MEMORANDUM OF UNDERSTANDING ON THE CONSERVATION OF MIGRATORY SHARKS

CMS/Sharks/MOS2/Doc.8.2.5

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Agenda Item 8

PROPOSAL FOR THE INCLUSION OF ALL SPECIES OF MOBULA RAYS, GENUS *MOBULA*, IN ANNEX 1 OF THE CMS MEMORANDUM OF UNDERSTANDING ON THE CONSERVATION OF MIGRATORY SHARKS

(Prepared by the Secretariat)

1. The present proposal for the inclusion of all species of all species of Mobula rays, genus *Mobula*, in Annex 1 to the MOU represents the original proposal for inclusion of the species in CMS Appendix I and II, submitted as UNEP/CMS/COP11/Doc.24.1.10/Rev.1 followed by an Addendum providing additional information by the Government of Fiji to the 11th Meeting of the Conference of the Parties (CMS COP11). The proposal was subsequently adopted by the Parties.

2. As agreed at the 1st Meeting of the Signatories (MOS1) and in line with the procedure explained in CMS/Sharks/MOS2/Doc.8.2.1, the original proposal is now being resubmitted for consideration by the Second Meeting of the Signatories (MOS2). Signatories are requested to consider the inclusion of the genus *Mobula* in Annex 1 of the Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU) based on the information provided in this document.

3. The Advisory Committee of the MOU has presented a review of the proposal in CMS/Sharks/MOS2/Doc.8.2.10 in which the Committee recommends all nine species for inclusion in Annex 1.

PROPOSAL FOR INCLUSION OF SPECIES ON THE APPENDICES OF THE CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS

(Originally submitted as UNEP/CMS/COP11/Doc.24.1.10/Rev.1 to CMS COP11 by the Government of Fiji on 4 November 2014

A. PROPOSAL: Inclusion of mobula rays, Genus *Mobula*, in Appendix I and II

B. PROPONENT: Government of Fiji

C. SUPPORTING STATEMENT:

1. Taxon

1.1 **Class:** Chondrichthyes, subclass Elasmobranchii
1.2 **Order:** Rajiformes
1.3 **Subfamily:** Mobulinae
1.4 **Genus and species:** All nine species within the Genus *Mobula* (Rafinesque, 1810): *Mobula mobular* (Bonnaterre, 1788), *Mobula japanica* (Müller & Henle, 1841), *Mobula thurstoni* (Lloyd, 1908), *Mobula tarapacana* (Philippi, 1892), *Mobula eregoodootenkee* (Bleeker, 1859),*Mobula kuhlii* (Müller & Henle, 1841), *Mobula hypostoma* (Bancroft, 1831), *Mobula rochebrunei* (Vaillant, 1879), *Mobula munkiana* (Notarbartolo-di-Sciara, 1987) and any other putative *Mobula* species.

Scientific Synonyms:

M. mobular: *Raja diabolus (Shaw, 1804), Raja giorna* (Lacépède, 1802).
M. japanica: *Mobula rancureli* (Cadenat, 1959).
M. thurstoni: *Mobula lucasana* (Beebe & Tee-Van, 1938).
M. tarapacana: *Mobula coilloti* (Cadenat & Rancurel, 1960) & *Mobula formosana* (Teng 1962).
M. eregoodootenkee: *Mobula diabolus* (Whitley, 1940).
M. kuhlii: *Mobula draco* (Günther, 1872), *Cephaloptera kuhlii* (Müller & Henle, 1841) & *M. diabolus* (Smith, 1943).
M. hypostoma: *Ceratobatis robertsii* (Boulenger, 1897), *Cephalopterus hypostomus* (Bancroft, 1831).
M. rochebrunei: *Cephaloptera rochebrunei* (Vaillant, 1879).
M. munkiana: None.

1.5 **Common Names:**

M. mobular: English: Giant Devil Ray. French: Mante. Spanish: Manta.
M. japanica: English: Spinetail Mobula, Spinetail Devil Ray, Japanese Devil Ray. French: Manta Aguillat. Spanish: Manta De Espina, Mante De Aguijón.
M. thurstoni: English: Bentfin Devil Ray, Lesser Devil Ray, Smoothtail Devil Ray, Smoothtail Mobula, Thurton’s Devil Ray. French: Mante Vampire. Spanish: Chupasangre, Chupa Sangre, Diablo, Diablo Chupasangre, Diablo Manta, Manta, Manta Diablo, Manta Raya, Muciélago.

M. tarapacana:	English: Box Ray, Chilean Devil Ray, Devil Ray, Greater Guinean Mobula, Sicklefin Devil Ray, Spiny Mobula. French: DiableGéant De Guinée, ManteChilienne. Spanish: Diabolo Gigante De Guinea, Manta Cornuada, Manta Cornuda, Manta Raya, Raya Cornuda, Vaquetilla.
M. eregoodootenkee:	English: Pygmy Devil Ray, Longhorned Devil Ray.
M. kuhlii:	English: Shortfin Devil Ray, Lesser Devil Ray, Pygmy Devil Ray. French: Petit Diable
M. hypostoma:	English: Atlantic Devil Ray, Lesser Devil Ray. French: DiableGéant. Spanish: MantadelGolfo.*M. rochebru*nei: English: Lesser Guinean Devil Ray. French: Petit Diable de Guinée. Spanish: Diablito de Guinea.
M. munkiana:	English: Munk's Devil Ray, Pygmy Devil Ray, Smoothtail Mobula. French: Mante De Munk. Spanish: Diabolo Manta, Manta Raya, Manta Violácea, Tortilla.

Overview

i. The Genus *Mobula*, (including *Mobula mobular, Mobula japanica, Mobula thurstoni, Mobula tarapacana, Mobula eregoodootenkee, Mobula kuhlii, Mobula hypostoma, Mobula rochebrunei, Mobula munkiana* and any putative species of *Mobula*), a globally distributed and highly migratory group of species, is proposed here for listing on CMS Appendix I and II. All of these ray species would benefit from strict range state protections under a CMS Appendix I listing as well as collaborative management initiated under a CMS Appendix II listing, since they are all low productivity, commercially exploited aquatic species that are in decline. In addition, international cooperation under the Appendix II listing would be greatly facilitated by adding all species of the Subfamily Mobulinae (genus *Manta* and genus *Mobula*) to Annex I of the CMS Sharks MoU. Increasing international trade in Mobulinae gill plates, and to a lesser degree skins and cartilage, and unregulated bycatch in industrial and artisanal fisheries have led to significant rates of decline in population sizes in recent years.

Since fifty-four of the CMS parties are range states for one or more of the Mobula species, representing a majority of the global ranges for these species, the range state protections called for under a CMS Appendix I listing are urgently needed to avoid further population declines. Methods have already been developed to aid CMS Parties implement the listings by releasing bycaught rays alive. Collaborative management initiated under a CMS Appendix II listing would also greatly benefit these species by ensuring international cooperation to collect population data and identify the most critical habitats. The current research provides troubling new evidence of increased threats from rapidly escalating demand for Mobula gill plates in China, expansion of targeted fisheries, as well as large incidental catch in industrial tuna fisheries with very low post release survival. In light of this new evidence combined with the extremely low reproductive capacity of these species, continued lack of population data, lack of conservation or management measures, and the potentially much higher value from sustainable non-consumptive ecotourism compared with fisheries, we strongly urge the Parties to act fast in the spirit of the precautionary approach to include these highly vulnerable species on Appendix I and II.

ii. The Genus *Mobula* are slow-growing, large-bodied migratory animals with small, highly fragmented populations that are sparsely distributed across the tropical and temperate oceans of the world. *Mobula* rays are likely to be among the least fecund of all elasmobranchs, however scientific data on the life history strategies of these species is severely lacking to date (Couturier *et al.* 2012, Dulvy *et al.* 2014). Their biological and behavioural characteristics (low reproductive rates, late maturity and aggregating behaviour) make these species particularly vulnerable to over-exploitation in fisheries and extremely slow to recover from depletion.

iii. *Mobula* rays are caught in commercial and artisanal fisheries throughout their global warm water range in the Atlantic, Pacific and Indian Oceans. Directed fisheries primarily utilize harpoons and nets, while significant bycatch occurs in purse seine, gill and trawl net fisheries targeting other species, including on the high seas. A recent surge in demand for mobula ray products (gill plates) in China and reports of increased direct fishing effort in key range states suggests an urgent and escalating threat to these species.

iv. There have been no stock assessments, official monitoring, catch limits or management of *Mobula spp.* fisheries in the waters of range states with the largest fisheries. Regional Fishery Management Organizations (RFMOs) have not taken any measures to minimize high seas bycatch of *Mobula spp.* Incidental landings and discards are rarely recorded at the species level. Several species within the genus are legally protected in a few countries and in some small Marine Protected Areas (MPAs), though throughout most of their range most *Mobula* species have little or no protection.

v. While there are no historical baseline population data for the genus, recent declines have been reported in range states for several species (Doumbouya 2009, Mohanraj *et al.* 2009, Llanos *et al.* 2010, Fernando and Stevens in prep, Anderson *et al.* 2010; Heinrichs *et al.* 2011, Setiasih *et al.* in prep, Couturier *et al.* 2012, White *et al.* 2014, Abudaya *et al.* 2014).

vi. While much of the published data on fisheries and trade of *Mobula spp*. refers to *M. japanica* or *M. tarapacana*, the other seven species in the genus: *M. mobular, M. thurstoni, M. eregoodootenkee, M. kuhlii, M. hypostoma, M. rochebrunei, M. munkiana* and any other putative species of *Mobula* are likely to also be at risk of overexploitation due to their similar biological and behavioural characteristics. The lack of specific records of *Mobula* landings at the species level, mainly as a result of the difficulty in distinguishing between the different *Mobula spp.* in the field makes assessment of the conservation status of individual *Mobula* species extremely difficult.

vii. Following consideration of a taxonomic review prepared by the IUCN SSC Shark Specialist Group (Fowler & Valenti/SSG 2007), the CMS Scientific Council agreed in March 2007 (CMS SCC14) that these threatened migratory species meet the criteria for listing on the Appendices and should be considered by the Conference of Parties to CMS.

viii. *M. mobular* is listed as Endangered on the IUCN Red List of Threatened Species; *M. rochebrunei* as Vulnerable; *M. japanica, M. thurstoni, M. eregoodootenkee,* and *M. munkiana* as Near Threatened; and *M. tarapacana, M. kuhlii,* and *M. hypostoma* as Data Deficient. *M. japanica* and *M. tarapacana* assessed as Vulnerable in SE Asia where these species are increasingly targeted (White *et al.* 2006a).

