UNEP

CMS

CONVENTION ON MIGRATORY SPECIES

Distribution: General

UNEP/CMS/COP11/Doc.24.1.9/Rev.1
04 November 2014

Original: English

11th MEETING OF THE CONFERENCE OF THE PARTIES
Quito, Ecuador, 4-9 November 2014
Agenda Item 24.1.1

PROPOSAL FOR THE INCLUSION OF THE REEF MANTA RAY (*Manta alfredi*) IN CMS APPENDIX I AND II

Summary

The Government of Fiji has submitted a proposal for the inclusion of the species *Manta alfredi* (Reef Manta Ray) on CMS Appendix I and II for the consideration of the 11th Meeting of the Conference of the Parties (COP11), 4-9 November 2014, Quito, Ecuador.

A revised proposal for the inclusion of the Reef Manta Ray (*Manta alfredi*) in CMS Appendices I and II was subsequently submitted by Fiji pursuant to Rule 11 of the COP Rules of Procedure.

The proposal is reproduced under this cover for a decision on its approval or rejection by the Conference of the Parties.

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

A. **PROPOSAL:** Inclusion of the species *Manta alfredi* (Reef Manta Ray), Genus *Manta*, Subfamily *Mobulinae*, in Appendix I and II

B. **PROPONENT:** Government of the Fiji Islands

C. **SUPPORTING STATEMENT:**

1. **Taxon**

1.1 **Class:** Chondrichthyes, subclass Elasmobranchii
1.2 **Order:** Rajiformes
1.3 **Subfamily:** Mobulinae
1.4 **Genus and species:** Genus *Manta* (Bancroft 1829): *Manta alfredi* (Krefft 1868) and any other putative *Manta* species.
Scientific Synonyms: *Deratoptera alfredi (Krefft 1868)*
Manta fowleri (Whitley 1936)
1.5 **Common Names:** English: Reef Manta Ray, Prince Alfred's Ray, Inshore Manta Ray, Coastal Manta Ray, Resident Manta Ray

Overview

i. *Manta alfredi*, a globally distributed and highly migratory species, is proposed here for listing on CMS Appendix I and II. This iconic and highly vulnerable 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 it is a slow reproducing, commercially exploited aquatic species that is 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.

App I listing would encourage range state Parties where *M. alfredi* are targeted to seek help with implementing measures to protect this species and enable artisanal fishers to benefit from the much more lucrative and sustainable tourism revenues this species generates. For example in Mozambique, *Manta alfredi* and the closely related *Manta birostris* (already included on Appendix I) contribute over US$13 million annually to tourism revenues. However, off Praia do Tofo, an important manta and whale shark tourism area in southern Mozambique, artisanal fishers opportunistically target mantas for their low value meat. In this area, Rohner et al. (2013) observed a decline in *Manta alfredi* abundance of 88% over only 8 years (less than a third of one generation period for this species).

In addition, new evidence of growing demand for manta and mobula gill plates and expansion of this trade threatens to motivate the emergence of new, targeted manta fisheries

in range states where *M. alfredi* are currently not protected. CMS parties that are *M. alfredi* range states, which currently do not have protection measures in place for *M. alfredi,* include Australia, Comoros-Mayotte (France) Cook Islands, Djibouti, Egypt, Fiji, India, Madagascar, Mozambique, New Caledonia (France), Pakistan, Palau, Philippines, Saudi Arabia, Seychelles, South Africa, and Yemen. The CMS Appendix I listing, therefore, will help this species by curbing existing targeted fisheries and preventing emergence of new fisheries in response to demand from the mobulid gill plate trade.

ii. *M. alfredi* are slow-growing, large-bodied migratory animals with small, highly fragmented populations that are sparsely distributed across the tropical and oceans of the world. They have among the lowest fecundity of all elasmobranchs, typically giving birth to a single pup with a gestation period of approximately one year, placing them into FAO's lowest productivity category. Global population numbers are unknown, but thought to be declining in parts of 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.

