCPO	BUM	149	2008-2010	Pilling et al. 2013
WCPO	MLS	26	2008-2010	Pilling et al. 2013
WCPO	SWO			
WCPO	MAH	46	2008-2010	Pilling et al. 2013
WCPO	WAH	5	2008-2010	Pilling et al. 2013
WCPO	FRI			
WCPO	RR	82	2008-2010	Pilling et al. 2013
WCPO	YT			
WCPO	TRI			

PS_FAD		Catch (mt)	Reference: Years	Reference: Ref
EPO	RHN	3	2008-2010	Murua et al. 2013_Observer
	FAL	206	2012-2013	IATTC 2013 & IATTC 2014
	OCS	<1	2012-2013	IATTC 2013 & IATTC 2014
	SPN	16	**(SPL only)** 2013	Hall 2014
	BSH	0.2	2008-2010	Murua et al. 2013_Observer
	BTH	1	2008-2010	Murua et al. 2013_Observer
	POR			
	SMA	1	2008-2010	Murua et al. 2013_Observer
	MR	2 0.2	2007-2009 **(PLS)** 2013	Hall et al. 2013 Hall 2014
	SAI/SFA	<0.1	2013	Hall 2014
	BLM	4	2013	Hall 2014
	BUM	14	2013	Hall 2014
	MLS	0.5	2013	Hall 2014
	SWO			
	MAH	489	2013	Hall 2014
	WAH	590	2012-2013	IATTC 2013 & IATTC 2014
	FRI	280	**(FRZ)** 2012-2013	IATTC 2013 & IATTC 2014
	RR	191	2007-2009	Hall et al. 2013
	YT	5	2013	Hall 2014
	TRI	169	2012-2013	IATTC 2013 & IATTC 2014

PS_FAD		Catch (mt)	Reference: Years	Reference: Ref
AO	FAL	5.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	OCS	<0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	SPN	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	BSH			
	POR			
	SMA	0	**(EU-PS)** 2003-2007	Amande et al. 2010
	MR	0.3	**(EU-PS)** 2003-2007	Amande et al. 2010
	SAI/SFA	0.2	**(EU-PS)** 2003-2007	Amande et al. 2010
	BLM	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	BUM			
	MLS			
	WHM	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	SWO	0.1	**(EU-PS)** 2003-2007	Amande et al. 2010
	MAH	1	**(EU-PS)** 2003-2007	Amande et al. 2010
	WAH	2	**(EU-PS)** 2003-2007	Amande et al. 2010
	FRI	7	**(EU-PS)** 2003-2007	Amande et al. 2010
	RR	4	**(EU-PS)** 2003-2007	Amande et al. 2010
	YT			
	TRI	**4**	(EU-PS) 2003-2007	Amande et al. 2010

PS_FAD		Catch (mt)	Reference: Years	Reference: Ref
IO	RHN			
	FAL	22	**(EU-PS)** 2003-2009	Amande et al. 2012
	OCS	139	2003-2007 **(EU PS)**	Ardill et al. 2011
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR	1	**(EU-PS)** 2003-2009	Amande et al. 2012
	SAI/SFA	135	2010-2013	IOTC DB/ Ardill et al. 2011
	BLM	320	2010-2013	IOTC DB/ Ardill et al. 2011
	BUM	1	**(EU-PS)** 2003-2009	Amande et al. 2012
	MLS	25	2010-2013	IOTC DB/ Ardill et al. 2011
	SWO	1	**(EU-PS)** 2003-2009	Amande et al. 2012
	MAH	37	**(EU-PS)** 2003-2009	Amande et al. 2012
	WAH	9	**(EU-PS)** 2003-2009	Amande et al. 2012
	FRI	80	**(EU-PS)** 2003-2009	Amande et al. 2012
	RR	39	**(EU-PS)** 2003-2009	Amande et al. 2012
	YT			
	TRI			

PS_FAD		Catch (mt)	Reference: Years	Reference: Ref
WCPO	RHN			
	FAL	90110	2009	Rice and Harley 2013
	OCS	3410	2009	Rice and Harley 2012
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR			
	SAI/SFA	6	2008-2010	Pilling et al. 2013
	BLM	64	2008-2010	Pilling et al. 2013
	BUM	136	2008-2010	Pilling et al. 2013
	MLS	24	2008-2010	Pilling et al. 2013
	SWO			
	MAH	725	2008-2010	Pilling et al. 2013
	WAH	65	2008-2010	Pilling et al. 2013
	FRI			
	RR	2191	2008-2010	Pilling et al. 2013
	YT			
	TRI			

PS_DOL		Catch (mt)	Reference	
			Years	Ref
EPO	RHN	0	2008-2010	Murua et al. 2013_Observer
	FAL	45	2012-2013	IATTC 2013 & IATTC 2014
	OCS	0	2012-2013	IATTC 2013 & IATTC 2014
	SPN	0.5	(**SPL only**) 2013	Hall 2014
	BSH	0.4	2008-2010	Murua et al. 2013_Observer
	BTH	1	2008-2010	Murua et al. 2013_Observer
	POR			
	SMA	0.1	2008-2010	Murua et al. 2013_Observer
	MR	13 0.7	2007-2009 (**PLS**) 2013	Hall et al. 2013 Hall 2014
	SAI/SFA	1	2013	Hall 2014
	BLM	0.3	2013	Hall 2014
	BUM	0.2	2013	Hall 2014
	MLS	0.2	2013	Hall 2014
	SWO			
	MAH	0	2013	Hall 2014
	WAH	<1	2012-2013	IATTC 2013 & IATTC 2014
	FRI	1	(**FRZ**) 2012-2013	IATTC 2013 & IATTC 2014
	RR	0	2007-2009	Hall et al. 2013
	YT	1	2013	Hall 2014
	TRI	<1	2012-2013	IATTC 2013 & IATTC 2014

