Study on Conservation Priorities for Shark and Ray Species included and proposed for inclusion in Annex 1 to the CMS Memorandum of Understanding on the Conservation of Migratory Sharks

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Abbreviations

AC	Advisory Committee
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CR	Critically Endangered (in the IUCN Red List of Threatened Species)
DD	Data Deficient (in the IUCN Red List of Threatened Species)
EEZ	Exclusive Economic Zone (usually extends 200 nautical miles from the coast)
EN	Endangered (in the IUCN Red List of Threatened Species)
FAO	United Nations Food and Agriculture Organization
IPOA	International Plan of Action
IUCN	International Union for Conservation of Nature
LC	Least Concern (in the IUCN Red List of Threatened Species)
MEA	Multi-lateral Environmental Agreement
MOS	Meeting of Signatories
MOU	Memorandum of Understanding
NPOA	National Plan of Action
NT	Near Threatened (in the IUCN Red List of Threatened Species)
RFMO	Regional Fisheries Management Organization
SSG	Shark Specialist Group
UNEP	United Nations Environment Programme
VU	Vulnerable (in the IUCN Red List of Threatened Species)

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Executive Summary

The Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS) currently lists 29 elasmobranch species (13 sharks and 16 rays) on its Appendices I and/or II, with Appendix I requesting the full protection of species and II the development of a specialized ("regional") agreement to foster cooperation of all Range States to conserve the listed species. All species of sharks and rays are included in Appendix II, which means that these species would benefit from international cooperation, and 19 species are additionally included in Annex 1 of the Convention. In 2010 a specialized agreement as foreseen for Appendix II listed species was concluded for migratory sharks. This Memorandum of Understanding for migratory Sharks (Sharks MOU) already includes seven species in Annex 1.

Of the other 22 species currently listed on the CMS Appendices, but not on Annex I, six are sharks and 16 are batoids; the term "shark" henceforth will refer to any species of the Class Chondrichthyes, including sharks, batoids, and chimaeras. It has been agreed at the first Meeting of the Signatories to the Sharks MOU that any shark species listed on the CMS Appendices be assessed and considered for listing on Annex I of the MOU.

The aims and purpose of this review was to identify conservation priorities for the seven species already listed in Annex I plus those 22 species proposed for inclusion at MOS2.

The review study identified several common themes to emerge throughout, including a lack of species-specific data, poor taxonomic resolution, a need for identification guides, outdated conservation assessments, determination of essential habitats, and population and subpopulation information. To address these gaps, 25 recommendations were developed and are proposed for implementation by Signatories. Each of the proposed recommendations states an objective and provides an expect outcome(s). The recommendations broadly can be applied to all of the taxa proposed for, and currently listed on Annex I. However, some recommendations may be more relevant to certain taxa than others. The recommendations includes developing data matrices for data gap analysis to determine where information is needed globally and regionally, identification field guides for improved species-specific identification, taxonomic resolution for several species or species groups, identification of essential habitat, including nursery areas, development of species-specific conservation strategy plans, and establishment of benchmarks.

The sawfishes are the most vulnerable group and a very high priority since this group more than any other has documented declines from its historical distribution from 38 to 81%, largely by anthropogenic impacts to its coastal habitat. The next group reviewed was the Mobulidae, including both genera, although it is acknowledged that this family has several complex challenges ahead, including taxonomic revisions that may eliminate one genus and at least one species. Furthermore, species-specific identification

is problematic within the group and the distribution of several regional endemic species is not well known.

The mantas and mobulids are also a high priority for conservation, but it is acknowledged that some of these species may represent complicated challenges. It is recommended that future conservation, management, and research consider splitting the mobulids into two subgroups, based mostly on maximum disc width (DW), e.g. large (DW >150 cm) and small (DW <150 cm). The five smaller species are very poorly known, especially in regards to their distribution, field identification, and fisheries exploitation. The large Devil Ray (*M. mobular*) is taxonomically problematic since it may not be distinct from *M. japonica*; the issue should be revisited pending taxonomic resolution.

The Silky Shark it has been determined is subject to increased mortality rates due to Fish Aggregation Devises. The three thresher shark species would also strongly benefit from international cooperation due to vulnerable life history characteristics and intense fishing exploitation throughout their ranges. The Pelagic Thresher Shark, however, it is recognized that population genetic studies strongly suggest at least two distinct species may exist. Similarly, the hammerhead sharks it is recognized may have cryptic and lookalike species are likely involved. The Scalloped Hammerhead Shark especially should be carefully studied regionally since additional species, possibly cryptic, may co-occur within its distribution, and each may have distinctly different life history characteristics. Regional Fisheries Bodies, and or Regional Fisheries Management Organizations should closely examine these possible different life history characters in relation to current and proposed management measures.

The seven species currently on Annex I include three high profile and charismatic species, which are afforded significant protection through conservation measures, and several species intensely fished. All of these species have active research programs centered on, but lack benchmarks to determine whether any experiencing improvements in their populations.

1. Background and Objectives

The Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU) was concluded under the auspices of the Convention on the conservation of Migratory Species (UNEP/CMS) in 2010 in Manila, Philippines. This MOU was among the first global measures aimed at facilitating international coordination for the protection, conservation, and management of sharks. The stated objectives of the MOU are to "*achieve and maintain a favorable conservation status for migratory sharks based on the best available scientific information, taking into account socio-economic values of these*." The MOU initially had 10 Signatories at the negotiation meeting in Manila, but currently (August 2015) has 39 Signatories, including 38 national governments and the European Union.

The inaugural Meeting of Signatories (MOS1), held in Bonn, Germany, 24-27 September 2012, formed an Advisory Committee (AC), as described in section 7 of the MOU on the Conservation of Migratory Sharks to serve and assist the Signatories in the implementation of the MOU, including the Conservation Plan as described in section 4, paragraphs 11-14 of the MOU. At MOS1, and in accordance with section 6, paragraph 20 of the MOU, the Signatories should assess any amendments to Annex 1 at each future session of the MOS. Furthermore, it was agreed that any shark or ray species listed on the CMS Appendices would automatically be considered by the AC for listing on Annex 1 of the MOU. Currently seven shark species are listed on Annex I of the MOU; all species listed on Annex I are true sharks, none are batoids. However, 16 of the 22 additional species currently listed on Appendices I and/or II of the Convention and being proposed for inclusion on Annex I are batoids.

The recent review on the conservation status of CMS migratory sharks listed 44 migratory and 11 potentially migratory species whose conservation status, as assessed by the IUCN Red List criteria, was vulnerable or higher (Fowler, 2014). Of these 55 species, it was noted that only eight species had been listed in the CMS Appendices (I and/or II), all assessed as Vulnerable on the IUCN Red List of Threatened Species, but no migratory species had been proposed that were listed as Endangered or Critically Endangered. However, at the CMS CoP 11, held in Quito, Ecuador, 4-9 November 2014, an additional 15 species were added to CMS Appendices I and II, and 6 species to Appendix II (Table 1). The additional species included the Reef Manta (*Manta alfredi*), all nine mobulids (Mobulidae), and all five sawfish (Pristidae) species being added on Appendices I and II, and the great hammerhead shark (*Sphyrna mokarran*) and scalloped hammerhead shark (*Sphyrna lewini*), silky shark (*Carcharhinus falciformis*), and the three thresher shark (Alopiidae) species being added to Appendix II. The Giant Manta Ray (*Manta birostris*) had previously been listed on Appendices I and II in 2011 at CMS COP 10, held in Bergen, Norway 20-25 November 2011.

The scope of the present study was design to identify the conservation priorities for seven shark species currently listed on Annex I and for 22 species of sharks and batoids currently listed on CMS Appendices I and/or II (Table 1). The Sharks MOU has defined general objectives for the conservation and management of species and populations listed under the MOU, and these are further developed in the global Conservation Plan for Migratory Sharks in Annex 3 to the MOU. The Conservation Plan's current activities require further specification on a species and/or population level in order to deliver specific outcomes for those taxa under consideration. The present study identifies those priorities for the conservation of species or species groups that are currently listed or are proposed for listing in Annex I of the CMS MOU's Conservation

Plan and objectives, including recommendations on priority measures for their conservation.

The following report, presented to the Sharks MOU Advisory Committee provides additional information for the Programme of Work for the 2016-2018 triennium that will be discussed by the Signatories at their 2nd Meeting (MOS2) in February 2016.

2. Migratory Sharks

2.1. Biodiversity

Sharks, and their relatives the batoids and chimaeras, collectively referred to as Chondrichthyans, are one of the most successful fish groups inhabiting most aquatic ecosystems, including tropical and high latitude coastal and continental shelves, deep-sea, pelagic, and freshwater habitats; the term 'Shark' may refer to any species or population in the Class Chondrichthyes, e.g. sharks, batoids (rays and skates), and chimaeras. Presently, there are 13 orders, 57 families, 202 genera, and approximately 1,225 species of sharks (Table 2). The majority of species (~55%) occur on continental shelves from the intertidal zone, including bays and estuaries, along coastal nearshore areas and out to about 200 m depth (Compagno, 1990; Ebert and Winton, 2010). The diversity of shelf species is greater in the tropics (~40%) and lower in temperate (~30%) seas, while nearly one-half (~50%) of all species are considered deep-sea (Ebert and Winton, 2010; Kyne and Simpfendofer, 2010; White and Sommerville, 2010). Species diversity in pelagic and freshwater habitats is comparatively low, making up only approximately 3% and 2%, respectively (Stevens, 2010; Dulvy et al., 2014).

Knowledge of regional shark geographic biodiversity is relatively uneven, with some areas such as Australia, Europe, and North America being relatively well known, while other regions, often those considered biodiversity "hotspots" are poorly known (Ebert et al., 2013; Dulvy et al., 2014; Ebert and van Hees, 2015). Regionally, the number of species is highest in Australian waters, followed by India, Japan, Southern Africa, Indonesia, the western Central Atlantic, and Taiwan (Table 3). Contrasting these regions of rich shark biodiversity, areas such as the Gulf of Guinea, large portions of the Western Indian Ocean, and Southeast Asia are very poorly known. Furthermore, many of these poorly known regions have essential habitat for some of the most critically endangered elasmobranch species and species groups globally, such as the sawfishes (Pristidae) and river sharks (*Glyphis* spp.) (Dulvy et al., 2014).

Sharks although they may be characterized by broad assumptions about their habitat utilization or type, very little is known regarding ontogenetic, spatial, and temporal changes for most species (Ebert and Winton, 2010; Grubbs, 2010; Simpfendorfer and Heupel, 2012). Furthermore, there is a growing body of evidence that sharks depending on their life-cycle stage will occupy different habitats, with some sharks migrating from a coastal to pelagic habitat with age and maturity (Grubbs, 2010). This may be problematic when trying to assess the health of a population or stock that may be migratory or spend parts of their life cycle in different habitats. For example, it is known that several squaloid species, including members of the genus *Squalus* (e.g. *S. acanthias*, *S. suckleyi*) at birth are mesopelagic, spending the early portion of their lives in the midwater column. Several species of *Carcharhinus* spp. and *Sphyrna* spp. will utilize coastal habitats, but as they mature will migrate offshore and take up residency on the out continental shelf (Grubbs, 2010). Skates (Rajiformes), usually considered to be benthic species, in the eastern Bering Sea will deposit their egg cases in nurseries at the shelf slope break at about the 200 m contour, but upon hatching will migrate hundreds of meters down the slope and take up residency in this habitat for the first few years of life. It is their behavior to migrate to, and occupy, different habitat types, depending on the species, throughout their life cycle that can make conservation and management decisions problematic. Compounding matters is a lack of information on the movement patterns, nursery grounds and habitat, and reproductive cycle for most species.

2.2. Status of Migratory Sharks

The term 'migratory' species follows the definition as given in Article 1 of the Conservation of Migratory Species (CMS), whereby migratory marine species are defined not just by national jurisdictional boundaries between States, but includes boundaries between high seas, e.g. those that do not fall under the jurisdiction of any States, and States' Exclusive Economic Zones (EEZ) or territorial waters where no EEZ has been declared (see Box). However, it is recognized that the term 'migratory' from a behavioral and or ecological sense can vary in definition between various taxa, and even within the sharks the term can be rather flexible. Migratory movement patterns may change over both long-time periods, e.g. throughout a shark's life cycle, or for shorter time periods, such as seasonal temporal movements into and out of habitat-specific nursery grounds.

A review of CMS listed migratory sharks estimated that a relatively high percentage (47.5%) of 'migratory' species that were evaluated had been categorized on the IUCN Red List of Threatened Species as Threatened or higher (CMS Tech #15, 2007). However, the number of known, valid shark species has increased exponentially over the past decade and a half, with approximately 25.8% of all known species having been formally named during this time (Figure 1). The most recent CMS review on the conservation status of migratory sharks (Fowler, 2014) included 153 species, up from 140 species in 2007, but this number is likely low given that 178 new species were described between 2007-2015; an average of 19.8 new species per year. This represents an increase of 17.1% in new shark species compared with an increase of only 9.3% in migratory species during the same timeframe (Fowler, 2014; D.A. Ebert, pers. database, 31 December 2015). The "taxonomic revolution" that began in the mid-2000s has continued apace with researchers primarily from Australia and California, U.S.A., leading the surge in discovering and naming new shark species (Figure 1). It is therefore likely that the number of new shark species, especially among the batoids, will continue to increase in the foreseeable future.

2.3. IUCN Red List status

Recent reviews of the IUCN Red List of Threatened Species (RLA) found that nearly half (~46-47%) of all shark species fell into the Data Deficient (DD) category and about one-quarter (23-25%) were assessed as Least Concern (Dulvy et al., 2014; Fowler, 2014). Results from both studies also found that about 17% of all species were assessed as Vulnerable or higher. These previous reviews of the Red List were based on 1,041 (Dulvy et al., 2014) and 1,093 (Fowler, 2014) species that had been assessed as of 2011 and 2012, respectively. Table 4 summarizes the assessment of 1,176 species as of December 2015, and although the percentage of Threatened Species appears to have declined slightly, these findings rather are reflective of outdated assessments (those > 10 years old), taxonomic changes, and habitat characterization for many species. The number of migratory sharks listed by the CMS, as stated above, only increased by 9.3% relative to the number of new species described (17.1%) over the same time period.

Of the 29 species either listed, or being proposed, for Annex I listing, 21 need to be updated since they are eight or more years old, including 16 of the 22 species being proposed for listing (Table 5). The only species that have been reassessed recently are the sawfishes (Pristidae) and the Devil Ray (*Mobula mobular*) in 2012-2013 and 2014, respectively. Six of seven species currently on Annex I, and nine of 22 species being proposed for Annex I listing were assessed at least one or more times prior to their most recent assessment, with most being seven years or less between assessments (Table 5).

In addition to their global assessments, 16 of species listed on Annex I, or Appendices I and or II have had regional assessments done, but most are also out of date (Table 6). Six of the seven species currently listed on Annex I have had at least one or more regional assessments done, the only exception is the Whale Shark that has only been assessed globally. Of the 22 species being proposed, 10 have had regional assessments including the Silky Shark, two species each of thresher sharks (Bigeye, Common), hammerhead sharks (Scalloped, Great), and sawfishes (Smalltooth, Largetooth, and three devil rays (Pygmy, Bentfin, Spinetail). The Spiny Dogfish has the most regional assessments with nine, followed by Silky Shark and Scalloped Hammerhead Shark with seven subpopulation assessments each. The region with the most assessments is the NE Atlantic with 13, plus six species subpopulation assessments exclusively for European and Mediterranean waters. Conversely, no regional assessments have been done for any of the listed species from the SW Pacific, and three regions, SE Atlantic, NE and NW Pacific were broadly done as ocean basin assessments.