It is considered that the IUCN Red List of Threatened Species categories are sufficiently developed and widely understood as to recommend them for use in assessing the appropriateness of listing a taxon to CMS Appendix I. It is suggested that a taxon, which is assessed as "Extinct in the Wild", "Critically Endangered", "Endangered" or "Vulnerable" using the IUCN Red List criteria, should qualify for listing on Appendix I. It is also suggested that migratory species with a status of EW, CR, EN, VU or NT should 'automatically' qualify for consideration for listing to Appendix II. Therefore six of the nine species of *Mobula* rays should 'automatically' qualify for one or both of the Appendices, while the other 3 species are assessed as Data Deficient, most likely due to the rarity of observation of these species and lack of data at the species level. Due to the difficulty in distinguishing *Mobula* rays at the species level, assessment of the conservation status of individual *Mobula* species is extremely difficult, and hence both Appendix I and II listing for the genus *Mobula* is strongly recommended as a precautionary measure (and also listed due to the classification of "look-alike species" as used under the current CITES Appendices Listing criteria). In the recent study led by the IUCN Shark Specialist Group on the extinction (Dulvy *et al.* 2014), it was found that for the 1,041 species of sharks, rays and chimaeras assessed, 487 were classed as Data Deficient. By applying the findings for data sufficient species to those deemed Data Deficient, the experts estimate that one-quarter of all shark, ray, and chimaera species are actually Threatened (249 species, 24% of 1,041). Also, rays make up 5 out of the 7 of the most threatened families of cartilaginous fishes.

2. Biological data

Genus *Mobula* comprises nine recognized species that attain a WD from 1 to 5 m: the giant devil ray *Mobula mobular* (Bonnaterre, 1788), the spinetail devil ray *Mobula japanica* (Müller & Henle, 1841), the bentfin devil ray *Mobula thurstoni* (Lloyd, 1908), the Chilean devil ray *Mobula tarapacana* (Philippi, 1892), the pygmy devil ray *Mobula eregoodootenkee* (Bleeker, 1859), the shortfin devil ray *Mobula kuhlii* (Müller & Henle, 1841), the Atlantic devil ray *Mobula hypostoma* (Bancroft, 1831), the lesser Guinean devil ray *Mobula rochebrunei* (Vaillant, 1879) and Munk's devil ray *Mobula munkiana* (Notarbartolo-di- Sciara, 1987). Although the existence of mobulids has been documented since at least the 17th century (Willughby & Ray, 1686), there is surprisingly little information available on their biology and ecology. The most recent, detailed taxonomic description of the recognized *Mobula spp*. can be found in the study of Notarbartolo-di-Sciara (1987b), although a focused genetic study on the Genus *Mobula* is currently near completion (Poortvliet et al, pers. comm.). While the genus *Mobula* currently comprises nine recognized species, at least 29 different species have been proposed previously (Notarbartolo-di-Sciara, 1987b; Pierce & Bennett, 2003; Froese & Pauly, 2010).

Species-specific reports are often mixed and can be confusing, particularly without adequate descriptions or photographs. Care should be taken when using reports or accounts of one species to ensure that the authors are not referring to another *Mobula spp*., or possibly a *Manta spp*.

All *Mobula spp.* are large-bodied, migratory, planktivorous and ichthyophagous rays. *M. mobular* is the largest of the genus *Mobula*, but often confused with *M. japanica,* which grows to a maximum of 3100 millimetres wingspan (disc width or DW; Notarbartolo-di-Sciara 1987), with males maturing at 2016 millimetres wingspan and females at >2360 millimetres (Notarbartolo-di-Sciara 1987). *M. tarapacana* grows to a maximum of 3700 millimetres wingspan (disc width or DW; Compagno & Last 1999), with males maturing at 2340-2522 millimetres wingspan. The size at maturity for females is unknown (White et al. 2006) but it is likely to be >2700 millimetres.

All *Mobula spp.* are planktivorous and ichthyophagous with some species favouring certain creatures. *M. thurstoni's* diet is highly specialized; the euphausid Nyctiphanes simplex accounts for the vast majority of observed prey items but mysids (*Mysidium* spp.) are also common. *M. japanica* feed mainly on euphausiid shrimps (Sampson et al. 2010, Fernando & Stevens, in prep.), while *M. tarapacana and M. eregoodootenkee* appear to specialize in catching small schooling fishes, using rapid acceleration to lunge through densely packed schools of fish (G.

Stevens, pers. comm.).

Mobula rays are likely to be among the least fecund of all elasmobranchs, however scientific data on the life history strategies of these species is severely lacking to date (Couturier *et al*. 2012, Dulvy *et al.* 2014). They typically give birth to a single pup with a likely gestation period of approximately one year, placing them into FAO’s lowest productivity category.

2.1 Distribution and range states (current and historical)

M. japanica, M.tarapacana and *M. thurstoni* have worldwide distributions, with all three species reported from both the tropical and temperate waters of the Pacific, Atlantic and Indian Oceans (White *et al*. 2006, Couturier *et al*. 2012, Bustamante *et al*. 2012). Within this broad range populations of all three species are thought to be sparsely distributed and highly fragmented, likely due to their resource and habitat needs. *M. tarapacana* and *M. japanica* have been observed underwater travelling in schools (G. Stevens, pers. comm.) and all three species have also been observed underwater as solitary individuals (G. Stevens, pers. comm.). Fishermen frequently report catching large numbers of *M. japanica* in gill nets during a single set, supporting the observations that this species often travels in groups (Fernando et al. in prep.).

Aggregations of *M. tarapacana* congregate around the seamounts at the Princess Alice Bank in the Azores during the summer months of June-September. Many of the females observed during this time appear to be close to parturition and this site probably serves as an important birthing and mating ground for *M. tarapacana* in the North Atlantic Ocean (E. Villa, pers. comm.). Similar aggregations of this species are also reported from the St Peter & St Paul's Archipelago in Brazil (R.Bonfil, pers. comm.) and around Cocos Island of Costa Rica (E. Herreño, pers. comm.).

M. mobular occurs in offshore, deep waters and occasionally in shallow waters throughout the Mediterranean Sea (with the exception of the northern Adriatic) and possibly in the nearby North Atlantic, in depths ranging from few tens of metres to several thousands (Bradai and Capapé 2001). *M. munkiana* is an inshore devil ray known to form large aggregations, which is endemic to the Eastern Pacific from the Gulf of California, México to Peru. *M. hypostoma* is endemic to the western Atlantic and found from North Carolina (USA) to northern Argentina, including the Gulf of Mexico and Greater and Lesser Antilles. It is primarily pelagic but also occurs in coastal waters. *M. rochebrunei* is found in the eastern Atlantic along the West African coastline from Mauritania to Angola. *M. eregoodootenkee* is widely distributed through the coastal continental waters of the tropical Indo-West Pacific. This species has been reported from the Western Indian Ocean, Eastern Indian Ocean and Western Central Pacific. It occurs in the Red Sea, Arabian Sea and Persian Gulf to South Africa and the Philippines, north to Vietnam, and south to southeast Queensland and northern Western Australia. It has not been recorded from oceanic islands. *M. kuhlii* has a similar range to *M. eregoodootenkee*. Although records of its occurrence are sparser, it does occur around oceanic islands, such as the Maldives archipelago in the Indian Ocean.

See Annexes I & II for distribution maps, range states and FAO fishing areas of all *Mobula spp*.

2.2 Population estimates and trends

All species within the genus *Mobula* are slow-growing, migratory animals with small, highly fragmented populations that are sparsely distributed across the tropical and temperate oceans of the world. Global population numbers are unknown, but thought to be declining across their range. Their biological and behavioural characteristics (low reproductive rates, late maturity and aggregating behaviour) make these species particularly vulnerable to over- exploitation in fisheries and extremely slow to recover from depletion.

Global population sizes of all species are unknown and research into mobulid population trends is in its infancy (Couturier *et al.* 2012). Without significant natural markings on which to base photo-ID studies (which are used to determine population sizes in genus *Manta*), efforts to quantify numbers of *Mobula spp.* are effectively limited to fisheries data, aerial surveys and studies that employ conventional tags. Such approaches have yet to be employed on these species or have so far not produced reliable population estimates for these species. Though estimates of the world's global catch of mobulids have increased from 900 t in 2000 to >3300 t in 2007 (FAO, 2009; Lack & Sant, 2009), dramatic declines in mobulid catches have been documented in some areas (e.g. Philippines: Alava *et al.*, 2002) suggesting serial depletions through over-fishing (Couturier *et al.* 2012).

