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Review of Migratory Chondrichthyan Fishes

Prepared by the Shark Specialist Group of the
IUCN Species Survival Commission on behalf of
the CMS Secretariat



Review of Chondrichthyan Fishes

IUCN Species Survival Commission's Shark Specialist Group

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Cover photographs © J. Stafford-Deitsch. Front cover: *Isurus oxyrinchus* Shortfin mako shark. Back cover, from left: *Sphyrna mokarran* Great hammerhead shark, *Carcharodon carcharias* Great white shark, *Prionace glauca* Blue shark. Maps from Collins *Field Guide to Sharks of the World*. 2005.

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1 Introduction

1.1 Background

The Convention on Migratory Species (CMS) currently includes three species of chondrichthyan fishes on its Appendices, in recognition of their unfavourable conservation status and need for concerted international conservation measures. Whale shark *Rhincodon typus* was listed on Appendix II in 1999, white shark *Carcharodon carcharias* on Appendices I and II in 2002, and basking shark *Cetorhinus maximus* on Appendices I and II in 2005.

Also in 2005, the Eighth meeting of the Conference of Parties adopted Recommendation 8.16 “Migratory sharks” (see Annex 1). This recognises the importance of sharks in the marine ecosystem and the many threats to their populations and, *inter alia*, calls upon Parties to strengthen measures to protect migratory sharks and to develop a global migratory shark conservation instrument.

The IUCN Species Survival Commission Shark Specialist Group (IUCN SSG) was commissioned by the UK Department for Environment, Food and Rural Affairs (Defra) and the CMS Secretariat to prepare a database of all migratory chondrichthyan fishes (the sharks, skates, rays and chimaeras) and to identify potential species that would benefit from a CMS listing due to their current status and conservation needs. This paper summarises the results of this review.

A CMS meeting is being held in the Seychelles in December 2007 in order to identify options for international cooperation on migratory sharks under CMS. A separate background paper on the conservation status of migratory

sharks and possible options for international cooperation under CMS (IUCN SSC Shark Specialist Group 2007) has been prepared for this meeting and is available as an information document. It includes information on the global conservation status of sharks that is reproduced here, but excludes data on the rays and chimaeras. The background paper also describes the global, regional and national legal and management status of sharks and options for international cooperation under CMS, which, while relevant to other chondrichthyan taxa, are not presented in this document.

1.2 Objectives

The primary purpose of this study was to prepare a database of migratory chondrichthyan fishes (the sharks, skates, rays and chimaeras) and to use the database in order to identify potential species that would benefit from a CMS listing due to their current status and conservation needs. The authors were asked to specify the appropriate CMS Appendix for each species, to summarise the main reasons why such a listing would be valuable, and to identify range States that might potentially make specific listing proposals. Otherwise, the methodology used and the structure of the database and the final report were left to the discretion of the authors.

The secondary purpose was to provide a pilot study that can be used as a starting point for developing the methodology and outputs of future taxonomic reviews under CMS. It is envisaged that the Scientific Council will also consider this as a more general discussion document and make recommendations for improvements before any other such reviews are undertaken.

2 Methods, definitions and datasets

2.1 Methodology

The IUCN Shark Specialist Group (SSG) Secretariat, in consultation with the SSG's volunteer network, developed a migratory chondrichthyan species database from information collated over the past decade under the SSG's Red List Assessment programme for all species of chondrichthyan fishes (sharks, skates, rays and chimaeras). The SSG network was also asked to provide additional information on any migratory chondrichthyan species of which they were aware, since the migratory status of many species is uncertain and not provided in the literature.

The published, submitted and draft IUCN Red List assessments for chondrichthyans identified as migratory were used as the basis for determining whether these species are of unfavourable conservation status as defined by CMS (Annex 2), and hence to identify potential candidate species that would benefit from listing on the Appendices and consequently action through CMS. Fortunately, Red List assessments have been completed for some 90% of migratory or possibly-migratory species, providing a very good picture of the relative extinction risk for these species.

The structure of the database is described in Annex 3. For each species, where known, fields provide taxonomic information, migratory status, distribution (including range States and ocean basins), habitat, depth, IUCN Red List Status (published and in preparation), and management status. Hyperlinks are included to sources such as Fishbase (www.fishbase.org), the IUCN Red List (www.iucnredlist.org), and FAO Factsheets.

The database has collated details of approximately 140 migratory and possibly migratory species of chondrichthyan fishes and their conservation status (where known). It was used to extract brief tabulated reports on the distribution, migration and conservation status of these species, which are presented in the following pages. The authors selected 42 species for a more detailed discussion. These were chosen because they appear to warrant further consideration by CMS due to their unfavourable conservation status and the apparent potential for CMS intervention to address this. These species are highlighted in the final section of this report, and their range States are listed in Annex 5.

2.2 Definition of migratory species

Species included in this analysis appear, on the basis of current information, to fall under the definition given in Article I of CMS i.e. "the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries". For the purposes of migratory marine species, national jurisdictional boundaries are taken to include not just national boundaries between States, but also the boundaries between the high seas (those that do not fall under the jurisdiction of any State) and States' Exclusive Economic Zones (EEZ) or territorial waters (where no EEZ has been declared).

Under this definition:

- i) The word "cyclically" in the phrase "cyclically and predictably" relates to a cycle of any nature, such as astronomical (circadian, annual etc.), life or climatic, 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) National jurisdictional boundaries include national land and territorial sea borders, and the outer 200 mile EEZ boundary of each nation where this has been declared.

While it is easy to identify many chondrichthyan species that are clearly migratory as defined above, published and unpublished data are currently inadequate to identify conclusively all migratory chondrichthyans. Several species are considered to be 'possibly migratory' and described as such in the database where there is evidence suggesting that migrations occur, but their precise nature remains uncertain, or when inferences have been drawn from knowledge of the migratory movements of better known closely related taxa.

The GROMS database was consulted and found to include a subset of the species identified by this study, but also some sharks that are apparently not migratory but likely restricted to very small home ranges.

It should be noted that while a species that occurs in more than one ocean basin may undertake seasonal migrations of similar length in different regions, it is possible in one region for the entire migration to be undertaken without crossing a national boundary, whereas in another the migrating stock may cross several because its range States have shorter coastal fringes.

The document prepared for the December 2007 CMS shark meeting refers to the UN Convention on the Law of the Sea (UNCLOS) and the FAO definitions of its Annex 1 'Highly Migratory Species', 'high seas', transboundary and 'straddling fish stocks'. These species are potentially covered by the UN Fish Stocks Agreement (FSA) and generally also fall within the CMS definition of migratory species, with the potential exception of high seas stocks that never enter any State's EEZ or territorial waters.

2.3 Taxonomy and nomenclature

Class Chondrichthyes, the cartilaginous fishes, includes about 60 families, 189 genera and some 1,200 living species (Compagno *et al.* 2005, Compagno 2001 and in preparation, see Annex 4). These taxonomic references are used in preference to Eschmeyer (1990) because they include some significant updates to our knowledge of chondrichthyan taxonomy and many important recently described species. For example, Compagno *et al.* (2005) note that 95 new species and six new genera of cartilaginous fishes were described between 1980 and 1990, and at least 30 new species, three new genera and one new family between 1990 and 1999. The list reviewed for this study is still, however, incomplete. Twenty new species have been identified in Indonesia alone during a recently concluded five year study there (White *et al.* 2007). Six of these are now described and 14 await description; none of these or many other recent discoveries are included in the summary in Annex 4.

The Chondrichthyans are the most diverse group of vertebrates after the teleost fishes. They are comprised of the sharks (34 families and about 500 species), batoids (23 families and about 650 species, including skates, stingrays, guitarfishes and sawfishes) and chimaeroid fishes (three families and some 40–50 species). The chimaeras fall in Subclass Holocephalii and the sharks and rays in Subclass Elasmobranchii (the latter are also commonly referred to as elasmobranchs). Early classifications divided the elasmobranchs into sharks (Squalii, Pleurotremata) and rays (Batoidea, Hypotremata). Taxonomic research in the 1990's (e.g. Shirai 1996, de Carvalho 1996, Compagno

2000) subsequently suggested that the elasmobranchs should be subdivided into two Superorders, Squalomorpha (squalomorph sharks, containing the batoids in Order Rajiformes) and Galeomorpha (galeomorph sharks). However, the most recent taxonomy, based on molecular and paleontological analyses of the neoselachians show that the Batoids (skates and rays) are indeed the sister group of the Selachii (sharks), which is divided into Squalomorpha, and Galeomorpha. Thus the batoids are no longer considered to be part of the squalomorphs (Maisey *et al.* 2004, Musick *et al.* 2004, Musick and Ellis 2005, Naylor *et al.* 2005). To further confuse the issue, it is fairly common to refer to all of the chondrichthyan fishes as 'sharks' – for example this is routine practice in FAO and CITES documents.

For the purpose of this study, and recognising that a separate initiative is underway through CMS to consider migratory sharks, the review has been divided into the sharks and the batoid fishes. (No chimaeras have been identified that fulfil the CMS definition of migratory, although some do undertake seasonal breeding migrations from deep to shallow water).

2.4 Ecology and life history

The living chondrichthyans are the end products of over 400 million years of evolution. While a few species are similar to their primitive ancestors, modern sharks and rays exhibit advanced characteristics such as placental reproduction and live birth, homothermy, very large brains and extremely sophisticated sensory capacity. They are all predatory, feeding on a wide range of species from zooplankton and tiny benthic invertebrates to large bony fishes including other sharks and, in a few cases, turtles, seabirds and marine mammals.

The cartilaginous fishes occupy niches in every marine environment except the deepest oceans below 4,000 m. About 50% of described species occur on continental and insular shelves and slopes to 200 m, 35% in waters deeper than 200 m, much smaller numbers (about 5%) in the open ocean, another 5% in freshwater, and the remainder in several of these habitats. Most species favour temperate to tropical conditions, from coral reefs to cold coastal waters, but some live under the Arctic ice and range into the Antarctic Ocean. The greatest diversity occurs in the tropical Indo-west Pacific Ocean, where a widespread lack of survey and monitoring combined with high pressures on the coastal zone, have the potential to result in extinctions before species can be

described. There is also significant diversity in continental slope habitats, where chondrichthyan species may be restricted to relatively narrow depth bands. These habitats are also coming under pressure from fisheries expanding into deeper water as shallow stocks become over-exploited.

Adult size ranges from less than 10 cm to 20 m. The largest species tend to be wide-ranging and even circumglobal, often undertaking regular, possibly even continuous, migrations that may cross ocean basins, while many coastal species undertake seasonal migrations along the continental shelf. Many of the smaller chondrichthyans, particularly benthic species (those that live on the seabed), tend not to be strong swimmers and to have a limited range. These include regional, national and insular endemics (the later two groups do not, of course, qualify for CMS attention). At one extreme, Last and Stevens (1994) reported that more than half of the Australian chondrichthyan fauna is endemic to the country, with most of these endemics found in warm waters. Conversely, there are relatively few regional endemics in the North Atlantic.

The chondrichthyan fishes are generally K-selected; that is most species are characterised by all or many of the following characteristics: low fecundity, large precocious young, slow growth, late maturity, long life and high survival at all age classes. They therefore have a low reproductive potential and a low capacity for population increase. This makes most chondrichthyans (with the exception of the most abundant and fecund species), poor candidates for sustainable fisheries exploitation. The majority of threats to these species arise from mortality in fisheries that take unsustainable numbers as part of the target catch, or as a utilised or discarded bycatch.

The above summary draws upon Fowler *et al.* 2004a and Camhi *et al.* 1998.

2.5 Data sources

Much of the analysis presented in this document draws upon published IUCN Red List data, the Red List data sheets submitted in 2006 but not yet published and, to a lesser extent, draft Red List assessments still in

preparation by the IUCN Species Survival Commission Shark Specialist Group (SSG). These data sheets include all key literature identified for each species, and have been compiled during the Shark Specialist Group's Global Assessment of Chondrichthyan Fishes, which is scheduled for completion at the end of 2007.

The FAO Catalogue of Sharks of the World (Compagno 1984, 2001 and in preparation) has been a particularly important source of information, both for published Red List assessments and for those species not yet reviewed for the Red List. Finally, SSG members were also consulted and asked for their feedback on the provisional list of migratory species prepared during this study.

2.6 Database structure

No database specification was provided for this project. Excel was therefore used for the construction of the prototype migratory shark species database since this can easily be exported into more complex database formats. Annex 3 describes the structure of the database prepared for this study and the fields included.

The database includes information, where available, on CMS migratory status, global and regional Red List (threatened) status, legal and management status, range States, and a bibliography. This information is not comprehensive. In particular, information on the national legal and management status of sharks is not readily available and likely incomplete (much of this was obtained in the form of 'personal communications' from the members of the IUCN SSC Shark Specialist Group network who kindly assisted with research for this study).

Summing the columns for each State in the 'Range' section of the database provides an index of the number of CMS migratory shark species occurring in each State. This can be sorted to show the range States by the number of shark species occurring in their waters. When these data are amalgamated, the range States can be identified in whose waters the largest number of species of migratory chondrichthyans occur. This analysis is presented in the resources paper prepared for the December 2007 CMS Migratory Shark Meeting (IUCN SSG 2007).

3 Results

3.1 Global conservation status and threats

Migratory chondrichthyans whose conservation status is not favourable under the CMS definition (see Annex 2) generally fail to meet the definition in Article 1(c)4: “the distribution and abundance of the migratory species approach historic coverage and levels to the extent that potentially suitable ecosystems exist and to the extent that is consistent with wise wildlife management”. Many chondrichthyan species’ abundance is greatly reduced below historic levels and the majority of these do not benefit from any wildlife or fisheries management. These species qualify for inclusion in IUCN Red List Threatened (Vulnerable, Endangered or Critically Endangered) or Near Threatened Categories using Criterion A (population decline).

Table 1 summarises the number and percentage of all chondrichthyans by IUCN category of threat for non-migratory, migratory and possibly migratory species, drawing upon the 2006 Red List and further assessments pending publication in 2007 and 2008. While these assessments only cover about two-thirds of all living

sharks and slightly over half of all living chondrichthyans, they do include 90% of migratory and potentially migratory species (roughly 70 sharks and 70 batoids).

The results of these appraisals, summarised in Table 1, reveal that a much higher percentage of migratory chondrichthyans are of unfavourable conservation status (47.5% are assessed as Threatened: Critically Endangered, Endangered or Vulnerable, and 27.5% as Near Threatened), than are non-migratory species (18.9% and 13.4% respectively). The degree of threat to the small number of possibly migratory species (that may meet CMS criteria) is also high. Correspondingly, therefore, a much smaller proportion of migratory species than non-migratory species are Data Deficient or Least Concern. The latter arises partly from the large proportion of Data Deficient and/or Least Concern deepwater species that are not known to be migratory and/or are out of range of fisheries, and partly by the high proportion of Australian endemics that are in favourable conservation status because they are largely unfished or well managed.

Table 1
Comparison of the global Red List status of non-migratory, migratory and possibly migratory chondrichthyan species (assessments published and pending publication)

IUCN Red List Category	Non-migratory		Migratory		Possibly migratory	
	Number	Percentage*	Number	Percentage*	Number	Percentage*
Critically Endangered	11	2.6%	8	10.0%	0	0.0%
Endangered	21	5.0%	4	5.0%	1	2.2%
Vulnerable	47	11.2%	26	32.5%	6	13.3%
Subtotal Threatened	79	18.9%	38	47.5%	7	15.6%
Near Threatened	56	13.4%	22	27.5%	18	40.0%
Subtotal Threatened & Near Threatened	135	32.3%	60	75.0%	25	55.6%
Data Deficient	164	39.2%	13	16.3%	15	33.3%
Least Concern	118	28.2%	7	8.8%	5	11.1%
Conservation Dependent	1	0.2%	0		0	
Not Evaluated	446		9		4	
Total evaluated	418	48.4%	80	89.9%	45	91.8%
Total all species	864		89		49	

* The percentage of the total number of species evaluated.

Table 2 lists all migratory and potentially migratory chondrichthyan fish species identified during this study (approximately 70 sharks and 70 batoids), in taxonomic order, and the major threats to their populations. The most common threat to these species is population depletion caused by fisheries that either target them directly (primary target) or take them as a utilised bycatch (secondary target). In some cases breeding or migrating aggregations are specifically targeted, but this is likely to occur to many more species than noted in the Table (data are very incomplete). A smaller number of species are primarily threatened because of bycatch discard mortality, not because they are utilised in fisheries.

Habitat destruction is a secondary threat for a fairly small proportion of species, with the exception of the Southeast Asian and South American freshwater stingrays for which habitat damage and utilisation are both primary threats. Climate change and other threats are not listed because they have been identified in only a very small number of species assessments and are not considered to be having a major impact upon these species. This information is available on www.redlist.org. No threats are listed for some species that are assessed as 'Least Concern' or 'Data Deficient', and for a few species that have not yet been evaluated.

Table 2

The major threats to migratory and possibly migratory chondrichthyan species

Key: Red List assessments in brackets are in preparation. 1: primary threat, 2: secondary threat.

Species name	IUCN Red List	Harvest Mortality (Primary and secondary target)	Unutilised Bycatch Mortality	Habitat Destruction	Notes
<i>Hexanchus griseus</i>	NT	1	2		
<i>Notorynchus cepedianus</i>	DD	1			
<i>Squalus acanthias</i>	VU	1	2		Aggregations targeted
<i>Squalus megalops</i>	DD	1			
<i>Squalus mitsukurii</i>	DD	1			
<i>Somniosus antarcticus</i>	DD				
<i>Somniosus microcephalus</i>	NT	1			
<i>Somniosus pacificus</i>					
<i>Squatina squatina</i>	CR	1		2	
<i>Nebrius ferrugineus</i>	VU		1	2	
<i>Rhincodon typus</i>	VU	1			Aggregations targeted
<i>Carcharias taurus</i>	VU	1			
<i>Odontaspis ferox</i>	DD	1			
<i>Odontaspis noronhai</i>	DD				
<i>Pseudocarcharias kamoharai</i>	NT		1		
<i>Megachasma pelagios</i>	DD		1		
<i>Alopias pelagicus</i>	VU	1			
<i>Alopias superciliosus</i>	VU	1			
<i>Alopias vulpinus</i>	VU	1			
<i>Cetorhinus maximus</i>	VU	1			Aggregations targeted
<i>Carcharodon carcharias</i>	VU	1			
<i>Isurus oxyrinchus</i>	VU	1			
<i>Isurus paucus</i>	VU	1			
<i>Lamna ditropis</i>	LC	1			
<i>Lamna nasus</i>	VU	1			Aggregations targeted
<i>Leptocharias smithii</i>	NT	1			
<i>Galeorhinus galeus</i>	VU	1		2	Aggregations targeted
<i>Mustelus asterias</i>	LC				

Table 2, cont'd

The major threats to migratory and possibly migratory chondrichthyan species

Species name	IUCN Red List	Harvest Mortality (Primary and secondary target)	Unutilised Bycatch Mortality	Habitat Destruction	Notes
<i>Mustelus canis</i>	NT	1			
<i>Mustelus mustelus</i>	LC				
<i>Hemipristis elongatus</i>	VU	1			
<i>Carcharhinus acronotus</i>					
<i>Carcharhinus albimarginatus</i>	NT	1			
<i>Carcharhinus altimus</i>	DD	1			
<i>Carcharhinus amblyrhynchoides</i>	NT	1			
<i>Carcharhinus amblyrhynchus</i>	NT	1		2	
<i>Carcharhinus amboinensis</i>	DD	1			
<i>Carcharhinus brachyurus</i>	NT	1		2	
<i>Carcharhinus brevipinna</i>	NT	1		2	
<i>Carcharhinus dussumieri</i>	NT	1			
<i>Carcharhinus falciformis</i>	(NT/VU)	1	2		
<i>Carcharhinus galapagensis</i>	NT	1			
<i>Carcharhinus isodon</i>		1		2	
<i>Carcharhinus leucas</i>	NT	1		2	
<i>Carcharhinus limbatus</i>	NT	1		2	
<i>Carcharhinus longimanus</i>	VU	1			
<i>Carcharhinus macroti</i>	NT	1			
<i>Carcharhinus melanopterus</i>	NT	1		2	
<i>Carcharhinus obscurus</i>	VU	1	2		
<i>Carcharhinus perezi</i>	NT	1			
<i>Carcharhinus plumbeus</i>	VU	1			
<i>Carcharhinus porosus</i>	DD	1			
<i>Carcharhinus sealei</i>	NT	1			
<i>Carcharhinus signatus</i>	VU	1			
<i>Carcharhinus sorrah</i>	DD	1			
<i>Galeocerdo cuvier</i>	NT	1			
<i>Isogomphodon oxyrhynchus</i>	CR	1			
<i>Lamiopsis temmincki</i>		1			
<i>Nasolamia velox</i>		1			
<i>Negaprion acutidens</i>	VU	1		2	
<i>Negaprion brevirostris</i>	NT	1		2	
<i>Prionace glauca</i>	NT	1			
<i>Rhizoprionodon acutus</i>	LC				
<i>Rhizoprionodon terraenovae</i>	LC				
<i>Eusphyra blochii</i>	NT	1			
<i>Sphyrna corona</i>	NT	1			
<i>Sphyrna lewini</i>	EN	1			Aggregations targeted
<i>Sphyrna media</i>	DD	1			
<i>Sphyrna mokarran</i>	EN	1			
<i>Sphyrna tiburo</i>	LC				
<i>Sphyrna tudes</i>	VU	1			
<i>Sphyrna zygaena</i>	NT	1			
<i>Anoxypristis cuspidata</i>	CR	1		2	
<i>Pristis microdon</i>	CR	1		2	
<i>Pristis pectinata</i>	CR	1		2	
<i>Pristis perotteti</i>	CR	1		2	
<i>Pristis pristis</i>	CR	1		2	
<i>Rhynchobatus djiddensis</i>	VU	1		2	

Table 2, cont'd

The major threats to migratory and possibly migratory chondrichthyan species

Species name	IUCN Red List	Harvest Mortality (Primary and secondary target)	Unutilised Bycatch Mortality	Habitat Destruction	Notes
<i>Rhinobatos annandalei</i>					
<i>Rhinobatos annulatus</i>	LC				
<i>Rhinobatos horkelii</i>	CR	1	2		
<i>Rhinobatos lionotus</i>					
<i>Rhinobatos percellens</i>	(NT)	1			
<i>Discopyge tschudii</i>	NT		1		
<i>Narcine brasiliensis</i>	DD		1		
<i>Torpedo fuscomaculata</i>	DD		1	2	
<i>Torpedo nobiliana</i>	(DD)		1		
<i>Amblyraja radiata</i>	(VU)	1	2		
<i>Leucoraja erinacea</i>	(LC)	1			
<i>Malacoraja senta</i>	(VU)	1			
<i>Raja binoculata</i>	NT	1			
<i>Raja clavata</i>	NT	1			
<i>Raja eglanteria</i>	(LC)				
<i>Raja 'pulchra'</i>	(DD)				
<i>Raja straeleni</i>	(DD)	1			
<i>Potamotrygon constellata</i>					Freshwater
<i>Potamotrygon hystrix</i>	(DD)	1		1	Freshwater
<i>Potamotrygon motoro</i>	DD	1		1	Freshwater
<i>Potamotrygon scobina</i>	DD	1		1	Freshwater
<i>Dasyatis colarensis</i>	VU	1			
<i>Dasyatis geijskesi</i>	NT	1			
<i>Dasyatis guttata</i>	DD	1			
<i>Dasyatis sabina</i>	LC				
<i>Dasyatis say</i>	LC				
<i>Himantura bleekeri</i>					
<i>Himantura chaophraya</i>	VU	1		2	Freshwater
<i>Himantura fai</i>	(NT)	1			
<i>Himantura imbricata</i>	(VU)	1			
<i>Himantura krempfi</i>					
<i>Himantura marginatus</i>					
<i>Himantura schmarde?</i>	DD	1			
<i>Himantura uarnak</i>		1			
<i>Himantura walga</i>	(NT)	1			
<i>Dasyatis americana</i>	DD	1			
<i>Dasyatis centroura</i>	LC				
<i>Dasyatis chrysonota</i>	(DD)				
<i>Dasyatis dipterura</i>	DD	1		2	
<i>Dasyatis fluviorum</i>	VU		1	1	
<i>Pastinachus sephen</i>					
<i>Pteroplatytrygon violacea</i>	LC		1		
<i>Gymnura micrura</i>	DD	1			
<i>Gymnura natalensis</i>	DD				
<i>Aetobatus flagellum</i>	EN	1			
<i>Aetobatus narinari</i>	NT	1			
<i>Aetomylaeus nichofii</i>	VU	1			
<i>Pteromylaeus bovinus</i>	DD	1		2	
<i>Rhinoptera bonasus</i>	NT	1			
<i>Rhinoptera brasiliensis</i>	EN		1		
<i>Rhinoptera javanica</i>	VU	1			

Table 2, cont'd

The major threats to migratory and possibly migratory chondrichthyan species

Species name	IUCN Red List	Harvest Mortality (Primary and secondary target)	Unutilised Bycatch Mortality	Habitat Destruction	Notes
<i>Rhinoptera marginata</i>	(NT)	1			Aggregations targeted, W. Africa
<i>Rhinoptera steindachneri</i>	NT	1			
<i>Manta birostris</i>	NT	1			
<i>Mobula hypostoma</i>	(VU)	1			
<i>Mobula japanica</i>	NT	1			
<i>Mobula kuhlii</i>	(VU)	1			
<i>Mobula mobular</i>	EN	1			
<i>Mobula munkiana</i>	NT	1			
<i>Mobula rochebrunei</i>	(VU)	1			Aggregations targeted, W. Africa
<i>Mobula tarapacana</i>	DD	1			
<i>Mobula thurstoni</i>	NT	1			

Key: Red List assessments in brackets are in preparation. 1: primary threat, 2: secondary threat.

3.2 Migratory behaviour, distribution and regional status

The migratory and possibly migratory chondrichthyan species that have been evaluated using the IUCN Red List criteria as threatened or near threatened globally are listed in Table 3 with details of their migratory behaviour. (Table 3 lists species in descending degree of threat, rather than in taxonomic order, as in Table 2.) It can be seen from this summary that data are lacking on the migrations of many of the species that taxonomic and regional experts consider are likely or very likely migratory. This is due to the lack of life history information that characterises even relatively common and abundant chondrichthyans. Most have not been the subject of tagging studies. Even when conventional tagging studies have included very large

numbers of animals, they do not necessarily provide detailed information on their migratory movements. For example, if research is focused on single study sites it may not yield information on where the animals go between capture events. For example, re-captures of mature females may occur annually, or on alternate years, when they visit pupping grounds to give birth, but if there are no tag returns during the other 11 to 23 months of the breeding cycle, the majority of their range remains unknown. Electronic tracking studies are beginning to provide such data, but have not been widely used.

Table 4 summarises the regional distribution and if available, regional Red List status of migratory species. These are listed in alphabetical order, sharks followed by batoids, for ease of reference.