iii. Populations of *M. alfredi* have not been assessed but appear to be generally small, sparsely distributed, and characterized by very low productivity and aggregating behaviour, leaving them especially vulnerable to exploitation and with limited capacity to recover from depletion. Additional impacts from the overexploitation of manta rays include the significant economic consequences to sustainable ecotourism operations estimated to generate US$140 million annually due to the presence of manta rays (O'Malley *et al.* 2013). Non-consumptive utilization of manta rays through tourism can yield much larger and longer-term benefits to range states than manta ray fisheries (Anderson et al. 2010, Heinrichs *et al.* 2011, O'Malley *et al.* 2013), which are not likely to be sustainable even at moderate levels (Dulvy *et al.* 2014, Rohner *et al.* 2013).

iv. The prebranchial appendages (or gill plates), which *M.alfredi* use to filter planktonic food from the water, are highly valued in international trade. Cartilage and skins are also traded internationally. A single mature *M. alfredi* can yield up to 5 kilos of dried gills that retail for up to US$390 per kilo in China (Whitcraft *et al* 2014). Since there are no specific import-export codes for *Manta spp*. gill plates and trade records for cartilage and skins are generally not species-specific, international trade levels, patterns and trends cannot be accurately documented. Existing DNA tests and visual ID guides can enable informed non-experts to distinguish *Manta spp*. and their parts and derivatives in trade from other species.

v. *M. alfredi* 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 and Manta alfredi are caught incidentally as by-catch in purse seine, gill and trawl net fisheries targeting other species. The high value of gill plates has driven increased target fishing pressure for all *Manta spp*. in key range states, with the largest landings observed in Indonesia, Sri Lanka and Mozambique. Fisheries in other countries may also be significant, but landings data from most locations are not readily available. The recent increase in demand for gill plates has resulted in dramatic increases in fishing pressure, with many former bycatch fisheries having become directed commercial export fisheries. There are also recent reports of mantas being 'gilled' (gills removed and the carcasses discarded) at sea (D. Fernando pers. obs.).

vi. There have been no stock assessments, official monitoring, catch limits or management of *M. alfredi* 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 *Manta spp.* Incidental landings and discards are rarely recorded at the species level. *M. alfredi* are legally protected in a few countries and in some small Marine Protected Areas, but most laws protecting manta rays define "Manta Ray" as "*Manta birostris*", leaving *M. alfredi* unprotected.

vii. While there are no historical baseline population data, recent declines have been reported in key *M. alfredi* range states, including Indonesia and Mozambique (M. Erdmann, pers. comm., S. Lewis, pers. comm., J. Friedlander, pers. comm., Rohner *et al.* 2013).

viii. 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. *Manta birostris*, the other species in the genus *Manta*, was added to CMS Appendix I and II at the 10th CoP in 2011. Until the recent split of the genus *Manta* (Marshall et al. 2009, Kashiwagi et al. 2012), all manta rays were classified as *M. birostris;* the two species share highly similar biological and behavioural characteristics and face the same threats.

2. Biological data

The subfamily Mobulinae encompasses two genera: *Manta* and *Mobula*. This group is characterized by the presence of one lobe on each side of the head, wing-liked pectoral fins, terminal mouth and a stingless tail (Notarbartolo-Di-Sciara 1987a). All are planktivorous, feeding on zooplankton and (in the case of several of the *Mobula spp.*) small schooling fishes. The genus *Manta* was previously considered monotypic; a focused genetic study has confirmed that *M. birostris* and *M. alfredi* are two distinct species (Kashiwagi et al. 2012). Descriptions or photographs can be used to verify accounts to the species level.

Manta spp. are large-bodied, pelagic, planktivorous rays. *M. birostris* can grow to over 7 meters wingspan (disc width or DW; Marshall *et al*. 2009) with anecdotal reports up to 9 meters (Compagno 1999). *M. alfredi* grows to an average 3.5 meters DW, and a maximum of 5 meters DW (Marshall *et al*. 2011b). *Manta spp*. are distinguished by their large diamond-shaped body with elongated wing-like pectoral fins, ventrally placed gill slits, laterally placed eyes, wide terminal mouths, and paired cephalic lobes. Melanistic (black) and leucistic (white) colour morphs occur in both species (Marshall *et al*. 2009). Most *Manta spp*. show a counter-shading pattern (black dorsally and white ventrally) and have unique spot patterns on their ventral surface that do not change over time and help identify individuals (Clark 2001, Marshall *et al*. 2008, Kitchen-Wheeler 2010, Deakos *et al*. 2011).