In June 2014, the IUCN Shark Specialist Group (SSG) convened a Manta and Devil Ray Global Conservation Strategy Workshop to review the status of all mobulid species and develop detailed conservation actions required to conserve these species globally. The SSG considers devil rays to be a key target species for a Species Conservation Strategy as they are highly vulnerable to overexploitation and still inadequately understood.

The working group agreed that updated IUCN Red List assessments for all nine Mobula species should be completed as soon as possible as a high priority action item. Currently, 2 of the Mobula species are assessed as Endangered or Vulnerable globally (*M. Mobular* – EN with a decreasing population trend (Notarbartolo et al. 2006); *M. rochebrunei* – VU with an unknown population trend (Valenti et al. 2009)), 4 species are assessed as Near Threatened (*M. japanica* with an unknown population trend (White et al. 2006); *M. thurstoni* with an unknown population trend (Clark et al. 2006), *M. eregoodootenkee* with an unknown population trend (Pierce et al. 2003), *M. munkiana* with an unknown population trend (Bizzarro et al. 2006)) and 3 as Data Deficient (*M. tarapacana* with an unknown population trend (Clark et al. 2006), *M. kuhlii* with a decreasing population trend (Bizzarro et al. 2009) and *M. hypostoma* with an unknown population trend (Bizzarro et al. 2009)).

Three of the NT or DD species are assessed as VU in SE Asia (*M. tarapacana* (2006), *M. japanica* (2006), *M. thurstoni* (2006)), and these assessments all noted that "VU listings may also be warranted elsewhere if future studies show declines in populations where fished." The NT assessment for *M. eregoodootenkee* (2003) noted that "Fishing pressure could severely impact this species, and given the lack of quantitative data available it is prudent to assign the species with an assessment of Near Threatened (close to Vulnerable A3d) until its population is otherwise proven to be stable". The NT assessment for *M. munkiana* (2006) concluded that "Life history characteristics, limited distribution, and exposure to many fisheries due to its highly migratory nature will likely result in designation of the species as Vulnerable should additional fisheries details become available." The DD assessment for *M. kuhlii* (2007) noted "Given that this species is of low reproductive potential and is exploited in intensive target and bycatch fisheries in parts of its range, further information is urgently required. Obtaining such information to enable reassessment of the species should be a priority".

While fishery data at the species level is still sparse for *Mobula* species, there is new evidence of increasing threats that was not available at the time of these assessments. Given the new evidence of escalating demand, increased fishing pressure and low post-release survival (see section 3) it is likely that most, or all, of the Mobula species now meet the IUCN Red List criteria for Vulnerable or Endangered. New data on the scale and impacts of mobulid fisheries in Sri Lanka, India, Indonesia, the Philippines, Peru, and Guinea strongly suggests inferred or projected declines of ≥30% or more for the Mobula species with migratory ranges within the reach of these fisheries. While the generation time for Mobula species is not known, it is estimated at 25 years for the closely related genus Manta species, suggesting the declines observed took place over only a fraction of one generation.

2.3 Habitat (brief description and tendencies)

The role of *Mobula spp.* in their ecosystem is not fully known but, as large filter feeders, it may be similar to that of the smaller baleen whales. As large species, which feed low in the food chain, *Mobula spp.* can be viewed as indicator species for the overall health of the ecosystem. Studies have suggested that removing large, filter-feeding organisms from marine environments can result in significant, cascading species composition changes (Springer *et al*. 2003). In addition, like other large planktivorous marine organisms *Mobula spp.* are suspected on death to significantly contribute to food falls supporting fauna in deep water environments and increase the transfer efficiency of the biological pump of carbon from the surface of the oceans to the deep sea (Higgs et al. 2014).

M. japanica and *M. tarapacana* appear to be seasonal visitors along productive coastlines with regular upwelling in oceanic island groups, and near offshore pinnacles and seamounts. The southern Gulf of California is believed to serve as an important spring and summer mating and feeding ground for adults *M. japanica* (Notarbartolo-di-Sciara 1988, Sampson et al. 2010). Pupping appears to take place offshore (Ebert 2003) possibly around offshore islands or seamounts. *M. tarapacana* are known to make seasonal migrations into the Gulf of California during the summer and autumn, and sightings are rare in winter months (Notarbartolo-di-Sciara 1988). *M. japanica* and *M. tarapacana* are commonly found throughout the year in the Indian Ocean waters around Sri Lanka (Fernando & Stevens 2011).
Observations of *M. mobular* by Notarbartolo di Sciara and Serena (1988) suggest that in the northern Mediterranean the species gives birth in summer. The gestation period is still largely conjectural, but could be one of the longest known in Chondrichthyans (Serena 2000).

M. munkiana, a schooling species typically found in shallow coastal waters, is known to form large, highly mobile aggregations (Notarbartolo-di-Sciara 1987, 1988). Location of copulation is unknown but parturition has been reported in Bahía de La Paz during the months of May and June (Villavicencio-Garayzar 1991). *M. thurstoni* is usually observed in the pelagic zone within shallow, neritic waters (<100 m) (Notarbartolo-di-Sciara 1988). Mating, parturition, and the early life history of this species are reported to take place in shallow water during summer months and possibly early fall (Notarbartolo-di-Sciara 1988). The southern Gulf of California is considered an important feeding and mating ground for *M. thurstoni* and segregation by size and sex is seasonal, with all size classes and sexes appearing together during summer (Notarbartolo-di-Sciara 1987).

M. hypostoma occurs in coastal and occasionally oceanic waters (McEachran and Carvalho 2002), and frequently travels in schools (Robbins et al. 1986). *M. rochebrunei* is a pelagic species usually encountered in groups swimming either at the surface or close to the bottom (McEachran and Seret 1990). Primarily a shelf pelagic species found in continental coastal areas and around oceanic islands groups *M. kuhlii* is uncommon inshore (Compagno and Last 1999, G. Stevens pers. comm.). *M. eregoodootenkee* is not known to penetrate the epipelagic zone; mating and birthing occur in shallow water, and juveniles remain in these areas. This species feeds on planktonic organisms and small fish (Michael 1993).

2.4 Migration (types of movement, distances, proportion of the population that migrates)

Mobula species, especially *M. japanica*, *M. tarapacana* and *M. thurstoni* demonstrate long migrations across national jurisdictional boundaries, both along the coastline between adjacent territorial waters and national EEZs and from national waters into the high seas Molony 2005, Perez and Wahlrich 2005, White et al. 2006, Zeeberg et al. 2006, Pianet et al. 2010, Couturier et al. 2012.).

Satellite tagging data from *M. japanica* captured in Baja California Sur documented long-distance movement of these mobulid rays, utilizing a broad geographic range including coastal and pelagic waters from southern Gulf of California, the Pacific coastal waters of Baja California and the pelagic waters between the Revillagigedos Islands and Baja California (Croll *et al.* 2012.).

Specifics of *M. munkiana* migratory patterns are largely unknown or speculative (Notarbartolo-di-Sciara 1988, J. Bizzarro pers. obs). Migrations are likely driven by temporal changes in water temperature with local movements presumed to be associated with the distribution and abundance of planktonic crustaceans, especially mysid shrimp (*Mysidium spp.*).

New data from tagging *M. tarapacana* in the Azores provides the first evidence of large-scale movement and deep diving behaviour of this species (Thorrold *et al.* 2014). Individuals traveled straight line distances up to 3,800km over 7 months, crossing through oligotrophic tropical and subtropical waters.

3. Threats data

3.1 Direct threats to the population (factors, intensity)

The greatest threat to *Mobula spp.* is unmonitored and unregulated directed and bycatch fisheries. This is increasingly driven by the international trade demand for their gill plates, used in an Asian health tonic purported to treat a wide variety of conditions. A new report by Whitcraft *et al.* (2014) documents the alarming escalation in demand for mobulid gill plates in China. The estimated number of mobulids represented in Guangzhou, China gill plate markets increased almost threefold from 2010 to 2013. The Mobula species most prevalent in the gill plate markets were *M. tarapacana* (~ 22,000 represented) and *M. japanica* and other unidentified *Mobula spp.* (~ 120,000 represented). (Note that the gill plates from Manta species and *M. tarapacana* are easily identifiable, while the smaller gill plates from *M. japanica* and other species are difficult to distinguish visually.)

Prices for *M. tarapacana* gill plates increased by ~ 30% from an average of US$172 per kg in 2010 to US$223 per kg in 2013, while prices for *M. japanica* and other species increased by over 40% from an average of US$133 per kg in 2010 to US$189 in 2013. The study also reported intensified marketing efforts by gill plate traders and continued increasing consumer demand. In addition, the identification of high levels of heavy metal contamination including arsenic, cadmium, mercury and lead in many of the samples tested highlights the threat this trade poses to consumers, many of whom are children and breast-feeding mothers (the product is recommended as a remedy to improve lactation, to help children recover from chicken pox, and even for “hyperactive babies”).