Table 3

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species
(Published (bold) and pending publication assessments. CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened)

Species name	English name	Global status	Summary of migratory behaviour	Ref
<i>Anoxypristis cuspidata</i>	Knifetooth, pointed, or narrow sawfish	CR	Amphidromous	1
<i>Isogomphodon oxyrinchus</i>	Daggernose shark	CR	Makes seasonal migrations. More common in landings samples from north Brazil fish markets in the second half of the year. Believed to migrate north towards Central America and the Caribbean as the discharge from the Amazon River increases in the first half of the year. Family listed on UNCLOS Annex.	2
<i>Pristis microdon</i>	Greattooth or freshwater sawfish	CR	Amphidromous	1
<i>Pristis pectinata</i>	Smalltooth or wide sawfish	CR	Amphidromous. Seasonal migrations along US east coast and possible into/within Gulf of Mexico (NMFS 2006).	3
<i>Pristis perotteti</i>	Largetooth sawfish	CR	Amphidromous	1
<i>Pristis pristis</i>	Common sawfish	CR	Oceandromous	1
<i>Rhinobatos horkelii</i>	Brazilian guitarfish	CR	Oceandromous. May migrate between southern Brazil, Uruguay and Argentina	1
<i>Squatina squatina</i>	Angel shark	CR	Seasonally migratory in the northern parts of European range, makes northwards incursions in summer.	4
<i>Aetobatus flagellum</i>	Longheaded eagle ray	EN	Amphidromous. A seasonal visitor to Ariake Sound, Japan. May migrate between range states.	5
<i>Carcharias taurus</i>	Sand tiger, ragged tooth shark, grey nurse shark	EN	This is a warm-temperate, sub-tropical shark, generally with seasonal migrations into higher latitudes in summer and lower latitudes in winter. Migrations are well studied in western North Atlantic. Migrations also occur within Australia, in Southwest Atlantic and off southern Africa, and probably elsewhere.	6
<i>Mobula mobular</i>	Giant devil ray, devil ray	EN	Oceandromous. Probably migrates throughout the Mediterranean, possibly also into adjacent Atlantic.	1
<i>Rhinoptera brasiliensis</i>	Ticon or Brazilian cownose ray	EN	Summer seasonal migrations to shallow water maybe related to temperature changes.	7
<i>Sphyrna lewini</i>	Scalloped hammerhead	EN	Circum-global in warm temperate and tropical seas. Highly mobile and aggregating in large schools, sometimes segregated by age and sex. Seasonally migratory in parts of its range; resident in other areas. All Sphyrnidae are listed on Annex I of UNCLOS.	8
<i>Sphyrna mokarran</i>	Great hammerhead	EN	Apparently nomadic and migratory. Some populations (e.g. off Florida and in the South China Sea) moving to higher latitudes in summer. (The global assessment for this species is submitted and will be published later in 2007). All Sphyrnidae are listed on Annex I of UNCLOS.	4
<i>Aetomylaeus nichofii</i>	Banded or Nieuhof's eagle ray	VU	Amphidromous	1
<i>Amblyraja radiata</i>	Thorny skate	VU	Oceanodromous. There seems to be evidence that thorny skates can make small seasonal migrations but they generally remain in a defined home range (Kittle FMNH website). There is evidence that this species crosses the border between Canadian waters and the NFAO Regulatory Area on the Grand Banks as part of its seasonal movements (D. Kulka pers. comm.)	9
<i>Carcharhinus longimanus</i>	Oceanic whitetip shark	VU	An oceanic species. Population dynamics and structure are little known. Exhibits size and sexual segregation. Could potentially undertake long-distance oceanic movements. Longline catches in the Central Pacific show it definitely increases in abundance with increasing distance from land, and it does not congregate around land masses.	4

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
			Most abundant in the tropics from 20oN to 20oS, but can occur far beyond its normal range with movements of warm-water masses. Member of family Carcharhinidae, listed on Annex I of UNCLOS.	
<i>Carcharhinus obscurus</i>	Dusky shark	VU	A coastal species. Strongly migratory in the temperate and subtropical Eastern North Pacific and Western North Atlantic, moving north during the summer months and retreating south when the water cools. Off the southern Natal coast, South Africa, newborn sharks occur in a nursery area, larger immature sharks over 90 cm move out of this area, with females tending to move north and males south, but there is some overlap in this partial sexual segregation. This pattern is complicated by seasonal, temperature-related migrations, to higher latitudes in spring and summer and lower latitudes in winter, and also a tendency for the sharks to move into deeper water during cooler months. Other factors may affect the distribution of young sharks, which form large feeding schools or aggregations. Family Carcharhinidae listed on Annex I of UNCLOS.	8
<i>Carcharhinus plumbeus</i>	Sandbar shark	VU	A coastal species. Some stocks migrate seasonally, often in large schools, as water temperatures change. Young form mixed-sex schools on shallow coastal nursing grounds, moving into deeper, warmer water in winter. Member of family Carcharhinidae, listed on Annex I of UNCLOS.	8
<i>Carcharhinus signatus</i>	Night shark	VU	This species is pelagic at slope/shelf edge. Possibly seasonal geographic migrations within its tropical Atlantic distribution. Member of family Carcharhinidae, listed on Annex I of UNCLOS.	8
<i>Carcharodon carcharias</i>*	White shark	VU	Capable of swimming long distances and for extended periods; long distance migrations of 3,500 km recorded. While white sharks are also considered to be a migratory species within their home range, it is possible that they may also move in and out of these areas on a seasonal basis. Equatorial waters may deter large-scale movement but are not a complete barrier since sharks are recorded from very deep water in the tropics. Genetic and tagging research indicates exchange between populations worldwide. Listed on UNCLOS Annex 1, CMS Appendix I and II.	10
<i>Cetorhinus maximus</i>*	Basking shark	VU	Seasonal migrations, from deep to shallow water and/or from lower to higher latitudes in summer (up to 3,000 km). Most records from waters of 8°–14°C in UK, Japan and Newfoundland, up to 24°C in New England, USA. Records in warmer waters are generally of moribund or stranded specimens, but healthy sharks may occur in deep cold water. At least some populations are migratory and possibly seasonally segregated by sex; their winter distribution and locations used by pregnant females are unknown, although it seems likely that wintering sharks occur mainly in deep shelf or shelf edge water. Recent satellite tagging data show some basking sharks from the New England shelf may over-winter in the thermocline (300 m depth) in the Caribbean and off northern South America. Listed on UNCLOS Annex 1 and CMS Appendix I and II.	11
<i>Galeorhinus galeus</i>	Tope shark	VU	Migrations of 16,000 km recorded. At least in some areas (Northeast Atlantic, Tasman Sea) they also extend offshore up to 1,610 km from the coast.	12

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
<i>Hemipristis elongatus</i>	Snaggletooth shark	VU	Poorly known behaviour, may migrate in parts of its Indo-West Pacific shelf range.	8
<i>Isurus oxyrinchus</i>	Shortfin mako	VU	May be the fastest shark and one of the swiftest and most active fishes. Highly migratory and has a tendency to follow movements of warm water masses polewards in the summer, in the extreme northern and southern parts of its range. Catches in the KwaZulu-Natal shark nets indicate inshore movements from deeper water over the continental slopes off South Africa. Long-range movements are being studied by conventional tagging in the North Atlantic. Family is listed on Annex I of UNCLOS.	13
<i>Isurus paucus</i>	Longfin mako	VU	Possibly worldwide in tropical oceanic waters. Likely migratory, but may be slower and less active than its better-known relative, the shortfin mako. Family is listed on Annex I of UNCLOS.	14
<i>Lamna nasus</i>	Porbeagle shark	VU	Occurs singly and in schools and feeding aggregations. May come inshore and to the surface in summer, but will winter offshore and beneath the surface. Fisheries catches in Europe indicate population segregation by size (age) and sex. Porbeagle seem to constitute a single population in the Northwest Atlantic that undertakes extensive migrations between southern Newfoundland (Canada) in summer to at least Massachusetts (USA) in the winter. Longterm tagging data suggests limited mixing between populations on either side of the Atlantic. Annex I of UNCLOS.	13
<i>Nebrius ferrugineus</i>	Tawny nurse shark	VU	Possible seasonal or breeding migrations in its coastal tropical Indo-Pacific range. Occurs off South Africa and is possibly a summer migrant from Mozambique.	15
<i>Negaprion acutidens</i>	Sharptooth lemon shark	VU	Probably a seasonal visitor from Mozambique to northern KwaZulu-Natal, South Africa. Family listed on Annex I of UNCLOS.	15
<i>Rhincodon typus</i>*	Whale shark	VU	Highly migratory, making long-distance, long-term migrations. Tagging and photo-identification studies indicate regular visits to favoured feeding sites to feed at annual, seasonal or lunar fish and invertebrate spawning events. Listed on Annex I of UNCLOS, Appendix II of CMS.	16
<i>Odontaspis ferox</i>	Smalltooth sand tiger	VU	Poorly known biology and behaviour, but an active offshore swimmer which may carry out seasonal migrations	8
<i>Alopias pelagicus</i>	Pelagic thresher	VU	A little-known, active, strong-swimming species, probably migratory but with movements little-known. In the eastern North Pacific there is a possible population centre off central Baja California, which tends to shift northwards (along with other oceanic sharks) during strong El Niño events. Annex I of UNCLOS.	8
<i>Alopias superciliosus</i>	Bigeye thresher	VU	Little is known of migratory movements, but inferred migrator based on behaviour of other thresher sharks. Listed as a highly migratory oceanic shark. Listed on Annex I of UNCLOS.	17
<i>Alopias vulpinus</i>	Thresher shark	VU	In the northwestern Indian Ocean and off the west coast of North America they show spatial and depth segregation by sex. Off the west coast of North America (and probably elsewhere) the species is seasonally migratory, and moves northwards from Baja California into California waters during the spring, with adult males tending to travel farther northwards than females and reaching the coast of British Columbia. Juveniles are mostly found in shallow warm-temperate inshore waters, particularly off southern California	8

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
			where an important nursery area occurs. Juveniles may be less cold-tolerant than adults, and seldom range north of Central California. Both adults and juveniles congregate in inshore waters of southern California, primarily during spring and summer. Listed on Annex I of UNCLOS.	
<i>Dasyatis colarensis</i>	Colares Stingray	VU	Presents annual movements (migration?) that are influenced by seasonal salinity variations.	18
<i>Himantura chaophraya</i>	Giant freshwater stingray or whipray	VU	Potamodromous. Riverine species.	1
<i>Himantura imbricata</i>	Scaly stingray or whipray	VU	Amphidromous.	1
<i>Mobula hypostoma</i>	Atlantic devil ray	VU	A pelagic wanderer. Known to travel alone, in small groups, or in larger schools. Found singly, in small groups, and in schools. Swimming at high speed and often leap high above the surface.	19
<i>Mobula kuhlii</i>	Shortfin devil ray	VU	Generally found in schools, inferred migratory.	20
<i>Mobula rochebrunei</i>	Lesser Guinean devil ray	VU	Lives in groups – its behaviour is rather sluggish at the surface; however, they can swim rapidly and make impressive leaps out of the water. Inferred migratory.	20
<i>Rhinoptera javanica</i>	Javanese cownose ray or flapnose ray	VU	Little information available, but forms large shoals and may make migrations.	21
<i>Rhynchobatus djiddensis</i>	White-spotted wedgefish or giant guitarfish	VU	Tagged animals have been shown to travel a mean distance of only 49 km, reflecting local movement during the summer. It is unknown where the animals go in winter but it is possible that South African animals move north into the warmer waters of Mozambique.	22
<i>Sphyrna tudes</i>	Smalleye hammerhead	VU	May migrate seasonally along its southwest Atlantic coastal range. Little known but inferred migratory on basis of its distribution and the behaviour other hammerheads. All Sphyrnidae are included on the UNCLOS Annex 1 list of highly migratory species.	17
<i>Squalus acanthias</i>	Piked dogfish	VU	Usually coastal and demersal. Movements seem to be correlated to water temperature; they favour a temperature range from minimum of 7–8°C to a maximum of 12–15°C. Make latitudinal (north–south) and depth (nearshore–offshore) migrations, possibly to stay within this range. Travel in large, dense “packs,” segregated by size and sex, with pregnant females preferentially targeted by fisheries.	23
<i>Aetobatus narinari</i>	Spotted eagle ray or bonnetray	NT	Known to swim long distances across open waters as evidenced by its presence in Bermuda. Although primarily observed near the coast and around islands and reefs, the species is likely to be capable of crossing ocean basins. Use coastal waters off Caiçara do Norte, Brazil, as both primary and secondary nurseries.	24
<i>Hexanchus griseus</i>	Bluntnose sixgill shark	NT	Further data are required on long-range movements, but this powerful swimmer is probably migratory in temperate areas where it occurs. Tagging studies off South Africa and Namibia show movements of 0–530 km from the tagging site. There was no exchange between Namibian and South African sharks, and Namibian sharks travelled less than the latter, 0–130 km vs 7–539 km. Tagging studies and colouration suggest that adjacent breeding bays may have separate populations or subpopulations that return to their breeding grounds each year. Time-lapse video observations in the Strait of Georgia, British Columbia, recorded more sharks in summer than in other months. Listed on Annex I of UNCLOS.	25

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
<i>Somniosus microcephalus</i>	Greenland shark	NT	At higher latitudes, this species may migrate seasonally into warmer near shore waters.	8
<i>Pseudocarcharias kamoharai</i>	Crocodile shark	NT	Offshore oceanic species that may migrate through offshore areas of EEZs.	13
<i>Leptocharias smithii</i>	Barbeled houndshark	NT	Possibly seasonally migratory within its west African coastal range. Pregnant females occur July to October off Senegal, which may perhaps be evidence that they seasonally migrate.	8
<i>Mustelus canis</i>	Dusky smoothhound	NT	Northern population migrates inshore and north in summer, south and offshore in winter.	8
<i>Carcharhinus albimarginatus</i>	Silvertip shark	NT	May not disperse widely between sites. Young restricted to shallower nearshore water, little overlap with more wide-ranging adults. Strong preference for offshore islands, coral reefs and banks. Range from inside lagoons and near dropoffs to well offshore, not truly oceanic. Family listed on UNCLOS Annex I.	8
<i>Carcharhinus amblyrhynchoides</i>	Graceful shark	NT	Poorly known tropical inshore and offshore shelf coastal-pelagic Indo-Pacific shark. Migrations not described. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus amblyrhynchos</i>	Gray reef shark	NT	Active, strong-swimming social coastal-pelagic and inshore Indo-Pacific species that forms daytime schools or aggregations in favoured areas such as reef passes, lagoons, or near passes and drop-offs. Sonic-tagged individuals have ventured several kilometres offshore at depths less than 100 m. Migrations not described. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus brachyurus</i>	Bronze whaler	NT	Apparently migratory in temperate parts of its range, moving to higher latitudes in spring and summer, returning in fall and winter. Uses inshore bays and open coastline for nursery grounds in South Africa, and neonates occur there during spring (October-December); Namibian sharks have a later breeding period, during summer (December to March), and may form a separate breeding population from South African sharks. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus brevipinna</i>	Spinner shark	NT	Highly migratory off Florida and Louisiana in the Gulf of Mexico, moving inshore in spring and summer to reproduce and feed, but possibly moving southwards and into deeper water during the fall and winter. Young are born in spring to early summer here; in summer off Senegal. There is a nursery ground for one population on the Natal coast; adult females occur there year-round, males seasonally in summer. Tagging studies off South Africa suggest that young sharks prefer slightly lower temperatures than adults, moving south from Natal when temperatures rise. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus dussumieri</i>	Whitecheek shark	NT	Tropical inshore Indo-west Pacific shark, behaviour poorly known. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus falciformis</i>	Silky shark	NT	An active shark, found with tuna schools in the eastern Pacific. Population dynamics and structure poorly known. Longline sampling in the Eastern and Central Pacific shows this shark is more abundant offshore near land than in the open ocean. Listed on UNCLOS Annex I.	8
<i>Carcharhinus galapagensis</i>	Galapagos shark	NT	Circumtropical. Mostly known from around islands, although it does occur off coasts of continents in a few places (mostly in the tropical Eastern Pacific, but possibly also Spain in the Eastern Atlantic). Capable of crossing considerable distances of open ocean between islands. Juveniles seem to be restricted to shallower water, in 25 m or less, which they apparently use as nursery grounds, while the adults range well offshore. Family listed on Annex I of UNCLOS.	8

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
<i>Carcharhinus leucas</i>	Bull shark	NT	A northwards movement along the West Atlantic coast during summer from its tropical stronghold, and a southwards retreat when water cools. Commonly migrates into fresh water. Family on UNCLOS Annex I.	8
<i>Carcharhinus limbatus</i>	Blacktip shark	NT	Population segregation off Natal, South Africa, where mostly adult males and non-pregnant females occur, with a few young and adolescent sharks and periodic influxes of pregnant females in spring. Pregnant females mostly do not pup there but apparently migrate elsewhere, possibly to nursery grounds in southern Mozambique. This species appears to move to lower latitudes in winter; may move from Tampa Bay to Florida Keys. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus macroti</i>	Hardnose shark	NT	Forms large aggregations in Indian and North Australian waters. In Bombay waters over 95% of the individuals caught are males, the rest females, indicating strong sexual segregation within its populations. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus melanopterus</i>	Blacktip reef shark	NT	Thought to penetrate into brackish lakes and estuaries in Madagascar and into fully fresh water in Malaysia, but its ability to tolerate fresh water for any length of time is uncertain. May be a migrant at northern and southern extremes of range, but this is uncertain. UNCLOS Annex I.	8
<i>Carcharhinus perezii</i>	Caribbean reef shark	NT	Poorly studied. Different life-history and reproductive stages may be segregated to some extent within its Western Atlantic range. For example, there may be a pupping ground off the northern coast of Brazil. Family listed on Annex I of UNCLOS.	8
<i>Carcharhinus sealei</i>	Blackspot shark	NT	Small, common, coastal Indo-west Pacific shark. Abundance varies seasonally off Natal, South Africa. Family listed on Annex I of UNCLOS.	8
<i>Galeocerdo cuvier</i>	Tiger shark	NT	Capable of moving relatively large distances, including across ocean basins and to oceanic islands. There is good evidence of migration to higher latitudes in summer in continental waters; unclear whether in response to water temperature and physiological constraints, or changes in prey abundance or distribution. The influence of prey availability on movements has been overlooked although they appear to take advantage of seasonally abundant food resources. For example, tiger sharks are only present in large numbers at the Houtman Abrolhos Islands, Western Australia, during the Western rock lobster fishing season, when discarded bait is an abundant food source. Family listed on Annex I of UNCLOS.	8
<i>Himantura fai</i>	Pink whipray	NT	Occurs in large aggregations and may migrate.	20
<i>Himantura walga</i>	Dwarf whipray	NT	Moves into large coastal embayments.	20
<i>Negaprion brevirostris</i>	Lemon shark	NT	Some populations migrate seasonally, moving into deeper water or lower latitudes in winter. Family listed on Annex I of UNCLOS.	8
<i>Prionace glauca</i>	Blue shark	NT	Highly migratory species, migrating continuously across and around ocean basins, including between State EEZs and across the high seas. Family listed on Annex I of UNCLOS.	8
<i>Eusphyra blochii</i>	Winghead shark	NT	Shallow water tropical Indo-West Pacific continental and insular shelf species. No data on migrations, biology poorly known; inferred migratory on basis of distribution and behaviour of other hammerheads. Family listed on Annex I of UNCLOS.	17

Table 3 cont'd

Migratory behaviour of Threatened and Near Threatened migratory and possibly migratory chondrichthyan species

Species name	English name	Global status	Summary of migratory behaviour	Ref
<i>Sphyrna corona</i>	Mallethead shark	NT	Very poorly known East Pacific continental shelf species. No information on possible migrations and biology poorly known, but inferred migratory on basis of distribution and behaviour other hammerheads. Family listed on Annex I of UNCLOS.	17
<i>Sphyrna zygaena</i>	Smooth hammer-head	NT	Young sharks sometimes occur in huge migrating schools. Family listed on Annex I of UNCLOS.	8
<i>Dasyatis geijskesi</i>	Wingfin stingray	NT	Presents annual movements (migration?) that are influenced by seasonal salinity variations.	26
<i>Malacoraja senta</i>	Smooth skate	VU	Oceanodromous. Coastal seasonal migrations are deeper in winter.	1
<i>Manta birostris</i>	Manta ray	NT	Oceandromous. Subset of populations make longer migrations, with annual migrations of up to 350 km in Japan. Known to move regularly between several cleaning stations and feeding areas and thought to migrate away from remote islands and seamounts for part of the year.	27
<i>Mobula munkiana</i>	Pygmy devil ray	NT	Oceanodromous. Known to form large, highly mobile aggregations. Specifics of migratory patterns are largely unknown or speculative.	28
<i>Rhinoptera bonasus</i>	Cownosed ray	NT	Oceanodromous. Seasonal mass schooling migrations. Use coastal waters off Caiçara do Norte, Brazil, as both primary and secondary nurseries. Seasonal reproductive aggregations appear at locations on the Belize coast (protected by default as they fall within the boundaries of a national park).	29
<i>Rhinoptera steindachneri</i>	Hawkray or Pacific cownose ray	NT	Oceanodromous. A transient, highly mobile species, it often forms large schools or moves in loose aggregations. Movements may be related to water temperature, as it tends to migrate northward in the Gulf of California during the spring and south in the autumn.	30
<i>Discopyge tschudii</i>	Apron ray	NT	This is a cold water species entering south Brazilian waters from the south in small numbers during winter, but not spreading farther north than 33°S.	31
<i>Mobula thurstoni</i>	Bentfin or smoothtail devil ray	NT	Pelagic, may have spawning migrations to nursery grounds.	32
<i>Raja clavata</i>	Thornback skate	NT	Tagging studies revealed migrations within North Sea.	33
<i>Raja binoculata</i>	Big skate	NT	Relatively restricted range – a few tagged skates in British Columbia migrated up to 1,000s of km.	
<i>Rhinobatos percellens</i>	Southern guitarfish	NT	Use coastal waters off Caiçara do Norte, Brazil, as both primary and secondary nurseries.	34
<i>Rhinoptera marginata</i>	Lusitanian cownose ray	NT	Often forming large groups swimming near the surface, inferred migratory.	20
<i>Mobula japanica</i>	Spinetail devil ray	NT	This species almost certainly migrates seasonally to NZ from islands of the SW Pacific but its distribution in the SW Pacific is very poorly known and potential source populations have not been identified.	35

*Already listed on CMS

Ref:

- 1 Riede (2004)
- 2 Charvet-Almeida, P. pers. comm., Lessa *et al.* (1999)
- 3 Reide (2004), NMFS (2006)
- 4 Compagno in preparation
- 5 Riede (2004), Yamaguchi *et al.* (2005)
- 6 Bass *et al.* (1975), Gilmore (1983), Gilmore (1993), Branstetter and Musick (1994), Pollard *et al.* (1996), Otway and Parker (1999), Lucifora *et al.* (2003), Bass *et al.* (1975), Dudley (2000),

- Gilmore (1993), Otway and Parker (1999), Allen and Peddemors (2000), Otway *et al.* (2004), Stow *et al.* (2006)
- 7 Vooren and Lamónaca (2004)
- 8 Compagno in prep., Compagno *et al.* 2005, Musick, J. pers. comm. (2007)
- 9 Riede (2004), Kulka, D. pers. comm.
- 10 Fergusson (1996), Pardini *et al.* (2001), Bonfil *et al.* (2005), Barrull and Mate (2001), Bonfil *et al.* (2005), Chen (1996), Dewar *et al.* (2004)

- 11 Sims *et al.* (2003), Sims *et al.* (2005), Skomal (2005).
- 12 Brown *et al.* (2000), Duarte *et al.* (2002), Dudley, S. (pers. comm.), Fitzmaurice (1979), Lucifora *et al.* (2004), Olsen (1990), Peres and Vooren (1991), West and Stevens (2001)
- 13 Campana and Joyce (2004)
- 14 Compagno (2001)
- 15 Dudley, S. pers. comm.
- 16 Heyman *et al.* (2001) Wilson *et al.* (2001), CMS listing proposal
- 17 Maguire (2006)
- 18 Charvet-Almeida and de Almeida (2005a)
- 19 Boonstra, FMNH website (2007), Michael (1993), Bigelow and Schoeder (1953)
- 20 Froese and Pauly (2007)
- 21 Dudley *et al.* (2005)
- 22 Mann (2003)
- 23 Hjertenæs (1980), Ketchen (1986), McFarlane and King (2003), Compagno (1984), Compagno in prep.
- 24 Riede (2004), Compagno and Last (1999), Yokota and Lessa (2006), Bester (2007)
- 25 Ebert (1994), Compagno in prep.
- 26 Charvet-Almeida and de Almeida (2005b)
- 27 Reide (1994), Homma *et al.* (1999), Ishihara and Homma (1995)
- 28 Reide (1994), Notarbartolo-di-Sciara (1987, 1988)
- 29 Reide (1994), Clark (1963), Schwartz (1965), Smith and Merriner (1985, 1986, 1987), Rogers (1990), Yokota and Rosângela (2006), R. Graham pers. comm. (2007) *et al.*
- 30 Reide (1994), Bizzarro *et al.* (submitted)
- 31 Massa *et al.* (2004)
- 32 Clarke *et al.* (2005)
- 33 Hunter *et al.* (2005)
- 34 Yokota and Lessa (2006)
- 35 Duffy, C. pers. comm. (2007)

The range States for each migratory species listed in the Tables are provided in the database, but it is important to note that many migratory species with an unfavourable status are fished on the high seas or in other States EEZ through fisheries access agreements by vessels flagged in States that are not range States for these species. For example, large numbers of European vessels operate in the Indo-Pacific, where they capture and utilise species that do not occur in European waters. This is where the global and regional membership of regional fisheries bodies (see below) and international biodiversity conventions is particularly important; in many cases the fishing States that are not range States for the species, but are still having a potentially detrimental effect upon stocks of migratory chondrichthyan, may be Party to the international or regional bodies with the capacity to develop management measures for these species.

3.3 Legal and management status

A detailed account of the main global and regional measures adopted to date that have the potential to contribute towards the conservation and management of migratory chondrichthyan populations is provided in the resources paper for the December 2007 CMS migratory sharks meeting (IUCN SSG 2007). This document also summarises the lack of implementation and/or generally very poor performance of the global instruments that are in force. In a number of cases (the UN Convention on the Law of the Sea (UNCLOS), the 1995 Agreement for the Implementation of the Provisions of UNCLOS relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the Fish Stocks Agreement, or UNFSA), and the listing of shark species on appendices of CMS and CITES), the measures are too recent realistically to have had much impact upon the status of listed species.

Progress under the FAO's voluntary International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks), which is intended to operate at national and regional level, has been particularly disappointing during the eight years in which it has been in effect. All shark fishing States were urged to develop and implement National Shark Plans before February 2001; six years later, fewer than 20% appear to have done so.

The IPOA-Sharks also envisages fisheries management action being taken at regional level. This would be most effective through Regional Fisheries Management Organizations (RFMOs). They serve as fora through which States meet and cooperate to manage fisheries for the conservation and sustainable use of marine living resources and have a mandate to establish binding management measures for fisheries resources, including on the high seas. To date, RFMO activity with respect to the management of chondrichthyans has largely been confined to the adoption of shark finning bans by the tuna management bodies, some basic catch reporting, and in the case of the International Council for the Conservation of Atlantic Tunas (ICCAT) an unsatisfactory attempt to develop initial stock assessments for two migratory shark species (lack of catch and to a lesser extent biological data imposed serious limitations on the outputs).

Several relevant national and subregional biodiversity conservation and fisheries management initiatives are underway. Table 5 provides an incomplete overview of the regional and national legal and management status of some migratory chondrichthyans. This Table was developed with the assistance of the IUCN Shark Specialist Group network and is not comprehensive, but intended to provide an indication of the range of species-specific activities that are in existence.

Table 4, cont'd

The regional status and regional distribution of migratory chondrichthyans

Regional/Subpopulation Status by Ocean Basin																	
Species name	Global Ass.	NEA	NWA	CEA	CWA	SEA	SWA	Med. Sea	Southern Ocean	EIO	WIO	NEP	NWP	CEP	CWP	SEP	SWP
<i>Sphyrna zygaena</i>	NT							VU		LC							LC
<i>Squalus acanthias</i>	VU	CR	EN				VU	EN		LC	LC	VU	EN			VU	LC
<i>Squalus megalops</i>	DD									LC							LC
<i>Squalus mitsukurii</i>	DD									EN							NT
<i>Squatina squatina</i>	CR																
<i>Aetobatus flagellum</i>	EN																
<i>Aetobatus narinari</i>	NT									VU							
<i>Aetomylaeus nichofii</i>	VU																
<i>Amblyraja radiata</i>	VU																
<i>Anoxypristis cuspidata</i>	CR																
<i>Dasyatis americana</i>	DD		LC														
<i>Dasyatis centroura</i>	LC																
<i>Dasyatis chrysonota</i>	DD							DD									
<i>Dasyatis colarensis</i>	VU													NT			
<i>Dasyatis diptera</i>	DD																
<i>Dasyatis fluviorum</i>	VU																
<i>Dasyatis geijskesi</i>	NT																
<i>Dasyatis guttata</i>	DD																
<i>Dasyatis sabina</i>	LC																
<i>Dasyatis say</i>	LC																
<i>Discopyge tschudii</i>	NT						VU									DD	
<i>Gymnura micrura</i>	DD																
<i>Gymnura natalensis</i>	DD																
<i>Himantura bleekeri</i>																	
<i>Himantura chaophraya</i>	VU										CR						
<i>Himantura fai</i>	NT																
<i>Himantura imbricata</i>	VU																
<i>Himantura krempfi</i>																	
<i>Himantura marginatus</i>																	
<i>Himantura schmardae?</i>	DD																
<i>Himantura uarnak</i>																	
<i>Himantura walga</i>	NT																
<i>Leucoraja erinacea</i>	LC																
<i>Malacoraja senta</i>	VU																

[illegible]

Table 5

The regional and national legal and management status of migratory sharks

(This table was drawn up with the assistance of the IUCN Shark Specialist Group network and is not comprehensive. National species-specific conservation and management initiatives may apply to EEZ in more than one ocean basin. RFO initiatives focus on sea areas – ICCAT is Atlantic, IATTC Pacific. HMSFMP: Highly Migratory Species Fishery Management Plan.