Mantas are slow-growing and long-lived with low fecundity and reproductive output and long generation times (Marshall *et al.* 2011b, Kashiwagi 2014). Longevity is estimated to be at least 40 years (Marshall *et al*. 2011b, Kashiwagi 2014) and natural mortality is thought to be low (Couturier *et al.* 2012, Kashiwagi 2014). Mantas are among the least fecund of all elasmobranchs (Couturier *et al*. 2012; Dulvy et al. 2014), bearing only one pup on average every two to four years (Marshall and Bennett 2010, Kashiwagi 2014) with a gestation period of 10– 14 months (Kashiwagi 2014; Marshall and Bennett 2010) Lower reproductive rates (one pup every seven years) have been observed for female *M. alfredi* in a subpopulation in

the Maldives (G. Stevens in prep.). Females have been reported to reach maturity between 9-16 years (Marshall *et al*. 2011b,c, Kashiwagi 2014). Maturity in male *M. alfredi* has been estimated to occur from 4-9 years of age (Kashiwagi 2014). A slightly earlier age-range at maturity (~3-6 years) was estimated in males in one subpopulation in Kona, Hawaii (Clark 2010). A maximum reproductive span 27 years was observed in a well-documented population of *M. alfredi* in Japan (Kashiwagi 2014). With such conservative life history characteristics, a female manta ray will likely produce between 4-15 pups over her lifetime (Kashiwagi 2014). Subpopulations are therefore exceptionally vulnerable to extirpation, slow to recover once depleted; the possibility of successful re-colonization is low. In local populations with low anthropogenic influences, *Manta alfredi* females have been found to need to produce at least one pup for every 3.1 years on average to achieve a small, but positive population growth (Kashiwagi 2014).

2.1 Distribution and range states (current and historical)

Manta spp. are circumglobal in range (see Annex I), with the two described species sympatric in some locations and allopatric in others (Kashiwagi et al. 2011). *M. alfredi* is found in tropical and subtropical waters (Marshall et al. 2009, Kashiwagi et al. 2011, Couturier et al. 2012). *Manta alfredi* populations are sparsely distributed and highly fragmented, likely due to their resource and habitat needs.

2.2 Population (estimates and tendencies)

In extensively studied *M. alfredi* subpopulations in Mozambique, eastern Australia and the Maldives, a significant female bias has been observed, with the majority in Mozambique considered to be mature (Marshall *et al.* 2011a, Couturier *et al.* 2014; G. Stevens, unpubl. data). In an *M. alfredi* subpopulation in Maui, Hawaii, the sex ratio is close to parity with juveniles and adults present. This study also suggests that juveniles may segregate from the adult population, residing in areas where they are less vulnerable to predation (Deakos *et al.* 2011). In Ningaloo, Australia, the distribution of males to females and adults to juveniles fluctuates throughout the year, but mature females consistently dominate (McGregor 2009). Of three *M. alfredi* aggregation sites surveyed in eastern Australia, only the largest site exhibited a significant female bias while the other two showed no bias (Couturier *et al.* 2011).

Subpopulations of the *M. alfredi* appear, in most cases, to be small (less than 1,000 individuals). Photo-identification studies at aggregation sites in Hawaii (Deakos et al. 2011), the Yaeyama Islands Japan (Kashiwagi 2014), southern Mozambique (Marshall et al. 2011), and the east coast of Australia (Couturier et al. 2014) have produced sighting records or estimated annual or sub-population sizes of approximately 100 to 700 individuals, despite some being active for many decades. The one exception is the Maldives with 3,300 individuals identified throughout the 26 atolls that make up the archipelago (G. Stevens, unpublished data 2012) and population estimates for the entire archipelago reaching 9,677 individuals (Kitchen-Wheeler et al. 2011). These preliminary studies at major aggregation sites suggest resident population sizes of *Manta alfredi* are generally small, with some areas having large seasonal influxes.