Several of the species have undergone recent taxonomic revisions, with some species being synonymized (Pristidae) as known species and others being separated into two species (e.g. *Squalus acanthias* North Pacific population is now a different species, *Squalus suckleyi*). The Pristidae, as will be discussed further, recently had their RLA updated to reflect these changes, but the Spiny Dogfish is still listed as occurring in the North Pacific on both the IUCN Red List of Threatened Species and CMS web sites; it should be noted that changes are in progress for the Spiny Dogfish for the former web site. It should also be recognized that several potentially significant taxonomic changes are forthcoming and may influence some of the species under consideration for Annex I listing; these will be discussed further.

2.4. Fisheries, Conservation and Management

Global shark fisheries experienced a rapid increase in annual landings from less than 300,000 tonnes in 1950 to a peak of nearly 900,000 tonnes in 2003 before declining to below 800,000 tonnes, prompting concern over the depletion or collapse of impacted populations (Figure 2). Of the five-major FAO regions (Africa, Americas, Asia, Europe, and Oceania) reporting shark catch statistics, only the Asian region experienced a decline in landings, of about 26%, while Europe increased slightly the Americas declined slightly, and the other two regions (Africa, Oceania) experienced very little change in landings (Figure 3). The average landings for the top 30 states over the 10-year period from 2004-2013, the year most recent data is available, was 767,389 tonnes (Table 7). However, shark landings data are likely incomplete and underestimated due to significant bycatch and discard that occur in some fisheries, but are usually not reported. In addition, species-specific landings data, when available, is usually aggregated and rarely distinguishes between species, especially when it comes to lookalike species, e.g. most carcharhinid sharks, mobulids. Furthermore, activities including artisanal and recreational fisheries, habitat loss, and other anthropogenic activities are likely impacting shark populations, but impacts from these activities are mostly unknown and or not very well studied. These various activities combined with poorly known intrinsic life history characteristics and sensitive ecological requirements, makes them especially vulnerable.

A review of the chondrichthyan landings from the top 30 fishing countries, averaged over the most recent five years (2009-2013), and comprising 84% of the total global landings during this time period, reveals many of these range states have some of the most diverse chondrichthyan faunas (Table 8). However, it is acknowledged that many of these states fish far outside their own EEZ, possibly in the EEZ of other states, and on the high seas in international waters. Therefore, the reported landings do not necessarily reflect what is being caught in their own territorial waters. It is worth noting though that although the faunas of some states are relatively well surveyed, others are poorly documented, have not been surveyed in decades, and lack capacity or political will. Regional identification guides are lacking, especially for coastal species, which tend to be more diverse than the pelagic realm, but maybe impacting many more species.

The Food and Agriculture Organization (FAO) under the auspices of its Code of Conduct for Responsible Fisheries adopted the International Plan of Action for the Conservation and Management of Sharks (IPOA Sharks). The aim of the IPOA was to ensure the conservation and management of sharks and their long-term sustainable use. Fischer et al. (2012) in a review of the IPOA reported that 18 of the top 26 shark fishing countries, areas, and territories had adopted a National Plan of Action (NPOA) and that five additional countries were in the process. Of the 143 countries reporting shark catches, only 47 (33%) had adopted a NPOA, but since that report was published another 10 countries have either adopted or are in the process of implementing a NPOA. Management measures adopted by many countries with a NPOA include shark finning measures, closed areas and season, bycatch and discard regulations, data collection and reporting among other initiatives.

The majority of Regional Fisheries Management Organizations (RFMO) similarly have adopted some shark measures, binding and non-binding, and most have some measures for catch/gear regulations, finning, prohibited species, areas closures, reporting requirements, and research, but these do not cover coastal species unless they have an offshore/high seas component to their life cycle. Furthermore, there appears to be little coordination between groups regarding data quality and the kind of data being collected. This would be important for comparing regions and populations between adjacent regions.

3. Recommendations

The following recommendations for the 29 species that were reviewed in this study were the result of an extensive literature review and discussions with colleagues and experts. The 25 proposed recommendations are primarily medium to short term, with most serving to lay the foundation for future long-term projects, beyond the next triennial (2016-18). Each of the proposed recommendations broadly states the objective, followed by some suggested methods and expected outcomes.

The recommendations broadly can be applied to all of the taxa proposed for, and currently listed on Annex I. However, some recommendations may be more relevant to certain taxa than others. A summary of each species or species group is provided at the end (Recommendation #25) indicating those species that would benefit the most from Annex I listing.

3.1. Shark Life History Data Matrix

3.1a. Objectives. Development of a comprehensive Life History Data Matrix (LHDM) for the 29 species currently listed on the appendices and Annex I, and for all 95 threatened species of migratory and 58 possibly migratory sharks identified by Fowler (2014) and as assessed by the IUCN Red List Assessment (Table 9). The LHDM should be design to provide comprehensive information on individual species and clearly indicate which aspects of their life history and distribution is known and more importantly unknown (Figure 4). The LHDM would allow fisheries biologists, researchers, stakeholders, and others to review and quickly assess gaps in the biological knowledge of individual species. Thus, other researchers are better able to develop studies to address those areas where critical gaps exist in information on a species. The LHDM should be created as a queriable web-based tool that would serve as a valuable resource and source of information on migratory sharks.

3.1b. Methods. The design and scope of the LHDM should be tailored to meet the needs of the various stakeholder groups and to provide the information necessary to meet the stated aims and goals of the CMS MOU. However, it should include a comprehensive survey of electronic databases of Aquatic and Fisheries Science Abstracts, Biosis, Catalogue of Fishes, Shark References, and Zoological Record for published references and resources pertinent to migratory sharks. It should also include a comprehensive search through 'grey' literature sources. Examples of information that may be detailed includes longevity, fecundity, gestation period, growth, age and size at maturity, size at birth, mortality, feeding habits, distribution, movement patterns, habitat use, maximum recorded size, and population structure that would be entered into a queriable database.

3.1c. Outcomes. The resulting LHDM could be made available via the web through CMS or another host organization(s) web site for fisheries management agencies, stakeholders, and the general public; it could be made downloaded. The LHDM would serve as an important resource tool for developing future research projects, many of which could be carried out in collaboration with academic institutions, and to develop additional grant funded research projects. Once it has been made available, the LHDM should be updated periodically as new information becomes available.

It is recommended that LHDM be developed regionally by Regional Fisheries Bodies (RFB) and incorporated into future Shark National Plans of Action (NPOA). Regional LHMD would provide information and expose potential gaps in knowledge that would be more relevant to those organizations operating within those areas.

3.2. Shark Fisheries Data Matrix

3.2a. Objectives. A comprehensive database compiling all available catch statistics and regulations containing species-specific information on sharks from FAO, NPOAs, RFB, RFMOs, and Range States. The objective of this recommendation would be to develop, maintain and update a centralized database for regional staff and potential collaborative researchers. Similar to the LHDM this resource fisheries database would be made available to the public through the program's host website.

3.2b. Methods. Commercial and recreational fisheries data and regulations would be compiled from each region. For each region, overall commercial and recreational landings would be included and further subdivided by gear type, month, and region, where possible. These data would additionally be displayed as figures within the database. A list of relevant fishery publications will also be included for each of the Range States. All data, if possible, would be subdivided into spreadsheets containing commercial landings, recreational landings, commercial regulations, recreational regulations, and associated literature and incorporated into a queriable database.

3.2c. Outcomes. The resulting Shark Fisheries Database Matrix (SFDM) once completed would be made available via the web on a regional host organization's web site. It is intended for use by resource managers, researchers, fishers, and others, and can be downloaded or queried. The SFDM would contain information on commercial regulations, commercial landings, recreational regulations, recreational landings, and other relevant information.

Range State–specific landings data would also be graphically depicted for all shark taxa. The SFD will serve as an important resource tool for resource managers and others to develop research projects concerning long–term trends in shark fisheries and targeted populations. It can also be use by commercial and recreational fishers to check regulations. The SFD would be updated yearly as new information becomes available.

Similar to the LHDM, it is recommended that the SFDM be developed regionally by Regional Fisheries Bodies (RFB) and incorporated into future Shark National Plans of Action (NPOA). Regional LHMD would provide information and expose potential gaps in knowledge that would be more relevant to those organizations operating within those areas. It is recognized that FAO and some RFMOs already maintain landings databases, the information is only as good as the information provided by the various entities. The goal here would be to improve landings data, including regional species-specific information, which is lacking for many regions. This should enable RFBs, RFMOs, and other management bodies to address management gaps in a timely manner.

3.3. Databases Training Workshops

3.3a. Objectives. An important requirement to ensure the quality and consistency of the data to be incorporated into the Life History (LHDM) and Shark Fisheries (SFDM) matrices would be the training of personnel responsible for the collection and compilation of such information. The information available from different regions may vary due to local capacity to collect fisheries data or have access to reference libraries and journals, but with well-trained personnel many of these challenges could be overcome.

3.3b. Methods. The workshops would be held in conjunction with proposed regional IUCN Shark Specialist Group (SSG) Red List Assessment workshops over the next three years (2016-2018). The training workshops would be held prior to, or after, planned RLA workshops since many of the personnel likely be involved with developing and maintaining these databases and matrices would already be in attendance. The workshops would be planned for 1 or 2 days, and would likely involve many of the participants from the RLA workshops. Coordination and organization would be required between the IUCN SSG and the CMS Sharks coordinators to harmonize and facilitate each of these workshops, but with planned preparation both activities would be greatly enriched. The tools produced from these workshops would have mutual benefits.

3.3c. Outcomes. The primary outcomes from holding training workshops in conjunction with the RLA workshops would be in the training of regional personnel (Figure 5). The development and functionality of these matrices will hinge on the data collection and gathering, researching, and timely continued maintenance of both the LHDM and SFDM. Accessibility of both matrices will be an important aspect for fisheries managers and researchers to identify gaps to be addressed. Trained personnel and accessibility to these matrices, and in the RLA process, would be invaluable as resource tools to highlight data gaps, and provide improved local knowledge on migratory sharks.

3.4. Shark Identification Regional Guides

3.4a. Objectives. The importance of obtaining species-specific information on sharks that are caught or impacted by fisheries, either targeted, as bycatch, or incidental catch has been highlighted in several fora and other instruments. In according to the FAO the need to improve species identification undeniable since a comparison of deep-sea species caught to the number of known species per region, only a very small number of species are reported to species level (Figure 6). Although primary commercial fish species are often recorded in fishery logbooks, many species, especially sharks, are not. Development of species identification guides in support of improved reporting of species at sea has been recommended by the FAO and other organizations. The FAO has historically developed regional identification guides for fishers, at sea observers, and non-specialist, in addition to other users. Recent identification catalogues and field guides were developed for the Chondrichthyans of the North Atlantic, Indian and Southeastern Atlantic oceans, and an identification guide to pelagic sharks of the Western Indian Ocean; this latter project was in coordination with the Indian Ocean Commission (IOC) and Indian Ocean Tuna Commission (IOTC).

3.4b. Methods. In cooperation with the FAO, other receptive parties (e.g. Tuna Commissions) and interest groups (e.g. Manta Trust) develop up to date regional species lists, compile and prepare descriptions of individual species using external morphological characteristics. Additional information including biological, ecological, distributional, and fisheries information may be considered. A detailed illustration and key to look-alike species should be included. Identification training workshops, as outlined in 3.7 below, should also be held in conjunction with development of these guides.

3.4c. Outcomes. The overall aims of these catalogues and field guides would be to facilitate species-specific identification and data collection of sharks occurring in specific regions. A key aspect would be for easy to use field identifications. Group specific (family or genera) identification guides would be another consideration especially in regions where several similar, look-a-like species occurs; both the sawfishes and mobulids would especially benefit. Coastal marine regions in areas that lack capacity would be high priority for development of field guides. Presently, there are some regional guides available for sawfishes and mobulids design and produced by various organizations; this should be built upon and expanded. Other identification products could be brochures or flyers that would be very region specific. To this end, it would assist scientists, fishery officers, observers, interested stakeholders, and the general public.

Related link example of identification guides:

Deep-sea Cartilaginous Fishes of the Southeastern Atlantic Ocean
http://www.fao.org/publications/card/en/c/44928512-014c-42ea-b332-c1a85f02b6b5

Identification guide to deep-sea cartilaginous fishes of the Southeastern Atlantic Ocean
http://www.fao.org/publications/card/en/c/273babb4-9a5a-4f16-84e9-9fbc751a3cd7

Sharks of the Arabian Seas: an identification guide
http://www.gulfelasmoproject.com/species-information.html

Deep-sea Cartilaginous Fishes of the Indian Ocean. Volume 2. Batoids and Chimaeras
http://www.fao.org/3/a-i3888e.pdf

On board guide for identification of pelagic sharks and rays of the Western Indian Ocean
http://commissionoceanindien.org/activites/smartfish/publications/manuals-and-guides

Deep-sea Cartilaginous Fishes of the Indian Ocean. Volume 1. Sharks
http://www.fao.org/docrep/019/i3477e/i3477e.pdf

Identification guide to the deep-sea cartilaginous fishes of the Indian Ocean
http://www.fao.org/3/a-i3486e.pdf

3.5. iSharkFin project

3.5a. Objectives. The global shark finning trade is an issue of immense conservation concern. However, in many regions where finning occurs, especially in developing countries, there is little capacity or training to identify shark fins to species. To help resolve this issue, the FAO developed an expert system that uses machine leaning techniques to identify shark species from shark fin shapes. The aim of the project is to provide port inspectors, customs agents, fish traders, and other users without formal taxonomic training to identify shark species from a picture of the fin.

3.5b. Methods. The iSharkFin uses an interactive process whereby users can download and install from the web a program to identify shark fins from their shape (Figure 7). The program can also be set to the users native language; currently 11 languages can be selected from. The process starts by taking a standard photograph of the fin, and the interactive process directs the user to select some characteristics of the fin and to measure its shape receiving as an automatic response the shark species to which the fin belongs.

3.5c. Outcomes. The first version was recently published for the identification of 35 shark species commonly seen in the international trade, including some species listed in the CMS and CITES Appendices. Links and instructions for downloading the program should be made easily available through webs hosted by regional fisheries bodies and other organizations to make it easily accessible. RFMOs, RFBs, among other regional organizations should consider fins from additional species, especially relevant to certain regions, for inclusion. The list of 35 species at present does not include any batoids.

Future releases will include the capability to identify all the main shark species in the trade. Also, the FAO is currently developing an app that can be used on mobile devices such that photographs can be taken and uploaded, with a shark fin identification being made within minutes in the field. Field genetics tests are also being developed at this time. These advances in field technologies should improve field identification. It is acknowledged that the iSharkFin tool is relatively new, and is still being tested, but this emerging technology provides an opportunity for international cooperation to improve and refine field identification of shark fins.

A key priority for this recommendation would be future inclusion of those batoid taxa that have been identified as being Threaten or higher. This would immediately include all the sawfishes, but other batoid taxa such as the guitarfishes, although not under consideration here for CMS listing, should be included.

Related links:

iSharkFin: http://www.fao.org/fishery/ipoa-sharks/iSharkFin/en

iSharkFin Manuel: ftp://ftp.fao.org/FI/Document/sharks/iSharkFinManual.pdf

3.6. iSharkGill project

3.6a. Objectives. The trade in gill plates from *Manta* spp. and *Mobula* spp. is an increasing issue of global conservation concern. The flesh of these rays is of poor quality and until recently they were not subjected to targeted fisheries. However, dried gill plates have become desirable in some regions and as a result they are now being targeted. Similar to the shark finning issue there is little capacity or training to identify gill plates to species. The aim here is to develop and build upon guides to identifying the dried gill plates for port inspectors, customs agents, fish traders, and other users without formal taxonomic training to identify gill plates to species.