Species	Africa	Australasia and Indian Ocean	Central America and Caribbean	Central and South America	Europe	North America (US HMSFMP=Atlantic only)
<i>Alopias pelagicus</i>	South Africa: bycatch & recreational bag limit					
<i>Alopias superciliosus</i>	South Africa: bycatch & recreational bag limit					Pelagic species on US HMSFMP
<i>Alopias vulpinus</i>	South Africa: bycatch & recreational bag limit					Pelagic species on US HMSFMP
<i>Carcharhinus acronotus</i>						Small Coastal Shark on US HMSFMP
<i>Carcharhinus albimarginatus</i>	South Africa: Recreational bag limit					
<i>Carcharhinus altimus</i>	South Africa: Recreational bag limit					Prohibited Species on US HMSFMP
<i>Carcharhinus amboinensis</i>	South Africa: Recreational bag limit					
<i>Carcharhinus brachyurus</i>	South Africa: Recreational bag limit					
<i>Carcharhinus brevipinna</i>	South Africa: Recreational bag limit					Large Coastal Shark on US HMSFMP
<i>Carcharhinus falciformis</i>	ICCAT finning ban South Africa: bycatch & recreational bag limit		ICCAT and IATTC: finning ban	ICCAT and IATTC: finning ban	ICCAT: finning ban	ICCAT: finning ban Large Coastal Shark on US HMSFMP
<i>Carcharhinus galapagensis</i>		NZ: Protected in Kermadec Islands Marine Reserve				Prohibited Species on US HMSFMP
<i>Carcharhinus isodon</i>						Small Coastal Shark on US HMSFMP
<i>Carcharhinus leucas</i>	South Africa: Recreational bag limit					Large Coastal Shark on US HMSFMP
<i>Carcharhinus limbatus</i>	South Africa: Recreational bag limit					Large Coastal Shark on US HMSFMP
<i>Carcharhinus longimanus</i>	ICCAT: finning ban. South Africa: Recreational bag limit		ICCAT and IATTC: finning ban	ICCAT and IATTC: finning ban	ICCAT and IATTC: finning ban	ICCAT: finning ban Pelagic Shark on US HMSFMP

<i>Carcharhinus melanopterus</i>	South Africa: Recreational bag limit							Prohibited Species on US HMSFMP
<i>Carcharhinus obscurus</i>	South Africa: Recreational bag limit							Large Coastal Shark on US HMSFMP
<i>Carcharhinus plumbeus</i>	South Africa: Recreational bag limit							Prohibited Species on US HMSFMP
<i>Carcharhinus signatus</i>	South Africa: Prohibited species commercial line fishery. Recreational bag limit				Australia: Protected Species. National Recovery Plan		Mediterranean Sea: UNEP Action Plan urges legal protection	Prohibited Species on US HMSFMP
<i>Carcharodon carcharias</i>	South Africa and Namibia: Protected.				NZ: Protected. Australia: Protected in all State and Commonwealth waters incl. EEZ. Recreational catch & release permitted. Maldives: Protected		Zero total allowable catch (TAC) in EU waters. Mediterranean Sea: Barcelona Convention. Protected in Malta and Croatia.	Prohibited species in the HMS FMP Canada: COSEWIC: Assessed as At Risk. Considering listing on Sched. 1 of Species at Risk Act. Research programme. USA, Pacific Ocean: Limited entry, specific time-area closures. Protected in California.
<i>Cetorhinus maximus</i>	South Africa: Prohibited species commercial line fishery. Recreational bag limit.				NZ Fisheries Act: no target fishing, bycatch may be utilised. Being considered for full protection.		Zero total allowable catch (TAC) in EU waters. Mediterranean Sea: Barcelona Convention Protected: UK, Isle of Man, Guernsey, Malta, Croatia	Prohibited species in the HMSFMP.
<i>Galeocerdo cuvier</i>	South Africa: Recreational bag limit.							Large Coastal Shark on US HMSFMP
<i>Galeorhinus galeus</i>	South Africa: Recreational bag limit.				Australia: Limited entry for gillnets and longlines, net length and mesh size limits, TAC, nursery closed seasons. Closed areas. Recreational bag limits.			

Table 5, cont'd

The regional and national legal and management status of migratory sharks

Species	Africa	Australasia and Indian Ocean	Central America and Caribbean	Central and South America	Europe	North America (US HMSFMP=Atlantic only)
<i>Hemipristis elongatus</i>	South Africa: Recreational bag limit.					
<i>Hexanchus griseus</i>					Mediterranean Sea: General ban on bottom trawling below 1,000m.	San Francisco Bay: quota for fish per recreational angler
<i>Isogomphodon oxyrinchus</i>				Brazil: Protected on Federal Regulation of Endangered Species.		
<i>Isurus oxyrinchus</i>	South Africa: bycatch & recreational bag limit.	NZ: Managed under Quota management system	ICCART and IATTC: finning ban	ICCART and IATTC: finning ban Chile: gear regulations for artisanal fishery.	ICCART: finning ban. 2005 ICCART shark stock assessment workshop recommended research and monitoring. Europe: Bern & Barcelona Conventions	ICCART: finning ban. 2005 ICCART shark stock assessment workshop recommended research and monitoring Atlantic US: Commercial quotas. Limited entry, time-area closures. Recreational area closures. Recreational bag limits. Atlantic Canada: COSEWIC At Risk. Research. Catch and bycatch limits. License limits, finning ban, gear restrictions, area and seasonal closures, recreational hook and release only. Pacific Canada: Limited entry, time-area closures. Pacific US: Closure of targeted longline fishery. Recreational fishery bag limits in California. Harvest guidelines for Ca, Or, Wa.
<i>Isurus paucus</i>	South Africa: bycatch & recreational bag limit.		ICCART and IATTC: finning ban	ICCART and IATTC: finning ban	ICCART: finning ban.	Prohibited Species on US HMSFMP ICCART: finning ban.

<i>Lamna ditropis</i>									Alaska: Commercial fishing banned. Recreational bag limit. Bycatch permitted.
<i>Lamna nasus</i>	South Africa: Recreational bag limit.	NZ: small regulated fishery with TAC.						Bern Convention (Europe). Norway, Faeroe Islands: quota in EC waters. Quotas exceed total landings.	Prohibited Species on US HMSFMP. COSEWIC At Risk but not placed on Sched. 1 of Species at Risk Act. Quota. Ongoing monitoring programme.
<i>Megachasma pelagios</i>									
<i>Negaprion acutidens</i>	South Africa: Recreational bag limit.								
<i>Negaprion brevirostris</i>									Large Coastal Shark on US HMSFMP
<i>Notorynchus cepedianus</i>									
<i>Odontaspis ferox</i>	South Africa: Recreational bag limit.	Australia: Protected in NSW since 1984. NZ: Being considered for legal protection.							Prohibited Species on HMS FMP
<i>Odontaspis noronhai</i>	South Africa: Recreational bag limit.								Prohibited Species on US HMSFMP
<i>Prionace glauca</i>	South Africa: bycatch & recreational bag limit.	NZ: Managed under QMS						ICCAT: Bern & Barcelona Conventions	Pelagic Species on US HMSFMP. Canada, COSEWIC: Assessed as At Risk
<i>Pseudocarcharias kamoharui</i>									
<i>Rhincodon typus</i>	South Africa: Prohibited species in commercial line fishery. Research programme. Seychelles: Protected. Mozambique: Research Programme.	Australia: Protected in Commonwealth waters, Queensland, Tasmania and Western Australia. NZ: Being considered for legal protection. Protected in Maldives, India, Thailand, Philippines, Malaysia. Taiwan: quota recently reduced.							Prohibited Species on US HMSFMP
<i>Rhizoprionodon acutus</i>	South Africa: Recreational bag limit.								

Table 5, cont'd

The regional and national legal and management status of migratory sharks

Species	Africa	Australasia and Indian Ocean	Central America and Caribbean	Central and South America	Europe	North America (US HMSFMP=Atlantic only)
<i>Rhizoprionodon terraenovae</i>						Small Coastal Shark on US HMSFMP
<i>Somniosus antarcticus</i>						
<i>Somniosus microcephalus</i>						
<i>Somniosus pacificus</i>						
<i>Sphyrna lewini</i>	South Africa: Recreational bag limit.		ICCART and IATTC: finning ban	ICCART and IATTC: finning ban	ICCART finning ban	ICCART and IATTC: finning ban. Large Coastal Shark on US HMSFMP
<i>Sphyrna mokarran</i>	South Africa: bycatch & Recreational bag limit.		ICCART and IATTC: finning ban	ICCART and IATTC: finning ban		ICCART and IATTC: finning ban. Large Coastal Shark on US HMSFMP
<i>Sphyrna tiburo</i>						Small Coastal Shark on US HMSFMP
<i>Sphyrna zygaena</i>	South Africa: Recreational bag limit.		ICCART and IATTC: finning ban	ICCART and IATTC: finning ban	ICCART finning ban	ICCART and IATTC: finning ban. Large Coastal Shark on US HMSFMP
<i>Squalus acanthias</i>	South Africa: bycatch limit.				TACs in force. ICES recommendation for a Zero quota not heeded by EU.	USA Atlantic: 1999/2000 US federal dogfish rebuilding plan, quotas, trip limits. USA Pacific: quotas, trip limits. Canada: quota.
<i>Squatina squatina</i>					Annex III of Bern Convention. UK: Proposed for UK Wildlife and Countryside Act in 2001 – no decision. OSPAR listing proposal under consideration.	

Table 5, cont'd

The regional and national legal and management status of migratory sharks

Species	Africa	Australasia and Indian Ocean	Central America and Caribbean	Central and South America	Europe	North America (US HMSFMP=Atlantic only)
<i>Dasyatis geijskesi</i>						
<i>Dasyatis guttata</i>						
<i>Dasyatis sabina</i>						
<i>Dasyatis say</i>						
<i>Discopyge tschudii</i>						
<i>Gymnura micrura</i>						
<i>Gymnura natalensis</i>						
<i>Himantura bleekeri</i>						
<i>Himantura chaophraya</i>						
<i>Himantura fai</i>						
<i>Himantura imbricata</i>						
<i>Himantura krempfi</i>						
<i>Himantura marginatus</i>						
<i>Himantura schmarde?</i>						
<i>Himantura uarnak</i>	South Africa: Recreational bag limit.					
<i>Himantura walga</i>						
<i>Leucoraja erinacea</i>						
<i>Malacoraja senta</i>						
<i>Manta birostris</i>	South Africa: Recreational bag limit.	Maldives: banned export of ray meat in 1995, skins in 1996. Philippines bans fishing mobula or manta, but illegal catch continues. NZ: being considered for protection under review of Schedules to the Wildlife Act.	Mexican Shark Management Plan coming into force May 2007 will protect all mantas and mobulids in Mexican waters and prohibit their possession and trade.			Hawaii: legislative protection for manta rays from fishing or intentional harm was proposed in 2005 and 2006 through House Bill 960; Bill still under review in 2006.
<i>Mobula hypostoma</i>						
<i>Mobula japonica</i>		Being considered for protection in NZ waters under review of schedules to the Wildlife Act.				

<i>Mobula kuhlii</i>										
<i>Mobula mobular</i>									Listed on Barcelona Convention. Recent GFCM & ICCAT Mediterranean-wide banning of pelagic driftnets will; if implemented, eliminate one of the most severe threats to <i>mobular</i>	
<i>Mobula munkiana</i>									Mexican Shark Management Plan coming into force May 2007 will protect all mantas and mobulids in Mexican waters and prohibit their possession and trade.	
<i>Mobula tarapacana</i>	South Africa: Recreational bag limit.								As above	
<i>Mobula rochebrunei</i>										
<i>Mobula thurstoni</i>									Mexico: 1993 moratorium on elasmobranch fishing permits. Shark Management Plan from 2007.	
<i>Narcine brasiliensis</i>										
<i>Pastinachus sephen</i>										
<i>Potamotrygon constellata</i>									Fishing and export for ornamental trade is illegal in Brazil, however	
<i>Potamotrygon histrix</i>									fishing for food is totally unmonitored and unregulated.	
<i>Potamotrygon motoro</i>									Therefore these species continue to be taken and utilised.	
<i>Potamotrygon scobina</i>										

Table 5, cont'd

The regional and national legal and management status of migratory sharks

Species	Africa	Australasia and Indian Ocean	Central America and Caribbean	Central and South America	Europe	North America (US HMSFMP=Atlantic only)
<i>Pristis microdon</i>	South Africa: sawfish capture banned.	Australia: protected under Endangered Species Act. India: protected under Wildlife Protection Act. Protected in Lake Sentani, Indonesia.				
<i>Pristis pectinata</i>	South Africa: sawfish capture banned.	India: protected under Wildlife Protection Act.	Mexico: all sawfish species protected. Nicaragua: Ban on target sawfish fishing in Lake Nicaragua since early 1980s, total protection 2006.			US Endangered Species List in 2003. Draft smalltooth sawfish recovery plan 2006.
<i>Pristis perotteti</i>			Mexico: all sawfish species protected.			
<i>Pristis pristis</i>						
<i>Pteromylaeus bovinus</i>	South Africa: Recreational bag limit.					
<i>Pteroplatytrygon violacea</i>						
<i>Raja binoculata</i>						
<i>Raja clavata</i>					Minimum 40 cm size for skates and rays in some inshore waters of England and Wales (Sea Fishery Committee bylaws). A single total allowable catch for all skates and rays in EU North Sea and adjacent waters.	
<i>Raja eglanteria</i>						Managed under New England Management Council skate FMP quota.
<i>Raja 'pulchra'</i>						
<i>Raja straeleni</i>	South Africa: Recreational bag limit.					

<i>Rhinobatos annandalei</i>									
<i>Rhinobatos annulatus</i>	South Africa: Recreational bag limit.								
<i>Rhinobatos horkelii</i>									
<i>Rhinobatos lionotus</i>									
<i>Rhinobatos percellens</i>									
<i>Rhinoptera bonasus</i>									
<i>Rhinoptera brasiliensis</i>									
<i>Rhinoptera javanica</i>	South Africa: Recreational bag limit.								
<i>Rhinoptera marginata</i>									
<i>Rhinoptera steindachneri</i>						Mexico: 1993 moratorium on elasmobranch fishing permits. Shark Management Plan comes into force May 2007.			
<i>Rhynchobatus djiddensis</i>	South Africa: Recreational bag limit.								
<i>Torpedo fuscumaculata</i>	South Africa: Recreational bag limit.								
<i>Torpedo nobiliana</i>								See <i>Raja clavata</i> (but <i>Torpedo</i> is discarded)	

4 Species that may potentially benefit from a CMS listing

This initial taxonomic review has identified about 140 migratory or potentially migratory species of chondrichthyan fishes, roughly 50% sharks and 50% batoids. Information on the migrations of many of these species is, however, seriously lacking (particularly for the rays), making it difficult to determine whether it would be appropriate to consider them for listing on CMS, or indeed to judge whether a CMS listing could be applied effectively so as to yield benefits for the species. Many of the species identified in the previous pages are not, therefore, considered further here, although it is likely that some may warrant consideration in the future as knowledge improves. Others may prove in due course not to be migratory under the CMS definition and therefore outside its remit.

A number of species and taxonomic groups are, however, identified as worthy of further consideration under CMS at this stage. These are described below. They have been selected on the basis of their conservation status, management needs, and the potential for CMS intervention to add value to current regional management regimes, if these exist, or to stimulate such management if it appears unlikely to take place under current circumstances.

The threats to many large wide-ranging pelagic-oceanic chondrichthyan species are very similar: their greatest need is collaborative management measures to regulate the fleets and fisheries that capture them. Unfortunately such regulation appears to be a low priority for national and regional fisheries management bodies at the present time, despite repeated acknowledgement in international fora over the past decade of the urgency of introducing such management. (See resources paper prepared for the December 2007 Shark meeting for a more detailed discussion.) CMS intervention will yield the greatest benefits if it helps to stimulate these measures but, in order to do so, it does not necessarily have to list a large number of qualifying species; many unlisted species will also benefit from any improvements to overall fisheries and bycatch management that CMS may stimulate. Rather than propose very large numbers of migratory requiem sharks with similar conservation problems for listing on CMS, therefore, a relatively small number of the strongest cases have been identified below from family Carcharhinidae. All three large hammerhead sharks

are proposed for consideration because they are all of unfavourable status and very similar in appearance; it seems unnecessarily confusing not to address them all.

In the case of the batoid fishes, lack of information is an even greater problem than for sharks. Fewer species have been the subject of tagging studies and their migrations are therefore largely unknown. There are also fewer data available on their status and distribution. For this group, therefore, only a few taxa have been selected for initial consideration by CMS because their need appears to be particularly urgent. Apart from these, it is not recommended that other batoid fishes be proposed for listing at present, unless more information becomes available to justify this.

Annex 5 lists the range States for all of the following species, extracted from the database. The authors were asked to identify CMS Parties that are range States and that might be willing to propose species for listing on CMS. For most species described below, a small number of range States have been selected for consideration from the comprehensive list in the Annex.

The following species and taxa are considered in taxonomic order, except that all sharks are listed first, followed by batoid species (see Table 2).

4.1 *Hexanchus griseus* bluntnose sixgill shark

This primarily deepwater species is included in this section primarily because it is listed on Appendix I (Highly Migratory Species) of UNCLOS. It is unclear why this species should have been selected for that list, since it is not obviously a strongly migratory species nor, so far as can be ascertained, is it taken in high seas fisheries outside State EEZs. Its IUCN Red List assessment is Near Threatened, recognising that this is a target species that is vulnerable to overexploitation, and that there have been some stock depletions caused by fisheries, albeit not known to be sufficiently serious to warrant a Vulnerable listing (Shark Specialist Group 2000). A CMS Appendix II listing would potentially be appropriate for this species, but it is not considered to be a particularly high priority for CMS action at this time.

4.2 *Squalus acanthias* spiny dogfish or spurdog

This highly migratory coastal and shelf shark is globally Vulnerable on the IUCN Red List. Regional population status (Table 4) ranges from Least Concern where there is little or no fishing pressure or fisheries are well-regulated, to Endangered and Critically Endangered where stocks have been seriously depleted by unmanaged or poorly managed fisheries (Fordham *et al.* 2006). Fisheries pose a particular threat to this species because of its highly vulnerable life history (it has a very low intrinsic rate of population increase), high demand for its products in international trade (it is currently proposed for a CITES Appendix II listing), and its vulnerability to the target fisheries that preferentially target aggregations of pregnant females. In the Northern Hemisphere and South America, *Squalus acanthias* stocks are shared and exploited by more than one coastal State, requiring collaborative management action if they are to be fished sustainably. Such collaborative management either does not exist, or has yet to be demonstrated successfully. This species should certainly be a much higher priority for collaborative management by range States than it appears to be at the present time. It is therefore potentially a high priority for a CMS Appendix II listing. The purpose of such a listing would be to help drive the improvements in regional management that are so urgently needed; this might be achieved by prompting improved synergies between environment and fisheries management authorities, since only a small number of fisheries management bodies appear so far to consider this species a high priority for action despite many years' discussion of this species as a possible candidate for CITES Appendix II.

Range States that might consider proposing *Squalus acanthias* for a CMS Appendix II listing include Germany,

which has taken a strong leadership role over the proposal to list this species on CITES, with particular support from Georgia, which offered to co-sponsor the proposal. Other range States that strongly supported the proposal to list this species on CITES during consultations and in internal EU discussions (where the CITES listing proposal was approved without opposition) included Albania, Latvia, Lithuania, Monaco, Netherlands, Poland and the UK.

4.3 *Squatina squatina* angel shark

This formerly common coastal shark is a Northeast Atlantic endemic that undertakes seasonal migrations, at least in the northern part of its range. It has been assessed as Critically Endangered because it has become extremely rare in, if not extirpated from, large areas of its former range (which extended from Norway and North Sea to the Mediterranean and Western Sahara) (Morey *et al.* 2006). It is listed on Annex III of the Bern Convention and was proposed in 2002 by the UK and Belgium for listing on the OSPAR Priority List of Threatened and Endangered Species. Although this proposal was deemed appropriate by the ICES Study Group on Elasmobranch Fishes (ICES 2002), the scientific advisory body for fisheries in the region, the nomination was not adopted by OSPAR. A new proposal from Germany will be considered by OSPAR in 2007. This species is also a high priority for a CMS Appendix I listing, which has the potential to yield important benefits for this species since it would stimulate strict legal protection from the CMS Parties whose waters cover a large part of its range. It should be noted, however, that the species is now so seriously depleted in (if not extirpated from) the northern part of its range, where seasonal migrations were presumably formerly most common, that it may be difficult to determine how much migratory activity still takes place.

Figure 1. Global distribution of *Squalus acanthias*

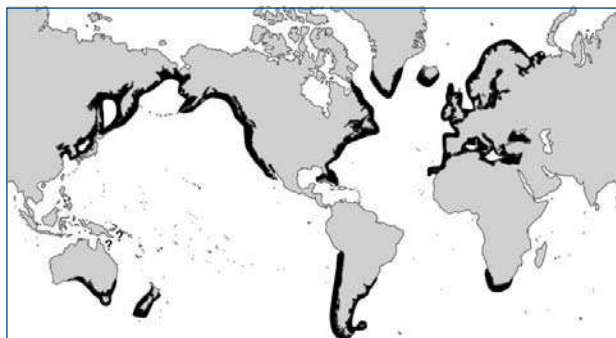


Figure 2. Global distribution of *Squatina squatina*



Range States that might consider proposing *Squatina squatina* for a CMS listing include Germany, Belgium and the UK, all of which have proposed this species for listing on OSPAR during the past five years.

4.4 *Carcharias taurus* sandtiger, grey nurse, ragged tooth shark

This large slow-moving coastal shark occurs in disjunct populations in most sub-tropical, warm-temperate oceans, with the exception of the Eastern Pacific. Seasonal migrations, probably governed by water temperature, have been observed in the western North Atlantic. Similar migrations are also thought to occur in subtropical areas of the southwest Atlantic and off southern Africa, where they are likely to include movements between range States. Migrating sharks exhibit philopatry: they regularly return to very small home areas after undertaking long migrations. The species is currently on the IUCN Red List as Vulnerable globally, as a result of depletion in target and utilised bycatch fisheries. It is taken in small numbers for display in large public aquaria and is economically-important for dive ecotourism in some regions (Pollard and Smith 2000). Some seriously depleted regional populations are assessed as Endangered or Critically Endangered; others are 'only' Near Threatened. The species is currently under consideration for uplist to Endangered globally and would certainly benefit from higher global awareness of its threatened status and the importance of collaborative management (if not strict protection) for migrating stocks. A CMS Appendix II listing would potentially stimulate improved management of these migratory stocks by helping to drive the improvements in regional management that are so urgently needed. This could be achieved by prompting improved synergies between environment and fisheries

management authorities; this species is managed under environmental legislation in some States, fisheries legislation in others, but remains unmanaged in much of its range. An Appendix I listing, which would initiate strict protection measures, is potentially appropriate in parts of its range where populations are most seriously depleted.

Range States that might consider proposing *Carcharias taurus* for a CMS listing include Croatia, Italy and Malta (which are among the few Mediterranean States to have introduced protection for shark species listed on the Barcelona Convention) and South Africa, which shares a population with Mozambique that is very important for dive tourism. Australia is an important range State and places a very high priority on the conservation of this species, which is strictly protected, but does not share its stocks with any other range State.

4.5 *Alopias pelagicus*, *A. superciliosus*, *A. vulpinus* thresher sharks

Family Alopiidae – the thresher sharks, is comprised of three species of large-eyed sharks with hugely elongated, curved whip-like caudal fins as long as their bodies. *A. pelagicus* occurs in the Indo-Pacific Ocean, *A. superciliosus* is almost circumglobal except in the North Pacific and Southern Ocean, and *A. vulpinus* is globally distributed. Their migrations are not well studied, but all are likely migratory within at least parts of their range. Thresher sharks have valuable meat and fins. All three species were assessed in 2007 as Vulnerable because of the serious declines in their populations that have been caused by target and utilised bycatch fisheries in coastal waters and on the high seas (these assessments have not yet been published). The whole family is listed on Annex I,

Figure 3. Global distribution of *Carcharias taurus*



Figure 4. Global distribution of *Alopias pelagicus*

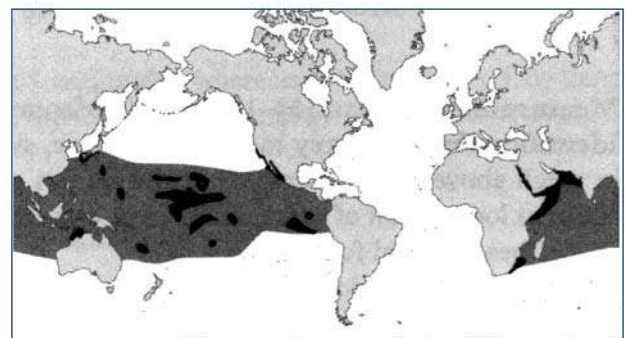


Figure 5. Global distribution of *Alopias superciliosus*

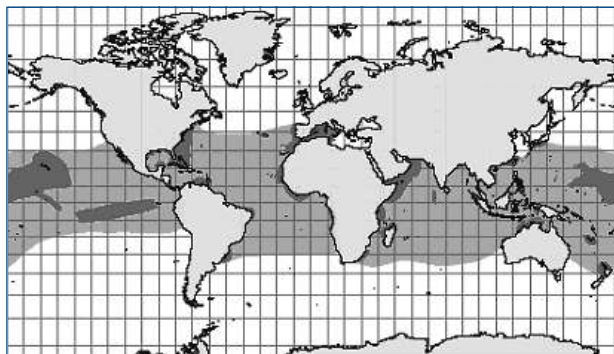
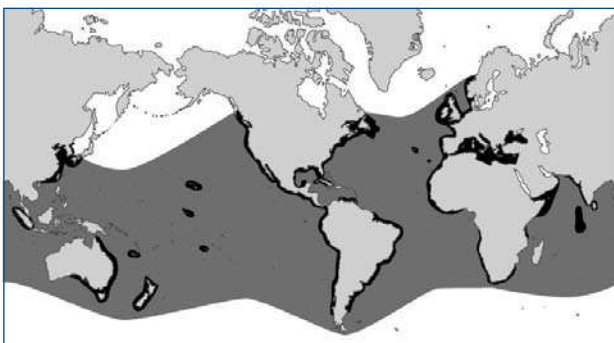


Figure 6. Global distribution of *Alopias vulpinus*



Highly Migratory Species, of UNCLOS, in recognition of the importance of collaborative management for thresher shark stocks. As can be seen in Table 5, however, very few range States and no regional fisheries management bodies appear to have introduced management measures for these species. They certainly warrant a much higher priority for collaborative management by range States than is currently the case. A CMS Appendix II listing could help drive the improvements in national and regional management that are so urgently needed; for example by prompting improved synergies between environment and fisheries management authorities, since so few of the latter appear to consider the thresher sharks a priority for action. Because these species are very similar in appearance and have a partly overlapping distribution, it would seem most practical to seek to list all three on CMS.

Range States that might consider proposing family Alopiidae for a CMS listing because they are range States for more than one species and/or have demonstrated an interest in shark conservation and management issues include South Africa, India, Ecuador, Kenya, Portugal, UK, and several other EU States.