This rapid escalation of the market for mobula ray products suggests an urgent threat to these slow-reproducing species. The high value of gill plates has driven increased target fishing pressure for all *Mobula spp*., predominantly *M. japanica* and *M.tarapacana*, in key range states, with the largest landings observed in Indonesia, Sri Lanka, India and Peru:
Significant declines in the number and size of *Mobula spp.* caught in Indonesian target fisheries in Lombok are reported over the past decade (Heinrichs et al. 2011, Setiasih et al. in prep.) despite

evidence of increased directed fishing effort (Setiasih et al. in prep). Surveys from 2007 to 2011 estimated annual landings of 908 (Heinrichs et al. 2011, Setiasih et al. in prep.), compared with 1244 during 2001-2005 surveys (White et al. 2006) (27% decline in 6 years), with catches comprising *M. japanica*, *M. tarapacana*, *M. thurstoni,* and *M. kuhlii*.

In Sri Lanka, fishermen have reported declines in *Mobula spp.* catches over the past 5 to 10 years as targeted fishing pressure has increased (Fernando and Stevens in prep, Anderson et al. 2010). Data collected since 2011 shows a steady decline in both 2013 and 2014, although fishing pressure has either remained stagnant or increased (Fernando and Stevens, in prep). Anecdotal data from 2014 indicates fishermen reporting steep declines in mobulid landings when compared to 2013, without any decrease in fishing pressure (Fernando, pers. comm.).

In India, Mobulid catches have declined in several regions, including Kerala, along the Chennai and Tuticorin coasts and Mumbai, despite increased fishing effort (Couturier *et al.* 2012, Mohanraj *et al.* 2009). A total of 1994 individuals were caught over 18 months of survey from July 2012 to December 2013, of which 95% were *M. japanica* (Mohanraj *et al.*, pers.comm.)

In Peru, reported landings of *Mobula spp*. fluctuated considerably from year to year, but appear to show a significant downward trend with an apparent peak of 1,188t in 1999 (Llanos et al. 2010) to 135t in 2013 (IMARPE 2013 No. 9). The IMARPE landings report describe all the mobulas landed as *M. thurstoni*, but this information is likely incorrect. Recent fishery surveys conducted by Planeta Oceano observed landings in northern Peru of *M. japanica* most frequently, followed by *M. munkiana* and *M. thurstoni*, with probable landings of *M. tarapacana* based on physical characteristics reported.

In Bohol, Philippines, mobulid fishing grounds expanded dramatically from small coastal waters within 5 km of shore from the 1900s to 1960s to offshore waters extending over the jurisdiction of municipal waters (15 km from the coastline) following fleet modernization (or motorization) in 1970s. By 2013-14, the mobulid fishing grounds from Bohol had contracted to a smaller area in the north west of the Bohol Sea, suggesting a decreased mobulid fishing effort lead by a possible depletion of fishing grounds and decrease in financial viability of the fishery, compared to historical records (A. Ponzo, unpublished data).

In Guinea, West Africa, reported annual catch of mobulids (predominantly *M. rochebrunei* and *M. thurstoni*) based on 3 survey sites (Kassa, Kamsar and Katcheck) was 18t in 2004, and decreased significantly in subsequent years to 4t in 2005, 3t in 2006, 8t in 2007, and 7t in 2008 despite increased fishing efforts and fishermen adopting new techniques (Doumbouya, 2009). In 2009, annual catch of mobulids was reported 17t, which could be explained by the fact that fishing fleets expanded their range to the waters of Sierra Leone and Liberia (Doumbouya, 2009).

Significant decline of 78% in the abundance of mobula rays at Cocos Island, Costa Rica have been reported over the past 21 years (White et al., 2014). Cocos Island is one of the world’s oldest MPAs, yet faces pressures from multi-nation fisheries in the eastern tropical Pacific, which is well within the home ranges for these species (White et al., 2014).

In Gaza, Palestine, a new report documents directed catch and bycatch of *M. mobular* with 370 recorded in 2013. While the mobulas are primarily utilized for their meat, this report confirms the emergence of a gill plate export trade from this region in the past three years (Abudaya et al. 2014). Liberia reported ‘Mantas, devil rays nei’ catches of 1,470t to the FAO from 2002-11 in the Eastern Central Atlantic (Mundy-Taylor and Crook 2014).

Mobulid gill plate traders in Guangzhou, China frequently reported Vietnam, Malaysia and China as source regions, suggesting the occurrence of undocumented and unregulated mobulid fisheries in these countries. Other source regions reported include the Middle East, South America, Brazil, South Africa and Japan, especially troubling since it suggests that the gill plate trade has begun to spread beyond SE Asia to areas in which it has not been previously reported (Whitcraft *et al.* 2014).

The recent rise in demand for gill plates has resulted in dramatic increases in fishing pressure, with many former by-catch fisheries having become directed commercial export fisheries (White *et al.* 2006, Fernando and Stevens in prep, Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Dewar 2002), and there are now also reports of mobulas being 'gilled' (gills removed and the carcasses discarded at sea) (D. Fernando pers.comm.). Targeted *Mobula* spp. fisheries have been observed in Peru: ~8,000 per year (Heinrichs *et al.* 2011), China (Zhejiang): ~2,000 per year (Heinrichs *et al.* 2011) and Mexico (Notarbartolo- di-Sciara 1987b). Gill nets and harpoons are used to target mobulids seasonally in the Gulf of California on the West coast of Mexico (Notarbartolo- di-Sciara, 1987b). Targeted fisheries are reported in Sri Lanka: ~48,357 *M. japanica* and 6,691 *M.tarapacana* per year (Fernando and Stevens in prep), India: ~1,215 *M. japanica* per year (Heinrichs *et al*. 2011), Thailand (R. Parker, pers. comm.) and Myanmar (J. Williams, pers. comm.).

M. japanica are directly targeted using harpoons in the Gulf of California and represented 30% of the catch of mobulids observed during a survey of artisanal landings in Bahia de la Ventana, south western Gulf of California (Notarbartolo-di-Sciara 1988). *M. thurstoni* represented 58% of the catch. There is still an active mobulid fishery in the southwest Gulf of California, south of La Paz and devil rays are also landed in nearshore artisanal elasmobranch fisheries throughout the Gulf of California. *M. japanica* and *M.tarapacana* fisheries have been observed in Indonesia in Lamakera and Lamalera (Nusa Tenggara) and Tanjung Luar (Lombok), Cilacap (Central Java) and Kedonganan (Bali) (Dewar 2002, White *et al*. 2006, Barnes 2005, Heinrichs *et al.* 2011, Setiasih *et al.* in prep) with ~1915 & ~1273 *M. japanica* and *M.tarapacana* landed respectively per year (Heinrichs *et al.* 2011, Setiasih *et al.* in prep.). *M. rochebrunei* was reported to be of commercially important to fisheries throughout its range (McEachran and Séret 1990), but this species has not been recorded since (D. Fernando, pers. comm.). Like all *Mobula spp.* their aggregating habit makes them easy to target in large numbers as they travel in schools.

Artisanal fisheries also target *Mobula spp.* for food and local products (White *et. al.* 2006, Fernando and Stevens in prep., Avila *et al.* in prep.). These species are easy to target because of their large size, slow swimming speed, aggregating behaviour, predictable habitat use, and lack of human avoidance. They are killed or captured by a variety of methods including harpooning, longlining, netting and trawling (White *et al.* 2006, Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Fernando and Stevens in prep). Due to their ichthyophagous diet these species are also captured on baited longlines. Targeting of these rays at critical habitats or aggregation sites, where individuals can be caught in large numbers in a short time frame, is a serious threat (Couturier *et al.* 2012). Their conservative life history also constrains their ability to recover from a depleted state and they are not likely to be able to tolerate high catch levels, given their low reproductive potential (Dulvy *et al.* 2014).
Mobula spp. are taken as bycatch in surface gill net, longline, and purse seine throughout much of their range, however details of these fisheries are poorly documented. Bycatch data are collected in only a few fisheries and, when they are, *Mobula spp.* are often recorded under various broad categories such as "Other", "Rays", or "Batoids", with a breakdown by species almost never recorded (Lack and Sant 2009, Camhi*et al*. 2009). Numbers of animals released alive are only rarely recorded, while visual identification field guides for *Mobula* and *Manta spp.* have only recently been published (G. Stevens, 2011). As such, *Mobula spp.* have generally been overlooked in most oceanic fisheries reports, with very little effort to properly identify or

accurately record the species caught (Chavance et al, 2011, G. Stevens, pers. comm.). See Annex III.

New data available on mobulid bycatch in tuna purse seine fisheries estimates mobulid bycatch of ~ 14,000 annually (Croll et al. in prep). The Mobula species incidentally caught in IATTC region purse seine fisheries include *M. thurstoni, M. japanica, M. tarapacana*, and *M. munkiana*. While identification of mobulid bycatch at the species level has improved dramatically in IATTC fisheries, as of 2011 more than 1/3 of the mobulid catch was still not identified to species level. IATTC catch and bycatch data of Mobula from purse seine fisheries in the Eastern Pacific between 1998-2009 shows a slow increase and peak in 2006 where >80t of Mobula were caught, and a subsequent steep decrease over three years until 2009, where the reported catch was 40t (Hall and Roman, 2013).

Data from a New Zealand Department of Conservation study, which tagged *M. japanica* specimens released alive after being incidentally caught in a tuna purse seine fishery, suggests a very high post release mortality rate (Francis, 2014). Six individuals were tagged, yet 4 tags transmitted information, and 3 of the 4 transmitting rays died within 2-4 days of release even though the released individuals were carefully selected to ensure high survivability upon release.