3.6b. Methods. The iSharkGill, similar to the iSharkFin, would be developed such that it would be an interactive process whereby users can download and install an application from the web to identify the gills from their shape. Once a photograph of the gill has been taken, the interactive process will direct the user to select some gill characteristics, to measure its shape, and upon receiving the information will automatically respond with an identification of the manta or mobulid species from which the gill belongs.

3.6c. Outcomes. Following the format of the iSharkFin project, develop a simple user guide to identifying manta and mobulid gill plates to individual species. Presently, the Manta Trust has an identification guide to the gills of mantas and mobulids that can be downloaded as a PDF, but this only separates out the two genera, e.g. Manta's from Mobulids. The mobulids currently comprise nine species, and given the relatively small number of species involved compared to the sharks should make development of an identification system much simpler. Field genetics testing would also enhance species-specific identification. Technological advances would improve field identification.

Related links:

http://www.mantatrust.org/threats/gill-plate-trade/

https://cites.unia.es/cites/file.php/1/files/pew-manta-ray-gill-plate-id-guide.pdf

3.7. Regional Identification and Data Collection Training Workshops

3.7a. Objectives. The primary objective would be to improve the capabilities of regional scientists from bordering countries in species identification and data collection methodologies of processing specimens (Figure 8). This would include development of an onboard support and data collection program, possibly through observer programs, to train personnel in techniques for improving species identification and maximizing biological data that could be collected. Training workshops for personnel from regional Range States, including local fisheries biologists, resource managers, researchers, and other stakeholder groups.

3.7b. Methods. Personnel would be trained in various aspects of field data collection, including learning external anatomical features to identify species, how to use taxonomic guides and keys for species identification, and processing specimens to collect basic biological data.

3.7c. Outcomes. Species-specific identification data and biological data collection are key aspects to developing long-term sustainable fisheries management, and implementing conservation priorities to maintain healthy shark populations. The highest priority for personnel attending these workshops would be training in the identification and collection of biological samples for age, growth, and molecular studies, how to photograph specimens in the field for later identification, and how to preserve biological samples and specimens.

3.8. Taxonomic Studies

3.8a. Objectives. Many migratory shark species are poorly described and not well known taxonomically, resulting in an extremely limited understanding of the species composition that is directly being impacted by fishing and anthropogenic activities. The sawfishes (Pristidae), for example, recently underwent an extensive taxonomic revision that resulted in the family being reduced from seven to five valid species. However, of the 17 other species currently being proposed for listing on Annex I, 14-15 of these species should be critically examined taxonomically. In addition, two or three of the species currently listed on Annex I may in fact represent cryptic species or species complexes with some potentially being split into different species in the future.

3.8b. Methods. Naylor et al. (2012) found strong genetic structure and support for additional species within and between ocean basins for some species, and found inconclusive results for others. Using traditional morphological and newer molecular tools a taxonomic reevaluation should be conducted for cryptic species, undescribed species, and invalid species names. Collaborative relationships should be established with experts and leading programs to expedite research and publication of these findings. For example, the "*Lost Sharks*" program at the Pacific Shark Research Center, Moss Landing Marine Laboratories is a global effort to discover and document those little known or unknown shark species that have largely been forgotten about in favor of a few high profile species. The Chondrichthyan Tree of Life project at the College of Charleston is completing an expansive revision of all major and minor taxonomic chondrichthyan groups. It is expected these projects will lead to significant changes in the classification of numerous taxa, including many CMS Sharks currently being proposed for addition to Annex I.

3.8c. Outcomes. All nine species comprising the Mobulidae should be reexamined since at least one species, *M. mobular*, is currently considered a Mediterranean endemic and may in fact not be a valid species. At the generic level, there is growing molecular evidence that the genus *Manta* does not appear to be valid, with both species nesting within the genus *Mobula*, since the latter name has priority. Both hammerhead sharks being proposed, *Sphyrna lewini* and *S. mokarran*, may involve cryptic species and the Pelagic Thresher Shark (*Alopias pelagicus*) may represent a different species on each side of the Pacific Ocean (Trejo, 2005; Naylor *et al*., 2012; Testerman and Shivji, 2013; Cardeñosa *et al*., 2014; Miller *et al*., 2014). The Porbeagle, White, and Shortfin Mako sharks exhibit regional differences and should be examined closer to determine their regional status.

Related links:

Lost Sharks
https://psrc.mlml.calstate.edu/current-research/lost-sharks/

Chondrichthyan Tree of Life
http://sharksrays.org/

3.9. Taxonomic Changes and Updating Species Assessment

3.9a. Objectives. The IUCN Red List of Threaten Species assessments for sharks are currently undergoing reevaluation since many species assessments are 10 or more years old. In addition, species RLA have not kept pace with taxonomic changes during this time. Approximately 250 new species have been described over the past decade, but few of these new species descriptions have been assessed. The objective here would be to assess taxonomic changes that need to be revised and updated quickly due to conservation concerns. Recent examples include the sawfishes (Pristidae), and North Pacific Spiny Dogfish (*Squalus suckleyi*) being separated from the North Atlantic Spiny Dogfish (*Squalus acanthias*); the former species RLA although completed still has not been published. In fact, on the CMS web site, the North Pacific Spiny Dogfish is still listed under the species name, *S. acanthias*, and on Annex I, even though the species does not occur in the North Pacific. Additional examples include CITES still lists seven species of sawfishes when it is now known that there are only five valid species.

3.9b. Methods. The Shark Specialist Group (SSG) is currently organizing RLA workshops to address time delay gaps from when a species has been identified, either as new or through a taxonomic revision, to when it has been assessed or reassessed. Proposed forthcoming RLA workshops over the next three years will address some of these issues, but for some species time may be of the essence. Therefore, close collaboration between the SSG, Regional SSG membership, and other experts will be important in assessing or reassessing species quickly to reflect taxonomic changes.

3.9c. Outcomes. The RLA's for sharks are becoming cited more frequently in the primary literature and in management and policy reports. The recent addition of digital object identifier (DOI) serial codes will only increase the citation rate of these references. Therefore, the timely and updated RLA of species will serve as an important resource tool in determining the conservation status of individual species.

CITES history of shark listings
https://cites.org/eng/prog/shark/history.php

CMS Spiny Dogfish, *Squalus acanthias*, web page description
http://www.cms.int/en/species/squalus-acanthias

3.10. Geographic Distribution

3.10a. Objectives. Shark distribution, in addition to habitat, may have substantive implications in how they are managed, and may have profound influence in formulating conservation priorities. Wide-ranging species may fall into multiple international fishery jurisdictions, thus requiring cooperation between Range States and Regional Fisheries Bodies. The distribution for many wide-ranging species, e.g. pelagic/oceanic forms, is spottily known and often may only represent a segment of the overall population. Furthermore, among coastal species, especially the sawfishes, their historical range depending on the species has contracted from 38 to 81%. Therefore, the objective of this recommendation component is examine the ecological and historical distribution of the 29 species, and where appropriate facilitate collaborations with neighboring Range States and RFBs to determine the geographic distribution.

3.10b. Methods. Distributional patterns can differ between taxa, and can change over large or small spatial scales, and may be influenced by seasonal climatic or oceanographic cycles and events. Anthropogenic effects to their habitat may also heavily influence coastal dependent species such that their historical distributional range has been altered. Therefore, landings data with species-specific, sex, length, weight, and approximate location combined with oceanographic data can be used initially to reconstruct and refine the geographic distribution. The use of sawfish rostra has been helpful in delineating the historical range of many of the species since they are unique to each species.

3.10c. Outcomes. The identification of many species is problematic, as noted throughout this document, and only through improved specific-species identification will the distribution for several species be better elucidated. Although it is fairly well known for some species, for others it is not well known. For example, the distribution of Longfin Mako Shark, the hammerhead sharks and several of the mobulids is very poorly known due to lack of identification or misidentification. Therefore, the most important outcome from this recommendation will be in developing and fostering collaboration between Range States, RFBs, and multilateral environmental agreements (MEAs) to determine the extent to which species may be crossing international jurisdictions. This will enable setting better conservation priorities to improve the abundance and population structure of the shark species being proposed for Annex I.

3.11. Habitat Classification

3.11a. Objectives. Classification of habitat preference for the 29 species under consideration in this study, following a modification of Dulvy et al. (2014), can be segregated into two categories, e.g. coastal and pelagic/oceanic (Table 9). Of the species currently listed on the appendices and Annex I, 17 are mostly pelagic/oceanic, while the remaining 12 are more coastal inhabitants. Given the vastly different habitats these species exhibit, jurisdictional management schemes and priorities will differ between species (Figure 10). For example, the sawfishes are primarily coastal inhabitants and would not benefit from High Seas measures (e.g. RFMOs) versus NPOAs or regional action plans involving multilateral agreements. The mako sharks by contract are pelagic inhabitants, often found outside EEZ, on the High Seas and, and thus would benefit from management measures covering this habitat.

3.11b. Methods. Determination of habitat classification is based on current best available information. However, with better data collection and improved species-specific information these categories could be refined taking into account regional differences. For the presence, coastal species are defined as those primarily inhabiting a nearshore, including bays, estuaries, to outer continental shelf environment extending out to about the 200 m contour. Those species inhabiting a pelagic/oceanic environment mostly occur offshore, along the outer continental shelf and in the open ocean far from shore. This group usually occurs beyond 50 m depth and is mostly found in the water column, although it is acknowledge that portions of their life cycle, especially neonates and juveniles residing in nurseries, may have a coastal component.

3.11c. Outcomes. Refinement of habitat classification should help in determining the best jurisdictional measures for the management and conservation of these species. Most species could be categorize with available information at least by their adult stage, but some juvenile life stages may be problematic such that the juveniles may require a different classification, e.g. juvenile coastal and adult pelagic/oceanic. For example, some hammerhead shark species will pup in the nearshore environment, but as they grow will take up a more pelagic/oceanic habitat.

3.12. Habitat Associations

3.12a. Objectives. Determine essential habitat associations of migratory sharks. With increased knowledge of habitat associations, movement patterns, and spatial utilization gained from these studies, proper steps can be taken to identify Essential Habitat for these species. Potential questions to be addressed through the course of these investigations are: 1) what are the spatial and temporal patterns of habitat utilization of individual shark species at different life stages? 2) what species-specific habitat features are associated with nursery areas across large (km) and small (m) spatial scales? and 3) what are the depth and habitat associations of the dominant migratory shark species across large (km) and small (m) spatial scales?

3.12b. Methods. Examination of site-specific information based on the abundance and distribution of sharks landed during commercial, recreational, or scientific surveys that can be overlaid onto geo-referenced habitat maps of each respective region. Species-specific occurrence would be examined in relation to habitat features, depth, season, size, and sex. In addition, data gathered from catch data and from previous survey cruises would be analyzed to determine their distributions, and relative abundance, and habitat associations.

3.12c. Outcomes. The key output from this component would be determination of essential habitat, especially identification of nursery ground habitat, for species-specific migratory sharks. Essential habitat at different life stages and identification of nursery grounds is critical to maintaining healthy marine habitats, and is linked to supporting sustainable shark fisheries. The sawfishes and other coastal dependent shark species would benefit immensely since they tend to be subjected negatively to anthropogenic influences impacting their habitats.

3.13. Nursery Areas

3.13a. Objectives. Developing conservation priorities and management plans for shark populations requires knowledge in identifying and defining critical or essential habitat for maintaining the population. Nursery areas are perhaps one of the most important habitats for perpetuating shark populations. No other taxa discussed here can demonstrate most vividly the impact habitat degradation can have on a shark population than the sawfishes (Pristidae). This group more than any other is coastally dependent and impacts whether anthropogenic or natural can have significant influence on its population. However, while sawfishes are coastal and 'comparatively' easy to study with regards to their habitat, nursery areas, especially for pelagic species are virtually known for most species. Therefore, impact to their populations whether through fishing or other human induced activities likely will go undetected without defining essential nursery habitat and location.

3.13b. Methods. Nursery areas by definition are those habitats where a species breeds, pups, provides protection and food resources for neonates and juveniles. Depending on the life cycle stage and taxa involved, nursery habitats may vary, e.g. the pups after birth may relocated to a different habitat with more food resources and less competition, minimizing mortality and increasing the prospects of growing to maturity.

3.13c. Outcomes. Presently, knowledge of nursery areas are mostly limited to anecdotal information or are broadly classified, but the habitat specific requirements for many species is largely unknown. In fact, nursery areas are unknown for all of mobulids, and many of the other species currently listed in the appendices. The pelagic species will be problematic since several of these species (e.g. Silky Shark, thresher sharks) are wide-ranging, crossing several national jurisdictions, making determination of nursery areas difficult to define. Close collaborative efforts between various entities, including MEAs, RFMOs and RFBs, will be crucial to determining and defining nursery areas.

3.14. Population Genetic Studies

3.14a. Objectives. Investigate the population structure of migratory sharks, with an emphasis on the thresher sharks (Alopiidae), sawfishes (Pristidae), mobulids (Mobulidae), and Scalloped Hammerhead Shark (*Sphyrna lewini*), but would eventually extend to all species listed on CMS Appendices and Annex I. The species identified here are those that based on current information would seem to be most urgent. For example, it has been determined that the Pelagic Thresher Shark (*Alopias pelagicus*) may represent such distinctly different populations between the eastern and western Pacific Ocean that it maybe that they are in fact different species (Trejo, 2005; Cardeñosa *et al*., 2014). The Scalloped Hammerhead Shark appears to be a species complex and may involve additional, as yet undescribed, species, some which may co-occur with it. Such is the case with the recently described Carolina Hammerhead Shark (S. gilbert) that appears to co-occur with the Scalloped Hammerhead Shark, but not readily separated by external characteristics. Recently, it was determined that the spiny dogfish from the North Pacific was in fact a different species from the North Atlantic Spiny Dogfish (*Squalus acanthias*).

3.14b. Methods. The population structure and extent of movement of highly mobile, pelagic species has proven difficult to discern. However recent and continuing advancements in molecular genetic techniques have been successful in determining population structure of shark species by quantifying the degree of genetic relatedness between geographically separated populations. Population studies should include specimens and genetic data made available by observer programs, and through regional collaborators.

3.14c. Outcomes. Despite growing conservation concerns over highly migratory sharks, genetic relatedness among shark populations, especially wide-ranging species, is poorly known. For some groups, e.g. thresher sharks, despite their high potential for dispersal, recent studies have shown them exhibit limited gene flow among different populations.

Gene flow in the Pelagic Thresher Shark across the Pacific Ocean is limited, but extensive among locations in both the eastern and western Indo-Pacific. The Bigeyed Thresher Shark (*A. superciliosus*) by comparison shows shallow population structure between Indo-Pacific and Atlantic populations, but not among populations spanning the entire Indo-Pacific Ocean. Findings for Common Thresher Shark (*A. vulpinus*) indicate genetic heterogeneity among almost all sampled populations, both within and between the Atlantic and Indo-Pacific oceans. Taken together, this data indicates that intraspecific biological and ecological differences among thresher sharks are sufficient to cause variable patterns of interspecific genetic population structure. This example highlights the need for not only increased population genetic studies, but for international cooperation for the conservation and management of sharks.

3.15. Regional Conservation and Management Priorities

3.15a. Objectives. Conservation and management decisions where little to no species-specific information is available is often made using known data from 'similar' species where some data maybe available, but without consideration to differences between species, ecosystems, or habitat. Population limits, including regional subpopulations, are also poorly known, thus developing sustainable practices, prioritizing projects, and improving the heath of shark populations maybe compromised. Furthermore, a lack of taxonomic knowledge between regions, as outlined in recommendation 4.8, does not take into account likely life history differences between regions. The recommendation here is that life history, fisheries, and conservation goals should be developed within regions where the species occurs rather than 'assuming' knowledge from one region is transferable to another.