4.6 *Isurus oxyrinchus* shortfin mako and *I. paucus* longfin mako

The mako sharks are among the five members of family Lamnidae (which includes the white shark, already listed on CMS Appendix I and II). Makos are large, fast swimming oceanic sharks with large fins and a crescent-shaped tail with pronounced keels. They are extremely valuable in target and utilised bycatch fisheries for their meat and fins and populations have declined significantly. Shortfin mako was recently uplisted from Near Threatened to Vulnerable on the IUCN Red List of Threatened species. Longfin mako is listed as Vulnerable (Reardon *et al.* 2005). Results from a large tagging study in the North Atlantic have demonstrated shortfin mako movements of well over 3,000 km; similar migrations are likely to take place in other parts of its global range in temperate and tropical oceans (this is probably the fastest-swimming shark in the world). The longfin mako is not so well known and may not be as fast and active as the shortfin, but is also likely to be migratory in its tropical oceanic range. The latter species is most common in the Western Atlantic and Central Pacific, possibly rare elsewhere. The lamnids are listed on Annex I, Highly Migratory Species, of UNCLOS, in recognition of the importance of collaborative management for

Figure 7. Global distribution of *Isurus oxyrinchus*

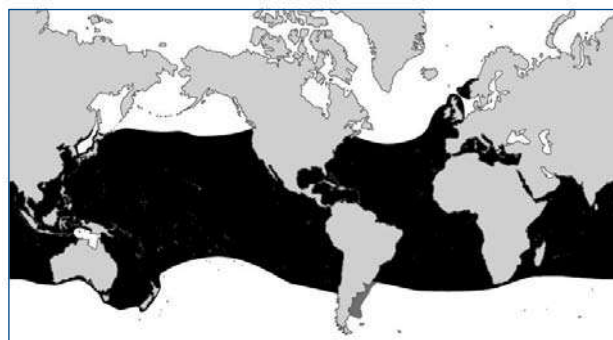
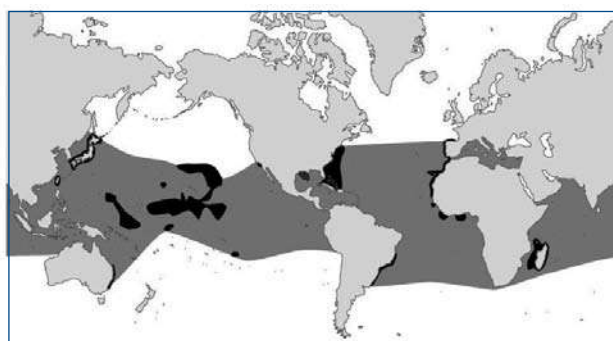


Figure 8. Global distribution of *Isurus paucus*



these sharks. As can be seen in Table 5, however, very few range States and no regional fisheries bodies appear to be considering management for the makos, despite requests in ICCAT for research, monitoring and management of shortfin mako. They certainly warrant a much higher priority for collaborative management by range States than is currently the case. A CMS Appendix II listing could help to drive the improvements in regional management that makos urgently require; for example by prompting improved synergies between environment and fisheries management authorities. If only one mako shark is to be considered for listing, then this should be the better known, more seriously threatened and widely distributed shortfin mako *I. oxyrinchus*. Because their distribution overlaps significantly and they are very similar in appearance, there does not appear to be any compelling practical or administrative reason, however, not to propose listing both species.

There is a very large number of Range States listed in Annex 5 that might consider proposing either or both of the mako sharks for a CMS listing. They include most EU Parties to CMS, Ecuador, India, Kenya and Uruguay. Fewer range States are confirmed for longfin mako, but these include Portugal, Madagascar, South Africa and several west African States with a strong interest in shark conservation and management (Cape Verde, Guinea-Bissau and Mauritania).

4.7 *Lamna nasus* porbeagle shark

The porbeagle shark is another member of family Lamnidae. It is listed as Vulnerable on the IUCN Red List because of the past and ongoing declines in its populations caused by target fisheries and utilised bycatch of this highly valuable species. It has been target fished for its meat for many decades in the North Atlantic, where stocks are assessed as Critically Endangered and Endangered, and it

is currently under consideration for an Appendix II listing on CITES. The Critically Endangered northeast Atlantic stock continues to be targeted because of the vulnerability of aggregations of this species. (In contrast, the lightly fished northern Pacific sister species, *Lamna ditropis*, has recently been assessed as Least Concern.) (Stevens *et al.* 2005). Migrations have been described in the North Atlantic, including some exchange across the ocean basin although this is primarily a coastal and continental shelf species. The structure and migrations of the southern hemisphere population(s) are very poorly known, but porbeagle is assessed as Near Threatened in most of these regions because of increasing fishing pressure in many areas combined with their high commercial value. As already noted, all lamnids are listed on Annex I, Highly Migratory Species, of UNCLOS, in recognition of the importance of collaborative management for these sharks. As can be seen from Table 5 however, only a few range States and no regional fisheries bodies have introduced sustainable management for the porbeagle shark, despite many years' discussion of this species as a possible candidate for a CITES Appendix II listing. The porbeagle shark certainly warrants a much higher priority for collaborative management by range States than is currently the case. A CMS Appendix II listing could help to drive the improvements in regional management that are required; for example by prompting improved synergies between environment and fisheries management authorities.

Range States that might consider proposing the porbeagle shark for a CMS listing include Germany, which initiated the proposal to list this species on CITES, with support during consultations from many other EU States, Albania, Madagascar and Monaco.

4.8 *Galeorhinus galeus* tope or soupfin shark

Galeorhinus galeus is listed as Vulnerable on the IUCN Red List because of the past and ongoing declines in many populations that have been caused by target fisheries harvesting the meat, fins and liver oil of this valuable species, although the conservation status of many stocks is unknown (Walker *et al.* 2005). *Galeorhinus* fisheries sometimes target aggregations. It is a highly migratory species, travelling up to 16,000 km. Australia is the only range State that is paying close attention to managing this species, as a result of former serious depletion of the stock in the target southern shark fishery. Requests

Figure 9. Global distribution of *Lamna nasus*

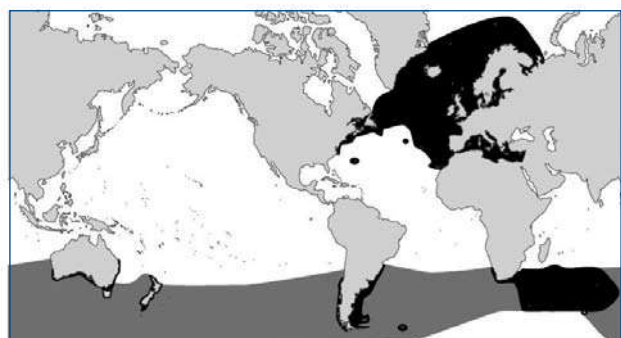
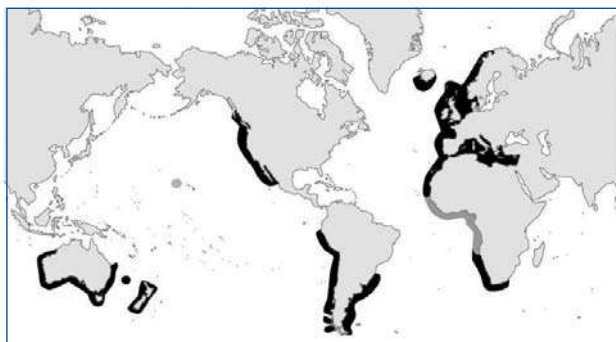


Figure 10. Global distribution of *Galeorhinus galeus*



from CITES in recent years for an improved focus on the assessment and management of *Galeorhinus* stocks, including through FAO, have so far been ignored by regional fisheries bodies and range States. This species certainly warrants a much higher priority for collaborative management by range States and through regional fisheries bodies than it is receiving. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

Range States that might consider proposing *Galeorhinus galeus* for a CMS listing include Belgium, Croatia, Denmark, Ecuador, Germany, Israel, Malta, Mauritania, Monaco, Netherlands, Portugal, Senegal, South Africa, Sweden and the United Kingdom. See Annex 5 for a full list.

4.9 Genus *Carcharhinus*

There are 12 genera and over 50 shark species in family Carcharhinidae, the requiem sharks, which is listed on Annex I, Highly Migratory Species, of UNCLOS. Many carcharhinids, however, are not migratory and many are extremely poorly known. This still leaves a relatively large number of species (about half of the family) listed in Table 2 that are migratory or probably migratory and of unfavourable conservation status. Many of these still appear not to warrant immediate consideration for listing on CMS Appendices for a number of reasons. These include the potential difficulty of making a strong case for listing because of a lack of data, identification difficulties, because it is not clear how a CMS listing could lead to management improvements, or because they might benefit indirectly anyway from the management measures that might be pursued under CMS or alternative regional management arrangements for the other migratory carcharhinid sharks for which a stronger case

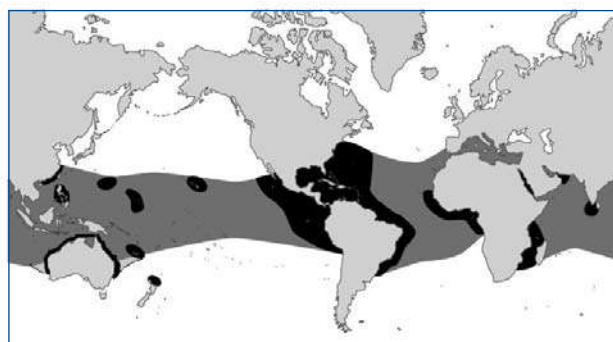
for listing is possible. The six species that are considered to be of highest priority for consideration by CMS are described below.

Several other carcharhinid species are considered to be of slightly lower priority on the basis of their conservation status, migratory data and geographical distribution. They include *Carcharhinus brachyurus* bronze whaler shark, *C. brevipinna* spinner shark, *C. galapagensis* Galapagos shark, *C. limbatus* blacktip shark and *C. perezi* Caribbean reef shark. The two lemon sharks *Negaprion* species appear, on the basis of current knowledge, not to undertake sufficient migratory activity definitely to qualify under CMS. These and the other carcharhinids listed in Table 2 are not, therefore, considered below in detail, but could prove to warrant further consideration on another occasion when more data are available. Successful listings of some or all of the species listed below would probably also yield significant management improvements for the lower priority species of carcharhinid sharks, since fairly broad improvements to the management of fisheries would be required for any wide-ranging species of shark that was listed from this taxonomic group.

4.10 *Carcharhinus falciformis* silky shark

The silky shark is one of the largest carcharhinids. It occurs in semi-pelagic coastal and oceanic shelf and slope waters of all tropical ocean basins, less commonly in the open ocean, and is likely to migrate across the boundaries of State EEZs. It is naturally one of the most abundant oceanic sharks and has been taken in very large numbers as a bycatch in pelagic fisheries, since it is often associated with tuna and may aggregate with target species. This bycatch is utilised for its fins. Although originally listed as Least Concern on the IUCN Red List, silky shark is being uplisted to Near Threatened because the intense fishing pressure experienced throughout its

Figure 11. Global distribution of *Carcharhinus falciformis*



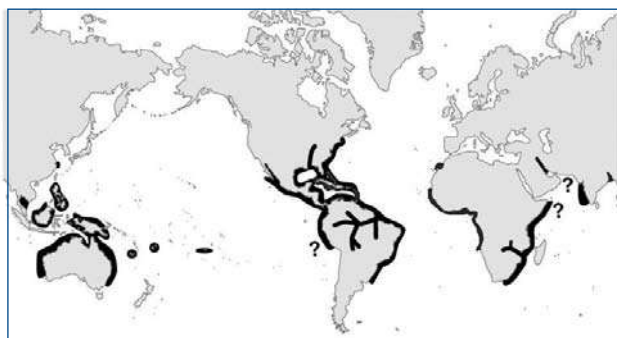
range is known or inferred to have caused extremely steep population declines in some regions (these populations are Vulnerable). It is completely unmanaged in most of its range. This species certainly warrants a much higher priority for collaborative management by range States and through regional fisheries bodies than it is receiving. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

Over 40 range States are also Party to CMS and might consider proposing silky shark for a CMS Appendix II listing (Annex 5), including Angola, Australia, Chile, Congo, Ecuador, Egypt, Gambia, Ghana, Guinea, Guinea-Bissau, India, Israel, Jordan, Madagascar, Mauritius, Nigeria, Panama, Peru, Philippines, Samoa, Saudi Arabia, Senegal, Somalia, Sri Lanka, Tanzania, Togo, Yemen.

4.11 *Carcharhinus leucas* bull shark

Bull shark is assessed as Near Threatened globally on the IUCN Red List, with some populations Vulnerable because of the susceptibility of this large shark to depletion in target and bycatch fisheries and the impact of other human impacts upon its largely coastal tropical and subtropical habitat (Simpfendorfer and Burgess 2000, Wintner *et al.* in prep.). It undertakes long distance seasonal and breeding migrations along coasts, into estuaries and long distances up rivers, and it is occasionally recorded from oceanic islands. Very few range States have established any management for this species, despite its importance for commercial and recreational fisheries and occasionally dive tourism. The bull shark would benefit from collaborative management by range States (coastal and riverine) and through regional initiatives. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

Figure 12. Global distribution of *Carcharhinus leucas*

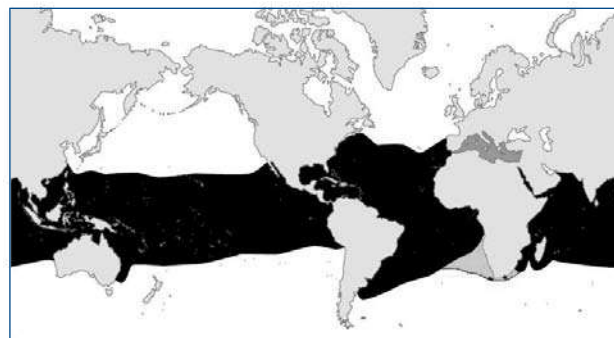


The 30 CMS Parties that are range States and might consider proposing bull shark for CMS Appendix II include Angola, Australia, Benin, Cameroon, Congo, Côte d'Ivoire, Ecuador, Ghana, Guinea, Guinea-Bissau, India, Kenya, Liberia, Madagascar, Mauritius, Morocco, Nigeria, Panama, Peru, Philippines, Samoa, Sao Tomé and Príncipe, Senegal, Somalia, South Africa, Tanzania, Togo. They also occur in some overseas Territories of France, Netherlands and UK.

4.12 *Carcharhinus longimanus* oceanic whitetip shark

The oceanic whitetip shark is one of the larger pelagic oceanic shark species and was formerly one of the most abundant of oceanic sharks. It is extremely susceptible to bycatch in intensive fisheries for tunas and other valuable pelagic species because of its inquisitive nature. This bycatch is utilised for the sharks' large fins and steep declines in catch rates have been reported in recent decades. It has recently been reassessed as Vulnerable globally, and Critically Endangered in the Northwest Atlantic where the greatest declines are reported (Baum *et al.* 2005). It is thought likely to be highly migratory in the surface waters it inhabits, although it is uncertain how frequently it enters State EEZs during these migrations because it is most abundant well away from land. Management measures are largely confined to finning bans on the high seas that should reduce bycatch mortality. The high value of this species' fins and steep population declines recently observed indicate that it should be a much higher priority for collaborative management by range States and particularly on the high seas. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

Figure 13. Global distribution of *Carcharhinus longimanus*



Oceanic whitetip sharks occur in the waters of over 50 CMS Parties. Range States that might consider proposing this species for a CMS listing because there have been particularly serious declines in their waters include Panama and EU States with Territories in the Caribbean (France, Netherlands, and the United Kingdom). Others are listed in Annex 5.

4.13 *Carcharhinus obscurus* dusky shark

The dusky shark is a large wide-ranging coastal and pelagic warm water species with a patchy distribution, which is among the slowest-growing, latest-maturing of known sharks. It undertakes long distance coastal seasonal and breeding migrations. The dusky shark's very low intrinsic rate of increase means that it is very vulnerable to exploitation and as slow to recover from depletion as the great whales. It is difficult to manage or protect because, in addition to being the subject of target fisheries for meat and fins, it is caught in many non-target fisheries and suffers from high bycatch mortality even if legally protected. It has recently been uplisted from Near Threatened to Vulnerable globally, with the Northwest Atlantic population assessed as Endangered because of serious depletion despite many years of management effort and, more recently, strict legal protection in the USA. It is generally unmanaged elsewhere in its global warm water range. Dusky shark requires a very much higher priority for management by range States and through regional initiatives than it is currently receiving outside the USA. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to recover from depletion and become managed sustainably. Indeed, the species is so very vulnerable to over-exploitation that it may qualify for an Appendix I listing, at least in parts of its range.

Figure 14. Global distribution of *Carcharhinus obscurus*



Because of its patchy distribution, there are relatively few confirmed range States that are also Party to CMS and might, therefore, consider proposing dusky shark for a CMS listing: Australia, Cape Verde, Egypt, Eritrea Saudi Arabia, Senegal, South Africa, Spain, Yemen.

4.14 *Carcharhinus plumbeus* sandbar shark

This is another large coastal shark with a global distribution in warm temperate and tropical waters that is taken in target and bycatch fisheries for its meat and large fins. It has also recently been uplisted from Near Threatened to Vulnerable globally on the IUCN Red List, with some stocks Endangered because of depletion in fisheries. It is biologically less vulnerable than the dusky shark and its stocks are therefore better able to recover under management from a depleted state. Sandbar sharks migrate seasonally along the coast, sometimes in large schools. As for the dusky shark, this species is largely unmanaged outside the US Atlantic coast. This species certainly warrants a much higher priority for collaborative management by range States and through regional fisheries bodies than it is receiving. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

About 40 range States are Party to CMS and might consider proposing sandbar shark for a CMS Appendix II listing (see Annex 5). In the Mediterranean, where there has been recent news of the discovery by divers of an aggregation of pregnant females, these include Albania, Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Libyan Arab Jamahiriya, Malta and Monaco.

Figure 15. Global distribution of *Carcharhinus plumbeus*



4.15 *Carcharhinus signatus* night shark

This Carcharhinid shark inhabits waters of the western North Atlantic from Delaware to Brazil and the eastern Atlantic off the western coast of Africa. It is an active schooling shark that migrates vertically into shallower water at night and is thought to make seasonal geographic migrations. Tagging data show that this species moves across the US EEZ (Kohler *et al.* 1998). It is the most important elasmobranch species in commercial seamount fisheries off northern Brazil and significant declines have been documented in catches throughout its range in the tropical western Atlantic (Castro *et al.* 1999). The night shark is assessed as Vulnerable globally on the IUCN Red List, based on significant population declines throughout its Western Atlantic range due to target and bycatch exploitation by fisheries for its meat and fins, which although now managed in US waters, is not the case elsewhere in the region (Santana *et al.* 2006). A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

Fifteen range States are Party to CMS and might consider proposing night shark for a CMS Appendix II listing (Annex 5): Angola, Cameroon, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Guyana, Liberia, Nigeria, Senegal, Togo, Uruguay.

4.16 *Prionace glauca* blue shark

The blue shark is one of the most abundant, well-studied and possibly the widest-ranging of all pelagic sharks. It undertakes very long distance possibly almost continuous migrations across and around ocean basins, entering range State EEZs and covering long distances on the high seas. Its migrations are very complex,

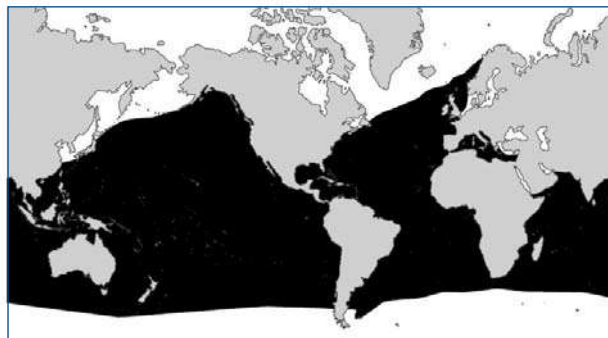
relating to prey availability and breeding cycles, with segregation by sex and reproductive stage. Fortunately this is a fairly fecund species, maturing at 5–7 years old, giving birth to an average of 35 pups per litter each year, which has enabled it to support extremely high fishery capture rates. Maximum sustainable yield is estimated as 7–12 million sharks per annum. Catches are hugely under recorded, but an estimated 11 million (range 5–16 million) blue sharks are estimated to enter the global fin trade annually, indicating that the total taken by target and bycatch fisheries is even higher than this. Catch declines of 40%, 60% and 80% have been reported in some studies, while others show no trend. Despite major concerns over the sustainability of these catch rates, continued high fishing pressure and the lack of management or restrictions on fishing effort in most of its range, the blue shark is still only listed as Near Threatened on the IUCN Red List (Stevens 2000). This is mainly due to its abundance and hence the inability of the Shark Specialist Group to reach consensus over the degree of risk of extinction for such a wide-spread species. Regional assessments are also still under debate. There is no disagreement, however, over the urgency of introducing management for this species; unfortunately no large-scale collaborative/regional management actions currently seem likely, other than those delivered through shark finning bans. The blue shark is certainly in urgent need of collaborative management by range States and through regional fisheries bodies, but appears not to be a high priority for action at the present time. A CMS Appendix II listing could help to drive the improvements in national and regional management that are required if this species is to be managed sustainably.

A very large number of blue shark range States that are also Party to CMS are listed in Annex 5. In view of the particularly poor status of Mediterranean and North Atlantic blue sharks, it might be appropriate to consider range States from these areas: Albania, Algeria, Cyprus,

Figure 16. Global distribution of *Carcharhinus signatus*



Figure 17. Global distribution of *Prionace glauca*



Denmark, Egypt, France, Germany, Greece, Ireland, Israel, Italy, Libyan Arab Jamahiriya, Malta, Monaco, Morocco, Portugal, Slovenia, Spain, Sweden, Tunisia, United Kingdom.

4.17 *Isogomphodon oxyrinchus* daggenose shark

This unusual tropical west Atlantic shark is found close to shore in turbid water, including in estuaries and mangroves. It undertakes seasonal migrations, possibly to avoid reduced salinity during the rainy season. Its populations have declined so steeply through depletion in coastal fisheries that it has been listed as Critically Endangered on the IUCN Red List (Lessa *et al.* 2005). It is unclear to what extent this species is primarily endemic to Brazil, where it is protected, and whether it undertakes sufficient cross-border migrations into its four other South American range States to qualify as migratory under CMS. If it is migratory, this species should benefit from an Appendix I listing with the aim of extending strict legal protection to other parts of its range.

Guyana is the only range State for this species that is also a CMS Party and might, therefore consider proposing the daggenose shark for a CMS Appendix I listing.

4.18 Family Sphyrnidae, hammerhead sharks

There are eight species in family Sphyrnidae, hammerhead sharks, which is listed on Annex I, Highly Migratory Species, of UNCLOS. These species occur worldwide in tropical and warm temperate seas, in coastal waters, on or near continental shelves and seamounts, sometimes in large schools. Some are widely distributed and fairly well-

studied; others have a fairly limited distribution and are poorly known with little or no information on possible migrations. *Eusphyra blochii*, *Sphyrna corona*, *S. media* and *S. tudes* are not sufficiently well-understood to warrant consideration under CMS at the present time. *S. tiburo* is classified as Least Concern on the IUCN Red List, thus in favourable conservation status and does not qualify for consideration.

The three largest and globally distributed species, *Sphyrna lewini* scalloped hammerhead, *S. mokarran* great hammerhead, and *S. zygaena* smooth hammerhead, do qualify for consideration by CMS because they are known to be migratory and are certainly of unfavourable conservation status. *S. lewini* and *S. mokarran* have both been reassessed recently as Endangered because of the steep population declines driven by target fisheries and high bycatch mortality (hammerheads die quickly when taken in nets or by hook and line and are also utilised for their valuable fins).

S. lewini is an aggregating seasonally-migratory species at least in part of its continental and insular shelf distribution. Its aggregations are targeted by fisheries. *S. mokarran* is not usually found in aggregations but is

Figure 19. Global distribution of *Sphyrna mokarran*

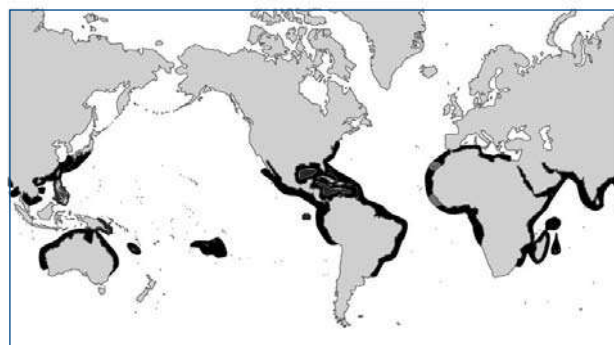


Figure 18. Global distribution of *Sphyrna lewini*

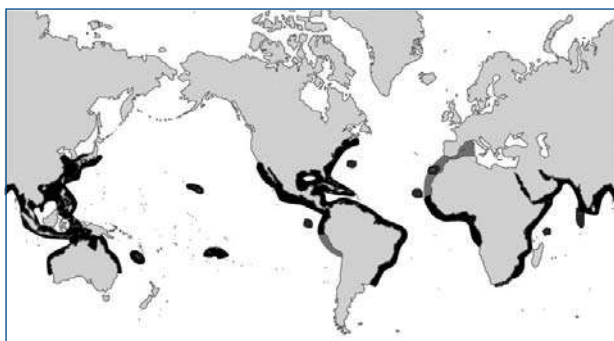
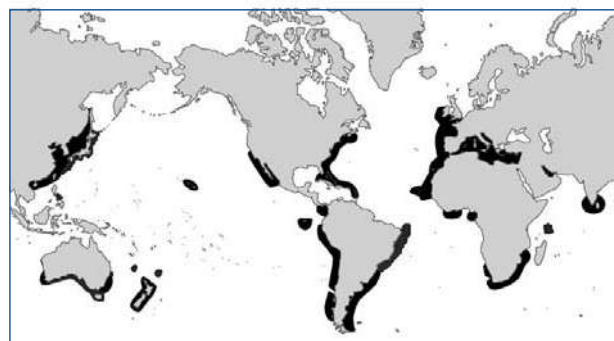


Figure 20. Global distribution of *Sphyrna zygaena*



nomadic and migratory in its worldwide coastal-pelagic tropical range. *S. zygaena* is assessed as Near Threatened as a result of less serious declines in fisheries (although this may require reassessment and some stocks may be more seriously threatened) (Simpfendorfer 2000). The young of *S. zygaena* occur in huge migrating schools. All three of these rather similar species would benefit from collaborative management initiated under a CMS Appendix II listing, since they are fished by many range States that currently have little or no management for hammerheads.

A large number of CMS Parties are range States for all three large hammerhead sharks (see Annex 5), aware of the problems that illegal and unregulated fisheries pose to these species, and might potentially consider proposing one or more for a CMS Appendix II or I listing. These include several West African and Mediterranean States, India, Ecuador (where there has been much illegal fishing for hammerheads in the Galapagos Marine Park), and many others.

4.19 Family Pristidae, sawfishes

Five of the seven species in family Pristidae, sawfishes, are migratory or potentially migratory: *Anoxypristis cuspidata*, *Pristis microdon*, *Pristis pectinata*, *Pristis perotteti*, and *Pristis pristis*. All are very seriously depleted, extirpated from large parts of their range, and listed as Critically Endangered on the IUCN Red List of Threatened Species (Compagno *et al.* 2006a, Compagno *et al.* 2006b, Adams *et al.* 2006, Charvet-Almeida *et al.* 2007, Cook and Compagno 2000). They are at such high risk of extinction because their morphology and their nearshore coastal, estuarine and freshwater tropical habitats, where human pressures are high, combine to put them at extremely high risk of entanglement in fishing gear and habitat deterioration. Their biology means that they are unable to recover rapidly from population reduction. The serious depletion of sawfish stocks makes it uncertain to what extent the remaining populations of some of these species still migrate across country boundaries and therefore technically qualify for attention under CMS (such migrations were far more obvious in the past when populations were large). Sawfishes are also now so rare that it is unlikely to be possible to undertake research into their population structure and movements in the majority of the remaining fractions of their former range. All species are currently proposed for a CITES Appendix I listing by Kenya, Nicaragua and the

USA. There is no question that these species require strict protection throughout as much of their range as possible, if they are not to be driven to extinction. As indicated in Table 5, protection is only known to have been granted to a few of these species in a few range States (one species in Australia, India, Mexico, Lake Nicaragua, Lake Sentani in Indonesia, South Africa, and one species in the USA). A CMS Appendix I listing would yield significant benefit for one of the most endangered groups of chondrichthyan fishes if it resulted in strict protection being extended to larger numbers of sawfishes in larger numbers of range States.