High mortality rates are reported for *M. mobular* from accidental takes in swordfish pelagic driftnets in the Mediterranean (Muñoz-Chàpuli *et al*. 1994), to unsustainable levels. *M. mobular* are also accidentally captured in longlines, purse seines, trawls (Bauchot 1987), and fixed traditional tuna traps 'tonnare'. They are also occasionally caught as bycatch in the western central Ligurian Sea, where long line catches have been monitored since 1999, especially from the harbours of Imperia and Sanremo. Devil ray bycatch in the Ligurian Sea is always discarded (Orsi Relini *et al*. 1999). There is also evidence to suggest significant directed fisheries exist for this species in Gaza and Egypt (D. Fernando pers. comm.).

In May 2014, the IATTC Scientific Committee issued a live release guidance for Mobula, recognizing and highlighting the vulnerability of these species, the need to release them alive and guidance on how to achieve this.

3.2 Habitat

Habitat destruction, pollution, climate change, oil spills and ingestion of marine debris such as micro plastics (Couturier *et al.* 2012) are all major threats to all *Mobula spp.* because of their wide ranging near-shore habitat preferences (Notarbartolo di Sciara 2005, Handwerk 2010).

Chin and Kyne (2007) estimated that mobulid rays (*Mobula* Genus; *Manta* Genus) are the pelagic species most vulnerable to climate change, since plankton, a primary food source, may be adversely affected by the disruption of ecological processes brought about by changing sea temperatures.

Of particular concern is the exploitation of *Mobula spp.* from within critical habitats, well-known aggregation sites, and migratory pathways, where numerous individuals can be targeted with relatively high catch-per-unit-effort (Couturier *et al.* 2012, Heinrichs *et al*. 2011).

3.3 Indirect threats

*Mobula spp.*are also threatened by entanglement (in phantom nets, mooring lines, anchor lines and fishing lines), boat strikes and sport fishing-related injuries.

3.4 Threats connected especially with migrations

Migrations across national jurisdictional boundaries (both along the coastline between adjacent territorial waters and national EEZs, and from national waters into the high seas) combined with predictable aggregations in easily accessible areas makes all Mobula species, but especially *M. japanica*, *M.tarapacana* and *M. thurstoni*, vulnerable to multiple fisheries, both targeted and bycatch, in coastal areas and in the high seas (Molony 2005, Perez and Wahlrich 2005, White *et al*. 2006, Zeeberg*et al*. 2006, Pianet *et al*. 2010, Couturier *et al.* 2012, Thorrold *et al.* 2014). Migrations into offshore environments where fisheries are unregulated could put these species at risk, even if their inshore habitats are protected.

New evidence of *M. tarapacana* long-range migratory behaviour highlights the vulnerability of this species to bycatch intensive fishing zones and regions of targeted fisheries during their migrations, and the fact that *M. tarapacana* frequently descended below depths recorded for any Mobula species underlines how little is known about these species (Thorrold *et al.* 2014). Similarly, a satellite tagging study in the Eastern Pacific confirms that the depths and geographic regions occupied by *M. japanica* coincide with the focus of artisanal and industrial fisheries, raising concerns of potentially damaging high bycatch mortality (Croll *et al.* 2012).

3.5 National and international utilization

All utilisation and trade in the products of *Mobula spp.* is derived from wild-caught animals. Records cannot be quantified fully, due to a lack of species and product-specific codes, catch, landings and trade data. However, all available information indicates that many former bycatch fisheries have become directed fisheries primarily in order to supply gill plates to Asian markets (White *et al.* 2006, Fernando and Stevens in prep, Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Dewar 2002).
There is no documented domestic use of *Mobula spp*. gill plates in the three largest *Mobula* fishing range states (Sri Lanka, India and Indonesia) (Heinrichs *et al*. 2011, Fernando and Stevens in prep, Setiasih *et al.* in prep.). The low-value meat of *Mobula spp.* taken in these and other domestic fisheries is used locally for shark bait, animal feed and human consumption or discarded, while high value products (primarily gill plates, also skin and cartilage) are exported for processing elsewhere (Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Fernando and Stevens in prep, Booda 1984,C. Anderson, pers. comm., D. Fernando pers. comm.).

Landings in China, reportedly from the South China Sea and international waters, are not exported for processing. A 2011 survey of a shark processing plant in Puqi, Zhejiang Province in China, which is a major processor of *Mobula spp*. and *Manta spp*., revealed that the gill plates are sold directly to buyers in Guangdong (with wholesale prices for *M. japanica* gills of~700RMB (US$110) per kg (Heinrichs *et al*. 2011). The carcasses are shipped to another plant in Shangdong, where the meat is ground up for fishmeal and the cartilage is processed to make chondroitin sulfate supplements. The latter are then exported for sale to Japan and Britain.
All international trade in *Mobula spp.* products is unregulated, with the exception of exports from those range states that have protected these species or have banned the possession or export of any ray products (See Annex IV). Illegal landings of *Mobula spp.* have been reported in some range states where protective legislation exists. However it is not known to what extent these illegally landed animals are being traded internationally, because no mechanisms have been implemented to monitor and regulate such trade.

The unsustainable *Mobula spp.* fisheries described above are primarily driven by the high value of gill plates in international markets (Dewar 2002, White *et al*. 2006, Heinrichs *et al*.

2011, Couturier *et al*. 2012). This trade is the driving force behind population depletion throughout most of the range of *M. japanica* and *M.tarapacana* and poses the greatest threat to their survival. Additional trade impacts include the significant economic consequences for existing (and potential) high value, non-consumptive sustainable ecotourism operations, which could yield much larger and longer-term benefits to range states than short-term unsustainable fisheries (Heinrichs *et al*. 2011).

Mobula species have considerable existing and potential value through non-consumptive, sustainable tourism activities. *M. tarapacana* and other Mobula species are boosting tourism in the Azores (E. Villa, pers. comm.), Costa Rica (E. Herreño, pers. comm.) and Indonesia (M. Miners, pers. comm.), and schools of *M. munkiana*, which leap out of the water, thrill tourists in Mexico (J. Murrieta, pers. comm.) and are an important attraction for a marine tourism economic development program underway in Peru (K. Forsberg, pers. comm.).

4. Protection status and needs

4.1 National protection status

National and regional protections for *Mobula* species include Croatia (*M. Mobular)*, Ecuador (*M. japanica*, *M. thurstoni*, *M. munkiana*, *M. tarapacana*), Maldives (no export of ray products), Malta (*M. Mobular*), Mexico (*M. japanica, M. thurstoni*, *M. munkiana*, *M. hypostoma*, *M. tarapacana*), New Zealand (*M. japanica*), Palau (no commercial fishery exports), the Raja Ampat Regency in Indonesia (genus *Mobula*), and the US states / territories of Florida (genus *Mobula)*, Guam and the Commonwealth of the Northern Mariana Islands (all ray species). However, enforcement is insufficient in some areas and mobulids are still being taken illegally, for example in Mexico (Bizarro *et al.* 2009).

No trade measures prevent the sale or export of landings except in the states that have prohibited *Mobula* ray product trade (Ecuador, Maldives, Mexico, New Zealand, the US state of Florida and the territories of Guam and the Commonwealth of the Northern Mariana Islands) (Heinrichs *et al*. 2011).

The top five *Mobula spp.* fishing countries (Sri Lanka, India, Indonesia, Peru and China), which account for an estimated 95% of the world's documented *Mobula spp*. catch (Heinrichs *et al*. 2011), have no regulations or monitoring of these fisheries. No Regional Fishery Management Organizations (RFMOs) have passed resolutions to regulate or monitor *Mobula spp*. fisheries.

4.2 International protection status

There are no controls, monitoring systems or marking schemes to regulate, track or assess trade in *Mobula spp.*
Two regional conservation bodies in Europe, the Bern Convention and the Barcelona Convention, have listed *M. mobular* as a species requiring strict protection. However, only Croatia and Malta have implemented protective measures. Recent regional legislation (e.g., GFCM, ICCAT) has introduced new basin-wide banning of pelagic driftnets; if implemented, this would eliminate one of the most severe threats to the species.A resolution passed during the 15th Micronesia Chief Executive Summit in 2011, which applies to the Federated States of Micronesia, Palau, the Republic of the Marshall Islands, Guam and the Commonwealth of the Northern Mariana Islands, states that all members will adopt legislation prohibiting the possession, sale, distribution and trade of shark fins, rays and ray parts from the end of 2012.

See Annex IV for table of regional, national and state protective measures for *Mobula spp.*

4.3 Additional protection needs

More research is needed on the exploitation, distribution, biology and ecology of all *Mobula spp.* In particular, catch data are required, and stock assessments should be undertaken where the species is fished. Because of their large size, migratory behavior, extremely low fecundity and large size at maturity, these species are likely highly vulnerable to fishing pressure. However, available life history information is limited and more research is required to make a more accurate assessment of the threat posed by fisheries. Improved clarity in catch records would provide a basis for detecting potential trends in effort and landings.