3.15b. Methods. A review of recent population genetic studies reveals several species and or species groups, e.g. both hammerhead shark species, pelagic thresher shark, that show strong population structure may in fact represent different species. Further compounding the issue is the wide variety of life history characteristics that also support the occurrence of different species. For example, until recently the North Pacific Spiny Dogfish (*Squalus suckleyi*) was considered to be the same species on the North Atlantic (*S. acanthias*) even though the life histories of these two populations were strikingly different. A systematic reexamination of these two populations lead to the conclusion that the North Pacific population was a different species, and should be subject to different conservation and fishery management practices. The Northwestern Atlantic scalloped hammerhead shark population is now known to be two species, *S. gilbert* and *S. lewini*, separation between these species in the field as noted above is still problematic and life histories differences between the two species is unknown. The *S. lewini* complex globally may represent several undescribed species; a critical issue that should be addressed as it is being considered for Annex I listing.

3.15c. Outcomes. Management and conservation priorities should take into consideration life history traits that are unique to species within a region or a population, rather than using by proxy traits that may differ between regional populations or stock differences. The white shark for example appears to exhibit age at maturity and growth rates that differ between and within ocean basins. Thus age-based demography and reproduction parameters from one region may differ substantively.

The outcome here is to develop improved conservation and management priorities based on data and information unique a specific region and individual species. Incorporating data gathered through recommendations 3.1, 3.4, and 3.7 will serve as guidelines to improving species-specific and regional information.

3.16. Taxa Specific (family/genera/species) Conservation Strategies

3.16a. Objectives. Development of a global conservation strategy plan for those species or species groups determined to be most at immediate risk of extinction. The threat status of most known shark species has been determined, albeit with limitations as stated in recommendation 4.8, and as such those species or species groups (Family or Genus) should be prioritize to determine those most at immediate risk. Dulvy et al. (2014) along with the IUCN SSG has identified those species and species groups most at risk, and determined that of the species currently on the CMS appendices, the sawfishes (Pristidae), thresher sharks (Alopiidae), and devil rays (Mobulidae) are among those requiring urgent attention.

3.16b. Methods. A strategic plan for the global conservation of sawfishes has been developed and published (Harrison and Dulvy, 2014), with a clear set of specific recommendations, e.g. global priorities for research, education, and conservation, and an outline for regional sawfish conservation strategies. The strategic plan was developed during a workshop attended by specialists from countries where sawfishes are native to, or previously had been native. The aims of the workshop were to review the global status of all sawfish species, review and revise the RLA for each species, and develop a global action list for meaningful research, education, and conservation.

3.16c. Outcomes. Presently, the sawfishes are the only group where a strategic plan has been developed, but a similar plan is currently being developed for mantas and mobulids (N. Dulvy, pers. comm.). The strategic plan for sawfishes should provide a roadmap for future similar plans currently being developed for mobulids, and eventually for other CMS species at risk groups. As these plans are completed, the obvious next step is the implementation of the actions developed within each plan.

3.17. CMS Migratory Shark Species Database

3.17a. Objectives. Development of an informational database for listed CMS Migratory Shark species that would be updated periodically, and made available for public access. The CMS currently has 153 species listed as being migratory (n = 95) or potentially migratory (n = 58) (Table 9). However, it is recommended that this list be reviewed and updated to reflect current information and knowledge of migratory species. Such a list would serve as a potential resource tool, along with the LHDM and SFDM, by identifying species that may be of high conservation concern.

3.17b. Methods. A prototype CMS Migratory Shark Database was outlined, but never formally published (IUCN SSG/CMS, 2007). The basic structure included a list of shark species, Regional Fisheries Bodies (RFB) by CMS region, range, red list summary exclusively for migratory species, a red list summary of migratory and potential migratory species, and a bibliography.

3.17c. Outcomes. The list of CMS Migratory Shark species could be 'hot'-linked to other databases currently in use or proposed here. This would include the IUCN Red List, LHDM, and SFDM. By clicking on a specific species on the checklist of species the 'hot'-link would take one to the desired site for additional information on the species in question.

3.18. Benchmarks and Timeframes

3.18a. Objectives. To determine the effectiveness of the conservation priorities, benchmarks should be established with the set of proposed recommendations, with a timeline for each item. This would help ensure the aims and goals of the recommendations would be met. Furthermore, a program coordinator should be hired to oversee the development and implementation of the proposed databases and workshops (see recommendation 3.19).

3.18b. Methods. The benchmarks and timelines should be set prior to the hiring of a program coordinator.

3.18c. Outcomes. The establishment of a set of benchmarks would serve to measure the progress towards the aims and goals as set forth in each recommendation.

3.19. CMS Migratory Shark Program Database Coordinator

3.19a. Objectives. The development of databases, organization and coordination of workshops associated with several of the recommendations will require an immense time commitment, and thus to make them effective will take a full time coordinator.

3.19b. Methods. External funding sources should be identified and approached to secure funding to support such a position. Support for this position could be done as a joint effort between CMS, IUCN SSG, RFMO, RFB, and other organizations that would be partners in this venture. A timeline for achieving the aims and goals of the databases and workshops should be established prior to filling such a position.

3.19c. Outcomes. The ideal individual for this position would ensure consistency in the assembly of the databases, and serve as a liaison between the various stakeholder groups supporting this position. Also, the coordinator in this position should be dedicated for this role and have no other duties than organizing the databases, and organizing and facilitating the workshops.

3.20. Ecotourism Monitoring

3.20a. Objectives. Shark ecotourism has been growing in popularity over the past couple of decades, with questions arising as to compatibility and sustainability of this emerging industry. Although there are obvious benefits to non-lethal human shark interactions, and they can play a positive role in educating the public through such experiences, very little has been done to address its impacts on targeted shark species and populations. Furthermore, there are few measures in place that address the compatibility of ecotourism and the ideals of sustainability.

3.20b. Methods. Studies on shark ecotourism have rapidly grown over the past decade, but there are many areas lacking substantive information about the impacts, positive and negative, these industries may be imposing on some of these species. Several species currently listed on the CMS appendices and or Annex I are major tourist attractions, e.g. White Shark, Whale Shark, Manta Rays, but none of the various organizations monitoring these species has provided input or monitored the growth of this activity.

3.20c. Outcomes. The shark ecotourism industry has the capacity to play an important role in decreasing harvest rates, and provides sustained job opportunities. This is especially true in States with artisanal fisheries and limited capacity to otherwise monitor the harvest rates of coastally dependent species. A database of the species involved, types of activities, e.g. scuba diving, boat viewing, location where elasmobranch ecotourism activities takes place, outreach and educational activities associated with these activities, and other relevant information may benefit the industry overall and enhance the elasmobranch experience for the tour operators. The public aquarium industry has a similar captive elasmobranch database of those species maintained in aquariums and sets standards for zoos and aquariums. This has lead to improved conservation science within the industry with organizations attaining and maintaining accreditation. Therefore, development of guidelines for global standards of good practices is recommended.

Related Link:

Association of Zoos and Aquariums
https://www.aza.org/

3.21. Cultural and Traditional Fishing Communities

3.21a. Objectives. Community-based artisanal and small-scale fisheries often fall outside formal fisheries management, and conservation strategies, and maybe overlooked as a potential source of valuable information for coastal dependent species. Coastal dependent species, mostly in developing countries, may be experiencing increased exploitation by small-scale fishing communities through increased market value for shark products such as fins, mobulid gill plates, and sawfish rostrums. Many of these communities have extensive local historic, and current, knowledge of coastal species, which could benefit conservation efforts, for example finding and identifying sawfish rostrums that are often kept as curios or have cultural significance in some communities.

3.21b. Methods. Developing communications with local fishers in communities, especially throughout Africa, Southeast Asia, and Central America, among other regions, may lead to improve current and historical information on the distribution of species that are suspected of having had their range contract in recent decades. This is has been done most effectively for the sawfishes in examining their historical ranges, but should be expanded to other coastal species, e.g. hammerhead sharks, some mobulid species.

3.21c. Outcomes. The sawfishes with their distinct rostrum are an obvious group to identify, but nursery grounds for other groups such as the mantas, mobulids, and some of the coastal dependent species such as juvenile hammerhead sharks would benefit. Determination of species occurrence and critical habitats (e.g. nursery grounds) through local fisher knowledge would benefit the communities through development of sustainable practices, and by improved conservation measures for those species these communities may be dependent on.

3.22. Education and Outreach

3.22a. Objectives. Development of collaborative educational and outreach activities highlighting and communicating information is recommended. This would include regional cooperation among existing organizations and programs to disseminate, highlight, and provide information on sharks related activities and events. These programs, usually academic or non-profit initiatives, may be focused on regional species composition, species-specific (e.g. white sharks, whale sharks) or species group (e.g. Sawfishes, Mantas), but with similar goals in advancing conservation, education, and research on elasmobranchs.

3.22b. Methods. Many of these organizations have on-line resources such as identification guides, informational flyers, and sightings reports whereby people can go on-line and submit information. Collaboration between the CMS and the IUCN Shark Specialist Group (SSG), which includes among its membership many of these same individuals, could serve as a point of information dissemination. The SSG has in place 12 regional groups with experts from 35 countries, covering much of the same fishing areas as the FAO, RFBs, and RFMOs.

3.22c. Outcomes. A dedicated web site to communicate information and where potential products resulting from this activity would include, but not be limited to, downloadable regional guides and species identification flyers could be obtained. It could also provide a portal for providing regional information and activities for school kids, formal educators, the general public, industry stakeholders, policy makers, and the scientific community.

3.23. Citizen Science

3.23a. Objectives. To promote the conservation of the sharks currently listed and proposed for Annex I listing it is critically important to learn more about their distribution and occurrence. In coordination with recommendations 4.20, 4.21, and 4.22 above, and especially to assist in collecting data a "Citizen Science" program should be enacted. A number of species-specific programs, aimed mostly at large migratory species, e.g. white and whale sharks, are ongoing, but some programs are focused at gaining a better understanding regional species composition, abundance, distribution, and population size.

3.23b. Methods. A broadly design citizen science program to gather information on those species listed on Annex I and the appendices could add substantively to the knowledge base of these species, especially regionally and in developing countries where capacity maybe limited. Species such as sawfishes and mobulids would benefit from improved knowledge of their distribution and occurrence.

3.23c. Outcomes. The scope of this recommendation would especially help researchers who cannot be everywhere at once. The type of data collected would be regional and or species-specific, and would provide insight into when and where migratory species occurs, and would provide information on species being landed in areas that may not collect species-specific data.

Examples of species-specific web-based Citizen Science Programs are provided below:

Spot a Basking Shark Program (Pacific Shark Research Center/Moss Landing Marine Laboratories)
http://psrc.mlml.calstate.edu/current-research/basking-shark

It's Hammertime! (Pacific Shark Research Center/Moss Landing Marine Laboratories)
https://psrc.mlml.calstate.edu/current-research/citizen-science/its-hammertime/

Gulf Elasmo Project
http://www.gulfelasmoproject.com/

Sawfish Encounter Reporting (Florida Program for Shark Research: University of Florida)
https://www.flmnh.ufl.edu/fish/sharks/sawfish/sawfishencounters.html

International Sawfish Encounter Database (Florida Program for Shark Research: University of Florida)
https://www.flmnh.ufl.edu/fish/sharks/sawfish/sawfishdatabase.html

3.24. Social Media

3.24a. Objectives. The advent of social media over the past decade has provided innovative opportunities for communicating and networking. The use of social media outlets is used extensively by numerous organizations, and would be of considerable benefit for many of the recommendations relevant to the Sharks MOU that have been put forth in this report.

3.24b. Methods. Most organizations nowadays have a web-based public presence and most use major networks like Facebook or LinkedIn among others to advertise or disseminate information. It can also be an important resource tool in gathering data and information relevant for developing shark conservation priorities and improving management. For example, many Citizen Science programs whereby information can be recorded and uploaded thereby provide documentation, often as images, into a database. The observation and location documentation collected is invaluable for confirming species-specific information, including identification. In addition to collecting data, social media can be used for discussion forums, networking among professionals and organizations, media releases, and to raise project funding, e.g. crowd funding.

3.24c. Outcomes. A social media presence would enhance and promote the activities and accomplishments of the CMS Sharks MOU program, and would serve as a valuable resource in support of most, if not all, of the recommendations made in this report.

3.25. Summary Review

3.25a. Objectives. The final recommendation here provides a summary review for each of the species or species groups recommended for Annex I listing and reviews those species already listed on Annex I.

3.25b. Methods. The 22 species summary for Annex I listing is based on a synthesis of current literature research, review of various fisheries and conservation measures, and subjective opinion.

3.25c. Outcomes. To follow is a summary review for each of the taxa. A non-comprehensive life history data matrix was constructed and is available as a supplemental table.

1. Sawfishes (Pristidae): The five sawfish species are perhaps the most vulnerable group of Chondrichthyans globally. The historical distribution of each of the five species has decline from 38 to 81% depending on the species. The recent taxonomic re-evaluation of this group will help in setting species-specific and regional conservation priorities. However, all species are very poorly known biologically, have intrinsic life history characteristics that makes them exceptional vulnerable to fishing exploitation and habitat degradation.

Sawfishes are mostly tropical to subtropical species, and the range of most species extends throughout Range States with little capacity to support conservation measures, and also political will to develop and enforce policies to help populations recover. By contrast, sawfish populations occurring primarily in Australia and the United States are being studied, and have capacity and will to enforce protective conservation policies. A recent global strategy for the conservation of sawfishes (Dulvy et al., 2014) has identified and set conservation priorities; the document may serve as a road map for other species listed here and on the CMS Migratory Sharks list.

2. Manta and Mobula Rays (Mobulidae): The mobulids present several potential challenges in how they should be handled with regards to future conservation and management measures. Each of these challenges are outlined below and followed by suggested recommendations.

i. Presently, there are two *Manta* spp. and nine *Mobula* spp., but it should be noted that forthcoming taxonomic revisions of the family might alter the current arrangement. The placement of the genus *Manta* into a separate genus from the *Mobula* has come under increasing scrutiny and it appears that these two genera will be merged into one, with the genus *Mobula* having priority. The decision to place the two *Manta* species into the genus *Mobula* should not affect any increased conservation measures, e.g. Annex I listing, since both species already enjoy such relative to the other *Mobula* species, but it is an issue the AC should be aware of, especially relative to item (iii) below.

ii. Two species, *M. japonica* and *M. mobular*, are undergoing taxonomic review, with the likelihood that they may be one in the same species, e.g. *M. japonica*. It is advisable to monitor and investigate the status of these two species pending resolution on the status of *M. mobular*. For simplicity, and given its current status, *M. mobular* is considered valid throughout this document.

iii. The nine *Mobula* species currently recognized should be broadly separated into two groups based on maximum disc width (DW), large (maximum DW >150 cm) and small (maximum DW <150 cm) species. The large species includes *M. japonica*, *M. mobular*, *M. tarapacana*, and *M. thurstoni*, while the small species includes *M. eregoodootenkee*, *M. hypostoma*, *M. kuhlii*, *M. munkiana*, and *M. rochebrunei*. The four largest species, excluding *M. mobular* since it appears endemic to the Mediterranean Sea, each has a circumglobal distribution in tropical, subtropical, and temperate seas. The five smaller species, which are coastal, are mostly regional endemics and their distribution is uncertain due to misidentification with co-occurring mobulid species.

iv. Although virtually nothing is known about the intrinsic life history characteristics for any of these species, the larger species appear to be at increased extinction risk relative to the smaller species. A further challenge with this group is the lack of knowledge on population structure, and even the distribution, especially of the smaller species is uncertain.

v. The separation of this group into large and small species is recommended given the lack of species-specific identification and distribution of the small species. The larger mobulid species do receive some additional fisheries measures through the RFMOs, but most of the effort appears directed at the *Manta* species, which are more easily identified and separated from the mobulids. The coastal occurring, smaller, mobulid species are rarely if ever identified to species and the range of many is not well documented. Identification guides distributed throughout the known and suspected ranges for this group would benefit it by better delineation of their individual distribution.

vi. The mobulids are a group that would benefit immensely from a comprehensive strategic global conservation plan; such a plan is presently in development (N. Dulvy, Simon Fraser University, pers. comm.) at the time of preparation for this report. Communication by the AC with those preparing the strategic plan for mobulids is recommended to ensure a cohesive approach to setting the conservation priorities for this group.