In view of their wide range and acutely threatened status, combined with a high cultural importance in some parts of the world, there is a large number of range States that might be willing to consider proposing the sawfishes, Family Pristidae, for a CMS Appendix I listing. These include Australia (on the assumption that sawfishes migrate between Northern Australia and Indonesia), Ecuador, India, Kenya, South Africa, some of the Arabian States, and several West African States (e.g. Guinea, Guinea Bissau, Mauritania, Senegal).

4.20 Myliobatoids, eagle rays

Three of the 21 species of eagle rays have been selected for consideration by CMS. These are the longheaded eagle ray *Aetobatus flagellum*, spotted eagle ray or bonnet ray *Aetobatus narinari*, and the banded or Nieuhof's eagle ray *Aetomylaeus nichofii*.

Aetobatus narinari spotted eagle ray is the most common and best studied of these species. It is a very active swimmer in tropical and warm temperate seas almost worldwide, occurring from the seabed to the surface, sometimes leaping out of the sea, and its ability to cover long distances is evidenced by its occurrence in many oceanic islands and atolls. It is usually seen in what may be small social groups as well as in schools of 100 or more. This is a spectacular animal that is a major attraction for dive tourism. Females produce one to four live pups per litter. It is assessed as Near Threatened on the IUCN Red List because it is a common utilised bycatch in various fisheries across large parts of its range that are likely to have caused population depletion because of its low reproductive potential. A Vulnerable listing is warranted in Southeast Asia where fishing pressure is particularly intense and the species is a common component of landings. With further data this species will likely fall into a threatened category in other

regions also (Kyne *et al.* 2005). For example, although specific details are not available, pressure on the inshore environment through artisanal fishing activities off West Africa, eastern Africa, throughout the Arabian Sea, the Bay of Bengal and in large portions of the species' American range has likely affected this species. There is nothing to suggest that pressure will decrease in these regions in the future. In a few parts of its range (e.g. South Africa, the Maldives, the USA and Australia) the species faces lower levels of threat, but overall, pressure on the species is high and likely to cause population depletions. The only known protection for this animal throughout its global distribution is on the US Atlantic coast.

***Aetobatus flagellum* longheaded eagle ray** is an uncommon Indo-West Pacific eagle ray, with a fairly limited distribution from the Red Sea to Japan and China. It is highly susceptible to a variety of fishing methods in regions where the level of exploitation of marine resources is extremely high and increasing. All caught are retained in most areas. This species is assessed as Endangered on the basis of inferred past and projected future declines due to the very high (and increasing) level of fishing pressure throughout its range, which is of great concern given that it is a naturally very uncommon species with limiting life history characteristics (White 2005). There are no known protection measures for this species at present.

***Aetomylaeus nichofii* banded eagle ray** is a wide-ranging but rare, little known eagle ray, occurring from the Indian subcontinent through Southeast Asia to Australia and Japan. It is a major commercial eagle ray that is marketed throughout its range, except in northern Australia. This species is naturally rare and has declined due to heavy trawling in Southeast Asia since the 1960s. It is assessed as Vulnerable, given actual (and increasing) levels of exploitation, observed and inferred declines, rarity and low fecundity (Kyne *et al.* 2003). There is no known protection for this species, except perhaps in small areas of the Great Barrier Reef Marine Park in Australia, although commercial fishing is still permitted in the majority of the park.

Range States for these species are listed in Annex 5. Distribution maps are not yet available. India and Pakistan are the two CMS Parties that are range States for all three of these species and may be prepared to consider propose one or more of them for listing on CMS. They could benefit from the introduction of collaborative management introduced under an

Appendix II listing and from protection as the result of an Appendix I listing.

4.21 Genus *Rhinoptera*, cownose rays

The cownose rays tend to swim almost continuously in groups or very large schools. Many species are considered to be seasonally migratory and several of these migratory or possibly migratory species have been assessed as Threatened or Near Threatened on the IUCN Red List. These are the **Brazilian cownose ray *Rhinoptera brasiliensis*** (EN), **Javanese cownose ray *R. javanica*** (VU), **cownosed ray *R. bonasus*** (NT), **Lusitanian cownose ray *R. marginata*** (NT) and **hawkray *R. steindachneri*** (NT). Aggregations of *R. marginata* are targeted as they migrate along the West African coast. Rhinopterids are regularly landed around the world and heavy pressure on the inshore ecosystem is having negative impacts on many of these species.

For example, *R. javanica* occurs in coastal inshore waters in depths less than 30 m, including estuarine and brackish waters, where fishing pressure is typically very heavy and unregulated, especially in Southeast Asia. Although catch data are lacking, this species' small litter size, its tendency to form large schools, its inshore and estuarine habitat and hence availability to a wide variety of inshore fishing gear, its marketability and the generally intense and unregulated nature of inshore fisheries all raise concerns for its conservation status. Despite a lack of species-specific catch data, declines are inferred across its range, warranting a global Vulnerable assessment (Dudley *et al.* 2005). There is no existing legislation for this species. *R. steindachneri* is one of the most common batoid species landed in both the northern Gulf of California (GOC) and Pacific Mexico, where it is taken almost exclusively with bottom set gillnets, but may be landed in nearshore surface gillnets and longlines as well. Furthermore, many embayments and estuaries (used by this species for feeding and reproduction) in this area are being modified to accommodate shrimp farming, which could have a detrimental impact on its abundance in affected areas (Smith and Bizzaro 2005).

Despite a lack of catch data and specific information on the movements of most of these species, their schooling nature, inshore habitat, together with their relatively late maturity and low productivity (generally one young per litter) increases their susceptibility to overexploitation and will limit their ability to recover from population decline.

Rhinopterids are also known to inhabit estuarine areas where fishing pressure is also extremely high and where (in Southeast Asia at least) pollution is also a major factor for all marine life.

Collaborative management for these species is unknown – indeed there seem to be very few national management measures in place. CMS could help to instigate management cooperation for these threatened migratory rays. Many CMS Parties are range States for one or more species (see Annex 5) and might be prepared to consider developing listing proposals for individual species or perhaps the entire genus.

4.22 *Manta birostris* manta ray

The manta is a member of family Mobulidae (devil rays). It is the world's largest living ray and like some other very large chondrichthyans, a harmless plankton feeder. It occurs throughout the world's tropical seas, from coasts to open oceans, but it is uncertain how much exchange takes place between different stocks or whether the populations in different oceans may actually be separate species. The manta ray is listed as Near Threatened on the IUCN Red List, with some regional stocks Vulnerable as a result of declines driven by target and bycatch fisheries for their meat and gill rakers (apparently increasingly utilised in traditional Chinese medicine). Target fisheries for this species currently exist in several countries, including the Philippines, Mexico, Mozambique, Madagascar, India, Sri Lanka, Brazil, Tanzania and Indonesia; regional population declines have been recorded. Unfished populations are not thought to be seriously threatened, however it is not well understood how their use of inshore areas around inhabited coastlines might be affected by anthropogenic influences such as pollution, coastal development, and eco-tourism pressures (Marshall *et al.* 2006). Females give birth to only one or two huge pups at intervals of two to three years, so their ability to recover from fisheries is extremely limited. Fortunately, though, they occur as solitary animals or in small groups so aggregations cannot be targeted. Their migrations are still being studied. These animals are of great importance for dive ecotourism in some areas and have been protected in several range States.

Some populations of mantas, like those in the Hawaiian Islands and the Island of Yap have a closed population structure, with high site fidelity and little to no migration away from island groups. Other studies on populations

with year-round sightings and high re-sighting rates reveal that a portion of the population is resident while a subset of the population appears to engage in larger migrations. In a few sites, mantas have been well documented to be seasonal and management plans for areas with open populations will have to include all other parts of their home range to be effective.

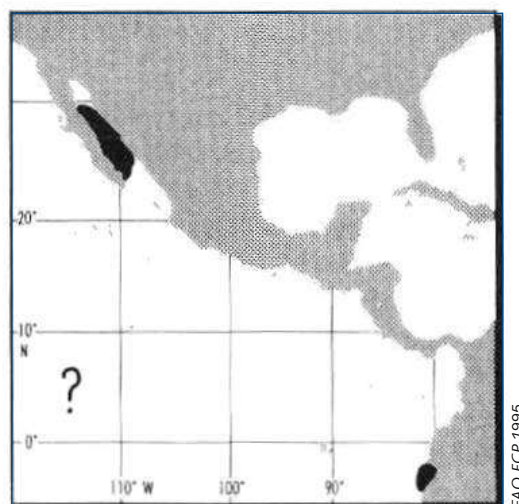
Range States for mantas that have protected or are considering protecting this species and are also CMS Parties include the Philippines, South Africa and New Zealand. Other range States are listed in Annex 5.

4.23 Genus *Mobula*, devil rays

Genus *Mobula* contains nine of the ten members of family Mobulidae. These are large, warm water filter-feeding epipelagic rays that give birth to single large pups after a long gestation. The devil rays generally have a relatively small range and few range States, particularly when compared with the manta ray. Most are considered migratory or, for the lesser-known species, likely migratory. Distribution maps are not available for these species, with the exception of *Mobula munkiana* (Figure 21). This is included to illustrate the poor availability of data for some of these species; it is possible that *M. munkiana* is far more widely distributed between the two locations shown, but is commonly misidentified as another species of *Mobula*.

Those species for which sufficient information is available to develop IUCN Red List assessments range from

Figure 21. Global distribution of *Mobula munkiana*



Endangered to Near Threatened. They are, like manta rays, taken in target and bycatch fisheries for their meat and gill rakers. Concern over the sustainability of these fisheries has resulted in their legal protection or consideration for legal protection in some range States (Philippines, Mexico, New Zealand) and the listing on the Barcelona Convention of the likely Mediterranean endemic, the Endangered **giant devil ray *Mobula mobular***. The devil rays have also been noted by CITES as species of concern in need of greater management attention. Other species with unfavourable status include **spinetail devil ray *Mobula japonica*** (NT) (which has a fairly large range), **Monk's devil ray *Mobula munkiana*** (NT), **box ray *Mobula tarapacana*** (NT) and **bentfin devil ray *Mobula thurstoni*** (NT).

M. japonica, *M. tarapacana* and *M. thurstoni* are all considered Vulnerable in Southeast Asia where catches and demand are increasing (White *et al.* 2005, Clark *et al.* 2005ab). The high value of gill rakers in some areas is driving a dramatic increase in the catch of mobulids in Indonesia where devil rays are now targeted. They appear to be particularly susceptible to overfishing as their fecundity is among the lowest of all elasmobranchs.

Options for listing on CMS range from selecting one or two of the more widely distributed species (*M. japonica* or *M. mobular*) for listing on Appendix I and II, or also to include the threatened species with a smaller range for listing on Appendix I. There are many CMS Parties that are range States for one or more of these species – see Annex 5.

5 Bibliography

- Adams, W.F., Fowler, S.L., Charvet-Almeida, P., Faria, V., Soto, J. and Furtado, M. 2006. *Pristis pectinata*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Allen, B. and Peddemors, V. 2000. Aliwal shoal: Refuge or roadhouse for raggedtooth sharks. University of Port Elizabeth, Port Elizabeth (South Africa), Rhodes University, Grahamstown (South Africa), University of Transkei, Umtata (South Africa) and University of Fort Hare, Alice (South Africa).
- Bakken, T. and Altin, D. 2002. Bluntnose sixgill shark *Hexanchus griseus* caught at Hitra, Norway. *Fauna (Oslo)* **55**(3):102–104.
- Barrull, J. and Mate, I. 2001. Presence of the great white shark, *Carcharodon carcharias* (Linnaeus, 1758) in the Catalanian Sea (NW Mediterranean): review and discussion of records, and notes about its ecology. *Anali za Istrske in Mediteranske Studije* **23**:3–12.
- Bass, A.J., D'Aubrey, J.D. and Kistnasamy, N. 1973. Sharks of the east coast of southern Africa. I. The genus *Carcharhinus* (Carcharhinidae). *S. Afr. Ass. Mar. Biol. Res., Oceanogr. Res. Inst., Invest. Rep.* **33**: 1–168.
- Bass, A.J., D'Aubrey, J.D. and Kistnasamy, N. 1975a. Sharks of the east coast of Southern Africa. II. The families Scyliorhinidae and Pseudotriakidae. *S. Afr. Ass. Mar. Biol. Res., Oceanogr. Res. Inst., Invest. Rep.* **37**, 64 pp.
- Bass, A.J., D'Aubrey, J.D. and Kistnasamy, N. 1975b. Sharks of the east coast of southern Africa. III. The families Carcharhinidae (excluding *Mustelus* and *Carcharhinus*) and Sphyrnidae. *S. Afr. Ass. Mar. Biol. Res., Oceanogr. Res. Inst., Invest. Rep.* **39**:1–100.
- Bass, A.J., D'Aubrey, J.D. and Kistnasamy, N. 1975c. Sharks of the east coast of southern Africa IV. The families Odontaspidae, Scapanorhynchidae, Isuridae, Cetorhinidae, Alopiidae, Orectolobidae and Rhiniodontidae. *S. Afr. Ass. Mar. Biol. Res., Oceanogr. Res. Inst., Invest. Rep.* **39**:102 pp.
- Baum, J.K. and Myers, R.A. 2004. Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. *Ecology Letters*, **7**(2), pp. 135–145.
- Baum, J.K., Myers, R.A., Kehler, D., Gerber, L., Blanchard, W., Harley, S.J. and Showell, M. 2002. Preliminary standardized catch rates for pelagic and large coastal sharks from logbook and observer data from the Northwest Atlantic. *Collective volume of scientific papers. International Commission for the Conservation of Atlantic Tunas/Recueil de documents scien (TRUNCATED)*, **54**(4), pp. 1294–1313.
- Baum, J.K., Myers, R.A., Kehler, D.G., Worm, B., Harley, S.J. and Doherty, P.A. 2003. Collapse and Conservation of Shark Populations in the Northwest Atlantic. *Science (Washington)*, **299**(5605), pp. 389–392.
- Baum, J., Medina, E., Musick, J.A. and Smale, M. 2005. *Carcharhinus longimanus*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Beamish, R.J., Mcfarlane, G.A. and King, J.R. 2005. Migratory patterns of pelagic fishes and possible linkages between open ocean and coastal ecosystems off the Pacific coast of North America. *Deep Sea Research (Part II, Topical Studies in Oceanography)*, **52**(5–6), pp. 739–755.
- Bester, C. 2007. Spotted eagle ray *Aetobatus narinari*. Education biological profiles. Available at: <http://www.flmnh.ufl.edu/fish/Gallery/Descript/SERay/SERay.html>.
- Bexiga, C., Viera, L., Sa, R., Viegas, P. and Erzini, K. 2002. Ecological associations of the fish species of the Guadiana River: habitat linkages. Litoral 2002, the Changing Coast.
- Bigelow, H.B. and W.C. Schroeder, 1953. Sawfishes, guitarfishes, skates and rays. p.1–514. In: J. Tee-Van et al. (eds.) *Fishes of the western North Atlantic*. Part 2. New Haven, Sears Found. Mar. Res., Yale Univ.
- Bizzarro, J.B., Smith, W.D., Márquez-Farias, J.F. and Hueter, R.E. Submitted to Fishery Bulletin. Reproductive biology and artisanal fisheries for the golden cownose ray (*Rhinoptera steindachneri*) in the northern Mexican Pacific.
- Blagoderov, A.I. 1993. Seasonal distribution and some biological characteristics of the salmon shark (*Lamna ditropis*) in the Northwest Pacific. *Voprosy ikhtiologii. Moscow*, **33**(5), pp. 715–719.
- Bonfil, R., Meyer, M., Scholl, M.C., Johnson, R., O'Brien, S., Oosthuizen, H., Swanson, S., Kotze, D. and Paterson, M. 2005. Transoceanic Migration, Spatial Dynamics, and Population Linkages of White Sharks. *Science (Washington)*, **310**(5745), pp. 100–103.
- Branstetter, S. and Musick, J.A. 1994. Age and growth estimates for the sand tiger shark in the Northwestern

- Atlantic Ocean. *Transactions of the American Fisheries Society* **123**, 242–254.
- Bray, R.N., and Hixon, M.A. 1978. Night-shocker: Predatory behavior of the Pacific electric ray (*Torpedo californica*). *Science* **200**:333–334.
- Brewster-Geisz, K.K. and Miller, T.J. 2000. Management of the sandbar shark, and : implications of a stage-based model. *Fishery Bulletin*, **98**(2), pp. 236–249.
- Brown, L., Bridge, N. and Walker, T. 2000. Summary of tag releases and recaptures in the Southern Shark Fishery. Marine and Freshwater Resources Inst., Queenscliff, Vic. (Australia).
- Burgess, G.H. and Morgan, A. 2003. Renewal of an observer program to monitor the directed commercial shark fishery in the Gulf of Mexico and South Atlantic: 2002(2) and 2003(1) fishing seasons. Final Report to Highly Migratory Species Division, National Marine Fisheries Service.
- Burgess, G.H., Beerkircher, L.R., Cailliet, G.M., Carlson, J.K., Cortes, E., Goldman, K.J., Grubbs, R.D., Musick, J.A., Musyl, M.K. and Simpfendorfer, C.A. 2005. Reply to "Robust estimates of decline for pelagic shark populations in the Northwest Atlantic and Gulf of Mexico". *Fisheries*, **30**(10), pp. 30–32.
- Buxton, C.D., Smale, M.J., Wallace, J.H. and Cockcroft, V.G. 1984. Inshore small-mesh trawling survey of the Cape south coast. 4. Contributions to the biology of some Teleostei and Chondrichthyes. *South African Journal of Zoology* **19**(3):180–188.
- Camhi, M., S. Fowler, J. Musick, A. Brautigam and S. Fordham. 1998. *Sharks and Their Relatives: Ecology and Conservation*. IUCN Occasional Paper No. 20. IUCN Cambridge UK and Gland Switzerland.
- Campana, S.E. and Joyce, W.N. 2004. Temperature and depth associations of porbeagle shark (*Lamna nasus*) in the northwest Atlantic. *Fisheries Oceanography*, **13**(1), pp. 52–64.
- Campana, S.E., Marks, L. and Joyce, W., 2005. The biology and fishery of shortfin mako sharks (*Isurus oxyrinchus*) in Atlantic Canadian waters. *Fisheries Research (Amsterdam)*, **73**(3), pp. 341–352.
- Campana, S.E., Marks, L., Joyce, W. and Kohler, N.E. 2006. Effects of recreational and commercial fishing on blue sharks (*Prionace glauca*) in Atlantic Canada, with inferences on the North Atlantic population. *Canadian Journal of Fisheries and Aquatic Sciences*, **63**(3), pp. 670–682.
- Capape, C., Guelorget, O., Barrull, J., Mate, I., Hemida, F., Seridji, R., Bensaci, J. and Bradai, M.N., 2003. Records of the bluntnose six-gill shark, *Hexanchus griseus* (Bonnaterre, 1788) (Chondrichthyes: Hexanchidae) in the Mediterranean Sea: a historical survey. *Annales Series Historia Naturalis (Koper)* **13**(2) 2003: 157–166.
- Capape, C., Hemida, F., Seck, A.A., Diatta, Y., Guelorget, O. and Zaouali, J. 2003. Distribution and reproductive biology of the spinner shark, *Carcharhinus brevipinna* (Mueller and Henle, 1841) (Chondrichthyes: Carcharhinidae). *Israel Journal of Zoology*, **49**(4), pp. 269–286.
- Capape, C., Seck, A.A., Diatta, Y., Reynaud, C., Hemida, F. and Zaouali, J. 2004. Reproductive biology of the blacktip shark, *Carcharhinus limbatus* (Chondrichthyes: Carcharhinidae) off west and north African coasts. *Cybiu*, **28**(4), pp. 275–284.
- Carlson, J.K. 1999. Occurrence of neonate and juvenile sandbar sharks, *Carcharhinus plumbeus*, in the northeastern Gulf of Mexico. *Fishery Bulletin*, **97**(2), pp. 387–391.
- Cartamil, D.P., Vaudo, J.J. Lowe, C.G., Wetherbee, B.M. and Holland, K.N. (2003). Diel movement patterns of the Hawaiian stingray, *Dasyatis lata*: implications for ecological interactions between sympatric elasmobranch species. *Marine Biology* [Mar. Biol.]. Vol. 142, no. 5, pp. 841–847.
- Casey, J. and Kohler, N. 1992. Tagging studies on the shortfin mako shark (*Isurus oxyrinchus*) in the western North Atlantic.
- Casey, J.G. 1985. Transatlantic migrations of the blue shark; a case history of cooperative shark tagging. Pp. 253–267 in R.H. Stroud, ed. *Proceedings of the First World Angling Conference, Cap d'Agde, France, September 12–18, 1984*. International Game Fisheries.
- Castillo-Geniz, J.L., Marquez-Farias, J.F., de la Cruz, M.C.R., Cortes, E. and del Prado, A.C. 1998. The Mexican artisanal shark fishery in the Gulf of Mexico: towards a regulated fishery. *Marine and Freshwater Research*, **49**(7), pp. 611–620.
- Castro, J.I. 1993. The biology of the finetooth shark, *Carcharhinus isodon*. *Environmental Biology of Fishes*. The Hague, **36**(3), pp. 219–232.
- Castro, J.I. 1996. Biology of the blacktip shark, *Carcharhinus limbatus*, off the southeastern United States. *Bulletin of Marine Science*, **59**(3), pp. 508–522.
- Castro, J.I., Woodley, C.M. and Brudek, R.L. 1999. A preliminary evaluation of the status of shark species. FAO Fisheries Technical Paper. No. 380. Rome, FAO. 72p.
- Charvet-Almeida, P. and de Almeida, M.P. 2005a. *Dasyatis colarensis*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 05 March 2007.

- Charvet-Almeida, P. and de Almeida, M.P. 2005b. *Dasyatis geijskesi*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 05 March 2007.
- Charvet-Almeida, P., Faria, V., Furtado, M., Cook, S.F., Compagno L.J.V. and Oetinger, M.I. 2007. *Pristis perotteti*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species. <www.iucnredlist.org>
- Chen, V.Y. and Phipps, M.J. 2002. Management and trade of whale sharks in Taiwan. TRAFFIC East Asia, Hong Kong.
- Chen, H.K. (ed.) (1996). An overview of shark trade in selected countries of Southeast Asia. TRAFFIC Southeast Asia, Petaling Jaya.
- Chevolot, M., Ellis, J.R., Haorau, G., Rijnsdorp, A.D., Stam, W.T. and Olsen, J.L. 2006. Population structure of the thornback ray (*Raja clavata*) in British Waters. *Journal of Sea Research*, 56: 305–316.
- Clark, E. 1963. Massive aggregations of large rays and sharks in and near Sarasota, Florida. *Zoologica* 48:61–64.
- Clark, T.B., Smith, W.D. and Bizzarro, J.J. 2005a. *Mobula tarapacana*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Clark, T.B., Smith, W.D. and Bizzarro, J.J. 2005b. *Mobula thurstoni*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 05 March 2007.
- Clarke, S.C., Magnussen, J.E., Abercrombie, D.L., Mcallister, M.K. and Shivji, M.S. 2006. Identification of Shark Species Composition and Proportion in the Hong Kong Shark Fin Market Based on Molecular Genetics and Trade Records. *Conservation Biology*, 20(1), pp. 201–211.
- Cliff, G. and Dudley, S.F.J. 1991. Sharks caught in the protective gill nets off Natal, South Africa. 4. The bull shark *Carcharhinus leucas* Valenciennes. *South African Journal of Marine Science/Suid-Afrikaanse Tydskrif vir*, 10, pp. 253–270.
- Cliff, G. 1995. Sharks caught in the protective gill nets off KwaZulu-Natal, South Africa. 8. The great hammerhead shark *Sphyrna mokarran* (Rueppel). *South African Journal of Marine Science/Suid-Afrikaanse Tydskrif vir Seewetenskap*. Vol. 15.
- Compagno, L., Dando, M. and Fowler, S. 2005. *A Field Guide to Sharks of the World*. HarperCollins, London, UK.
- Compagno, L.J.V. 1984. FAO Species Catalogue. Vol. 4, *Sharks of the World*. FAO Fisheries Synopsis No. 125. pt. 1–2. FAO, Rome, Italy.
- Compagno, L.J.V. 2000. An overview of chondrichthyan systematics and biodiversity in southern Africa. *Trans. Roy. Soc. South Africa*, 1999 54(1): 75–120, fig. 1–9, tab. 1–2.
- Compagno, L.J.V. 2001. *Sharks of the World*. Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). An annotated and illustrated catalogue of the shark species known to date. FAO Species Catalogue for Fisheries Purposes. FAO, Rome, Italy.
- Compagno, L.J.V. and J.E. Randall, 1987. *Rhinobatos punctifer*, a new species of guitarfish (Rhinobatiformes: Rhinobatidae) from the Red Sea, with notes on the Red Sea batoid fauna. *Proc. Calif. Acad. Sci.* 44(14):335–342.
- Compagno, L.J.V. and Last, P.R. 1999. Myliobatidae. Eagle rays. In: K.E. Carpenter and V.H. Niem (eds) *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific*. Volume 3. Batoid Fishes, Chimaeras and Bony Fishes Part 1 (Elopidae to Linophrynidae). pp. 1511–1519. Food and Agriculture Organization of the United Nations, Rome.
- Compagno, L.J.V. In preparation. *Sharks of the World*. Volumes 1 and 3. FAO Species Catalogue for Fisheries Purposes. FAO, Rome, Italy.
- Compagno, L.J.V., Cook, S.F., Oetinger, M.I. and Fowler, S.L. 2006a. *Anoxypristis cuspidata*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Compagno, L.J.V., Cook, S.F. and Fowler, S.L. 2006b. *Pristis microdon*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Cook, S.F. and Compagno, L.J.V. 2000. *Pristis pristis*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Cramer, J. 1997. Effect of regulations limiting landings of swordfish by weight on commercial pelagic longline fishing patterns.
- Dai, X.I. and Xu, L. 2003. The preliminary research on the stock of pelagic sharks in the Atlantic Ocean. *Journal of Fisheries of China/Shuichan Xuebao*, 27(4), pp. 328–333.
- Damalas, D. and Megalofonou, P. 2003. Size distribution of blue shark (*Prionace glauca*) in the Eastern Mediterranean Sea. National Centre for Marine Research, Athens (Greece).