5. Range states (see Annex II)

6. Comments from range states:

Fiji Islands: The two species that occur across Fijian waters are not targeted species, but have been recorded as bycatch species in other countries within the Western Central Pacific Ocean, which have Purse seine Fisheries targeting for Tuna and associated pelagic species. Mobulid Rays are largely not fished or harvested across the waters of the Fiji Islands, but used for ecotourism attractions in a number of targeted dive sites within Fiji's coastal reef and island systems. In Fiji, the local island systems that currently have Mobulid Ray dive tourisms are on the islands of Taveuni, Kadavu and the Lau groups. These rays migrate large distances across the Pacific and seem to come to Fiji's waters for abundant food & mating habitats. Because of the need for precautionary principle and application to the " look-alike species" consideration, it is incumbent for all range states and parties to CMS, to consider listing all the known nine (9) species of Mobula Rays under Appendix i or ii of the CMS Protected Species List (as an inclusion to the Shark List).

7. Additional remarks

Countries across the South-west Pacific (include Tonga, Samoa, Vanuatu, Fiji, Cook Island, and others) have documented and observed how species of Mobula, Manta and other rays interact within their local coastal and associated areas of national jurisdictions, and clearly noted from dive operators in a number of the local island systems, that these species are one of the big draw-cards for the dive and snorkel tourists to the region. Manta rays will receive protection under CITES listing in September2014, and including on CMS List would be a natural progression for these vulnerable species. The ray populations within the South Pacific are also on the decline, and the rest of the South Pacific region would also be very supportive if Fiji were able to start some form of protection for these species. Though the CMS is non-binding, voluntary, it is a strong indicator of countries showing willingness to take leadership in their conservation.

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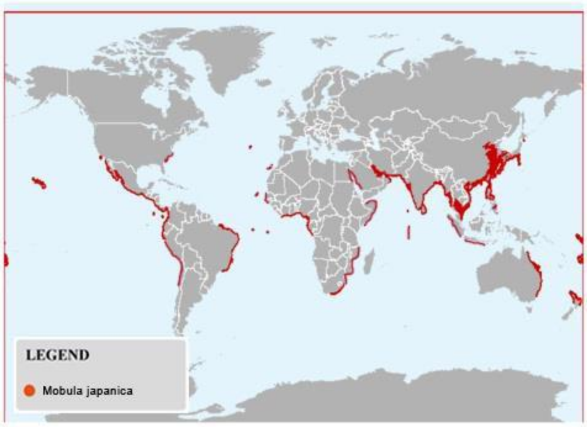
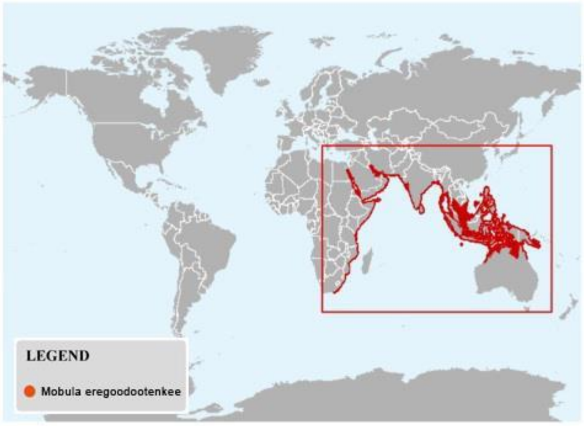
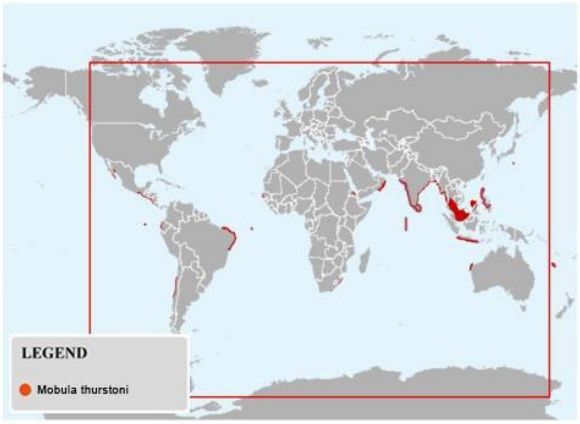
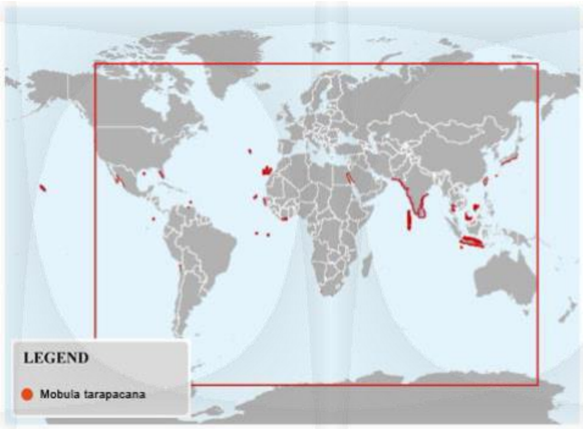
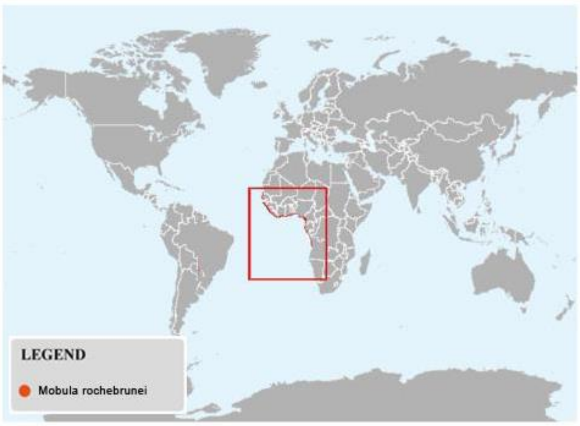
ANNEX I. Distribution maps

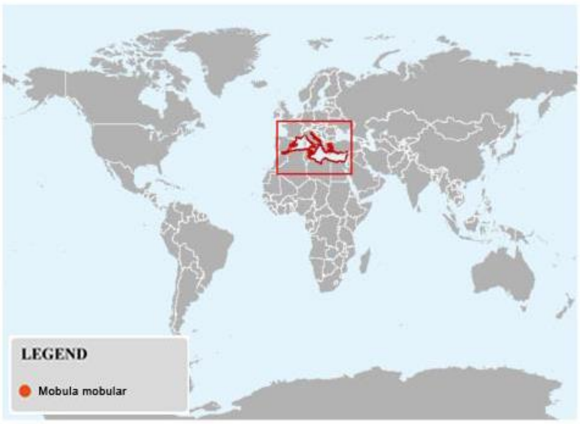


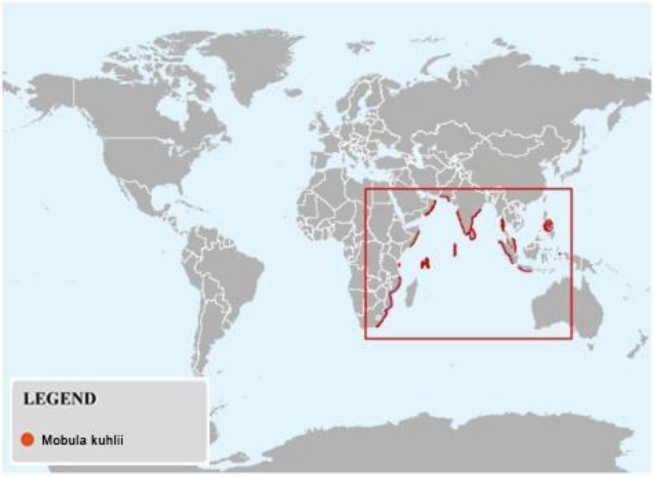












ANNEX II. Distribution table – range states and FAO fisheries areas

Range States and FAO Fisheries Areas	***Mobula mobular***	***Mobula japanica***	***Mobula thurstoni***	***Mobula tarapacana***	***Mobula eregoodoot enkee***	***Mobula kuhlii***	***Mobula rochebrunei***	***Mobula hypostoma***	***Mobula munkiana***
FAO Fisheries Areas	37	31, 34, 47, 51, 41, 87, 77, 81, 71, 61	34, 41, 47, 57, 51, 71, 77, 87	31, 51, 57, 61, 71, 77, 87	47, 51, 57, 71	47, 51, 57, 71	34, 47	31, 41	77, 87
Azores & Madeira Islands (Portugal)		x		x					
Canary Islands (Spain)		x		x					
Spain	x								
France	x								
Italy	x								
Croatia	x								
Greece	x								
Malta	x								
Algeria	x								
Israel	x								
Tunisia	x								
Cape Verde Islands		x		x					
Mauritania							X		
Senegal			x	x			X		
Guinea-Bissau							X		
Guinea							X		
Cote d'Ivoire		x	x	x					
Ghana		x							
Nigeria		x							
Gabon		x							
Congo		x							
Democratic Republic of the Congo		x							
Angola		x					X		
Ascension Island (British Oversees Territory)				x					
South Africa		x	x	x	x	x			
Mozambique		x			x				
Madagascar					x				
Seychelles						x			
Kenya					x				
Tanzania					x	x			
Somalia		x			x	x			
Egypt - Sinai (African part)	x	x		x	x				
Sudan					x				
Eritrea		x			x				
Saudi Arabia		x		x	x				
United Arab Emirates					x				
Qatar					x				
Yemen		x			x				
Djibouti					x				
Oman		x	x		x	x			
Kuwait					x				
Iran		x			x				
Pakistan		x			x				