3. Silky Shark (*Carcharhinus falciformis*): The population structure of the Silky Shark is not well known, but relative to many of the other species being proposed for Annex I listing some of its life history characteristics are known. Of particular note, the species through research has recently been found to experience increased mortality rates by Fish Aggregating Devise (FAD). Although the population structure of Silky Sharks is not well known, stock assessments indicate that the species, primarily through bycatch, has decline steadily.

4. Thresher Sharks (Alopiidae): The three (or more) species of threshers each represents a different challenge and set of assumptions that should be taken into consideration in future conservation and management measures. Each of the three species has somewhat diverse and varying life history characteristics between species, and within species. The diverse array of characteristics argues in favor of species-species and regional (sub)population research and against using lookalike species as being representative of data poor species. A review of each species follows:

Pelagic Thresher Shark (*Alopias pelagicus*): The species is known only from the Indian and Pacific oceans, unlike its two congeners that occur in all three major ocean basins. Despite its common name and the derivation of its scientific name the Pelagic Thresher

Shark appears to be more of a coastal inhabitant in tropical and warm temperate seas. It has mostly been studied in the western Pacific around Taiwan, and in Indonesian waters. Studies on its population genetics have revealed that this species may in fact represent at least one additional species. Populations on eastern and western Pacific basins are so significantly different that they may represent two distinctly different species. At the present time, there is no information available on whether the Indian Ocean population is different from either of the Pacific populations.

Bigeye Thresher Shark (*Alopias superciliosus*): The habitat and life history characteristics of this species differs strikingly from the other two thresher shark species in that it lives at much greater depths, usually along outer continental shelves and in the high seas. It shows strong diel movements patterns, and appears to have the most vulnerable life history characteristics of the three known thresher shark species. The majority of the research on the species has occurred in the Western North Atlantic. The population structure is not well known, but unlike the Pelagic Thresher Shark it appears at this time to be a single wide-ranging species.

Common Thresher Shark (*Alopias vulpinis*): The life history characteristics for this species are more favorable than the other two species in this genus with sustainable fishing practices, management enforcement and political will. However, the species is subject to intense fishing exploitation throughout much of its range and its populations have declined in many areas. Life history characteristics are highly variable regionally, and in those areas where it is poorly known should be studied. The global population does show significant structuring within the Pacific Ocean and with the Atlantic population; regional populations also exhibit different life history characteristics. These differences should be further investigated.

5. Hammerhead Sharks (Sphyrnidae): The two species being considered, the Scalloped Hammerhead Shark (*Sphyrna lewini*) and Great Hammerhead Shark (*S. mokarran*) each presents problematic challenges.

The Scalloped Hammerhead Shark is the most studied species within the genus. However, given the variable life history characteristics between, and possibly within, regional populations and growing evidence of strong regional population structuring this appears to be a species-complex with lookalike and cryptic species involved. Complicating matters is that some of these lookalike and cryptic species may co-occur, as is the case with the recently described Carolina Hammerhead Shark, *S. gilberti*.

The Great Hammerhead Shark although not as well researched globally, also presents similar issues do to differing life history characteristics between regions. Studies examining regional population structuring appear inconclusive at this time. The Northwestern Atlantic population of the Great Hammerhead Shark does exhibit a relatively moderate to fast growth rate along the “fast-slow” continuum.

6. Review of species currently listed on Annex I: The seven species reviewed here can broadly be classified into two categories: well-known charismatic species and those species of high fisheries value. Those species in the former group (Whale, Basking, and White sharks) due to their higher public profiles, are usually afforded more protection, whereas those species in the latter group (Spiny Dogfish, Longfin Mako, Shortfin Mako, and Porbeagle) although usually identifiable in fisheries have few protective measures and some are subject to intense fishing pressures.

The species in the charismatic category are the subjects of active research activities, mostly involving tracking studies and the focal point of numerous conservation organizations. However, despite their increased profile, with few exceptions, there are no defined benchmarks to indicate whether any of the regional conservation and or measures has had much of an impact. Recent eastern North Pacific studies on White Shark populations, off California (U.S.A.), indicate that the population is recovering, but outside this area very little information is available. Studies on Whale and Basking sharks have revealed both species capable of making extensive long distance migrations, but further synthesis of this information is lacking.

Those species of high fisheries value, excluding the Longfin Mako Shark, are relatively well studied regionally due to their being taken in targeted and non-target fisheries. The Longfin Mako Shark is of relatively low economic value, but is taken as bycatch in several fisheries. Similar to the charismatic species group, no benchmarks have been set to determine the status of these populations regionally.

In summary, all of the species currently listed on Annex I should have benchmarks set to determine how these populations are responding to current conservation measures and fisheries management. Although most of these species are the subjects of active research programs, very little is still known about each of these species.

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Figure 1. Total number of chondrichthyan species described globally since 1758, presented in 20-year time increments except for the time-periods 1750-1799 and 2000-2015.

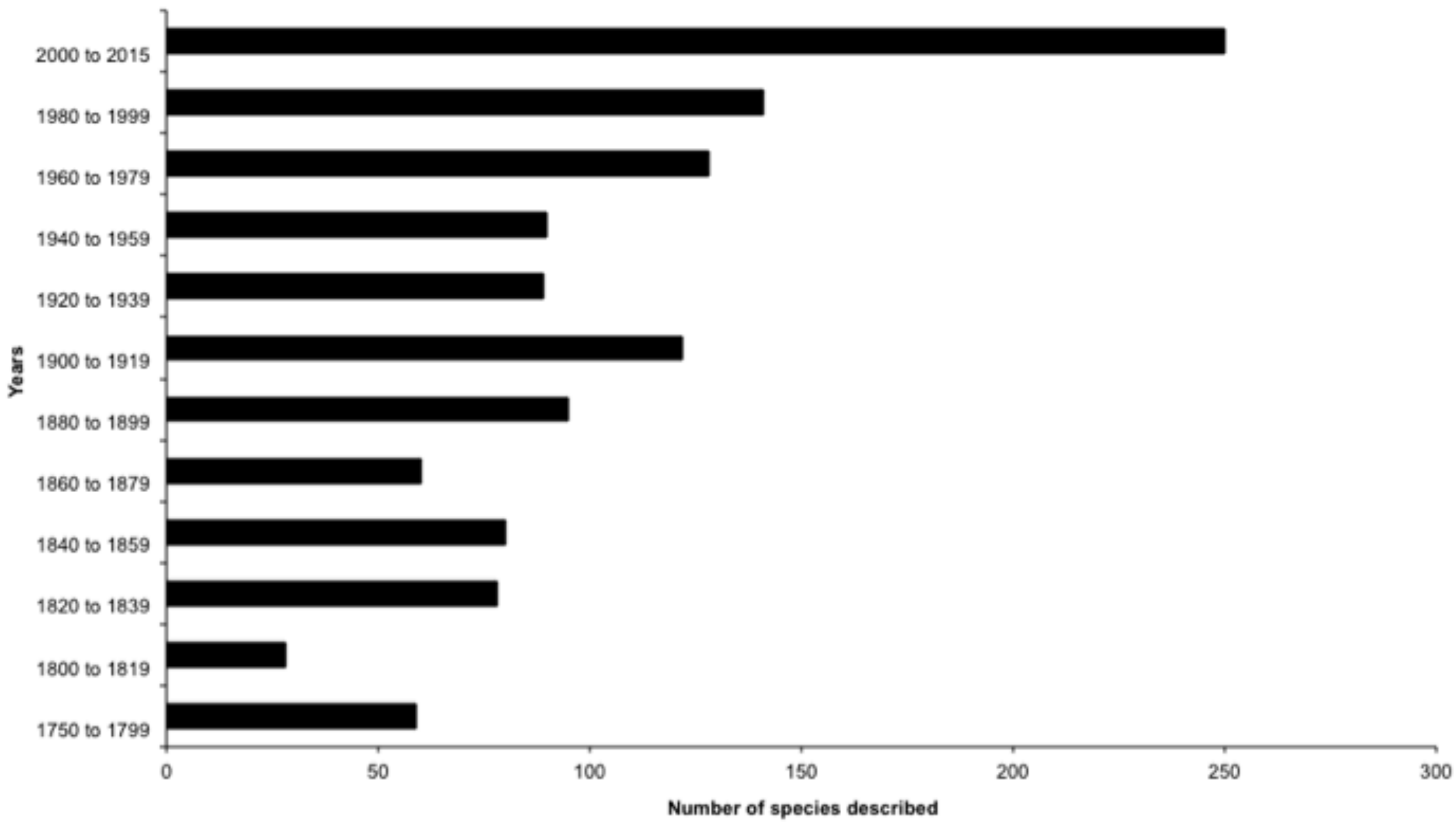

Figure 2. The landed catch chondrichthyans reported to the Food and Agriculture Organization of the United Nations from 1950 to 2009, with A) peak years in black and declining catch in red, and B) the rising contribution of rays relative to sharks (Figure 1 from Dulvy et al., 2014)

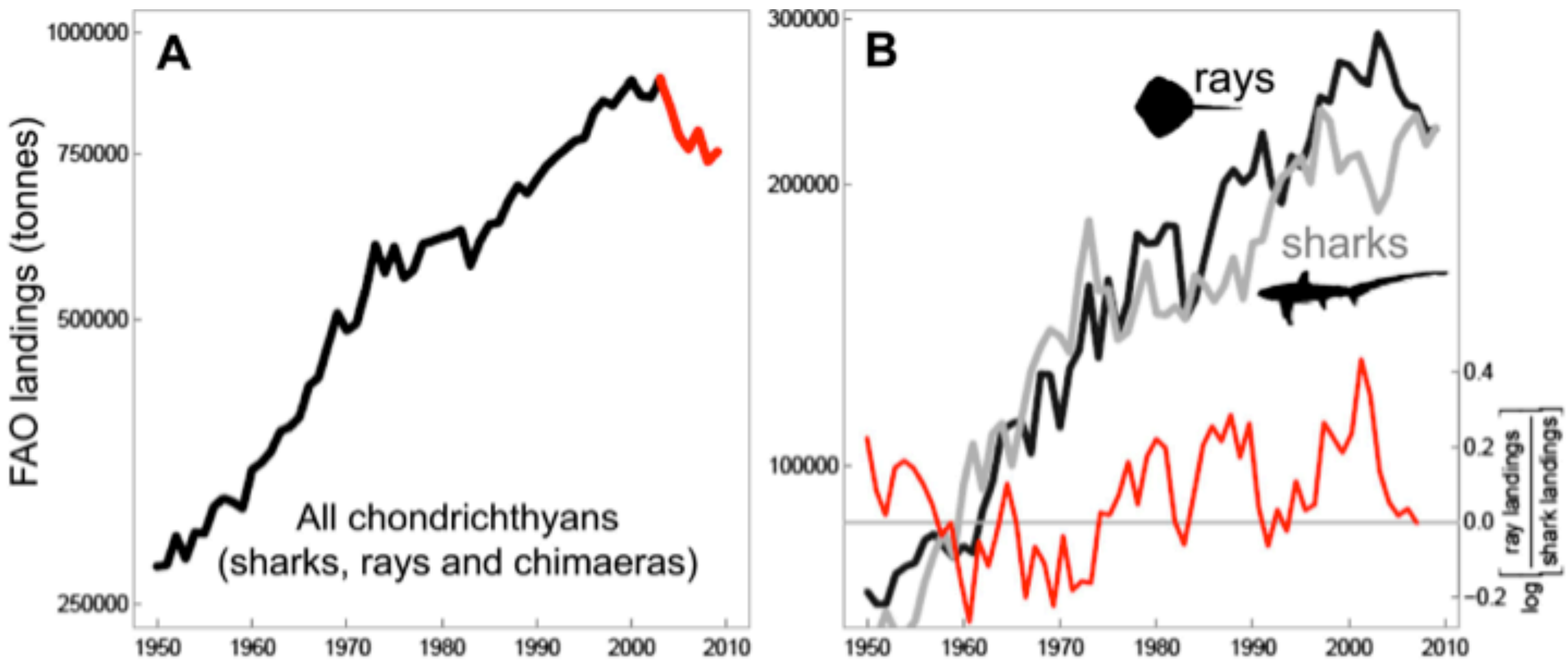

Figure 3. Regional average landings of Chondrichthyans from 2004-2013.

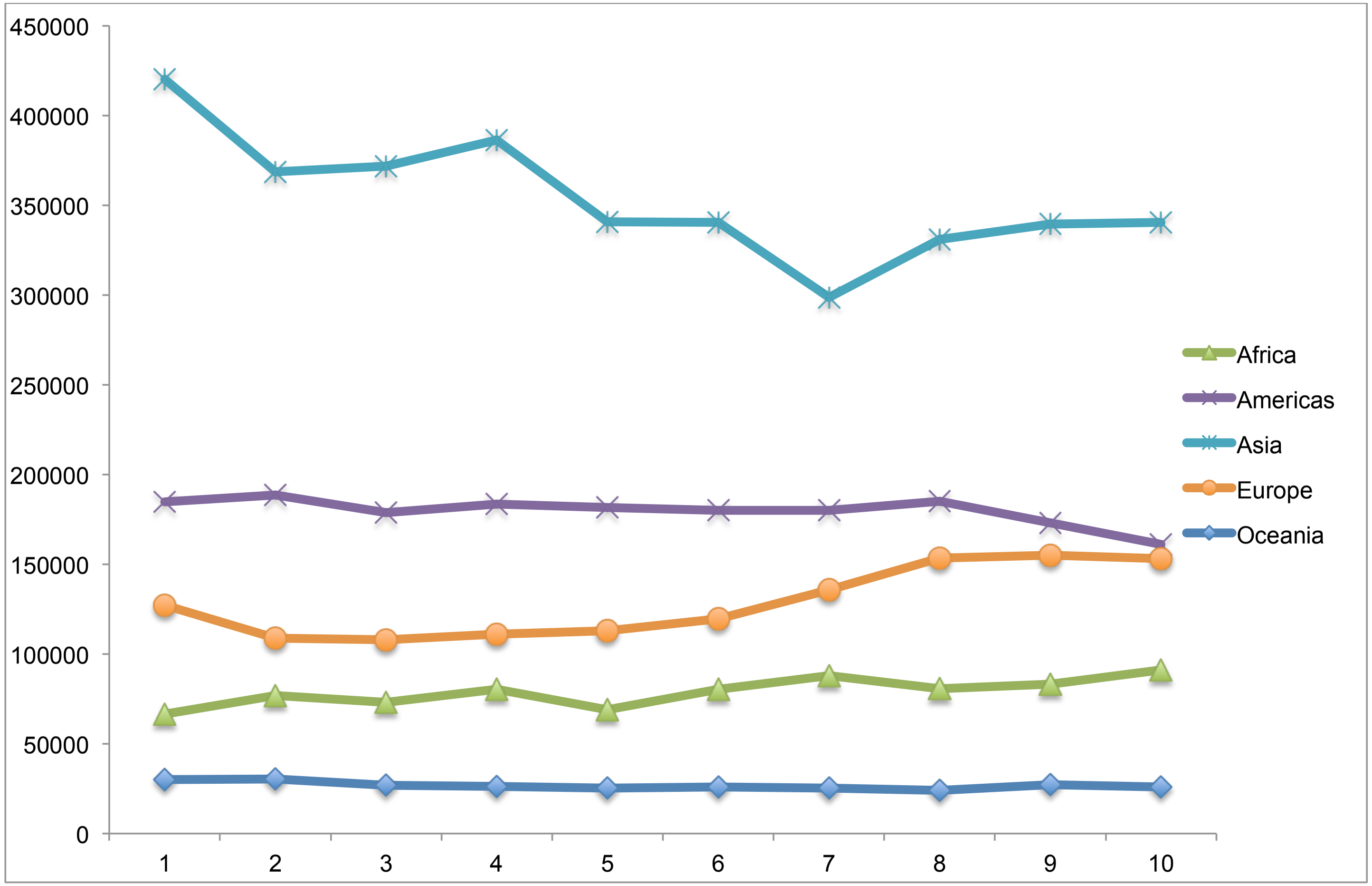
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Figure 4. Life history data matrix example with some suggested column headings and relevant information categories.