- de Carvalho, M. 1996. Higher-level elasmobranch phylogeny, basal squalians, and paraphyly. In: Melanie L.J. Stiassny, Lynne R. Parenti, and G. David Johnson, Eds, *Interrelationships of fishes*. Academic Press, San Diego, London, 35–62, fig. 1–7.
- de Carvalho, M.R., L.J.V. Compagno and J.K.L. Mee, 2002. *Narcine oculifera*: a new species of electric ray from the gulfs of Oman and Aden (Chondrichthyes: Torpediniformes: Narcinidae). *Copeia* (1):137–145.
- Department Of Commerce, National Marine Fisheries Service, 2003. *Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks*.
- Department Of Commerce, National Oceanic and Atmospheric Administration, 2002. *Regulatory Adjustment 2 to the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan: Final Rule to Reduce Sea Turtle Bycatch and Bycatch Mortality in Highly Migratory Species Fisheries. (Final Supplement to the Draft Environmental Impact Statement)*.
- Dewar, H., Domeier, M. and Nasby-Lucas, N. 2004. Insights into young of the year white shark, *Carcharodon carcharias*, behavior in the Southern California Bight. *Env Biol Fish*, **70**(2), pp. 133–143.
- Duarte, P., Silva, A. and Menezes, G., 2002. First results of a tagging program on tope shark, *Galeorhinus galeus*, and thornback ray, *Raja clavata*, in Azorean waters. Paris (France): Societe francaise d'Ichtyologie SFI.
- Dudley, S., Oosthuizen, H., Kroese, M., Sauer, W. 2000. FAO's International Plan of Action for the Conservation and Management of Sharks – A South African perspective. University of Port Elizabeth, Port Elizabeth (South Africa), Rhodes University, Grahamstown (South Africa), University of Transkei, Umtata (South Africa) and University of Fort Hare, Alice (South Africa).
- Dudley, S.F.J., Kyne, P.M. and White, W.T. 2005. *Rhinoptera javanica*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 05 March 2007.
- Duncan, K.M., Martin, A.P., Bowen, B.W. and de Couet, H.G. 2006. Global phylogeography of the scalloped hammerhead shark (*Sphyrna lewini*). *Molecular Ecology*, **15**(8), pp. 2239–2251.
- Ebert, D.A. 1994. Diet of the sixgill shark *Hexanchus griseus* off southern Africa. *South African Journal of Marine Science* **14**: 213–218.
- Economakis, A.E. and Lobel, P.S. 1998. Aggregation behavior of the grey reef shark, *Carcharhinus amblyrhynchos*, at Johnston Atoll, Central Pacific Ocean. *Environ.Biol.Fish*, **51**(2), pp. 129–139
- Edrem, C.S.M. and Gruber, S.H. 2005. Homing ability of young lemon sharks, *Negaprion brevirostris*. *Environ. Biol.Fish*, **72**(3), pp. 267–281.
- Eschmeyer, W.N. (1990). *Catalogue of the Genera of Recent Fishes*. California Academy of Sciences, San Francisco, California.
- Fergusson, I.K. 1996. Distribution and Autoecology of the white shark in the eastern North Atlantic Ocean and the Mediterranean Sea .Pp. 321–345. In: Klimley, A.P. and Ainley, D.G. (eds.). *Great White Sharks: The Biology of Carcharodon carcharias*. Academic Press, San Diego.
- Fitzmaurice, P. 1979. Tope, *Galeorhinus galeus* (L), migrations from Irish coastal waters and notes on Irish specimens. Pp. 26–33. In: *Report of The Inland Fisheries Trust 1979*.
- Fitzmaurice, P., Green, P., Kierse, G., Kenny, M. and Clarke, M. 2005. Stock discrimination of the blue shark, based on Irish tagging data. *International Commission for the Conservation of Atlantic Tunas Collective Volume of Scientific Papers* 58 2005: 1171–1178., **58**, pp. 1171–1178.
- Fordham, S., Fowler, S.L., Coelho, R., Goldman, K.J. and Francis, M. 2006. *Squalus acanthias*. In: *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org> Downloaded on 08 March 2007.
- Fowler, S., Mogenssen, C.B. and Blasdale, T. 2004. Plan of action for the conservation and management of sharks in UK waters. *JNCC Report*, **360**.
- Fowler, S.L., Camhi, M., Burgess, G.H., Cailliet, G., Fordham, S.V., Cavanagh, R.D., Simpfendorfer, C.A. and Musick, J.A. 2004. *Sharks, rays and chimaeras: the status of the chondrichthyan fishes*. IUCN SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- Frias-Torres, S. 2005. Large pelagic fish distribution in the tropical western Atlantic relevant to conservation. *Proceedings of the Gulf and Caribbean Fisheries Institute* **56**: 253–257.
- Froese, R. and D. Pauly. Editors. 2007. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2007).
- Gilmore, R.G. 1993. Reproductive biology of lamnoid sharks. *Env. Biol. Fishes*, **38**: 95–114.
- Gilmore, R.G., Dodrill, J.W. and Linley, P.A. (1983). Reproduction and embryonic development of the sand tiger shark, *Odontaspis taurus* (Rafinesque). *Fishery Bulletin* **81**(2): 201–225.
- Grace, M., de Anda Fuentes, D.E. and Castillo-Geniz, J.L. 2004. Biological Surveys to Assess the Relative Abundance and Distribution of Coastal Sharks and Teleosts of the Mexican Gulf of Mexico; 1997,

- 1998, 2001, and 2002. *Proceedings of the Gulf and Caribbean Fisheries Institute*, (55), pp. 271–279.
- Graham, K.J., Andrew, N.L. and Hodgson, K.E. 2001. Changes in relative abundance of sharks and rays on Australian South East Fishery trawl grounds after twenty years of fishing. *Marine and Freshwater Research*, **52**(4), pp. 549–561.
- Hazin, F.H.V., Pinheiro, P.B. and Broadhurst, M.K. 2000. Further notes on reproduction of the blue shark, *Prionace glauca*, and a postulated migratory pattern in the South Atlantic Ocean. *Ciencia e Cultura (Sao Paulo)*, **52**(2), pp. 114–120.
- Heemstra, P.C. 1995. Additions and corrections for the 1995 impression. p. v–xv. In: M.M. Smith and P.C. Heemstra (eds.) Revised Edition of Smiths' Sea Fishes. Springer-Verlag, Berlin.
- Heupel, M.R. and Simpfendorfer, C.A. 2002. Estimation of mortality of juvenile blacktip sharks, *Carcharhinus limbatus*, within a nursery area using telemetry data. *Canadian Journal of Fisheries and Aquatic Sciences* **59**(4), April 2002:624–632.
- Heupel, M.R., Simpfendorfer, C.A. and Hueter, R.E. 2003. Running before the storm: blacktip sharks respond to falling barometric pressure associated with Tropical Storm Gabrielle. *Journal of Fish Biology*, **63**(5), pp. 1357–1363.
- Heyman, R. Graham, B. Kjerfve and R.E. Johannes, Whale sharks *Rhincodon typus* aggregate to feed on fish spawn in Belize, Mar. Ecol. Prog. Ser. 215 (2001), pp. 275–282.
- Hjertenæs, P.O. 1980. The spurdogs in the North Sea area: the Norwegian fishery and observations on the changes in the migration patterns. *ICES CM 1980/H:60*.
- Holden, M.J. and Horrod, R.G. 1979. The migrations of the tope, *Galeorhinus galeus* (L), in the eastern North Atlantic as determined by tagging. *Journal du Conseil International pour l'Exploration de la Mer* **38**(3): 314–317.
- Holland, K.N., Wetherbee, B.M., Lowe, C.G. and Meyer, C.G. 1999. Movements of tiger sharks (*Galeocerdo curvier*) in coastal Hawaiian waters. *Marine Biology*, **134**(4), pp. 665–673.
- Holts, D.B. and Bedford, D.W. 1993. Horizontal and vertical movements of the shortfin mako shark, *Isurus oxyrinchus*, in the Southern California Bight. *Australian Journal of Marine and Freshwater Research*. Melbourne, **44**(6), pp. 901–909.
- Homma, K. et al. 1999. Biology of the Manta ray, *Manta birostris* Walbaum, in the Indo-Pacific, ed. B. Seret and J.Y. Sire. 1999, Paris (France): Societe Francaise d'Ichtyologie.
- Hulbert, L.B., Aires-Da-Silva, A.M., Gallucci, V.F. and Rice, J.S. 2005. Seasonal foraging movements and migratory patterns of female *Lamna ditropis* tagged in Prince William Sound, Alaska. *Journal of Fish Biology*, **67**(2), pp. 490–509.
- Hulbert, L.B., Sigler, M.F. and Lunsford, C.R. 2006. Depth and movement behaviour of the Pacific sleeper shark in the north-east Pacific Ocean. *Journal of Fish Biology*. **69**(2):406.
- Hunter, E., Buckley, A.A., Stewart, C. and Metcalfe, J.D. 2005. Migratory behaviour of the thornback ray, *Raja clavata*, in the southern North Sea. *Journal of the Marine Biological Association of the UK* **85**: 1095–1105.
- Hunter, E., Buckley, A.A., Stewart, C. and Metcalfe, J.D. 2005. Repeated seasonal migration by a thornback ray in the souther North Sea. *Journal of the Marine Biological Association of the UK*, **85**: 1199–1200.
- Hunter, E., Buckley, A.A., Stewart, C. and Metcalfe, J.D. 2006. Seasonal migration of thornback ways and implications for closure management. *Journal of Applied Ecology*, **43**: 710–720.
- ICES. 2002. Report of the Study Group on Elasmobranch Fishes. ICES Headquarters, 6–10th May 2002. Living Resources Committee, International Council for the Exploration of the Sea. ICES CM 2002/G:08 Ref. ACFM. pp. 119.
- International Commission for the Conservation of Atlantic Tunas and Department of Commerce, National Marine Fisheries Service, 2005. *Consolidated Atlantic Highly Migratory Species Fishery Management Plan*.
- Ishihara, H. and Homma, K. 1995. Manta rays in the Yaeyama Islands. *Shark News* **5**: 3.
- IUCN Shark Specialist Group. 2007. Background paper on the conservation status of migratory sharks and possible options for international cooperation under the Convention on Migratory Species. CMS/MS/4. Convention on Migratory Species, Bonn, Germany.
- Keeney, D.B. 2005. Population genetics and phylogeography of the blacktip shark (*Carcharhinus limbatus*). 300 N Zeeb Rd. PO Box 1346 Ann Arbor MI 48106–1346 USA, [mailto:info@il.proquest.com], [URL:http://www.il.proquest.com/umi/dissertations/]: ProQuest Information and Learning.
- Keeney, D.B., Heupel, M., Hueter, R.E. and Heist, E.J. 2003. Genetic heterogeneity among blacktip shark, *Carcharhinus limbatus*, continental nurseries along the US Atlantic and Gulf of Mexico. *Marine Biology (Berlin)*, **143**(6), pp. 1039–1046

- Ketchen, K. 1986. The spiny dogfish (*Squalus acanthias*) in the Northeast Pacific and a history of its utilization.
- Kiraly, S.J., Moore, J.A. and Jasinski, R.H. 2003. Deepwater and Other Sharks of the US Atlantic Ocean Exclusive Economic Zone. *Marine Fisheries Review*, **65**(4), pp. 1–20.
- Klimley, A.P. 1993. Highly directional swimming by scalloped hammerhead sharks, *Sphyrna lewini*, and subsurface irradiance, temperature, bathymetry, and geomagnetic field. *Marine Biology. Berlin, Heidelberg*, **117**(1), pp. 1–22.
- Klimley, A.P., Beavers, S.C., Curtis, T.H. and Jorgensen, S.J. 2002. Movements and swimming behavior of three species of sharks in La Jolla Canyon, California. *Environmental Biology of Fishes* **63**(2), February 2002:117–135.
- Klimley, A.P., Butler, S.B., Nelson, D.R. and Stull, A.T. 1988. Diel movements of scalloped hammerhead sharks, *Sphyrna lewini*, Griffith and Smith, to and from a seamount in the Gulf of California. *Journal of Fish Biology*, **33**(5), pp. 751–761.
- Klimley, A.P., Cabrera-Mancilla, I. and Castillo-Geniz, J.L. 1993. Horizontal and vertical movements of the scalloped hammerhead shark, *Sphyrna lewini*, in the southern Gulf of California, Mexico. *Ciencias marinas. Ensenada*, **19**(1), pp. 95–115.
- Kohler, N.E., Casey, J.G. and Turner, P.A. 1998. NMFS Cooperative Shark Tagging Program, 1962–93: An atlas of shark tag and recapture data. *Marine Fisheries Review*, **60**(2), pp. 1–87.
- Kohler, N.E., Turner, P.A., Hoey, J.J., Natanson, L.J. and Briggs, R. 2002. Tag and recapture data for three pelagic shark species, blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), and porbeagle (*Lamna nasus*) in the North Atlantic Ocean. *Collective volume of scientific papers. International Commission for the Conservation of Atlantic Tunas/ Recueil de documents scientifiques. Commission internationale pour la Cons (TRUNCATED)*, **54**(4), pp. 1231–1260.
- Kyne, P.M., Compagno, L.J.V. and Bennett, M.B. 2003. *Aetomylaeus nichofii*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Kyne, P.M., Ishihara, H., Dudley, S.F.J. and White, W.T. 2005. *Aetobatus narinari*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Last, P.R. and J.D. Stevens. 1994. *Sharks and rays of Australia*. CSIRO, Australia.
- Legat, J. 2004. Reproductive cycle and migration of blue shark (*Prionace glauca*) in South Atlantic Ocean, 1–5 Aug 2004.
- Lessa, R., Batista, V. and Almeida, Z. 1999. Occurrence and biology of the daggnose shark *Isogomphodon oxyrinchus* (Chondrichthyes: Carcharhinidae) off the Maranhao coast (Brazil). *Bulletin of Marine Science*, **64**(1), pp. 115–128.
- Lessa, R., Charvet-Almeida, P., Santana, F.M. and Almeida, Z. 2005. *Isogomphodon oxyrinchus*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded 08 March 2007.
- Liu, K. and Chen, C., 1999. Demographic analysis of the scalloped hammerhead, *Sphyrna lewini*, in the northwestern Pacific. *Fisheries science. Tokyo*, **65**(2), pp. 218–223.
- Lowe, C. G., R. N. Bray, and D. R. Nelson. 1994. Feeding and associated electrical behavior of the Pacific electric ray *Torpedo californica* in the field. *Mar. Biol.* **120**:161–169.
- Lucifora, L. and Universidad Nac. Mar Del Plata (Argentina). Fac. de Ciencias Exactas y Naturales, 2003. Ecology and conservation of large coastal sharks from Anegada Bay, Buenos Aires province, Argentina.
- Lucifora, L.O., Menni, R.C. and Escalante, A.H. 2002. Reproductive ecology and abundance of the sand tiger shark, *Carcharias taurus*, from the southwestern Atlantic. *ICES Journal of Marine Science*, **59**(3), pp. 553–561.
- Lucifora, L.O., Menni, R.C. and Escalante, A.H. 2002. Reproductive ecology and abundance of the sand tiger shark, *Carcharias taurus*, from the southwestern Atlantic. *ICES Journal of Marine Science*, **59**(3), pp. 553–561.
- Lucifora, L.O., Menni, R.C. and Escalante, A.H. 2004. Reproductive biology of the school shark, *Galeorhinus galeus*, off Argentina: support for a single south western Atlantic population with synchronized migratory movements. *Environmental Biology of Fishes*, **71**(2), pp. 199–209.
- Lucifora, L.O., Menni, R.C. and Escalante, A.H. 2005. Reproduction and seasonal occurrence of the copper shark, *Carcharhinus brachyurus*, from north Patagonia, Argentina. *ICES Journal of Marine Science*, **62**(1), pp. 107–115.
- Maguire, J.-J., Sissenwine, M., Csirke, J., Grainger, R. and Garcia, S. The state of world highly migratory, straddling and other high seas fishery resources and associated species. FAO Fisheries Technical Paper. No. 495. Rome: FAO. 2006. 84p.

- Maisey, J. G., Naylor, G. J. P. and Ward, D. 2004. Mesozoic elasmobranchs, neoselachian phylogeny, and the rise of modern neoselachian diversity. (in press). In G. Arratia and A. Tintori (eds) *Mesozoic Fishes III. Systematics, Paleoenvironments and Biodiversity*. Verlag Pfeil, Munich.
- Malcolm, H., Bruce, B., Stevens, J., CSIRO Marine Research, Hobart (Australia) and Environment Australia, Canberra (Australia), 2001. A review of the biology and status of white sharks in Australian waters. Hobart, Tas. (Australia): CSIRO.
- Mancusi, C., B. Catalano, S. Clò, M. Dalù, F. Serena, and M. Vacchi. (in press). Tag and release of Raja asterias juveniles in the South Ligurian Sea: preliminary results and future perspectives. Presented at the 6th Annual Scientific Meeting of the European Elasmobranch Association 6–8 Sept. 2002, Cardiff, UK.
- Mann, B. 2003. Fish facts. In: E. Bullen, B. Mann and B. Everett (eds). *Tagging News*. p:6. Oceanographic Research Institute, Durban.
- Marcano, J.S., Larez, A., Gutierrez, X., Alio, J.J., Salazar, H. and Marquez, M., 2004. Incidental catch of billfish and other species of Venezuelan longline vessels in the Caribbean Sea and western Atlantic Ocean: Period 1986–2000. *Ciencias Marinas*, **30**(1B), pp. 201–217.
- Martin, RA. 2005. Conservation of freshwater and euryhaline elasmobranchs. *Journal of the Marine Biological Association of the United Kingdom* [J. Mar. Biol. Assoc. U.K.]. Vol. 85, no. 5, pp. 1049–1073.
- Marshall, A., Ishihara, H., Dudley, S.F.J., Clark, T.B., Jorgensen, S., Smith, W.D. and Bizzarro, J.J. 2006. *Manta birostris*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Massa, A., Hozbor, N. and Lamilla, J. 2004. Discopyge tschudii. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 05 March 2007.
- McFarlane, G.A., and King, J.R. 2003. Migration patterns of spiny dogfish (*Squalus acanthias*) in the North Pacific Ocean. *Fishery Bulletin (Seattle)* 101(2), April 2003:358–367.
- Michael, S.W., 1993. *Reef sharks and rays of the world. A guide to their identification, behavior, and ecology*. Sea Challengers, Monterey, California. 107 p.
- Morey, G., Serena, F., Mancusi, C., Fowler, S.L., Dipper, F. and Ellis, J. 2006. *Squatina squatina*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Morrissey, J.F. and Gruber, S.H. 1993. Home range of juvenile lemon sharks, *Negaprion brevirostris*. *Copeia*. no.2.
- Munoz-Chapuli, R., 1984. (Reproduction behaviour of some sharks from the northeastern Atlantic.). *Cybiurn*, **8**(3), pp. 1–14.
- Musick, J.A., Branstetter, S. and Colvocoresses, J.A. 1993. *Trends in shark abundance from 1974 to 1991 for the Chesapeake Bight region of the US Mid-Atlantic coast*.
- Musick, J.A., Harbin, M.M and Compagno, L.J.V. 2004. Historical Zoogeography of the Selachii. pp. 33–77. In: J.C. Carrier, J.A. Musick and M.R. Heithaus (eds), *Biology of Sharks and Their Relatives*. CRC Press, Boca Raton, Florida.
- Musick, J.A. and J.K. Ellis. 2005. Reproductive Evolution of Chondrichthyes. pp. 45–79. In: Reproductive Biology and Phylogeny of Chondrichthyes: Sharks, Batoids and Chimaeras. William C. Hamlett. ed. Science Publishers, Inc. Plymouth, UK.
- Nakano, H. 1994. Age, reproduction and migration of blue shark in the North Pacific Ocean. *National Research Institute of Far Seas Fisheries. Bulletin*, (31), pp. 141–256.
- Nakano, H., Matsunaga, H., Okamoto, H. and Okazaki, M. 2003. Acoustic tracking of bigeye thresher shark *Alopias superciliosus* in the eastern Pacific Ocean. *Marine Ecology Progress Series*, pp. Vol. 265, p.
- National Marine Fisheries Service. 2006. Recovery Plan for Smalltooth Sawfish (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.
- Naylor, G.J.P., Ryburn, J.A., Fedrigo, O. and López, J.A. 2005. Phylogenetic relationships among the major lineages of modern elasmobranchs. In: W.C. Hamlett and B.G.M. Jamieson, Editors, Reproductive Biology and Phylogeny vol. 3, Science Publishers, Inc., Enfield, NH. pp. 1–25.
- Nelson, D.R., Mckibben, J.N., Strong, W.R., Lowe, C.G., Sisneros, J.A., Schroeder, D.M. and Lavenberg, R.J. 1997. An acoustic tracking of a megamouth shark, *Megachasma pelagios*: a crepuscular vertical migrator. *Environ.Biol.Fish*, **49**(4), pp. 389–399.
- Notarbartolo–Di-Sciara, G. 1987. A revisionary study of the genus *Mobula* Rafinesque, 1810 (Chondrichthyes: Mobulidae) with the description of a new species. *Zoological Journal of the Linnean Society* 91: 1–91.
- Notarbatolo-di-Sciara, G. 1988. Natural history of the rays of the genus *Mobula* in the Gulf of California. *Fishery Bulletin* **86**(1):45–66.

- Olsen, A.M. 1990. School shark tagging program 1947–1956. Details of releases in and recoveries from South Australian waters. *Safish*, **15**(1), pp. 5–8.
- Otway, N., and Burke, A. 2004. Mark-recapture population estimate and movements of Grey Nurse sharks. Cronulla, New South Wales Fisheries, Nelson Bay (Australia).
- Otway, N. and Parker, P. 1999. A review of the biology and ecology of the grey nurse shark (*Carcharias taurus*) Rafinesque 1810. New South Wales Fisheries Research Institute, Cronulla (Australia).
- Pacific Fishery Management Council and Department Of Commerce, National Marine Fisheries Service, 2001. *US West Coast Fisheries for Highly Migratory Species*.
- Pardini, A.T., Jones, C.S., Noble, L.R., Kreiser, B., Malcolm, H., Bruce, B.D., Stevens, J.D., Cliff, G., Scholl, M., Francis, M., Duffy, C.A.J. and Martin, A.P. 2001. Sex-biased dispersal of great white sharks. *Nature* **412**: 139–140.
- Parsons, G.R. and Hoffmayer, E.R. 2005. Seasonal changes in the distribution and relative abundance of the Atlantic sharpnose shark *Rhizoprionodon terraenovae* in the north central Gulf of Mexico. *Copeia*, **2005**(4), pp. 914–920.
- Pawson, M., and Vince, M. 1999. Management of shark fisheries in the Northeast Atlantic. In: Shotton, R. Ed. FAO, Rome.
- Peres, M.B. and Vooren, C.M. 1991. Sexual development reproductive cycle, and fecundity of the school shark *Galeorhinus galeus* off southern Brazil. *Fishery Bulletin*, **89**(4), pp. 655–667
- Pollard, D. A., Lincoln Smith, M.P. and Smith, A.K. 1996. The biology and conservation states of the grey nurse shark (*Carcharias taurus* Rafinesque 1810) in New South Wales, Australia. *Aquatic Conservation: Marine and Freshwater Ecosystems* **6**: 1–20.
- Pollard, D. and Smith, A. 2000. *Carcharias taurus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Reardon, M.B., Gerber, L. and Cavanagh, R.D. 2005. *Isurus paucus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Riede, K. 2004. Global register of migratory species – from global to regional scales. Final Report of the RandD-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany. 329 p.
- Rogers, C., Roden, C., Lohofener, R., Mullin, K. and Hoggard, W. 1990. Behavior, distribution, and relative abundance of cownose ray schools *Rhinoptera bonasus* in the northern Gulf of Mexico. *Northeast Gulf Science* **11**(1):69–76.
- Rogers, S. and Stocks, R. 2001. North Sea fish and fisheries. CEFAS, Lowestoft.
- Rogers, S.I. and Ellis, J.R. 2000. Changes in the demersal fish assemblages of British coastal waters during the 20th century. *ICES Journal of Marine Science*, **57**(4), pp. 866–881.
- Rossouw, G.J. 1983. The biology of the sand shark *Rhinobatos annulatus*, in Algoa Bay with notes on other elasmobranchs. PhD Thesis, University of Port Elizabeth, Cape Province, South Africa.
- Santana, F.M., Lessa, R. and Carlson, J. 2006. *Carcharhinus signatus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 14 November 2007.
- Schwartz, F.J. 1990. Mass migratory congregations and movements of several species of cownose rays, genus *Rhinoptera* : a world-wide review. *J. Elisha Mitchell Sci. Soc.* **106**:10–13.
- Schwartz, F.J. 1965. Inter-American migrations and systematics of the western Atlantic cownose ray, *Rhinoptera bonasus*. Meeting, Association of Island Marine Laboratories 6. (Abstract).
- Shark Specialist Group 2000. *Hexanchus griseus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Shark Specialist Group 2000. *Pristis perotteti*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Shing, C.C.A. 2005. Sharks: Overview of the fisheries in Trinidad and Tobago. *Proceedings of the Gulf and Caribbean Fisheries Institute*, (47), pp. 318–336.
- Shirai, S. 1996. Phylogenetic interrelationships of neoselachians (Chondrichthyes, Euselachii). In Melanie L.J. Stiassny, Lynne R. Parenti, and G. David Johnson, Eds, *Interrelationships of fishes*. Academic Press, San Diego, London, 9–34, fig. 1–4.
- Shivji, M., Clarke, S., Pank, M., Natanson, L., Kohler, N. and Stanhope, M. 2002. Genetic Identification of Pelagic Shark Body Parts for Conservation and Trade Monitoring. *Conservation Biology*, **16**(4), pp. 1036–1047.
- Simpfendorfer, C. 1992. Biology of tiger sharks (*Galeocerdo cuvier*) caught by the Queensland shark meshing program off Townsville, Australia.
- Simpfendorfer, C. and Burgess, G.H. 2000. *Carcharhinus leucas*. In: IUCN 2006. *2006 IUCN Red List of*

- Threatened Species*. <www.iucnredlist.org> Downloaded on 08 March 2007.
- Simpfendorfer, C. 2000. *Sphyrna zygaena*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Simpfendorfer, C.A., Hueter, R.E., Bergman, U. and Connett, S.M.H. 2002. Results of a fishery-independent survey for pelagic sharks in the western North Atlantic, 1977–1994. *Fisheries Research (Amsterdam)*, 55(1–3), pp. 175–192.
- Simpfendorfer, C. 2005. Threatened fishes of the world: *Pristis pectinata* Latham, 1794 (Pristidae) *Environmental Biology of Fishes*, Volume 73, Number 1, May 2005, pp. 20–20(1).
- Sims, D.W., Southall, E.J., Richardson, A.J., Reid, P.C. and Metcalfe, J.D. 2003. Seasonal movements and behaviour of basking sharks from archival tagging: No evidence of winter hibernation. *Marine Ecology Progress Series*, pp. Vol. 248, p.
- Sims, D.W., Southall, E.J., Tarling, G.A. and Metcalfe, J.D. 2005. Habitat-specific normal and reverse diel vertical migration in the plankton-feeding basking shark. *J. Animal Ecology*, 74(4), pp. 755–761.
- Skomal, G. 2005. 'Basking shark tagging update'. In DMF News bulletin Vol. 25 (June, 2005) <http://www.mass.gov/marinefisheries>
- Sminkey, T.R. and Musick, J.A. 1996. Demographic analysis of the sandbar shark, *Carcharhinus plumbeus*, in the western North Atlantic. *Fishery Bulletin*, 94(2), pp. 341–347.
- Smith, W.D. and Bizzarro, J.J. 2005. *Rhinoptera steindachneri*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Smith, J.W. and Merriner, J.V. 1985. Food habits and feeding behavior of the cownose ray, *Rhinoptera bonasus*, in lower Chesapeake Bay. *Estuaries* 8(3):305–310.
- Smith, J.W. and Merriner, J.V. 1986. Observations on the reproductive biology of the cownose ray, *Rhinoptera bonasus*, in Chesapeake Bay. *Fishery Bulletin* 84 (4):871–877.
- Smith, J.W. and Merriner, J.V. 1987. Age and growth, movements and distribution of the cownose ray, *Rhinoptera bonasus*, in Chesapeake Bay. *Estuaries* 10(2):153–164.
- Stehmann, M. and D.L. Bürkel, 1984. *Torpedinidae*. p. 159–162. In: P.J.P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese (eds.) *Fishes of the north-eastern Atlantic and Mediterranean*. UNESCO, Paris. Vol. 1.
- Stevens, J.D. (in press). The population status of highly migratory oceanic sharks in the Pacific Ocean. In: *Proceedings of the symposium on managing highly migratory fish of the Pacific Ocean*, 4–6 November 1996, Monterey, California. National Coalition.
- Stevens, J.D. 1976. First results of shark tagging in the north-east Atlantic, 1972–1975. *J.Mar.Biol.Assoc. U.K.*, 56(4), pp. 929–937.
- Stevens, J.D. 1990. Further results from a tagging study of pelagic sharks in the north-east Atlantic. *Journal of the Marine Biological Association of the United Kingdom.Plymouth*, 70(4), pp. 707–720.
- Stevens, J.D., West, G.J. and McLoughlin, K.J. 2000. Movements, recapture patterns, and factors affecting the return rate of carcharhinid and other sharks tagged off northern Australia. *Marine and Freshwater Research*, 51(2), pp. 127–241.
- Stevens, J. 2000. *Prionace glauca*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Stevens, J., Fowler, S.L., Soldo, A., McCord, M., Baum, J., Acuña, E., Domingo, A. and Francis, M. 2005. *Lamna nasus*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Stokesbury, M.J.W., Harvey-Clark, C., Gallant, J., Block, B.A. and Myers, R.A. 2005. Movement and environmental preferences of Greenland sharks (*Somniosus microcephalus*) electronically tagged in the St. Lawrence Estuary, Canada. *Marine Biology*, 148(1), pp. 159–165.
- Stow, A., Zenger, K., Briscoe, D., Gillings, M., Peddemors, V., Otway, N. and Harcourt, R., 2006. Isolation and genetic diversity of endangered grey nurse shark (*Carcharias taurus*) populations. *Biology Letters*, 2(2), pp. 308–311.
- Sundstroem, L.F., Gruber, S.H., Clermont, S.M., Correia, J.P.S., De Marignac, J.R.C., Morrissey, J.F., Lowrance, C.R., Thomassen, L. and Oliveira, M.T. 2001. Review of elasmobranch behavioral studies using ultrasonic telemetry with special reference to the lemon shark, *Negaprion brevirostris*, around Bimini Islands, Bahamas. *Environmental Biology of Fishes* 60(1–3), February 2001:225–250.
- Tavares, R. 2005. Abundance and distribution of sharks in Los Roques Archipelago National Park and other Venezuelan oceanic islands, 1997–1998. *Ciencias Marinas*, 31(2), pp. 441–454.
- Tremain, D.M., Harnden, C.W. and Adams, D.H. 2004. Multidirectional movements of sportfish species between an estuarine no-take zone and surrounding