Range States and FAO Fisheries Areas	***Mobula mobular***	***Mobula japanica***	***Mobula thurstoni***	***Mobula tarapacana***	***Mobula eregoodoot enkee***	***Mobula kuhlii***	***Mobula rochebrunei***	***Mobula hypostoma***	***Mobula munkiana***
Maldives		x	x	x		x			
India		x	x	x	x	x			
Sri Lanka		x	x	x	x	x			
Bangladesh		x							
Myanmar (Coco Is. & Mainland)		x			x				
Thailand		x	x	x	x				
Malaysia		x	x	x	x	x			
Cambodia		x							
Vietnam		x			x				
China		x							
North Korea		x							
South Korea		x							
Japan		x	x	x					
South China Sea (incl.Spartly Islands)				x					
Indonesia		x	x	x	x	x			
Australia		x	x		x				
Papua New Guinea					x				
Philippines		x	x		x	x			
Taiwan - Province of China (Main Island)		x		x	x				
Palau				x					
New Zealand		x							
Fiji		x	x						
Tuvalu		x							
Hawaiian Islands (USA)		x		x					
México		x	x	x				x	x
Guatemala		x	x						x
El Salvador		x	x						x
Honduras		x	x						x
Nicaragua		x	x						x
Costa Rica (Cocos I., Costa Rica Mainland)		x	x	x				x	x
Panama		x							x
Colombia (Malpelo Is.)		x							x
Ecuador (Galápagos Islands & Mainland)		x	x	x					x
Peru		x							x
Chile		x	x	x					
United States of America Continent (California, Texas, Florida, South Carolina, Massachusetts)		x		x				x	
The Bahamas								x	
Cuba								x	
Jamaica								x	
Haiti								x	
Dominican Republic								x	
Antigua								x	
Barbuda								x	
Guadaloupe								x	
Dominica								x	
Martinique								x	
St Lucia				x				x	
Barbados								x	
Grenada								x	
Venezuela				x					
Brazil (including St Peter and St Paul Archipelago)		x	x	x				x	
Uruguay								x	
Argentina								x	

ANNEX III. Estimated annual landings from available catch data – individuals

Notes:

- *Most fishery figures listed are extrapolated estimated catches.*
- *Reports by weight have been converted to estimates of number of individuals.*
- *Countries known to have targeted and/or bycatch fisheries for Manta spp. and Mobula spp., but where no catch records or estimates are available include, but are not limited to:*
    - *Southern China (only number from one processing plant included),*
    - *Mexico, Madagascar, Ghana, Tanzania, Thailand and the Philippines.*
- *Some landings estimates included under "Directed Fisheries" are from fisheries that primarily target other species. There is evidence, however, that these fisheries actively target Manta and Mobula spp. and catches should not be considered to be incidental. Organized trade in gill plates in Indonesia has moved some fisheries to actively target Manta spp. along with the original target species.*
- *Much of the bycatch from high seas fisheries is likely to be discarded and may not go into the gill plate trade.*
- *A great deal of the fishery data reported and almost all bycatch data refer only to Mobulids and do not report by individual species. It's suspected that the majority of the unclassified Mobulid catch data refer to Mobula spp.*

Table 1. Directed fisheries – individuals

Country/Region	Reference	Ref Year	International Trade	Annual Mobula spp.	Total Mobulids
Indonesia-Lamakera	Setiasih 2011	2011	Yes	330	990
Indonesia-Lombok	Setiasih 2011	2007-11	Yes	908	1,119
Indonesia-other[1]	White *et al*. 2006	2001-05	Yes	2175	2,535
Sri Lanka	Fernando & Stevens in prep	2011	Yes	55,497	56,552
India	Raje*et al*. 2007	2003-04	Yes	24,269	24,959
China	Hilton 2011, Townsend et al. in prep	2011	Yes	2,000	2,100
Peru	PlanetaOceano 2011	2011	DD	8,000	8,150
Madagascar	Graham pers. comm.	2007	DD	DD	DD
Ghana	Essumuang 2010		DD	DD	DD
Total Estimate				**93,179**	**96,405**

Table 2. Bycatch fisheries - individuals

Country/Region	Reference	Ref Year	International Trade	Annual Mobula spp.	Total Mobulids
Brazil	Perez and Wahlrich 2005	2001	DD	DD	809
Mauritania	Zeeberg *et al*. 2006	2001-04	DD	DD	620
Indian Ocean	Pianet *et al* 2010	2003-08	DD	325	361
New Zealand	Paulin *et al*. 1982	1975-81	DD	DD	39
W. Central Pacific	Molony 2005	1994-04	DD	DD	1,500
Total Estimate				**325**	**3,329**

Annex V. *Mobula spp.*legal protection measures – regional, national, state

Mobula spp. legal protective measures		
Location	**Species**	**Legal protection / conservation measure**
Regional		
Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)	*M. mobular*	Appendix II – Listed as a strictly protected species which requires that Parties endeavour to carry appropriate measures with the aim of ensuring the species is maintained in a favourable conservation state
Barcelona Convention	*M. mobular*	2001 included in Annex II 'List of endangered or threatened species' to the Protocol concerning Special Protected Areas and Biological Diversity in the Mediterranean
Micronesia: Federated States of Micronesia, Guam, Mariana Islands, Marshall Islands, Palau	All ray species	Micronesia Regional Shark Sanctuary Declaration to prohibit possession, sale, distribution and trade of rays and ray parts from end 2012
National		
Croatia	*M. mobular*	Law of the Wild Taxa 2006 Strictly prohibited
Ecuador	*M. japanica, M. munkiana*	Ecuador Official Policy 093, 2010
Honduras	All elasmobranchs	Full ban on fishing elasmobranchs 2010
Maldives	All ray species	Exports of all ray products banned 1995
Malta	*M. mobular*	Sch. VI Absolute protection
Mexico	*M. japanica, M. thurstoni, M. munkiana, M. hypostoma, M. tarapacana*	NOM-029-PESC-2006 Prohibits harvest and sale
New Zealand	*M. japanica*	Wildlife Act 1953 Schedule 7A (absolute protection)
State		
Guam and the Commonwealth of the Northern Mariana Islands, US Territory	All ray species	Bill 44-31 prohibiting possession, sale, distribution, trade in rays and ray parts
Florida, US State	*Genus Mobula*	FL Admin Code 68B-44.008 – No harvest
Raja Ampat Regency, Indonesia	*Mobula spp.*	Shark and Ray Sanctuary Bupati Decree 2010

ADDENDUM TO CMS PROPOSAL TO INCLUDE ALL NINE MOBULA SPECIES ON APPENDIX I AND II

During the meeting of the CMS Scientific Council in July, the Working Group recommended that all nine species of Mobula rays, as proposed by the government of Fiji, would qualify for listing in Appendix I and II of CMS. The Working Group recommended that the proponent provide more detailed evidence at the species level in order to justify a listing in Appendix I. It was noted by the Working Group that some of the proposed species were data deficient or near threatened accordance to IUCN, but that the last assessment was done 7-10 years ago. The Working Group assumed that the conservation status had likely changed in recent years, due to the high demand for gill plates which has rapidly increased.

The Government of Fiji has developed this addition to Proposal I/10 & II/11 in line with the advice of the CMS Scientific Council. The additional data provided clearly demonstrate that Appendix I listings for all *Mobula* species are justified and urgently needed. What follows is a compilation of the detailed relevant additional information that has become available since the outdated IUCN assessments of these species, which demonstrates the escalating threats they face, along with further information on their exceptional vulnerability.

The IUCN Shark Specialist Group (SSG) convened a Manta and Devil Ray Global Conservation Strategy Workshop in June to review the global conservation status of all species of manta and devil ray species and develop the detailed conservation actions required to conserve these species worldwide. The SSG considers manta and devil rays to be key target species for a Species Conservation Strategy as they are highly vulnerable to overexploitation and still inadequately understood.

Specifically, 2 of the *Mobula* species are currently assessed as Endangered or Vulnerable globally (*M. Mobular* - EN; *M. rochebrunei* - VU), 4 species are assessed as Near Threatened (*M. japanica*, *M. thurstoni*, *M. eregoodootenkee*, *M. munkiana*) and 3 as Data Deficient (*M. tarapacana*, *M. kuhlii*, *M. hypostoma*). All of these assessments, however, are outdated (7 to 11 years old).

Three of the NT or DD species are assessed as VU in SE Asia (*M. tarapacana* (2006), *M. japanica* (2006), M. thurstoni (2006)), and these assessments all noted that "VU listings may also be warranted elsewhere if future studies show declines in populations where fished." The NT assessment for *M. eregoodootenkee* (2003) noted that "Fishing pressure could severely impact this species, and given the lack of quantitative data available it is prudent to assign the species with an assessment of Near Threatened (close to Vulnerable A3d) until its population is otherwise proven to be stable", and the NT assessment for *M. munkiana* (2006) concluded that "Life history characteristics, limited distribution, and exposure to many fisheries due to its highly migratory nature will likely result in designation of the species as Vulnerable should additional fisheries details become available." The DD assessment for *M. kuhlii* (2007) noted "given that this species is of low reproductive potential and is exploited in intensive target and bycatch fisheries in parts of its range, further information is urgently required. Obtaining such information to enable reassessment of the species should be a priority."

While fishery data at the species level is still sparse for *Mobula* species, there is new evidence of increasing threats that was not available at the time of these assessments. Given the new evidence of escalating demand, increased fishing pressure and low post-release survival, it is likely that most, or all, of the *Mobula* species now meet the IUCN Red List criteria for Vulnerable or Endangered.