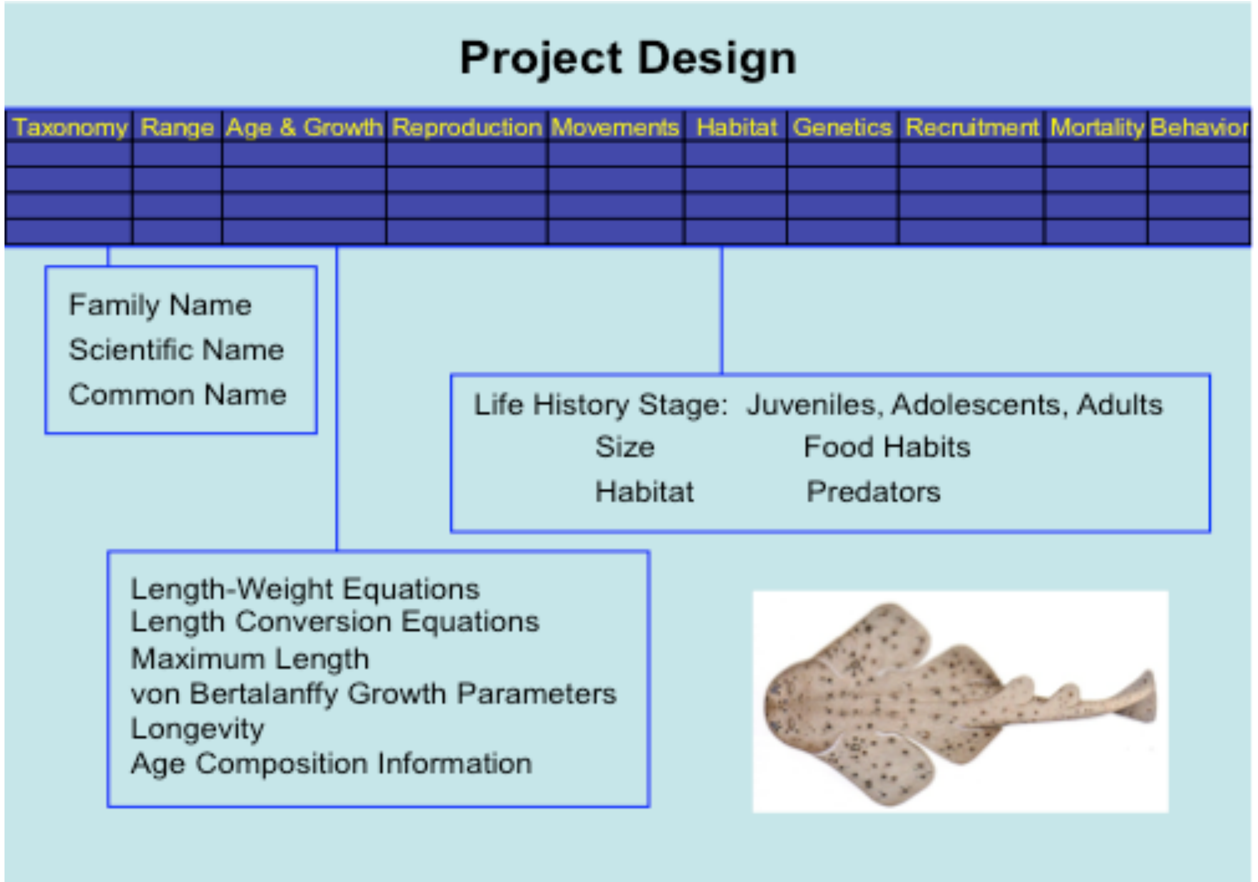

Figure 5. Participants at regional Red List Assessment workshop, Seattle, Washington, March 2014. Workshops like this would be good venues for bring participants together for developing LHDM and SFDM.

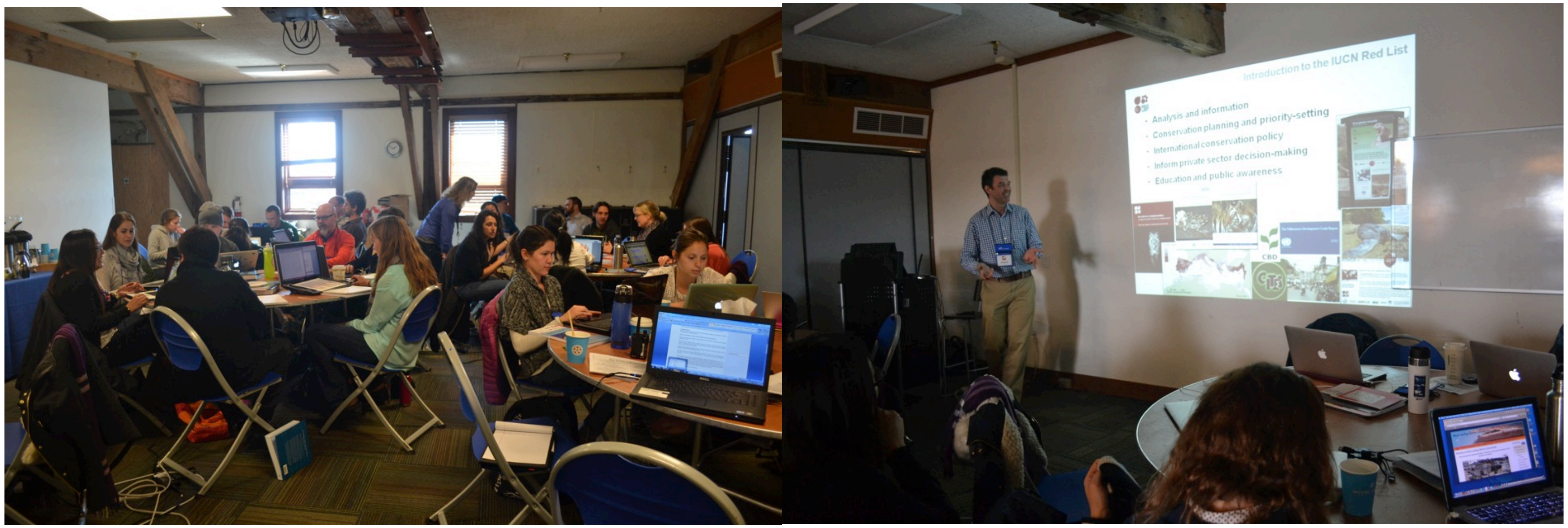

Figure 6. The number of deep-sea chondrichthyans reported to FAO (red) and known to occur (blue) in the various regions. Source: FAO Fisheries Report.

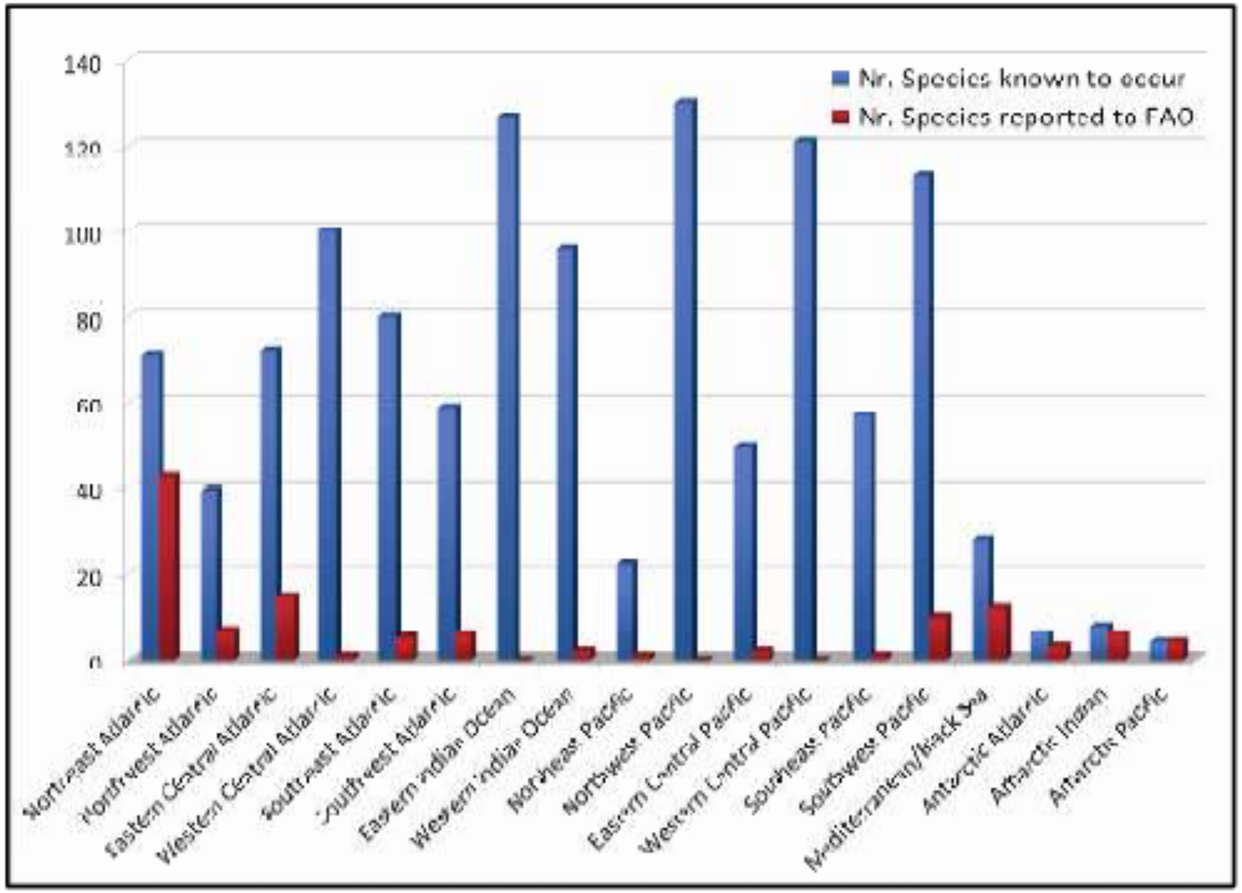

Figure 7. FAO iSharkFin interactive identification.

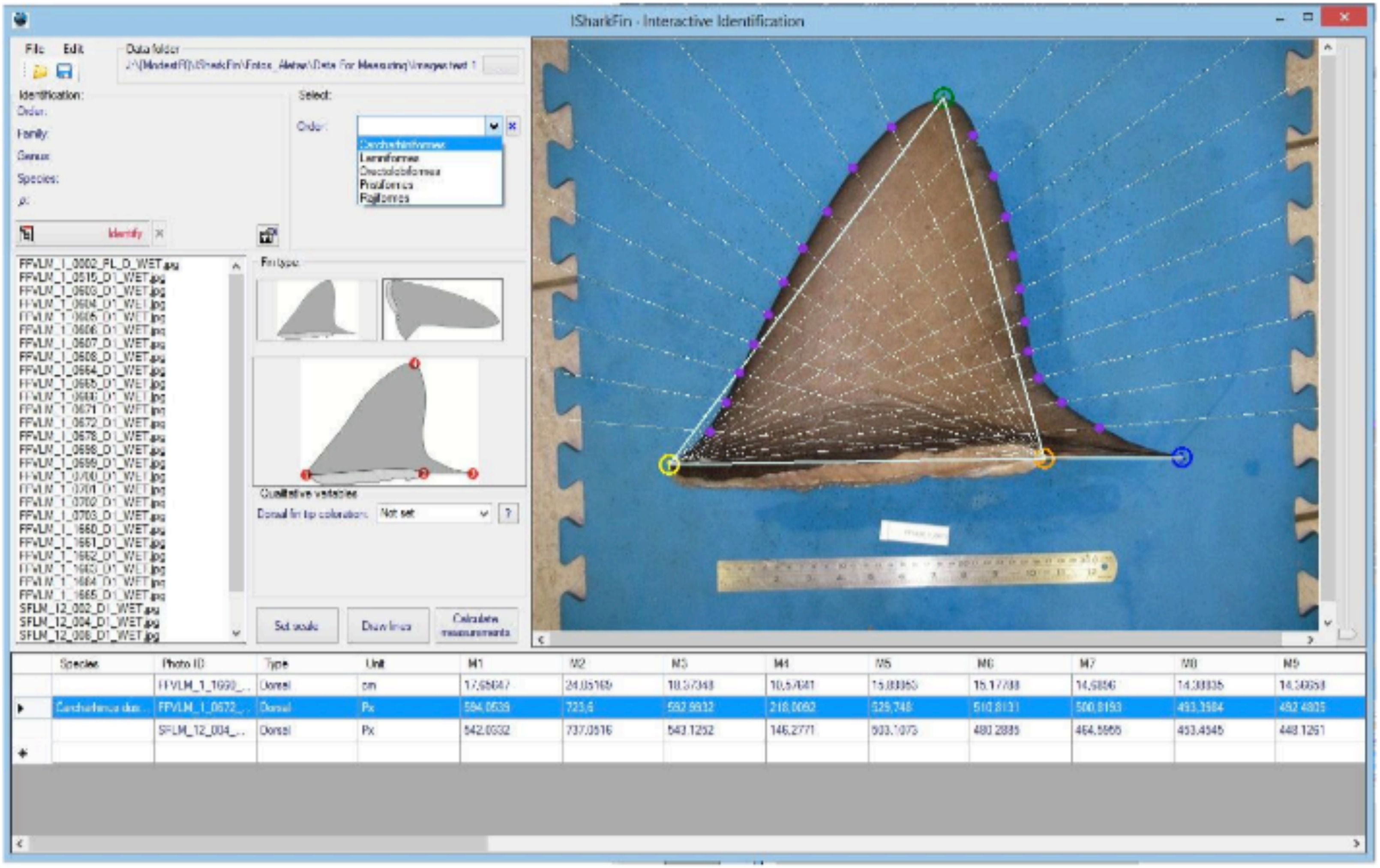

Figure 8. Training workshops to identify sharks and rays such as these in the Mauritius (B) and Seychelles will contribute to improving identification and build capacity.

(A)

(B)

Figure 9. Migratory sharks exhibit a wide difference in habitat preferences as shown by the oceanic habitat of a mako shark and a sawfish. Sawfish image courtesy © Dean Grubbs.

Box 1

Definition of Migratory Species (Fowler, 2014)

Article I of CMS: “the entire population or any geographically separate part of the population of any species or lower taxon of will animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries”.

Under this definition:

‘i) The word “cyclical” in the phrase “cyclically and predictably” relates to a cycle of any nature, such as astronomical (circadian, annual, etc.), life or climate, and of any frequency.