- waters of the Indian River Lagoon, Florida. *Fishery Bulletin*, **102**(3), pp. 533–544.
- Visser, T. 2002. FAO initiatives for elasmobranch fisheries research and monitoring. In: Fowler, S.L., Reed, T.M. and Dipper, F.A. (eds). (2002). *Elasmobranch Biodiversity, Conservation and Management: Proceedings of the International Seminar and Workshop, Sabah, Malaysia, July 1997*. IUCN SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. xv + 258 pp.
- Vooren, C.M. and Lamónaca, A.F. 2004. *Rhinoptera brasiliensis*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 05 March 2007.
- Walker, T., Brown, L. and Bridge, N. 1997. Southern Shark Tagging Project: final report to Fisheries Research and Development Corporation. Marine and Freshwater Resources Inst., Queenscliff (Australia).
- Walker, T., Hudson, R., Gason, A. 2005. Catch evaluation of target, by-product and by-catch species taken by gillnets and longlines in the shark fishery of southeastern Australia. Northwest Atlantic Fisheries Organization, Dartmouth, Ns (Canada).
- Walker, T.I., Cavanagh, R.D. and Stevens, J.D. 2005. *Galeorhinus galeus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- Walker, T.I., Hudson, R.J., and Gason, A.S. 2002. *Catch evaluation of target, by-product, and by-catch species taken by gillnets and longlines in the shark fishery of south-eastern Australia*. Northwest Atlantic Fisheries Organisation, Dartmouth, NS (Canada), 02/114.
- Weber, M. and Fordham, S. 1997. Managing shark fisheries: Opportunities for international conservation. Cambridge (UK): TRAFFIC International.
- West, G.J. and Stevens, J.D. 2001. Archival tagging of school shark, *Galeorhinus galeus*, in Australia: initial results. *Environmental Biology of Fishes*, **60**(1–3), pp. 283–298.
- White, W.T. 2005. *Aetobatus flagellum*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- White, W.T., Clark, T.B., Smith, W.D. and Bizzarro, J.J. 2005. *Mobula japanica*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 08 March 2007.
- White, W.T., Last, P.R., Stevens, J.D., Yearsley, G.K., Famhi, Dharmadi. 2006. *Economically Important Sharks and Rays of Indonesia*. Australian Centre for International Agricultural Research. pp: 329.
- Wilson, C.D. and Seki, M.P. 1994. Biology and population characteristics of *Squalus mitsukurii* from a seamount in the Central North Pacific Ocean. *Fishery Bulletin*, **92**(4), pp. 851–864.
- Wilson, S.G., Taylor, J.G. and Pearce, A.F. 2001. The seasonal aggregation of whale sharks at Ningaloo Reef, Western Australia: currents, migrations and the El Nino/Southern Oscillation. *Environmental Biology of Fishes* **61**(1), May 2001:1–11.
- Wintner, S.P., Ducrocq, M., Pérez, M., Siu, S., Medina, E., Casper, B.M., Graham, R.T., Simpfendorfer, C. and Burgess, G. In prep. *Carcharhinus leucas*. IUCN Red List Assessment.
- Yamaguchi, A., Kawahara, I. and Ito, S. 2005. Occurrence, Growth and Food of Longheaded Eagle Ray, *Aetobatus flagellum*, in Ariake Sound, Kyushu, Japan. *Envir. Biology of Fishes* **74** (2): 229–238.
- Yano, K., Stevens, J.D. and Compagno, L.J.V. 2004. A review of the systematics of the sleeper shark genus *Somniosus* with redescrptions of *Somniosus (Somniosus) antarcticus* and *Somniosus (Rhinoscyrnus) longus* (Squaliformes: Somniosidae). *Ichthyological Research* **51**: 360–373.
- Yokota, L. and Lessa, R.N. 2006. A nursery area for Sharks and Rays in Northeastern Brazil. *Environmental Biology of Fishes*. **75**: 349–360.
- Zorzi, G.D. and Anderson, M.E. 1988. Records of the deep-sea skates, *Raja (Amblyraja) badia* Garman, 1899, and *Bathyraja abyssicola* (Gilbert, 1896) in the eastern North Pacific, with a new key to California skates. *Calif. Fish Game* **74**:87–105.

Annex 1

Convention on Migratory Species Recommendation 8.16 “Migratory Sharks”

Adopted by the Conference of the Parties at its Eighth Meeting (Nairobi, 20–25 November 2005)

Acknowledging the obligations of the global community to conserve, protect and manage migratory sharks as underpinned by, *inter alia*, the Convention on Biological Diversity, CMS, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the United Nations Convention on the Law of the Sea, the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and the FAO International Plan of Action for the Conservation and Management of Sharks, and FAO’s Committee on Fisheries;

Recognising that under CMS, Range States should take action to conserve, protect and manage migratory species, and endeavour to conclude Agreements to promote the conservation and management of migratory species;

Noting that several shark species are already listed in Appendices I and II;

Aware of the vital ecosystem role played by sharks, and the significant and continuing mortality of sharks listed on Appendix I and II through a range of impacts, including habitat destruction, target fisheries, illegal, unreported and unregulated (IUU) fishing, and as fisheries by-catch; and

Noting the importance of cooperation between Range States in furthering research, awareness raising, trade monitoring and by-catch reduction of migratory sharks, and that these activities could greatly strengthen conservation outcomes for migratory sharks;

The Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals

1. *Requests* all Parties to strengthen measures to protect migratory shark species against threatening processes, including habitat destruction, IUU fishing and fisheries by-catch;
2. *Encourages* the FAO Committee on Fisheries to promote greater uptake of the International Plan of Action for the Conservation and Management of Sharks as a matter of urgency;
3. *Calls* upon Range States of migratory sharks listed on Appendix I or II to develop a global migratory sharks conservation instrument, in accordance with Articles III and V of the Convention, noting that discussions on the development of the instrument could, *inter alia*:
 - (a) consider the potential value of developing subsidiary regional and/or species specific conservation management plans to the instrument;
 - (b) involve, to the greatest extent possible, governments, intergovernmental organisations, non-governmental organisations and local communities;
 - (c) identify, as appropriate, effective mechanisms to mitigate threats such as by-catch, entanglement in marine debris, and IUU fishing;
 - (d) identify viable and practical alternatives to consumptive uses of migratory sharks while recognising the cultural and economic importance of these species for some communities; and
 - (e) develop mechanisms to facilitate developing country participation in the implementation of the future instrument; and
4. *Requests* the Secretariat to bring this recommendation to the attention of the FAO Committee on Fisheries, and CITES, and to explore future avenues of cooperation with these organisations as well as with Range States of migratory sharks that will lead to enhanced protection, conservation and management of these sharks.

Annex 2

The Definition of “Favourable Conservation Status” according to the Convention on the Conservation of Migratory Species of Wild Animals

According to Article 1(c) “conservation status” will be taken as “favourable” when:

1. population dynamics data indicate that the migratory species is maintaining itself on a long-term basis as a viable component of its ecosystems;
2. the range of the migratory species is neither currently being reduced, nor is likely to be reduced, on a long-term basis;
3. there is, and will be in the foreseeable future, sufficient habitat to maintain the population of the migratory species on a long-term basis; and
4. the distribution and abundance of the migratory species approach historic coverage and levels to the extent that potentially suitable ecosystems exist and to the extent that is consistent with wise wildlife management.

Conversely, Article 1(d) states:

“Conservation status” will be taken as “unfavourable” if any of the conditions set out in sub-paragraph (c) ... is not met.

Annex 3

Structure of the prototype CMS Migratory Shark Database

Sheet 1. CMS Species List

Column Code	Heading(s)	Contents
A	Class	This column can be ignored or hidden. The class chondrichthyes is copied to every record, to allow data in the sheet to be filtered.
B to F	Order/Suborder; Family; Species Name; Common Name	These include taxonomy and the scientific and common names of each species. (Column D provides an identification and running total of the number of species on the list).
G	CMS Migratory classification	Defined as 'Migratory' or 'Potential'. Migratory – indicates that the species is strongly suspected as migratory under the CMS definition. Potential – indicates that the species is a possible migrant under the CMS definition, but no data are available.
H	Distribution	An overview of the distribution of each species (See Sheet 3 'Range' for the full list of range States for each species).
I	Classification	Classification by zone. i.e. coastal, oceanic, deepwater, or shelf.
J	Habitat	i.e. pelagic or benthic or both.
K	Depth range	Species' approximate depth range.
L	Migration	Descriptive field with an overview of information known on the movements of each species.
M to W	Ocean Basins	Each ocean basin in which a species occurs is marked by a 1. When filtering the species list, using the Auto-filter feature in Excel, this allows you to select species based on the Ocean basins in which they occur. E.g. For all species occurring in the North Atlantic Ocean, select '1' on both of the filter's drop-down menus under NE Atlantic and NW Atlantic.
X to AB	2006 Red List Status (Global category; Year; Regional category, Region, Year)	All assessments submitted and published on the 2006 Red List to date. Columns X and Y give the published global assessment and year of publication. Columns Z, AA and AB give the regional and subpopulation assessments published to date, the region, and the year of publication. The species list can therefore be filtered by Global and regional Red List category, and by region, using the auto filter option.*
AC to AE	In Prep Red List Status (Global category; Regional category, Region)	All assessments in preparation. These assessments have not been submitted to the Red List, are not final and may be under review, therefore there are no dates of publication. These will be updated as appropriate.
AF to AH	Global Management Status	Indicates species listed on each global instrument (e.g. CMS; UNCLOS; CITES) by Annex/Appendix
AI to AV	Regional Management (Legal and Management Status by region: Africa; Australasia; Central America & Caribbean; Central & South America; Eurasia & North Africa; Europe; North America)	Regional Management (as for Range States) is classified by Biogeographic regions and Map of Parties on the CMS website. Presence on regional lists, (e.g. Barcelona and Bern Conventions in Europe) is noted under Legal Status and any management measures are noted under Management Status . These are descriptive text fields at the moment.
AW to AY	Links to FAO Factsheet; Fishbase and 2006 RL Assessment	Hyperlinks to these documents, where available

* The organisation of Global and regional Red List categories, both published and in preparation, is difficult within the Excel spreadsheet. It is hard to standardise the presentation of these, as a regional assessment can be done for any region throughout a species' range and the specific names vary widely. At present all the information within the database is organised so that it may be filtered by the global species assessment, on the same row as the species name.

Sheet 2. Regional Fisheries Bodies by CMS Region

This sheet presents the acronyms for all relevant Regional Fisheries Bodies within each CMS Region. The Ocean that each RFB applies to (Atlantic, Pacific or Indian) and the type of body (Management, Scientific, Advisory) are given next to each, under the 'Type' field. Each RFB name is also hyperlinked directly to the webpage for each body, and the full name of each body has been added to the screen tip, so just hover over the link to see the name of the body in full. Ultimately, the intention is to link this by the range States and management for each species, but this may not be workable until the database is migrated to table format in another programme.

Sheet 3. Range

In the same way as for Ocean Region, the list of range States for each species is marked by a '1', so that species may be filtered by country, to allow the total number of species occurring in each country to be calculated using the Sum feature in Excel, and to facilitate the format for transfer to an Access-based database. A '?' denotes where a species is may occur within a range State, but its presence is not confirmed. The Range States are organised according to CMS Biogeographical Region, to allow comparisons between regions. I would like to add the CMS Status (i.e. Party, Non-party, MoU, etc) of each of these countries to this sheet, and am considering the best place and way in which to record this.

Sheets 4 and 5. RL Sum ONLY Migratory sp and RL Sum Migratory & Potential

These sheets present some summaries from the Red List status data within the database. Each sheet provides a breakdown of the number and % of species in each category on the 2006 RL (Globally, regionally and by individual region, where possible).

Sheet 4 (RL Sum ONLY Migratory sp), gives this ONLY for the species strongly suspected as being migratory (i.e. those listed as Migratory under 'CMS Migratory' in Sheet 1, Column G). Sheet 5 RL Sum Migratory and Potential, gives this for all species, including those listed as 'Potential' migrators. Under both, summaries of the Global Status, and Regional status of all evaluated species are listed.

Sheet 6. Bibliography

The bibliography can be filtered by Region(s), Specie(s), Citation and Reference. This is being built on, and can be hyperlinked to the main database itself where each citation is referred to at a later stage. There is also the potential to link directly to the documents themselves from here, if these could be collected and if the database will not be published. (The Red List Assessments, for which links are provided, also give references relevant to each species).

Annex 4

Summary classification of the living chondrichthyan fishes (from Compagno *et al.* 2005)

Order	Family	No. of genera	No. of species
Class Chondrichthyes	Total cartilaginous fishes	189	1164
Subclass Holocephalii			
Chimaeriformes. Modern chimaeras	<i>Total chimaeras</i>	6	43
	Callorhynchidae. Elephant fishes	1	3
	Rhinochimaeridae. Longnose chimaeras	3	8
	Chimaeridae. Shortnose chimaeras	2	32
Subclass Elasmobranchii	<i>Total elasmobranchs</i>	183	1121
Superorder Squalomorphii	<i>Total squalomorph sharks</i>	108	785
	<i>Total non-batoid squalomorphs</i>	32	152
Hexanchiformes. Cow and frilled sharks	<i>Total cow and frilled sharks</i>	4	6
	Chlamydoselachidae. Frilled sharks	1	2
	Hexanchidae. Sixgill and Sevengill sharks	3	4
Squaliformes. Dogfish sharks	<i>Total dogfish sharks</i>	21	119
	Echinorhinidae. Bramble sharks	1	2
	Squalidae. Dogfish sharks	2	19
	Centrophoridae. Gulper sharks	2	15
	Etmopteridae. Lantern sharks	5	50
	Somniosidae. Sleeper sharks	4	18
	Oxynotidae. Roughsharks	1	5
	Dalatiidae. Kitefin sharks	6	10
Squatiniiformes. Angel sharks	Squatinae. Angel sharks	1	18
Pristiophoriformes. Sawsharks	Pristiophoridae. Sawsharks	2	9
Rajiformes. Batoids (rays)	<i>Total batoid squalomorphs (rays)</i>	76	633
Suborder Pristoidei. Sawfishes	Pristidae. Modern Sawfishes	2	7
Suborder Rhinoidei. Sharkrays	Rhinidae. Sharkrays	1	1
Suborder Rhynchobatoidei: Wedgefishes	Rhynchobatidae. Wedgefishes	1	6
Suborder Rhinobatoidei: Guitarfishes	Rhinobatidae. Guitarfishes	4	47
Suborder Platyrhinoidei: Thornbacks	Platyrhinidae. Thornbacks and fanrays	2	3
Suborder Zanobatoidei: Panrays	Zanobatidae. Panrays	1	4
Suborder Torpedinoidei. Electric rays	<i>Total electric rays</i>	11	77
	Narcinidae. Numbfishes	4	32
	Narkidae. Sleeper rays	5	14
	Hypnidae. Coffin rays	1	1
	Torpedinidae. Torpedo rays	1	30
Suborder Rajoidei. Skates	<i>Total skates</i>	28	286
	Arhynchobatidae. Softnose skates	11	95
	Rajidae. Hardnose skates	15	168
	Anacanthobatidae. Legskates	2	23
Suborder Myliobatoidei. Stingrays	<i>Total stingrays</i>	26	202
	Plesiobatididae Giant stingarees	1	1
	Urolophidae. Stingarees	2	27
	Urotrygonidae. Round stingrays	2	15
	Hexatrygonidae. Sixgill stingrays	1	1
	Potamotrygonidae. River stingrays	6	29
	Dasyatidae. Whiptail stingrays	5	75
	Gymnuridae. Butterfly rays	2	12
	Myliobatidae. Eagle rays	4	21
	Rhinopteridae. Cownose rays	1	11
	Mobulidae. Devil rays	2	10

Order	Family	No. of genera	No. of species
Superorder Galeomorphii	<i>Total galeomorph sharks</i>	75	336
Heterodontiformes. Bullhead sharks	Heterodontidae. Bullhead sharks	1	9
Orectolobiformes. Carpet sharks	<i>Total carpet sharks</i>	14	34
	Parascylliidae. Collared carpet sharks	2	7
	Brachaeluridae. Blind sharks	2	2
	Orectolobidae. Wobbegongs	3	7
	Hemiscylliidae. Longtailed carpetsharks	2	13
	Ginglymostomatidae. Nurse sharks	3	3
	Stegostomatidae. Zebra sharks	1	1
	Rhincodontidae. Whale sharks	1	1
Lamniformes. Mackerel sharks	<i>Total mackerel sharks</i>	10	15
	Odontaspidae. Sand tiger sharks	2	3
	Pseudocarchariidae. Crocodile sharks	1	1
	Mitsukurinidae. Goblin sharks	1	1
	Megachasmidae. Megamouth sharks	1	1
	Alopiidae. Thresher sharks	1	3
	Cetorhinidae. Basking sharks	1	1
	Lamnidae. Mackerel sharks	3	5
Carcharhiniformes. Ground sharks	<i>Total ground sharks</i>	50	278
	Scyliorhinidae. Catsharks	16	151
	Proscylliidae. Finback catsharks	3	5
	Pseudotriakidae. False catsharks	3	4
	Leptochariidae. Barbeled houndsharks	1	1
	Triakidae. Houndsharks	9	46
	Hemigaleidae. Weasel sharks	4	8
	Carcharhinidae. Requiem sharks	12	55
	Sphyrnidae. Hammerhead sharks	2	8

Annex 5

Range States of chondrichthyan species identified as priorities for CMS

Note: Where a species occurs only in a Territory of a range State that is party to CMS (and not in the waters of the range State that owns the Territory), both the range State and Territories are given in parentheses. Where a species occurs both in a range State and one or more of that State's Territories, the range State is given, followed by the territories in which it occurs, in parentheses.

Spiny dogfish *Squalus acanthias*

Parties to CMS: Albania, Algeria, Angola, Argentina, Australia, Belgium, Spain (Canary Islands), Chile, Croatia, Cyprus, Denmark, Egypt, Finland, France (and French Polynesia [Kerguelen Islands]), Georgia, Germany, Greece, Ireland, Israel, Italy, Latvia, Libyan Arab Jamahiriya, Lithuania, Malta, Mauritius, Monaco, Morocco, Netherlands, New Zealand, Norway, Philippines?, Poland, Portugal, Romania, Slovenia, South Africa, Spain, Sweden, Syrian Arab Republic, Tunisia, Ukraine, United Kingdom (Falkland/Malvinas Islands), Uruguay. **Other range States:** Canada, China, Cuba, Faeroe Islands, Gabon, Greenland, Iceland, Japan, Korea Democratic People's Republic of, Korea Republic of, Lebanon, Mexico, Namibia, Russian Federation, Serbia and Montenegro, Turkey, USA (Alaska), Western Sahara, Montenegro.

Angel shark *Squatina squatina*

Parties to CMS: Albania, Algeria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Egypt, France (Corse), Georgia, Germany, Greece, Ireland, Israel, Italy (Sardegna), Mauritania, Netherlands, Norway, Portugal, Romania, Slovenia, Spain, Sweden, Syrian Arab Republic, Tunisia, Ukraine, United Kingdom. **Other range States:** Bosnia and Herzegovina, Russian Federation, Montenegro, Turkey, Western Sahara.

Longheaded eagle ray *Aetobatus flagellum*

Parties to CMS: India, Pakistan. **Other range States:** China, Indonesia (Jawa), Japan.

Bonnet ray *Aetobatus narinari*

Parties to CMS: Angola, Australia (New South Wales; Northern Territory; Queensland; Western Australia), Bangladesh, Benin, Cameroon, Congo, The Democratic Republic of the, Côte d'Ivoire, Djibouti, Ecuador (Galápagos), Egypt, Eritrea, (France – Guadeloupe, New

Caledonia) Gambia, Ghana, Guinea, Guinea-Bissau, India, Israel, Jordan, Kenya, Liberia, Madagascar, Mauritania, Nigeria, Pakistan, Panama, Philippines, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Somalia, South Africa, Sri Lanka, Tanzania United Republic of, Togo, (United Kingdom –Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands), Yemen. **Other range States:** Anguilla, Antigua and Barbuda, Bahamas, Bahrain, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, China, Colombia, Congo, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, Fiji, French Guiana, Gabon, Grenada, Guatemala, Guyana, Haiti, Honduras, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Japan, Korea, Democratic People's Republic of, Korea, Republic of, Kuwait, Malaysia, Martinique, Mexico (Baja California; Baja California Sur; Campeche; Chiapas; Colima; Guerrero; Jalisco; Michoacan; Nayarit; Oaxaca; Quintana Roo; Sinaloa; Sonora; Tabasco; Tamaulipas; Veracruz; Yucatán), Micronesia, Federated States of, Mozambique, Myanmar, Nicaragua, Oman, Papua New Guinea, Puerto Rico, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Singapore, Solomon Islands, Sudan, Suriname, Taiwan – Province of China, Thailand, Timor-Leste, Trinidad and Tobago, United Arab Emirates, USA (Alabama; Florida; Georgia; Hawaiian Is.; Louisiana; Mississippi; North Carolina; South Carolina; Texas), Venezuela, Viet Nam, US Virgin Islands.

Banded eagle ray *Aetomylaeus nichofii*

Parties to CMS: Australia (Northern Territory; Queensland; Western Australia), Bangladesh, India, Pakistan, Philippines, Sri Lanka. **Other range States:** Brunei Darussalam, Cambodia, China, Indonesia, Japan, Korea – Democratic People's Republic of, Korea, Republic of, Malaysia, Maldives?, Mozambique?, Myanmar, Papua New Guinea, Singapore, Taiwan – Province of China, Thailand, Viet Nam.

Bullray *Pteromylaeus bovinus*

Parties to CMS: Albania, Algeria, Angola, Benin, Cameroon, Cape Verde, Congo, Croatia, Cyprus, Côte d'Ivoire, Egypt, France, Gambia, Ghana, Greece, Guinea, Guinea-Bissau, Israel, Italy, Liberia, Libyan Arab Jamahiriya, Malta, Mauritania, Monaco, Morocco, Nigeria, Portugal (Madeira), Sao Tomé and Príncipe, Senegal, Slovenia, South Africa, Spain (Canary Is.), Syrian Arab Republic,

Tanzania United Republic of, Togo, Tunisia, (United Kingdom – Gibraltar). **Other range States:** Bosnia and Herzegovina, Equatorial Guinea, Gabon, Kenya, Lebanon, Mozambique, Namibia, Montenegro, Sierra Leone, Turkey, Western Sahara.

Manta ray *Manta birostris*

Parties to CMS: Angola, Australia (Christmas Island, Cocos (Keeling) Islands), Cape Verde, Cook Islands, Djibouti, Ecuador (Galápagos), Egypt, (France – French Polynesia, Guatemala, Guyana, New Caledonia, Réunion), Guinea, Guinea-Bissau, India, Madagascar, Mauritania, Mauritius, (Netherlands – Aruba, Curaçao), New Zealand, Panama, Peru, Philippines, Portugal (Madeira), Saudi Arabia, Senegal, Seychelles, Somalia, South Africa, Spain (Canary Is.), Yemen, (United Kingdom – Bermuda, British Indian Ocean Territory/Chagos Archipelago, Cayman Islands). **Other range States:** Belize, Brazil, China, Colombia, Cuba, El Salvador, Guam, Honduras, Indonesia, Jamaica, Japan, Malaysia, Maldives, Marshall Islands, Mexico, Mozambique, Nicaragua, Northern Mariana Islands, Oman, Palau, Papua New Guinea, Sierra Leone, Solomon Islands, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, USA (California; Florida; Hawaiian Is.; North Carolina; South Carolina), Vanuatu, Venezuela, Viet Nam, US Virgin Islands.

Giant devil ray *Mobula mobular*

Parties to CMS: Algeria, Croatia, Cyprus?, Egypt?, France, Greece, Israel, Italy, Malta, Morocco?, Spain, Tunisia, (United Kingdom – Gibraltar). **Other range States:** Turkey?

Monk's devil ray *Mobula munkiana*

Parties to CMS: Ecuador, Panama, Peru.

Other range States: Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico (Baja California; Baja California Sur; Chiapas; Colima; Guerrero; Jalisco; Michoacan; Nayarit; Oaxaca; Sinaloa; Sonora), Nicaragua.

Box ray *Mobula tarapacana*

Parties to CMS: Cape Verde, Chile, Côte d'Ivoire, Egypt, South Africa. **Other range States:** Brazil, Indonesia, Japan, Mexico, Palau, Taiwan – Province of China, USA (Texas), Venezuela.

Bentfin devil ray *Mobula thurstoni*

Parties to CMS: Australia (Queensland), Chile, Côte d'Ivoire, Ecuador, Eritrea, India, Madagascar?, Philippines, Senegal, South Africa. **Other range States:** Brazil, Costa Rica, El Salvador, Guatemala, Honduras, Indonesia, Japan, Mexico, Nicaragua, Oman, Thailand.

Atlantic devil ray *Mobula hypostoma*

Parties to CMS: Argentina, (France – Guadeloupe, Guyana, Martinique), (Netherlands – Aruba, Bonaire, Curaçao), Panama, Uruguay. **Other range States:** Anguilla, Antigua and Barbuda, Bahamas, USA (south of North Carolina), Mexico, Belize, Honduras, Nicaragua, Costa Rica, Colombia, Venezuela, Suriname, French Guiana, Brazil, Cuba, Dominican Republic, Puerto Rico, Dominica, St. Lucia, Barbados, Grenada, Trinidad and Tobago.

Shortfin devil ray *Mobula kuhlii*

Parties to CMS: South Africa, Tanzania United Republic of (Zanzibar), India, Sri Lanka, Seychelles, Somalia. **Other range States:** Indonesia, Malaysia, Oman.

Lesser Guinean devil ray *Mobula rochebrunei*

Parties to CMS: Mauritania, Senegal, Guinea, Guinea-Bissau, Angola. **Other range States:** N/A

Japanese devil ray *Mobula japanica*

Parties to CMS: Australia (New South Wales; Queensland), Bangladesh, Côte d'Ivoire, Ecuador, India, New Zealand, Pakistan, Panama, Peru, Philippines, Somalia, South Africa, Sri Lanka, Yemen. **Other range States:** Brazil, Cambodia, China, Colombia, Costa Rica, El Salvador, Fiji, Guatemala, Honduras, Indonesia, Japan, Korea, Democratic People's Republic of, Korea, Republic of, Mexico, Myanmar, Nicaragua, Oman, Taiwan – Province of China, Thailand, Tuvalu, USA (California; Hawaiian Is.), Viet Nam.

Sandtiger shark *Carcharias taurus*

Parties to CMS: Algeria, Argentina, Spain, (United Kingdom – Bermuda), Uruguay, Croatia, Greece, Cyprus, Italy, Israel, Malta, Morocco, Tunisia, Sao Tome and Principe, Cape Verde, Senegal, Nigeria, Angola, South Africa, Pakistan, India?, Sri Lanka?, Philippines?, Australia, Uruguay. **Other range States:** Canada (a vagrant in the Gulf of Maine: New Brunswick), USA, Bahamas, Brazil, Lebanon, Western Sahara, Ghana, Cameroon, Namibia, Mozambique, Indonesia, Malaysia, Viet Nam, Japan, Taiwan Province of China, China.