Population reductions of *Manta alfredi* have been reported in areas with active fisheries or significant by-catch such as southern Mozambique where an 88% decline in observation sighting records has occurred over a nine year period (Rohner et al. 2013), well under one generation estimated at 25 years for *Manta spp.* (Marshall et al. 2011b,c). Globally a decline of 30% is strongly suspected (Marshall et al. 2011b,c) and currently *M. alfredi* is listed as Vulnerable on the IUCN Red List of Threatened Species with a decreasing population trend.

2.3 Habitat (brief description and tendencies)

M. alfredi are more commonly sighted inshore, but are also observed around offshore coral reefs, rocky reefs and seamounts. This species is often resident in or along productive near-shore environments, such as island groups, atolls, or continental coastlines, and may also be associated with areas or events of high primary productivity (e.g., upwelling) (Homma et al. 1999, Dewar et al. 2008, Kitchen-Wheeler 2010, Anderson et al. 2011, Deakos et al. 2011, Marshall et al. 2011b).

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

Telemetry studies and photographic matching studies show that *M. alfredi* is highly mobile, and while they typically exhibit smaller home range sizes than *M. birostris*, this species often undertakes regular or seasonal migrations (up to several hundred kilometers) most likely to exploit productive feeding grounds (Anderson *et al*. 2011, Jaine *et al.* 2012)

Long-term sighting records of *M. alfredi* at established aggregation sites suggest that this species, is quite resident to tropical water habitats, exhibits smaller home ranges, and shows philopatric behaviour for specific critical habitats like feeding areas and inshore reefs that support cleaning stations (Kashiwagi 2014, Kitchen-Wheeler et al. 2011, Marshall *et al*. 2011a, , Deakos *et al*. 2011, Clark 2010, Couturier *et al.* 2014).

Telemetry studies and broad-scale photo-matching studies are increasingly showing that *M. alfredi* is capable of traveling significant distances in short periods of time. Couturier *et al.* 2014 showed *Manta alfredi* undertaking migrations of up to 650 kilometers in a 6-month period along the eastern coast of Australia. Germanov and Marshall 2014 showed *Manta alfredi* making regular migrations between the Komodo National Park and the manta ray sanctuary of Nusa Penida in Indonesia (distances of up to 450km) in as little as 33 days. A study by Duinkerken 2010 showed *M. alfredi* in southern Mozambique traveling between sites up to 95 kilometers apart in as little as 40-hours, with maximum rate of movements of 3.7 km h^{-1} suggesting that this species is capable of traveling large distances in short periods of time. In most cases these longer range migrations occurred along continuous continental coastlines rather than across island chains or large bodies of water. However, a recent study by Jaine et al. 2014 using satellite telemetry off eastern Australia found *Manta alfredi* traveling up to 155km offshore to feed, swimming up to 2,441 km (not a straight-line distance) in 118 days. Braun et al. 2014 also found satellite tagged *M. alfredi* to be using offshore environments up to 28% of their monitored track.

While some sub-populations of *M. alfredi* may be deterred by physical barriers, like open expanses of sea (Deakos *et al.* 2011) it is clear that in certain circumstances or in some locations *M. alfredi* may undertake regular longer distance movements. While no international migrations have been documented in the literature, the distances that *M. alfredi* have been demonstrated to regularly undertake would suggest that they are capable and are most likely moving through and using habitats in adjoining countries in parts of their distribution. Photo matches of the same individuals using habitats in Inhambane Mozambique and those in Ponta de Oro (less than 1.5 km from the boarder of South Africa) are illustrations of this point (Manta Matcher public records-
http://mantamatcher.org/individuals.jsp?langCode=en&number=MZ0803A).
Daily diurnal migrations are reported in *M. alfredi* with individuals using inshore environments like shallow reef cleaning stations and coastal feeding grounds during daylight hours and deeper water/off shore habitats in the evening hours (Dewar *et al*. 2008, Marshall

2009, Anderson *et al*. 2011, Duinkerken 2010, Braun et al. 2014). Migrations from areas of protection to offshore environments (Braun et al. 2014, Jaine et al. 2014), or through areas fraught with anthropogenic threats (Germanov and Marshall 2014) could put *M. alfredi* at risk, even if their inshore or main critical habitats are protected. In other more closed sub-populations with little to no exchange between neighboring sub-populations (Deakos 2012, Kashiwagi 2014) unsustainable fishing or anthropogenic influences could deplete a single population quite rapidly, with little chance of recovery or re-population over time.