‘ii) The word “predictably” in the phrase “cyclically and predictably” implies that a phenomenon can be anticipated to recur in a given set of circumstances, though not necessarily regularly in time.

‘iii) For the purposes of this study, national jurisdictional boundaries include national land and sea borders and, where appropriate, the boundary between the Exclusive Economic Zone (EEZ) of each nation and the High Seas.

Table 1. Shark species currently listed and proposed for listing in the CMS MOU Annex 1.

Family	Species	Common name	Appendix I	Appendix II	MOU Annex 1
Squalidae	*Squalus acanthias* Linnaeus, 1758	Spiny dogfish[1]	--	2008	Listed
Rhincodontidae	*Rhincodon typus* Smith, 1828	Whale shark	--	1999	Listed
Cetorhinidae	*Cetorhinus maximus* (Gunnerus, 1765)	Basking shark	2005	2005	Listed
Lamnidae	*Carcharodon carcharias* (Linnaeus, 1758)	Great white shark	2002	2002	Listed
	Isurus oxyrinchus Rafinesque, 1810	Shortfin mako shark	--	2008	Listed
	Isurus paucus Guitart Manday, 1966	Longfin mako shark	--	2008	Listed
	Lamna nasus (Bonnaterre, 1788)	Porbeagle shark	--	2008	Listed
Alopiidae	*Alopias pelagicus* Nakamura, 1935	Pelagic thresher shark	--	2014	Proposed
	Alopias superciliosus (Lowe, 1839)	Bigeye thresher shark	--	2014	Proposed
	Alopias vulpinus (Bonnaterre, 1788)	Common thresher shark	--	2014	Proposed
Carcharhinidae	*Carcharhinus falciformis* (Müller & Henle, 1839)	Silky shark	--	2014	Proposed
Sphyrnidae	*Sphyrna lewini* (Griffith & Smith, 1834)	Scalloped hammerhead shark	--	2014	Proposed
	Sphyrna mokarran (Rüppell, 1837)	Great hammerhead shark	--	2014	Proposed
Pristidae	*Anoxypristis cuspidatus* (Latham, 1794)	Narrow sawfish	2014	2014	Proposed
	Pristis clavata Garman, 1906	Dwarf sawfish	2014	2014	Proposed
	Pristis pectinata Latham, 1794	Smalltooth sawfish	2014	2014	Proposed
	Pristis pristis (Linnaeus, 1758)	Common sawfish	2014	2014	Proposed
	Pristis zijsron Bleeker, 1851	Green sawfish	2014	2014	Proposed
Mobulidae	*Manta alfredi* (Krefft, 1868)	Reef Manta Ray	2014	2014	Proposed
	Manta birostris (Walbaum, 1792)	Manta Ray	2011	2011	Proposed
	Mobula eregoodootenkee (Bleeker, 1859)	Pygmy devil ray	2014	2014	Proposed
	Mobula hypostoma (Bancroft, 1831)	Atlantic devil ray	2014	2014	Proposed
	Mobula japonica (Müller & Henle, 1841)	Spinetail mobula	2014	2014	Proposed
	Mobula kuhlii (Müller & Henle, 1841)	Shortfin devil ray	2014	2014	Proposed
	Mobula mobular (Bonnaterre, 1788)	Devil ray	2014	2014	Proposed
	Mobula munkiana Notarbartolo Di Sciara, 1987	Smoothtail devil ray	2014	2014	Proposed
	Mobula rochebrunei (Vaillant, 1879)	Lesser Guinean devil ray	2014	2014	Proposed
	Mobula taracapana (Philippi, 1892)	Sicklefin devil ray	2014	2014	Proposed
	Mobula thurstoni (Lloyd, 1908)	Bentfin devil ray	2014	2014	Proposed

[1]Northern Hemisphere populations only

Table 2. Biodiversity of chondrichthyans by order, family, genera, and species (D.A. Ebert, pers. database, 31 Dec. 2015).

Order	Family	(%)	Genera	(%)	Species	(%)
Hexanchiformes (cow and frilled sharks)	2	3.5	4	2.0	7	0.6
Squaliformes (dogfish sharks)	7	12.3	24	11.9	126	10.3
Pristiophoriformes (sawsharks)	1	1.8	2	1.0	8	0.7
Squatiniformes (angel sharks)	1	1.8	1	0.5	20	1.6
Heterodontiformes (horn or bullhead shar	1	1.8	1	0.5	9	0.7
Orectolobiformes (carpet sharks)	7	12.3	14	6.9	48	3.9
Lamniformes (mackerel sharks)	7	12.3	10	5.0	15	1.2
Carcharhiniformes (ground sharks)	8	14.0	51	25.2	286	23.3
Torpediniformes (Electric rays)	2	3.5	13	6.4	69	5.6
Pristiformes (Sawfishes)	1	1.8	2	1.0	5	0.4
Rajiformes (Skates and Guitarfishes)	7	12.3	46	22.8	353	28.8
Myliobatiformes (Eagle rays)	10	17.5	28	13.9	230	18.8
Chimaeriformes (chimaeras or silver shar	3	5.3	6	3.0	49	4.0
Totals:	57		202		1225	

Table 3. Top 20 regions/countries with high biodiversity of sharks (D.A. Ebert, pers. database).

Region	Total	Shark	Batoid	Chimaera
Australia	323	183	123	15
India	227	114	107	6
Japan	212	126	75	11
Southern Africa[1]	205	118	79	8
Indonesia	192	103	86	5
Western Central Atlantic[2]	188	103	79	6
Taiwan	181	119	58	4
Eastern Central Pacific[3]	176	88	88	8
Brazil	169	82	81	6
Southeastern Pacific[4]	165	86	71	8
Arabian Sea[5]	142	73	69	2
Philippines	165	95	67	3
Northeast Atlantic[6]	127	70	49	8
New Zealand	119	69	33	17
Mexico (Pacific coast)	113	58	51	4
Argentina	110	55	52	2
Mediterranean	83	49	33	1
Northwest Atlantic[7]	83	54	23	6
Red Sea	77	44	33	0
Northeast Pacific[8]	77	43	30	4

[1] Southern Africa here includes Angola, South Africa, Mozambique.
[2] Western Central Atlantic includes the Mexican postion of the Gulf of Mexico and Caribbean Sea.
[3] Eastern Central Pacific or tropical eastern Pacific here includes Central America to Ecuador.
[4] Southeastern Pacific includes Peru and Chile.
[5] Arabian Sea includes the Arabian/Persian Gulf, but excludes the Red Sea
[6] Northeast Atlantic includes European States bordering on the Atlantic Ocean.
[7] Northwest Atlatic includes the Atlantic coast of Canada and the United States.
[8] Northeast Pacific includes the Pacific coast of Canada and the United States.

Table 4. Approximate number of Chondrichthyans group by their habitat and categorized by IUCN Red List Assessment.

			IUCN Red List Assessment					
Habitat	Species (%)	Threatened	CR	EN	VU	NT	LC	DD
Coastal	553 (47.0)	130 (23.6)	16 (2.9)	28 (5.1)	86 (15.6)	81 (14.6)	138 (25.0)	204 (36.9)
Deep-sea	542 (46.1)	27 (5.0)	1 (0.2)	9 (1.7)	17 (3.1)	43 (7.9)	171 (31.5)	301 (55.5)
Pelagic/Oceanic	50 (4.3)	17 (34.0)	0	3 (6.0)	14 (28.0)	13 (26.0)	14 (28.0)	6 (12.0)
Freshwater	31 (2.6)	13 (41.9)	3 (9.7)	7 (22.6)	3 (9.7)	1 (3.2)	1 (3.2)	16 (51.6)
Totals	**1176**	**187 (15.9)**	**20 (1.7)**	**47 (4.0)**	**120 (10.2)**	**138 (11.7)**	**324 (27.6)**	**527 (44.8)**

Table 5. Red List Assessment (RLA) for shark species currently listed and proposed for listing in the CMS MOU Annex 1.

Family	Species	Global RLA	Year Assessed	RLA History	RLA Status
Annex I					
Squalidae	**Spiny dogfish (*Squalus acanthias*)**[1]	VU	2006	NT 2000	RLA needs updating
Rhincodontidae	**Whale shark (*Rhincodon typus*)**	VU	2005	VU 2000; DD 1996; Indeterminate 1994, 1990	RLA needs updating
Cetorhinidae	**Basking shark (*Cetorhinus maximus*)**	VU	2005	VU 2000, 1996; Insufficiently Known 1994, 1990	RLA needs updating
Lamnidae	**Great white shark (*Carcharodon carcharias*)**	VU	2005	VU 2000, 1996; Insufficiently Known 1994, 1990	RLA needs updating
Lamnidae	**Shortfin mako shark (*Isurus oxyrinchus*)**	VU	2004	NT 2000	RLA needs updating
Lamnidae	**Longfin mako shark (*Isurus paucus*)**	VU	2006	None	RLA needs updating
Lamnidae	**Porbeagle shark (*Lamna nasus*)**	VU	2006	NT 2000; VU 1996	RLA needs updating

Table 6. Regional Red List Assessment (RLA) for shark species currently listed and proposed for listing in the CMS MOU Annex 1. NWA: Northwest Atlantic; NEA: Northeast Atlantic; WCA: Western Central Atlantic; ECA: Eastern Central Atlantic; SWA: Southwestern Atlantic; SEA: Southeastern Atlantic; IWP: Indo-Western Pacific; SWP: Southwestern Pacific; NWP: Northwestern Pacific; WCP: Western Central Pacific; NEP: Northeastern Pacific; SEP: Southeastern Pacific.

Annex I Common name (Species)	Global RLA Year	Regional RLA	NWA	NEA	WCA	ECA	SWA	SEA	IWP	SWP	NWP	WCP	NEP	ECP	SEP
Spiny dogfish[1,2] (*Squalus acanthias*)	VU 2006	Yes	EN 2006	CR 2006[3]											
Whale shark (*Rhincodon typus*)	VU 2005	No													
Basking shark (*Cetorhinus maximus*)	VU 2005	Yes		EN 2005							EN 2005		EN 2005		
Great white shark (*Carcharodon carcharias*)	VU 2005	Yes		CR 2014											
Shortfin mako shark (*Isurus oxyrinchus*)	VU 2004	Yes	VU 2004	VU 2004 DD 2015[4]	VU 2004	VU 2004	VU 2004	VU 2004	VU 2004				NT 2004		
Longfin mako shark (*Isurus paucus*)	VU 2006	Yes		DD 2014											
Porbeagle shark (*Lamna nasus*)	VU 2006	Yes	EN 2006	CR 2006 CR 2015 Europe[4]											
Appendices 1 and or 2															
Pelagic thresher shark (*Alopias pelagicus*)	VU 2004	No													
Bigeye thresher shark (*Alopias superciliosus*)	VU 2007	Yes	EN 2007	VU 2007 EN 2014 Europe[4]	EN 2007		NT 2007		VU 2007					VU 2007	
Common thresher shark (*Alopias vulpinus*)	VU 2007	Yes	VU 2007	VU 2007 EN 2014 Europe[4]	VU 2007				DD 2007					NT 2007	

Silky shark (*Carcharhinus falciformis*)	NT 2007	Yes	VU 2007	DD 2007 EN 2015 Europe[4]	VU 2007		NT 2007		NT 2007			NT 2007		VU 2007	VU 2007
Scalloped hammerhead shark (*Sphyrna lewini*)	EN 2007	Yes	EN 2007	DD 2015	EN 2007	VU 2007	VU 2007		EN 2007					EN 2007	EN 2007
Great hammerhead shark (*Sphyrna mokarran*)	EN 2007	Yes		DD 2015											
Smalltooth sawfish (*Pristis pectinata*)	CR 2012	Yes	CR 2012	CR 2012	CR 2012		CR 2012								
Common sawfish (*Pristis pristis*)	CR 2012	Yes	CR 2012	CR 2012	CR 2012	CR 2012	CR 2012	CR 2012	CR 2012				CR 2012	CR 2012	CR 2012
Green sawfish (*Pristis zijsron*)	CR 2012	No													
Narrow sawfish (*Anoxypristis cuspidatus*)	EN 2012	No													
Dwarf sawfish (*Pristis clavata*)	EN 2012	No													
Reef Manta Ray (*Manta alfredi*)	VU 2010	No													
Manta Ray (*Manta birostris*)	VU 2010	No													

Pygmy devil ray (*Mobula eregoodootenkee*)	NT 2003	Yes							LC 2003 DD 2002[5]						
Atlantic devil ray (*Mobula hypostoma*)	DD 2008	No													
Spinetail mobula (*Mobula japonica*)	NT 2006	Yes							VU 2006 SE Asia						
Shortfin devil ray (*Mobula kuhlii*)	DD 2007	No													
Devil ray (*Mobula mobular*)	EN 2014	No													
Smoothtail devil ray (*Mobula munkiana*)	NT 2006	No													
Lesser Guinean devil ray (*Mobula rochebrunei*)	VU 2007	No													
Sicklefin devil ray (*Mobula taracapana*)	DD 2006	No													
Bentfin devil ray (*Mobula thurstoni*)	NT 2006	Yes							VU 2006 SE Asia						

[1]Northern Hemisphere populations only
[2]North Pacific population is now known to be a different species
[3]NE Atlantic subpopulation were done for Europe EN 2014; Mediterranean EN 2006; Black Sea VU 2006
[4]NE Atlantic subpopulation were done for Europe
[5]LC 2003 Australia; DD 2002 Australia (Northern Territory)

Table 7. The top 30 fishing states from 2004 to 2013.

	Top 30 fishing states Country	10 yr mean 2004-2013 Tonnes
1	Indonesia	103,936
2	Taiwan Province of China	75,583
3	Spain	70,826
4	India	70,519
5	Japan	38,850
6	Pakistan	37,020
7	Mexico	35,398
8	United States of America	34,249
9	Argentina	22,491
10	France	20,402
11	United Kingdom	18,567
12	New Zealand	17,554
13	Brazil	17,317
14	Malaysia	16,875
15	Portugal	16,838
16	Sri Lanka	16,754
17	Korea, Republic of	15,430
18	Senegal	12,068
19	Thailand	11,637
20	Peru	10,785
21	Nigeria	8,873
22	Canada	8,312
23	Venezuela, Boliv Rep of	7,754
24	Yemen	7,735
25	Philippines	7,405
26	Ireland	7,004
27	Norway	6,835
28	Australia	6,347
29	Madagascar	5,677
30	Iran (Islamic Rep. of)	5,387

Table 8. Biodiversity of the top 30 Shark Fishing Countries between 2009-2013.

	Fishing Rank	Total	Shark	Batoid	Chimaera	Comments
Indonesia	1	192	103	86	5	
India	2	227	114	107	6	
Spain	3	144	80	55	9	NE Atlantic & Mediterranean combined
Taiwan	4	181	119	58	4	
Mexico	5	213	111	94	8	
Pakistan	6	93	47	46	0	
USA	7	227	116	102	9	
Japan	8	212	126	75	11	
Argentina	9	110	55	52	2	
France	10	144	80	55	9	NE Atlantic & Mediterranean combined
Malaysia	11	147	63	84	0	
Brazil	12	169	82	81	6	
United Kingdom	13	144	80	55	9	NE Atlantic & Mediterranean combined
Sri Lanka	14	89	61	27	1	
Korea, Republic of	15	n.a.	n.a.	n.a.	n.a.	Information not readily available
New Zealand	16	119	69	33	17	
Portugal	17	144	80	55	9	NE Atlantic & Mediterranean combined
Thailand	18	135	64	71	0	
Peru	19	115	66	43	6	
Nigeria	20	60	30	30	0	Eastern Tropical Atlantic
Philippines	21	165	95	67	3	
Iran (Islamic Republic of)	22	54	30	24	0	Arabian Sea including Arabian/Persian Gulf
Australia	23	323	183	123	15	
Canada	24	69	30	33	6	
Venezuela	25	188	103	86	5	
Senegal	26	60	30	30	0	Eastern Tropical Atlantic
Yemen	27	142	73	69	2	Arabian Sea
Italy	28	144	80	55	9	NE Atlantic & Mediterranean combined
Madagascar	29	n.a.	n.a.	n.a.	n.a.	Information not readily available
Oman	30	142	73	69	2	Arabian Sea

Table 9. CMS Migratory (n = 95) and possibly migratory (n = 58) shark species, with Red List Assessment and broadly categorized habitat characterization; coastal, pelagic, and deepsea. Freshwater species included in coastal habitat.