Pelagic thresher shark *Alopias pelagicus*

Parties to CMS: South Africa, Madagascar, Tanzania Republic of, Kenya, Somalia, Eritrea, Egypt, Saudi Arabia, Yemen, Pakistan, India, Sri Lanka, (France – French Polynesia, New Caledonia), Ecuador (including Galapagos Islands). **Other range States:** Mozambique, Sudan, Oman, Iran, Myanmar, China, Taiwan Province of China, Japan, Micronesia, Tahiti, USA, Mexico,

Bigeye thresher shark *Alopias superciliosus*

Parties to CMS: Argentina, Uruguay, Portugal (Madeira and Azores), Spain, Morocco, Senegal, Guinea, Angola, South Africa, Madagascar, Somalia, Sri Lanka, (France – New Caledonia), Australia, New Zealand, Ecuador (Galapagos Islands), Peru, Chile. **Other range States:** USA, Mexico, Bahamas, Cuba, Venezuela, Brazil, Maldives, Taiwan – Province of China, Viet Nam, Japan.

Common thresher shark *Alopias vulpinus*

Parties to CMS: Albania, Algeria, Argentina, Australia, Belgium, Canada (British Columbia), Chile, Cyprus, Côte d'Ivoire, Denmark, Djibouti, Ecuador (Galápagos), Egypt, France (French Polynesia, Guyana, New Caledonia, Réunion), Gambia, Germany, Greece, Guinea, Guinea-Bissau, India, Ireland, Israel, Italy, Kenya, Liberia, Libyan Arab Jamahiriya, Malta, Mauritania, Mauritius, Monaco, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Philippines, Portugal, Senegal, Slovenia, Somalia, South Africa, Spain (Canary Is.), Sri Lanka, Sweden, Syrian Arab Republic, Tanzania, United Republic of, Tunisia, United Kingdom (British Indian Ocean Territory/Chagos Archipelago), Uruguay, Yemen. **Other range States:** Bahamas, Brazil, China, Colombia, Cuba, Faroe Islands, French Guiana, Gabon, Indonesia, Japan, Kiribati, Korea, Republic of, Lebanon, Maldives, Mexico, Mozambique, Namibia, Nicaragua, Oman, Serbia and Montenegro, Sierra Leone, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turkey, USA (Hawaiian Is.), Venezuela, Viet Nam, Western Sahara.

Shortfin mako *Isurus oxyrinchus*

Parties to CMS: Algeria, Angola, Argentina, Australia, Bangladesh, Benin, Cameroon, Chile, Congo, Cook Islands, Cyprus, Côte d'Ivoire, Ecuador, Egypt, Eritrea, France (French Polynesia, Guadeloupe, Guyana, New Caledonia), Gambia, Ghana, Greece (East Aegean Is.; Kriti), Guinea, Guinea-Bissau, India, Ireland, Israel, Italy (Sardegna; Sicilia), Kenya, Liberia, Libyan Arab Jamahiriya, Madagascar, Morocco, New Zealand, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Portugal, Russian Federation, Senegal, Somalia, South Africa, Spain (Balears; Canary Is.), Sri Lanka, Tanzania, United Republic of, Tunisia, United Kingdom (Bermuda, British Virgin Islands, Gibraltar), Uruguay, Yemen. **Other range States:** Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, China, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Equatorial Guinea, Fiji, French Guiana, Gabon, Guatemala, Honduras, Indonesia, Iran (Islamic Republic of), Jamaica, Japan, Kiribati, Korea, Democratic People's Republic of, Korea,

Republic of, Macao, Malaysia, Maldives, Marshall Islands, Mexico, Micronesia, Federated States of, Mozambique, Myanmar, Namibia, Nauru, Nicaragua, Northern Mariana Islands, Oman, Palau, Papua New Guinea, Pitcairn, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Montenegro, Sierra Leone, Singapore, Sudan, Suriname, Taiwan – Province of China, Thailand, Timor-Leste, Tonga, Trinidad and Tobago, Turkey, Turks and Caicos Islands, Tuvalu, USA Venezuela, Viet Nam, US Virgin Islands, Western Sahara.

Longfin mako *Isurus paucus*

Parties to CMS: Cape Verde?, Ghana, Guinea-Bissau, Liberia, Madagascar, Mauritania, Morocco, Portugal, South Africa?, Spain (Canary Is.). **Other range States:** Brazil, Cuba, Japan, Micronesia, Federated States of, Nauru, Solomon Islands, Taiwan – Province of China, USA (California; Florida; Hawaiian Is.), Western Sahara.

Porbeagle shark *Lamna nasus*

Parties to CMS: Algeria, Argentina, Australia, Chile, Croatia, Cyprus, Denmark, Egypt, France (Kerguelen Islands), Germany, Greece, Guinea, Ireland, Italy, Libyan Arab Jamahiriya, Morocco, Netherlands, New Zealand, Norway, Portugal (Madeira, Azores), South Africa (Eastern Cape; Western Cape), Spain, Sweden, Tunisia, United Kingdom (Bermuda, Gibraltar), Uruguay. **Other range States:** Brazil, Canada, Greenland, Iceland, Namibia, USA, Russian Federation, South Georgia, Montenegro, Turkey.

Tope shark *Galeorhinus galeus*

Parties to CMS: Albania, Algeria, Angola, Argentina, Australia, Belgium, Cape Verde, Chile, Congo, Congo, The Democratic Republic of the, Croatia, Cyprus, Côte d'Ivoire, Denmark, Ecuador, France, Gambia, Germany, Greece, Guinea-Bissau, Israel, Italy, Libyan Arab Jamahiriya, Malta, Mauritania, Monaco, Netherlands, New Zealand, Nigeria, Norway, Peru, Portugal, Senegal, Slovenia, South Africa, Spain (Canary Is.), Sweden, Syrian Arab Republic, Tunisia, United Kingdom, Uruguay. **Other range States:** Bosnia and Herzegovina, Brazil, Canada (British Columbia), Faroe Islands, Gabon, Iceland, Lebanon, Mexico, Mozambique, Namibia, Serbia and Montenegro, Turkey, USA (California; Hawaiian Is.), Western Sahara.

Blacknose shark *Carcharhinus acronotus*

Parties to CMS: (France – Guyana), (United Kingdom – British Virgin Islands), (Netherlands – Aruba, Curaçao, Bonaire). **Other range States:** USA (North Carolina to Florida), Bahamas, Cuba, Honduras, Puerto Rico, Trinidad and Tobago, Venezuela, Brazil.

Silvertip shark *Carcharhinus albimarginatus*

Parties to CMS: Australia, Egypt, Eritrea, (France – New Caledonia), Kenya, Madagascar, Mauritius, Seychelles, South Africa, (United Kingdom – British Indian Ocean Territory/ Chagos Archipelago), Saudi Arabia, Yemen, Philippines, Ecuador (Galapagos Islands). **Other range States:** Mozambique, Sudan, Indonesia, Taiwan Province of China, Guam, Palau, Marshall, Solomon and Phoenix Islands, Tahiti, USA, Guatemala, Colombia, Mexico.

Bronze whaler *Carcharhinus brachyurus*

Parties to CMS: Albania, Algeria, Argentina, Australia (New South Wales; South Australia; Tasmania; Victoria; Western Australia), Chile?, Croatia, France, Greece, Italy, Malta, Mauritania, Morocco, New Zealand (North Is.), Peru, Portugal, South Africa, Spain (Canary Is.), Uruguay. **Other range States:** Bosnia and Herzegovina, Brazil, China (Hebei; Jiangsu; Liaoning; Shandong; Zhejiang), Equatorial Guinea, Japan (Honshu), Korea, Democratic People's Republic of, Korea, Republic of, Mexico (Baja California), Namibia, Russian Federation, Montenegro, Thailand?, Turkey, USA (California).

Spinner shark *Carcharhinus brevipinna*

Parties to CMS: Albania, Algeria, Angola, Argentina, Australia, Cape Verde, Croatia, Cyprus, Djibouti, Egypt, Eritrea, France (Guyana, Réunion), Gambia, Greece, Guinea, Guinea-Bissau, India, Israel, Italy, Jordan, Libyan Arab Jamahiriya, Madagascar, Malta, Mauritius, Monaco, Morocco, Nigeria, Philippines, Saudi Arabia, Senegal, Seychelles, Slovenia, Somalia, South Africa, Spain, Sri Lanka, Syrian Arab Republic, Togo, Tunisia, (United Kingdom – Gibraltar), Uruguay, Yemen. **Other range States:** Bahamas, Brazil, Cuba, Indonesia, Japan, Lebanon, Malaysia, Mexico, Mozambique, Nicaragua?, Oman, Papua New Guinea, Montenegro, Sierra Leone, Singapore, Sudan, Suriname?, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turkey, USA, Viet Nam.

Silky shark *Carcharhinus falciformis*

Parties to CMS: Angola, Australia, Bangladesh, Benin, Cameroon, Cape Verde, Chile, Congo, Congo, The Democratic Republic of the, Cook Islands, Côte d'Ivoire, Djibouti, Ecuador, Egypt, Eritrea, (France - French Polynesia (Clipperton I.), Guadeloupe, Guyana, Martinique, New Caledonia), Gambia, Ghana, Guinea, Guinea-Bissau, India, Israel, Jordan, Madagascar, Mauritius, (Netherlands – Aruba, Curaçao), New Zealand, Nigeria, Panama, Peru, Philippines, Portugal (Madeira), Samoa, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Somalia, South Africa, Spain (Canary Is.), Sri Lanka, Tanzania, United Republic

of, Togo, (United Kingdom – Cayman Islands, Montserrat, British Virgin Islands) Yemen. **Other range States:** American Samoa, Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, China, Colombia, Comoros, Costa Rica (Cocos I.), Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, French Guiana, Gabon, Grenada, Guam, Haiti, Honduras, Hong Kong, Indonesia, Jamaica, Japan, Kiribati, Lebanon, Malaysia, Maldives, Marshall Islands, Mexico (Revillagigedo Is.), Micronesia, Federated States of, Mozambique, Nicaragua, Northern Mariana Islands, Oman, Palau, Papua New Guinea, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Sudan, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turks and Caicos Islands, USA (Hawaiian Is.), Venezuela, US Virgin Islands.

Bull shark *Carcharhinus leucas*

Parties to CMS: Angola, Australia, Benin, Cameroon, Congo, Congo, The Democratic Republic of the, Côte d'Ivoire, Ecuador, (France - French Polynesia Guadeloupe, Guyana, Martinique, New Caledonia), Ghana, Guinea, Guinea-Bissau, India, Kenya, Liberia, Madagascar, Mauritius, Morocco, (Netherlands – Aruba, Curaçao), Nigeria, Panama, Peru, Philippines, Samoa, Sao Tomé and Príncipe, Senegal, Somalia, South Africa, Tanzania, United Republic of, Togo, (United Kingdom – Bermuda, Cayman Islands, Montserrat, Virgin Islands, British). **Other range States:** American Samoa, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, Fiji, French Guiana, Gabon, Grenada, Guatemala, Haiti, Honduras, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Kuwait, Malawi, Malaysia, Mexico, Mozambique, Nicaragua, Oman, Papua New Guinea, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turks and Caicos Islands, USA, Venezuela, Viet Nam, US Virgin Islands, Zimbabwe,

Blacktip shark *Carcharhinus limbatus*

Parties to CMS: Algeria, Angola, Australia, Bangladesh, Benin, Cameroon, Cape Verde, Congo, Congo, The Democratic Republic of the, Côte d'Ivoire, Djibouti, Ecuador (Galápagos), Egypt, Eritrea, France (French Polynesia Guadeloupe, Guyana, Martinique, New Caledonia), Gambia, Ghana, Guinea, Guinea-Bissau, India, Israel, Italy, Jordan, Kenya, Liberia, Libyan Arab Jamahiriya, Madagascar, Mauritius, Monaco, Morocco, (Netherlands – Aruba), Nigeria, Pakistan, Panama, Peru, Philippines,

Portugal (Madeira), Samoa, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Seychelles, Somalia, South Africa, Spain (Canary Is.), Sri Lanka, Syrian Arab Republic, Tanzania, United Republic of, Togo, Tunisia, Yemen, (United Kingdom – Bermuda, Cayman Islands, Montserrat, Virgin Islands, British). **Other range States:** American Samoa, Anguilla, Bahamas, Bahrain, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, China, Colombia, Comoros, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, French Guiana, Gabon, Grenada, Guatemala, Haiti, Honduras, Hong Kong, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Japan, Kuwait, Lebanon, Macao, Malaysia, Maldives, Marshall Islands, Mexico (Revillagigedo Is.), Mozambique, Myanmar, Nicaragua, Oman, Papua New Guinea, Puerto Rico, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Singapore, Sudan, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turks and Caicos Islands, United Arab Emirates, USA, Venezuela, Viet Nam, US Virgin Islands.

Oceanic whitetip shark *Carcharhinus longimanus*

Parties to CMS: Angola, Argentina, Australia (Christmas Island, Cocos (Keeling) Islands), Bangladesh, Benin, Cameroon, Cape Verde, Chile, Congo, The Democratic Republic of the, Cook Islands, Croatia?, Cyprus?, Côte d'Ivoire, Djibouti, Ecuador, Egypt, Eritrea, Finland?, (France – French Polynesia, Guadeloupe, Guyana, Martinique, New Caledonia, Réunion), Gambia, Ghana, Greece?, Guinea, Guinea-Bissau, India, Israel, Italy?, Jordan, Kenya, Liberia, Madagascar, Malta?, Mauritania, Mauritius, Morocco, (Netherlands – Aruba, Bonaire, Curaçao), Pakistan, Panama, Peru, Philippines, Portugal (Madeira), Samoa, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Seychelles, Slovenia, Somalia, South Africa (KwaZulu-Natal; Northern Cape; Western Cape), Spain (Canary Is.), Sri Lanka, Tanzania, United Republic of, Togo, Uruguay, (United Kingdom – Bermuda, British Indian Ocean Territory/Chagos Archipelago), Cayman Islands, Falkland Islands (Malvinas), Gibraltar?, Montserrat, Saint Helena, British Virgin Islands). **Other range States:** American Samoa, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Bouvet Island, Brazil, Brunei Darussalam, Cambodia, China, Colombia, Comoros, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, Ethiopia, Faroe Islands, Fiji, French Guiana, Gabon, Grenada, Guam, Guatemala, Haiti, Heard Island and McDonald Islands, Honduras, Hong Kong, Indonesia, Jamaica, Japan, Macao, Malaysia, Maldives, Marshall Islands, Mexico,

Myanmar, Nauru, Nicaragua, Oman, Palau, Papua New Guinea, Pitcairn, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Singapore, Solomon Islands, Sudan, Suriname, Taiwan – Province of China, Thailand, Tokelau, Tonga, Trinidad and Tobago, Turks and Caicos Islands, Tuvalu, USA (Alabama; California; Connecticut; Delaware; District of Columbia; Florida; Georgia; Hawaiian Is.; Louisiana; Maine; Maryland; Massachusetts; Mississippi; New Hampshire; New Jersey; New York; North Carolina; Rhode Island; South Carolina; Texas; Virginia), USA Minor Outlying Islands (Johnston I.; Wake Is.), Vanuatu, Venezuela, Viet Nam.

Dusky shark *Carcharhinus obscurus*

Parties to CMS: Australia, Portugal, ? (Madeira), Spain, Morocco?, Cape Verde, Senegal, South Africa, Madagascar?, Egypt, Saudi Arabia, Yemen, Eritrea, (France – New Caledonia), Chile? **Other range States:** USA, Bahamas, Cuba, Nicaragua; Brazil, Sierra Leone, Mozambique, Sudan, Japan, China, Viet Nam, Mexico.

Sandbar shark *Carcharhinus plumbeus*

Parties to CMS: Albania, Algeria, Angola, Australia, Benin, Cameroon, Cape Verde, Congo [vag], Congo, The Democratic Republic of the, Cyprus, Djibouti, Ecuador (Galápagos), Egypt, Eritrea, France (New Caledonia, Réunion), Gambia, Ghana, Greece, Israel, Italy, Jordan, Libyan Arab Jamahiriya, Madagascar, Malta, Mauritius, Monaco, Morocco, Nigeria, Panama, Portugal, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Seychelles, Somalia, Spain (Canary Is.), Syrian Arab Republic, Tanzania, United Republic of, Togo, Tunisia, Yemen. **Other range States:** Bahamas, Bahrain, Belize, Brazil, China, Colombia, Costa Rica, Cuba, Equatorial Guinea, Fiji, Gabon, Guatemala, Honduras, Hong Kong, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kuwait, Lebanon, Macao, Mexico, Mozambique, Nicaragua, Norfolk Island, Oman, Papua New Guinea, Qatar, Taiwan – Province of China, Trinidad and Tobago, Turkey, Tuvalu, United Arab Emirates, USA, Venezuela.

Night shark *Carcharhinus signatus*

Parties to CMS: Angola, Argentina, Benin, Cameroon, Congo, The Democratic Republic of the, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Senegal, Togo, Uruguay. **Other range States:** Brazil, Cuba, Sierra Leone, USA (Delaware; District of Columbia; Florida; Georgia; Maryland; North Carolina; South Carolina; Virginia).

Blue shark *Prionace glauca*

Parties to CMS: Albania, Algeria, Angola, Australia, Bangladesh, Benin, Cameroon, Cape Verde, Chile, Congo, Congo, The Democratic Republic of the, Cook Islands, Cyprus, Côte d'Ivoire, Denmark, Ecuador (Galápagos), Egypt, France (French Polynesia, Guadeloupe, Guyana, Martinique, New Caledonia, Réunion), Gambia, Germany, Ghana, Greece, Guinea, Guinea-Bissau, India, Ireland, Israel, Italy, Kenya, Liberia, Libyan Arab Jamahiriya, Madagascar, Malta, Mauritania, Mauritius (Rodrigues), Monaco, Morocco, (Netherlands – Aruba, Bonaire, Curaçao), New Zealand, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Portugal (Madeira), Samoa, Sao Tomé and Príncipe, Senegal, Seychelles, Slovenia, Somalia, South Africa, Spain (Canary Is.), Sri Lanka, Sweden, Syrian Arab Republic, Tanzania, United Republic of, Togo, Tunisia, United Kingdom (Bermuda, British Indian Ocean Territory, Montserrat, Saint Helena), Uruguay, Virgin Islands, British, Yemen. **Other range States:** American Samoa, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, Canada, China, Colombia, Comoros, Costa Rica (Cocos I.), Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, Fiji, French Guiana, Gabon, Grenada, Guam, Guatemala, Haiti, Honduras, Hong Kong, Indonesia, Iran (Islamic Republic of), Jamaica, Japan, Kiribati, Lebanon, Malaysia, Maldives, Marshall Islands, Mexico (Revillagigedo Is.), Micronesia, Federated States of, Mozambique, Myanmar, Namibia, Nauru, Nicaragua, Niue, Northern Mariana Islands, Oman, Palau, Papua New Guinea, Pitcairn, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Montenegro, Sierra Leone, Singapore, Suriname, Taiwan – Province of China, Thailand, Tokelau, Tonga, Trinidad and Tobago, Turkey, Turks and Caicos Islands, Tuvalu, USA, USA Minor Outlying Islands (Johnston I.; Wake Is.), Vanuatu, Venezuela, Viet Nam, US Virgin Islands, Wallis and Futuna Islands, Western Sahara,

Daggernose shark *Isogomphodon oxyrinchus*

Parties to CMS: Guyana. **Other range States:** Brazil, French Guiana, Suriname, Venezuela.

Crown or mallethead shark *Sphyma corona*

Parties to CMS: Ecuador, Panama, Peru. **Other range States:** Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, USA?.

Scalloped hammerhead shark *Sphyma lewini*

Parties to CMS: Algeria, Angola, Australia (Christmas Island, Cocos (Keeling) Islands), Bangladesh, Benin, Congo, Congo, The Democratic Republic of the, Cook Islands,

Côte d'Ivoire, Djibouti, Ecuador (Galápagos), Egypt, Eritrea, France (French Polynesia, Guadeloupe, Guyana, Martinique, New Caledonia), Gambia, Ghana, Guinea, Guinea-Bissau, India, Israel, Italy, Jordan, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Monaco, (Netherlands – Aruba, Curaçao), Pakistan, Panama, Philippines, Portugal (Madeira), Samoa, Sao Tomé and Príncipe, Saudi Arabia, Senegal, Seychelles, Somalia, South Africa, Spain (Canary Is.), Sri Lanka, Tanzania, United Republic of, Togo, Yemen (United Kingdom – Bermuda, Cayman Islands, Gibraltar, Montserrat, Virgin Islands, British). **Other range States:** American Samoa, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Brunei Darussalam, Cambodia, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Equatorial Guinea, Fiji, French Guiana, Gabon, Grenada, Guatemala, Honduras, Hong Kong, Indonesia, Iran (Islamic Republic of), Jamaica, Japan, Kiribati, Macao, Malaysia, Maldives, Mexico, Micronesia, Federated States of, Mozambique, Myanmar, Namibia, Nicaragua, Northern Mariana Islands, Oman, Papua New Guinea, Pitcairn, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sierra Leone, Singapore, Sudan, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turks and Caicos Islands, Tuvalu, USA (Hawaiian Is.), Venezuela, Viet Nam, US Virgin Islands, Western Sahara.

Scoophead shark *Sphyma media*

Parties to CMS: Ecuador, Panama, Peru, (France – Guyana). **Other range States:** Brazil, Colombia, Costa Rica, El Salvador, French Guiana, Guatemala, Honduras, Mexico, Nicaragua, Suriname, Trinidad and Tobago, Venezuela.

Great hammerhead shark *Sphyma mokarran*

Parties to CMS: Albania, Algeria, Australia, Bangladesh, Croatia, Cyprus, Djibouti, Ecuador (Galápagos), Egypt, Eritrea, France (French Polynesia, Guadeloupe, Guyana, Martinique, New Caledonia, Réunion), Gambia, Ghana, Greece, Guinea, Guinea-Bissau, India, Israel, Italy, Jordan, Kenya, Libyan Arab Jamahiriya, Madagascar, Mauritius, Monaco, (Netherlands – Aruba, Curaçao), Pakistan, Panama, Peru, Philippines, Portugal, Saudi Arabia, Senegal, Seychelles, Slovenia, Somalia, South Africa, Spain, Sri Lanka, Syrian Arab Republic, Tanzania United Republic of, Tunisia, (United Kingdom – Cayman Islands, Gibraltar, Montserrat, British Virgin Islands) Uruguay, Yemen. **Other range States:** Anguilla, Antigua and Barbuda, Bahamas, Bahrain, Barbados, Belize, Bosnia and Herzegovina, Brazil, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, French Guiana, Grenada, Guatemala, Honduras, Hong Kong, Indonesia, Iran (Islamic

Republic of), Iraq, Jamaica, Japan, Kuwait, Lebanon, Macao, Malaysia, Mexico, Micronesia, Federated States of, Mozambique, Myanmar, Oman, Papua New Guinea, Pitcairn, Puerto Rico, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Montenegro, Sudan, Suriname, Taiwan – Province of China, Thailand, Trinidad and Tobago, Turkey, Turks and Caicos Islands, United Arab Emirates, USA, Venezuela, Viet Nam, US Virgin Islands.

Bonnethead shark *Sphyma tiburo*

Parties to CMS: Ecuador, Panama, (France – Guyana), (Netherlands – Aruba). **Other range States:** Bahamas, Belize, Brazil, Costa Rica (Cocos I.), Cuba, El Salvador, French Guiana, Guatemala, Honduras, Mexico (Revillagigedo Is.), Nicaragua, Suriname, Trinidad and Tobago, USA, Venezuela.

Golden hammerhead shark *Sphyma tudes*

Parties to CMS: Uruguay, (France – Guyana). **Other range States:** Brazil, French Guiana, Suriname, Trinidad and Tobago, Venezuela.

Smooth hammerhead shark *Sphyma zygaena*

Parties to CMS: Algeria, Argentina, Australia, Cape Verde, Chile, Croatia, Cyprus, Côte d'Ivoire, Ecuador (Galápagos), Egypt, France, Gambia, Greece, Guinea, Guinea-Bissau, India, Ireland, Israel, Italy, Libyan Arab Jamahiriya, Madagascar, Malta, Mauritania, Mauritius, Monaco, Morocco, New Zealand (Kermadec Is.), Panama, Peru, Philippines, Portugal, Samoa [vag?], Senegal, Seychelles, Slovenia, South Africa, Spain (Canary Is.), Sri Lanka, Syrian Arab Republic, United Kingdom (Gibraltar and British Virgin Islands), Uruguay, **Other range States:** Albania, Bahamas, Belize, Bosnia and Herzegovina, Brazil, Canada, China, Cuba, Dominican Republic, Haiti, Hong Kong, Japan, Korea, Democratic People's Republic of, Korea, Republic of, Lebanon, Macao, Mexico, Mozambique, Namibia [vag?], Nicaragua [vag?], Norfolk Island, Puerto Rico, Russian Federation, Montenegro, Taiwan – Province of China, Turkey, Turks and Caicos Islands, Tuvalu, USA (Hawaiian Is.), Viet Nam, US Virgin Islands, Western Sahara.

Knifetooth sawfish *Anoxypristis cuspidata*

Parties to CMS: Australia, Bangladesh, India, Pakistan, Philippines, Somalia, Sri Lanka. **Other range States:** Andaman Islands, China, Indonesia, Japan, Korea Republic, Malaysia, Myanmar, Oman, Papua New Guinea, Singapore, Taiwan – Province of China, Thailand, Viet Nam.

Freshwater sawfish *Pristis microdon*

Parties to CMS: Angola, Australia, Benin, Cameroon, Cape Verde, Congo The Democratic Republic of, Congo, Cote d'Ivoire, Ecuador, (France Guyana, Réunion), Gambia, Ghana, Guinea Bissau, India, Kenya, Liberia, Madagascar, Mauritius, Nigeria, (Netherlands – Aruba, Curaçao), Philippines, Sao Tomé and Príncipe, Senegal, South Africa, Tanzania, Togo. **Other range States:** Brazil, Cambodia, Colombia, Equatorial Guinea, French Guiana, Gabon, Indonesia, Laos, Malawi, Malaysia, Mozambique, Myanmar, Nicaragua?. Papua New Guinea, Sierra Leone, Suriname, Thailand, Trinidad and Tobago USA, Venezuela, Viet Nam, Zimbabwe.

Smalltooth sawfish *Pristis pectinata*

Parties to CMS: Angola, Australia, Bangladesh, Benin, Cameroon, Cape Verde, Congo Dem. Rep. of, Congo, Cote d'Ivoire, Ecuador, (France – Guyana, Réunion), Gambia, Ghana, Guinea, Guinea Bissau, India, Israel, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Morocco, (Netherlands – Aruba, Curaçao), Nigeria, Pakistan, Peru, Philippines, Sao Tomé and Príncipe, Senegal, Somalia, (Spain – Canary Islands), Sri Lanka, South Africa, Syrian Arab Rep, Tanzania United Rep. of, Togo, (United Kingdom – Bermuda, Gibraltar). **Other range States:** Belize, Brazil, Colombia, Cuba, Equatorial Guinea, French Guiana, Gabon, Indonesia, Jamaica, Lebanon, Mexico, Mozambique, Myanmar, Namibia, Nicaragua, Oman, Sierra Leone, Suriname, Thailand, Trinidad and Tobago, USA, Venezuela, Western Sahara.

Large tooth sawfish *Pristis perotteti*

Parties to CMS: Ecuador, (France – Guyana). **Other range States:** Brazil, Colombia, French Guiana, Guyana, Mexico, Nicaragua, USA, Venezuela.

Common sawfish *Pristis pristis*

Parties to CMS: Angola, Australia, Benin, Cameroon, Cape Verde, Congo Dem. Rep. of, Congo, Cote d'Ivoire, Ecuador, Gambia, Ghana, Guinea, Guinea Bissau, India?, Liberia, Mauritania, Morocco, Nigeria, Panama, Sao Tomé and Príncipe, Senegal, Togo. Extinct from?: (United Kingdom – Gibraltar), Malta, Portugal (Madeira), Spain (Canary Islands). **Other range States:** Colombia, Costa Rica, El Salvador, Equatorial Guinea, Gabon, Guatemala, Honduras, Mexico, Nicaragua, Papua New Guinea, Western Sahara.



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