PS_ALL		Catch (mt)	Reference: Years	Reference: Ref
EPO	RHN			
	FAL	650	2008-2010	Aires-da-Silva et al. 2013
	OCS	3	2009-2011	Murua et al. 2013
	SPN	20	**(SPL only)** 2009-2011	Murua et al. 2013
	BSH	2	2009-2011	Murua et al. 2013
	BTH	4	2009-2011	Murua et al. 2013
	POR			
	SMA	3	2009-2011	Murua et al. 2013
	MR			
	SAI/SFA	18	2010-2013	IATTC DB
	BLM	72	2010-2013	IATTC DB
	BUM	169	2010-2013	IATTC DB
	MLS	24	2010-2013	IATTC DB
	SWO	3	2010-2013	IATTC DB
	MAH	1446	2010-2013	IATTC DB
	WAH			
	FRI			
	RR	55	**(Carangids)** 2010-2013	IATTC DB
	YT			
	TRI			
AO	RHN	1	1998	Capietto et al. 2014
	FAL	210	2000-2010	Murua et al. 2013
	OCS	11	2000-2010	Murua et al. 2013
	SPN	3	2000-2010	Murua et al. 2013
	BSH	2	2010-2013	ICCAT DB
	BTH			
	POR	<0.1	2010-2013	ICCAT DB
	SMA	28	2010-2013	ICCAT DB
	MR	226	**(MAN)** 2000-2010	Murua et al. 2013
	SAI/SFA	134	2010-2013	ICCAT DB
	BLM			
	BUM	59	2010-2013	ICCAT DB
	MLS			
	WHM	12	2010-2013	ICCAT DB
	SWO	19	2010-2013	ICCAT DB
	MAH	461	2010-2013	ICCAT DB
	WAH	52	2010-2013	ICCAT DB
	FRI	6930	2010-2013	ICCAT DB
	RR	193	2010	Hall et al. 2013
	YT	26	2011	ICCAT DB
	TRI			

PS_ALL		Catch (mt)	Reference: Years	Reference: Ref
IO	RHN	1	1999	Capietto et al. 2014
	FAL	1157	2000-2010	Murua et al. 2013
	OCS	216	2000-2010	Murua et al. 2013
	SPN			
	BSH			
	BTH			
	POR			
	SMA			
	MR	73	**(MAN)** 2000-2010	Murua et al. 2013
	SAI/SFA			
	BLM			
	BUM	15	2010-2013	IOTC DB (SC)
	MLS			
	SWO	83	2010-2013	IOTC DB (SC)
	MAH	356	2010	Ardill et al. 2011
	WAH	2	2010-2013	IOTC DB
	FRI	10301	2010-2013	IOTC DB (SC)
	RR	1200	2010	Ardill et al. 2011
	YT			
	TRI	776	2010	Ardill et al. 2011
WCPO	RHN	38 723	2009-2010 2005-2007	SPC-OFP 2012 Hall et al. 2013
	FAL	58826	2009-2010	Rice and Harley 2013
	OCS	788	2009-2010	Rice and Harley 2012
	SPN			
	BSH			
	BTH	24	**(THR)** 2010-2013	SPC Data 2014
	POR			
	SMA	5	**(MAK)** 2010-2013	SPC Data 2014
	MR	2245	**Mantas & devil rays** 2005-2007	Hall et al. 2013
	SAI/SFA			
	BLM	505	2010-2013	WCPFC Yearbook (WCP_CA)
	BUM	740	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS			
	SWO			
	MAH	750 476	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	WAH	260 250	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	FRI			
	RR	8200 2717	2003-2005 2010-2013	Hall et al. 2013 SPC Data 2014
	YT			
	TRI			

TR		Catch (mt)	Reference	
			Years	Ref
EPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
AO	SPN	28	(SPY) 2010-2013	ICCAT DB
	BSH	0.4	2010-2013	ICCAT DB
	POR	0.1	2009	ICCAT DB
	SAI/SFA	39	2010-2013	ICCAT DB
	BLM			
	BUM	120	2010-2013	ICCAT DB
	MLS			
	WHM	10	2010-2013	ICCAT DB
	SWO	44	2010-2013	ICCAT DB
	MAH	85	2010-2013	ICCAT DB
	WAH	468	2010-2013	ICCAT DB
	FRI	11	2010-2013	ICCAT DB
	RR			
	YT			
	TRI			

TR		Catch (mt)	Reference	
			Years	Ref
IO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
WCPO	SAI/SFA			
	BLM	2	2010-2013	WCPFC Yearbook (WCP_CA)
	BUM	389	2010-2013	WCPFC Yearbook (WCP_CA)
	MLS	14	2010-2013	WCPFC Yearbook (WCP_CA)
	SWO	1	2010-2013	WCPFC Yearbook (WCP_CA)
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			

TP		Catch (mt)	Reference	
			Years	Ref
EPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
AO	BSH	3	2010-2013	ICCAT DB
	POR	0.2	2009	ICCAT DB
	SMA	0.1	2012	ICCAT DB
	SAI/SFA			
	BLM			
	BUM			
	MLS			
	WHM	<0.1	2010-2013	ICCAT DB
	SWO	4	2010-2013	ICCAT DB
	MAH	0.2	2010-2013	ICCAT DB
	WAH	<0.1	2010-2013	ICCAT DB
	FRI	45	2010-2013	ICCAT DB
	RR			
	YT			
	TRI			

TP		Catch (mt)	Reference	
			Years	Ref
IO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			
WCPO	SAI/SFA			
	BLM			
	BUM			
	MLS			
	SWO			
	MAH			
	WAH			
	FRI			
	RR			
	YT			
	TRI			