Increased demand: A new report released in June documents an alarming escalation in demand for mobulid gill plates in China with the estimated number of mobulids represented in Guangzhou, China gill plate markets increasing almost threefold from 2010 to 2013 (Whitcraft et al. 2014). The *Mobula* species most prevalent in the gill plate markets were *M. tarapacana* (~ 22,000 represented) and *M. japanica* and other unidentified *Mobula* species (~ 120,000 represented). (Note that the gill plates from *Manta* species and *M. tarapacana* are easily identifiable, while the smaller gill plates from *M. japanica* and other species are difficult to distinguish visually.) Prices for *M. tarapacana* gill plates increased by ~ 30% from an average of US$172 per kg in 2010 to US$223 per kg in 2013, while prices for *M. japanica* and other species increased by over 40% from an average of US$133 per kg in 2010 to US$189 in 2013. The study also reported intensified marketing efforts by gill plate traders and continued increasing consumer demand. In addition, the identification of high levels of heavy metal contamination including arsenic, cadmium, mercury and lead, in many of the samples tested, highlights the threat this trade poses to consumers, many of whom are children and breast-feeding mothers (the product is recommended as a remedy to improve lactation, to help children recover from chicken pox, and even for "hyperactive babies").

Increased fishery pressure: New data on the scale and impacts of mobulid fisheries in Sri Lanka, India, Indonesia, the Philippines, Peru, and Guinea strongly suggests inferred or projected declines of ≥30% or more for the *Mobula* species with migratory ranges within the reach of these fisheries. While the generation time for *Mobula* species is not known, it is estimated at 25 years for the closely related genus *Manta* species, suggesting the declines observed took place over only a fraction of one generation.

- Significant declines in the number and size of *Mobula spp*. caught in Indonesian target fisheries in Lombok are reported over the past decade (Heinrichs *et al.* 2011, Setiasih *et al.* in prep.) despite evidence of increased directed fishing effort (Setiasih *et al.* in prep). Surveys from 2007 to 2011 estimated annual landings of 908 (Heinrichs *et al*. 2011, Setiasih *et al.* in prep.), compared with 1244 during 2001-2005 surveys (White *et al*. 2006) (27% decline in 6 years), with catches comprising M. *japanica*, M. *tarapacana*, M. *thurstoni*, and M. *kuhlii*.
- In Sri Lanka, fishermen have reported declines in *Mobula spp*. catches over the past 5 to 10 years as targeted fishing pressure has increased (Fernando and Stevens in prep, Anderson *et al.* 2010). Data collected since 2011 shows a steady decline in both 2013 and 2014, although fishing pressure has either remained stagnant or increased (Fernando and Stevens, *in prep*). Anecdotal data from 2014 indicates fishermen reporting steep declines in mobulid landings when compared to 2013, without any decrease in fishing pressure (Fernando, *pers. comm.*).
- In India, *Mobulid* catches have declined in several regions, including Kerala, along the Chennai and Tuticorin coasts and Mumbai, despite increased fishing effort (Couturier *et al*. 2012, Mohanraj *et al*. 2009). A total of 1994 individuals were caught over 18 months of survey from July 2012 to December 2013, of which 95% were *M. japanica* (*Mohanraj et al., pers.comm.*)
- In Bohol, Philippines, mobulid fishing grounds expanded dramatically from small coastal waters within 5 km of shore from the 1900s to 1960s to offshore waters extending over the jurisdiction of municipal waters (15 km from the coastline) following fleet modernization (or motorization) in 1970s. By 2013-14, the mobulid fishing

grounds from Bohol had contracted to a smaller area in the north west of the Bohol Sea, suggesting a decreased mobulid fishing effort lead by a possible depletion of fishing grounds and decrease in financial viability of the fishery, compared to historical records (A. Ponzo, unpublished data).

- In Peru, reported landings of *Mobula* species fluctuated considerably from year to year, but appear to show a significant downward trend with an apparent peak of 1,188t in 1999 (Llanos et al. 2010) to 135t in 2013 (IMARPE 2013 No. 9). The IMARPE landings report describe all the mobulas landed as *M. thurstoni*, but this information is likely incorrect. Recent fishery surveys conducted by Planeta Oceano observed landings in northern Peru of *M. japanica* most frequently, followed by *M. munkiana* and *M. thurstoni*, with probable landings of *M. tarapacana* based on physical characteristics reported.
- In Guinea, West Africa, reported annual catch of mobulids, *M. rochebrunei, M. thurstoni and M. birostris*, based on 3 survey sites (Kassa, Kamsar and Katcheck) was 18t in 2004, and decreased significantly to 4t (2005), 3t (2006), 8t (2007), and 7t (2008) in subsequent years despite increased fishing efforts and fishermen adopting new techniques. In 2009, annual catch of mobulids was reported 17t, which could be explained by the fact that fishing fleets expanded their range to the waters of Sierra Leon*e and Liberia* (Doumbouya, 2009).
- Significant decline of 78% in the abundance of mobula rays at Cocos Island, Costa Rica, over the past 21 years. This is one of the world's oldest MPAs, yet faces pressures from multi-nation fisheries in the eastern tropical Pacific, which is well within the home ranges for these species (White *et al*., 2014).
- In Gaza, Palestine, a new report documents directed catch and bycatch of *M. mobular* with 370 recorded in 2013. While the mobulas are primarily utilized for their meat, this report confirms the emergence of a gill plate export trade in the past three years (Abudaya et al. 2014).
- Liberia reported 'Mantas, devil rays nei' catches of 1,470t to the FAO from 2002-11 in the Eastern Central Atlantic (Mundy-Taylor and Crook 2014).
- Mobulid gill plate traders in Guangzhou, China frequently reported Vietnam, Malaysia and China as source regions, suggesting the occurrence of undocumented and unregulated mobulid fisheries in these countries. Other source regions reported include the Middle East, South America, Brazil, South Africa and Japan, especially troubling since it suggests that the gill plate trade has begun to spread beyond SE Asia to areas in which it has not been previously reported (Whitcraft et al. 2014).

High vulnerability to bycatch mortality: New data available on mobulid bycatch in tuna purse seine fisheries estimates mobulid bycatch of ~ 14,000 annually (Croll et al. in prep).

- The *Mobula* species incidentally caught in IATTC region purse seine fisheries include *M. thurstoni*, *M. japanica*, *M. tarapacana*, and *M. munkiana*. While identification of mobulid bycatch at the species level has improved dramatically in IATTC fisheries, as of 2011 more than a third of the mobulid catch was still not identified to species level. IATTC catch and bycatch data of *Mobula* from purse seine fisheries in the Eastern Pacific between 1998-2009 shows a slow increase and peak in 2006 where >80t of *Mobula* were caught, and a subsequent steep decrease over three years until 2009, where the reported catch was 40t (Hall and Roman, 2013).
- Data from a New Zealand Department of Conservation study, which tagged *M. japanica* specimens released alive after being incidentally caught in a tuna purse seine fishery, suggests a very high post release mortality rate (Francis, 2014). Six individuals were

tagged, yet only 4 tags transmitted information, and 3 of the 4 transmitting rays died within 2-4 days of release even though the released individuals were carefully selected to ensure high survivability upon release.

- New data from tagging *M. tarapacana* in the Azores provides the first evidence of large-scale movement and deep diving behaviour of these species (Thorrold *et al*, 2014). Tagged individuals traveled straight line distances up to 3,800km over 7 months, crossing through oligotrophic tropical and subtropical waters, which highlights their vulnerability to enter high fishing zones and regions of targeted fisheries during their migrations. The fact that *M. tarapacana* frequently descended below depths recorded for any *Mobula* species also shows how little is known about these species.

- In May 2014, the IATTC Scientific Committee issued a live release guidance for *Mobula*, recognizing and highlighting the vulnerability of these species, the need to release them alive and guidance on how to achieve this.

High non-consumptive value to tourism: *Mobula* species also have considerable existing and potential value through non-consumptive, sustainable tourism activities. *M. tarapacana* and other *Mobula* species are boosting tourism in the Azores (E. Villa, pers. comm.), Costa Rica (E. Herreño, pers. comm.) and Indonesia (M. Miners, pers. comm.), and schools of *M. munkiana*, which leap out of the water, thrill tourists in Mexico (J. Murrieta, pers. comm.) and are an important attraction for a marine tourism economic development program underway in Peru (K. Forsberg, pers. comm.).

In conclusion: Since fifty-four of the CMS parties are range states for one or more of the *Mobula* species, representing a majority of the global ranges for these species, the range state protections called for under a CMS Appendix I listing are urgently needed to avoid further population declines. Methods have already been developed to aid CMS Parties implement the listings by releasing bycaught rays alive. Collaborative management initiated under a CMS Appendix II listing would also greatly benefit these species by ensuring international cooperation to collect population data and identify the most critical habitats.

The current research provides troubling new evidence of increased threats from rapidly escalating demand for *Mobula* gill plates in China, expansion of targeted fisheries, as well as large incidental catch in industrial tuna fisheries with very low post release survival. In light of this new evidence combined with the extremely low reproductive capacity of these species, continued lack of population data, lack of conservation or management measures, and the potentially much higher value from sustainable non-consumptive ecotourism compared with fisheries, we strongly urge the Parties to act fast in the spirit of the precautionary approach to include these highly vulnerable species on Appendix I and II.