Family	Genus	Species	RLA	Habitat
	Migratory Species			
CARCHARHINIDAE	Daggernose Shark	*Isogomphodon oxyrhynchus*	CR 2006	Coastal
SQUATINIDAE	Angel Shark	*Squatina squatina*	CR 2014	Coastal
PRISTIDAE	**Smalltooth Sawfish**	***Pristis pectinata***	**CR 2012**	**Coastal**
PRISTIDAE	**Common Sawfish**	***Pristis pristis***	**CR 2013**	**Coastal**
PRISTIDAE	**Green Sawfish**	***Pristis zijsron***	**CR 2012**	**Coastal**
RHINOBATIDAE	Braziian Guitarfish	*Rhinobatos horkelii*	CR 2007	Coastal
SPHYRNIDAE	**Scalloped Hammerhead Shark**	***Sphyrna lewini***	**EN 2007**	**Pelagic**
SPHYRNIDAE	**Great Hammerhead Shark**	***Sphyrna mokarran***	**EN 2007**	**Pelagic**
PRISTIDAE	**Dwarf Sawfish**	***Pristis clavata***	**EN 2012**	**Coastal**
PRISTIDAE	**Narrow Sawfish**	***Anoxypristis cuspidatus***	**EN 2012**	**Coastal**
RAJIDAE	Smooth Skate	*Malacoraja senta*	EN 2012	Coastal
DASYATIDAE		*Himantura polylepis*	EN 2011	Coastal
MYLIOBATIDAE	Longheaded Eagle Ray	*Aetobatus flagellum*	EN 2006	Coastal
MOBULIDAE	**Devil Ray**	***Mobula mobular***	**EN 2014**	**Pelagic**
SQUALIDAE	**Spiny Dogfish**	***Squalus acanthias***	VU 2006	Coastal
GINGLYMOSTOMATIDAE	Tawny Nurse Shark	*Nebrius ferrugineus*	VU 2003	Coastal
ODONTASPIDIDAE	Grey Nurse Shark	*Carcharias taurus*	VU 2005	Coastal
RHINCODONTIDAE	**Whake Shark**	***Rhincodon typus***	**VU 2005**	**Pelagic**
ALOPIIDAE	**Pelagic Thresher Shark**	***Alopias pelagicus***	**VU 2004**	**Pelagic**
ALOPIIDAE	**Bigeye Thresher Shark**	***Alopias superciliosus***	**VU 2007**	**Pelagic**
ALOPIIDAE	**Common Thresher Shark**	***Alopias vulpinus***	**VU 2007**	**Pelagic**
CETORHINIDAE	**Basking shark**	***Cetorhinus maximus***	**VU 2005**	**Pelagic**
LAMNIDAE	**Shortfin Mako Shark**	***Isurus oxyrinchus***	**VU 2004**	**Pelagic**
LAMNIDAE	**White shark**	***Carcharodon carcharias***	**VU 2005**	**Pelagic**
LAMNIDAE	**Longfin Mako Shark**	***Isurus paucus***	**VU 2006**	**Pelagic**
LAMNIDAE	**Porbeagle**	***Lamna nasus***	**VU 2006**	**Pelagic**
TRIAKIDAE	Common Smoothhound	*Mustelus mustelus*	VU 2004	Coastal
TRIAKIDAE	Tope Shark	*Galeorhinus galeus*	VU 2006	Pelagic
CARCHARHINIDAE	Sicklefin Lemon Shark	*Negaprion acutidens*	VU 2003	Coastal
CARCHARHINIDAE	Oceanic Whitetip Shark	*Carcharhinus longimanus*	VU 2006	Pelagic
CARCHARHINIDAE	Dusky Shark	*Carcharhinus obscurus*	VU 2007	Pelagic
CARCHARHINIDAE	Sandbar Shark	*Carcharhinus plumbeus*	VU 2007	Pelagic
SPHYRNIDAE	Smooth Hammerhead Shark	*Sphyrna zygaena*	VU 2005	Pelagic
SPHYRNIDAE	Golden Hammerhead Shark	*Sphyrna tudes*	VU 2006	Pelagic
RHYNCHOBATIDAE	Giant Guitarfish	*Rhynchobatus djiddensis*	VU 2006	Coastal
RAJIDAE	Thorny Skate	*Amblyraja radiata*	VU 2004	Coastal
RAJIDAE	Mottled Skate	*Beringraja pulchra*	VU 2004	Coastal
DASYATIDAE	Bleeker's Stingray	*Himantura uarnacoides*	VU 2004	Coastal
DASYATIDAE	Honeycomb Stingray	*Himantura uarnak*	VU 2005	Coastal
DASYATIDAE	Colares Stingray	*Dasyatis colarensis*	VU 2006	Coastal
MYLIOBATIDAE	Banded Eagle Ray	*Aetomylaeus nichofii*	VU 2003	Coastal
RHINOPTERIDAE	Flapnose Ray	*Rhinoptera javanica*	VU 2006	Coastal
MOBULIDAE	**Reef Manta Ray**	***Manta alfredi***	**VU 2010**	**Coastal**
MOBULIDAE	**Manta Ray**	***Manta birostris***	**VU 2010**	**Pelagic**

Table 9 (continued). CMS Migratory (n = 95) and possibly migratory (n = 58) shark species, with Red List Assessment and broadly categorized habitat characterization; coastal, pelagic, and deepsea. Freshwater species included in coastal habitat.

Genus	Species	RLA	Habitat
Migratory Species			
Bluntnose Sixgill Shark	*Hexanchus griseus*	NT 2005	Deepsea
Greenland Shark	*Somniosus microcephalus*	NT 2006	Deepsea
Blacknose Shark	*Carcharhinus acronotus*	NT 2008	Coastal
Graceful Shark	*Carcharhinus amblyrhynchoides*	NT 2005	Coastal
Spinner Shark	*Carcharhinus brevipinna*	NT 2005	Pelagic
Bronze Whaler	*Carcharhinus brachyurus*	NT 2003	Pelagic
Silky Shark	***Carcharhinus falciformis***	**NT 2007**	**Pelagic**
Bull Shark	*Carcharhinus leucas*	NT 2005	Coastal
Blacktip Shark	*Carcharhinus limbatus*	NT 2005	Pelagic
Hardnose Shark	*Carcharhinus macloti*	NT 2003	Coastal
Tiger Shark	*Galeocerdo cuvier*	NT 2005	Pelagic
Lemon Shark	*Negaprion brevirostris*	NT 2005	Coastal
Blue Shark	*Prionace glauca*	NT 2005	Pelagic
Big Skate	*Beringraja binoculata*	NT 2005	Coastal
Sharpsnout Stingray	*Dasyatis geijskesi*	NT 2006	Coastal
Spotted Eagle Ray	*Aetobatus narinari*	NT 2006	Pelagic
Cownose Ray	*Rhinoptera bonasus*	NT 2006	Coastal
Spinetail Mobula	***Mobula japonica***	**NT 2006**	**Pelagic**
Smoothtail Devil Ray	***Mobula munkiana***	**NT 2006**	**Coastal**
Megamouth Shark	*Megachasma pelagios*	LC 2015	Pelagic
Salmon Shark	*Lamna ditropis*	LC 2008	Pelagic
Starry Smoothhound	*Mustelus asterias*	LC 2008	Coastal
Smoothtooth Shark	*Carcharhinus isodon*	LC 2008	Coastal
Bonnethead Shark	*Sphyrna tiburo*	LC 2005	Coastal
Lesser Guitarfish	*Acroteriobatus annulatus*	LC 2006	Coastal
Atlantic Stingray	*Dasyatis sabina*	LC 2006	Coastal
Roughtail Stingray	*Dasyatis centroura*	LC 2007	Coastal
Pink Whipray	*Himantura fai*	LC 2004	Coastal
Pelagic Stingray	*Pteroplatytrygon violacea*	LC 2007	Pelagic
Broadnose Sevengill Shark	*Notorynchus cepedianus*	DD 2005	Coastal
Shortnose Dogfish	*Squalus megalops*	DD 2003	Coastal
Shortspine Dogfish	*Squalus mitsukurii*	DD 2007	Coastal
Southern Sleeper Shark	*Somniosus antarcticus*	DD 2003	Deepsea
Pacific Sleeper Shark	*Somniosus pacificus*	DD 2008	Deepsea
Atlantic Electric Ray	*Tetronarce nobiliana*	DD 2004	Coastal
Biscuit Skate	*Raja straeleni*	DD 2003	Coastal
Thorny River Stingray	*Potamotrygon constellata*	DD 2003	Coastal
Porcupine River Stingray	*Potamotrygon histrix*	DD 2003	Coastal
Ocellate River Stingray	*Potamotrygon motoro*	DD 2005	Coastal
Raspy River Stingray	*Potamotrygon scobina*	DD 2004	Coastal
Scaly Whpray	*Himantura imbricata*	DD 2004	Coastal
Blackedge Whipray	*Himantura marginata*	DD 2009	Coastal
Cowtail Stingray	*Pastinachus sephen*	DD 2007	Coastal
Bullnose Ray	*Myliobatis freminvillii*	DD 2007	Coastal
Southern Eagle Ray	*Myliobatis goodei*	DD 2007	Coastal
Annadale's Guitarfish	*Rhinobatos annandalei*	DD 2008	Coastal
Smoothback Guitarfish	*Rhinobatos lionotus*	DD 2008	Coastal
Pacific Cownose Ray	*Rhinoptera steindachneri*	DD 2006	Coastal
Atlantic Devil Ray	***Mobula hypostoma***	**DD 2008**	**Pelagic**
Shortfin Devil Ray	***Mobula kuhlii***	**DD 2007**	**Pelagic**
Sicklefin Devil Ray	***Mobula taracapana***	**DD 2006**	**Pelagic**

Table 9 (continued). CMS Migratory (n = 95) and possibly migratory (n = 58) shark species, with Red List Assessment and broadly categorized habitat characterization; coastal, pelagic, and deepsea. Freshwater species included in coastal habitat.

Possibly Migratory Species			
Milk Shark	*Rhizoprionodon acutus*	LC 2003	Coastal
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*	LC 2005	Coastal
Clearnose Skate	*Raja eglanteria*	LC 2008	Coastal
Bluntnose Stingray	*Dasyatis say*	LC 2006	Coastal
Blue Stingray	*Dasyatis chrysonota*	LC 2008	Coastal
Bat Ray	*Myliobatis californica*	LC 2014	Coastal
Bigeye Sandtiger Shark	*Odontaspis noronhai*	DD 2005	Pelagic
Pigeye Shark	*Carcharhinus amboinensis*	DD 2005	Coastal
Smalltail Shark	*Carcharhinus porosus*	DD 2006	Coastal
Bignose Shark	*Carcharhinus altimus*	DD 2008	Deepsea
Whitenose Shark	*Nasolamia velox*	DD 2008	Coastal
Scoophead Shark	*Sphyrna media*	DD 2006	Coastal
Blackspotted Torpedo	*Torpedo fuscomaculata*	DD 2004	Coastal
Southern Eagle Ray	*Dasyatis americana*	DD 2006	Coastal
Diamond Stingray	*Dasyatis dipterura*	DD 2006	Coastal
Longnose Stingray	*Dasyatis guttata*	DD 2004	Coastal
Chupare Stingray	*Himantura schmardae*	DD 2006	Coastal
Dwarf Whipray	*Himantura walga*	DD 2004	Coastal
Smooth Butterfly Ray	*Gymnura micrura*	DD 2006	Coastal
Diamond Ray	*Gymnura natalensis*	DD 2006	Coastal
Common Eagle Ray	*Myliobatis aquila*	DD 2005	Coastal
Chilean Eagle Ray	*Myliobatis chilensis*	DD 2006	Coastal
Peruvian Eagle Ray	*Myliobatis peruvianus*	DD 2006	Coastal
Japanese Eagle Ray	*Myliobatis tobijei*	DD 2009	Coastal
Bullray	*Aetomylaeus bovinus*	DD 2006	Coastal
Sharpwing Eagle Ray	*Aetobatus guttatus*	n.a.	not valid

Table 9 (continued). CMS Migratory (n = 95) and possibly migratory (n = 58) shark species, with Red List Assessment and broadly categorized habitat characterization; coastal, pelagic, and deepsea. Freshwater species included in coastal habitat.

Possibly Migratory Species			
Flapper Skate	*Dipturus batis*	CR 2006	Coastal
Broadfin Shark	*Lamiopsis temmincki*	EN 2008	Coastal
Mekong Freshwater Stingray	*Dasyatis laosensis*	EN 2011	Coastal
Mottled Eagle Ray	*Aetomylaeus maculatus*	EN 2006	Coastal
Ornate Eagle Ray	*Aetomylaeus vespertilio*	EN 2006	Coastal
Brazilian Cownose Ray	*Rhinoptera brasiliensis*	EN 2004	Coastal
Smalltooth Sandtiger Shark	*Odontaspis ferox*	VU 2007	Deepsea
Snaggletooth Shark	*Hemipristis elongatus*	VU 2003	Coastal
Night Shark	*Carcharhinus signatus*	VU 2006	Pelagic
	Narcine brasiliensis	VU 2007	Coastal
Brown Stingray	*Dasyatis fluviorum*	VU 2003	Coastal
Lesser Guinean Devil Ray	***Mobula rochebrunei***	**VU 2007**	**Coastal**
Crocodile Shark	*Pseudocarcharias kamoharai*	NT 2005	Pelagic
Dusky Smoothhound	*Mustelus canis*	NT 2005	Coastal
Silvertip Shark	*Carcharhinus albimarginatus*	NT 2007	Pelagic
Grey Reef Shark	*Carcharhinus amblyrhynchos*	NT 2005	Coastal
Spottail Shark	*Carcharhinus sorrah*	NT 2007	Coastal
Whitecheek Shark	*Carcharhinus dussumieri*	NT 2003	Coastal
Galapagos Shark	*Carcharhinus galapagensis*	NT 2003	Pelagic
Blacktip Shark	*Carcharhinus melanopterus*	NT 2005	Coastal
Caribbean Reef Shark	*Carcharhinus perezi*	NT 2006	Coastal
Blackspot Shark	*Carcharhinus sealei*	NT 2003	Coastal
Winghead Shark	*Eusphyra blochii*	NT 2003	Coastal
Mallethead Shark	*Sphyrna corona*	NT 2004	Coastal
Apron Ray	*Discopyge tschudii*	NT 2004	Coastal
Southern Guitarfish	*Rhinobatos percellens*	NT 2004	Coastal
Thornback Skate	*Raja clavata*	NT 2005	Coastal
Little Skate	*Leucoraja erinacea*	NT 2008	Coastal
Longnose Eagle Ray	*Myliobatis longirostris*	NT 2006	Coastal
Lusitanian Cownose Ray	*Rhinoptera marginata*	NT 2006	Coastal
Pygmy Devil Ray	***Mobula eregoodootenkee***	**NT 2003**	**Coastal**
Bentfin Devil Ray	***Mobula thurstoni***	**NT 2006**	**Pelagic**