3. Threat data

The greatest threat to *M. alfredi* is unmonitored and unregulated directed fisheries, increasingly driven by the escalating international trade demand for their gill plates (Heinrichs et al. 2011, Whitcraft et al. 2014). The gill rakers are predominately used in Asian health tonics, purported to treat a wide variety of conditions. Artisanal fisheries also target reef manta rays for local consumption (B. Newton, pers. comm., J. Hartup, pers. comm., Rohner et al. 2013).

Manta species in general 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 (Couturier et al. 2012,White et al. 2006, Heinrichs et al. 2011, Fernando and Stevens 2011). 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 potentially 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 very low reproductive potential (Dulvy et al. 2014).

Industrial fisheries or inshore gill net fisheries, which are by nature quite indiscriminate, can result in manta ray by-catch. This species also faces many anthropogenic threats, particularly entanglement (in phantom nets, mooring lines, anchor lines and fishing lines), boat strikes and sport fishing-related injuries. Additional threats include habitat destruction, pollution, climate change, oil spills and ingestion of marine debris such as micro plastics (Couturier et al. 2012).

3.1 Direct threats to the population (factors and intensity)

Historically, subsistence fishing for *Manta spp*. occurred in isolated locations with simple gear, which limited the area and time fishermen could hunt. In recent years, however, fishers have begun targeting *Manta spp*. with modern fishing gear and expanding their fishing range and season, primarily in response to the emerging market for dried mobulid gill plates (Dewar 2002, White *et al*. 2006, Rajapackiam *et al*. 2007, White and Kyne 2010, Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Fernando and Stevens 2011). This increase in fishing pressure is driving regional *Manta spp*. subpopulations toward commercial extinction (Dewar 2002, White *et al*. 2006, Heinrichs *et al*. 2011).

As *M. alfredi* was only recognized a separate species from the other manta species, *M. birostris*, in 2009 (Marshall *et al.,* 2009, Kashiwagi et al. 2012), data prior to this does not distinguish among the two. However their relatively smaller home range, tendency for nearshore residency and philopatric behaviour to critical habitats such as inshore reefs makes *M. alfredi* a high target for fisheries, and it is likely they represent a significant proportion of

the reported manta catch. Today, the largest documented manta fishing and exporting Range States are Indonesia (Indonesia introduced complete protective legislation for both *Manta spp.* within its territorial waters in March 2014), Sri Lanka, and India. However, gill plate vendors in China also report Malaysia, Vietnam, South Africa, South America, the Middle East and the South China Sea as source regions for mobulid gill plates (Whitcraft et al. 2014), and high international trade demand is likely to stimulate directed and opportunistic fisheries elsewhere. In light of the lack of published fishery data at the species level, the very recent separation of the genus into two species (Marshall et al. 2009, Kashiwagi et al. 2012), the species' extremely high biological vulnerability (Dulvy et al. 2014) and the rapidly escalating trade demand for manta ray gill plates - regardless of species (Whitcraft et al. 2014), the precautionary approach is recommended to prevent the spread of unsustainable fisheries and population depletions.

Pacific Ocean: Opportunistic hunting of a small *M. alfredi* population has recently been reported in the islands of Tonga (B. Newton, pers. comm.) and Micronesia (J. Hartup, pers. comm.). Because of their isolation and low numbers, such local subpopulations of *M. alfredi* are extremely vulnerable to any fishing pressure. Neither of the Manta species are being targeted for commercial fishing or subsistence harvest across Fijian waters, and thus now are being currently protected under the Endangered and Protected Species Act, and its attending regulation. All species of *Manta* from September 2014 will be protected under CITES Appendix II.

Indo-Pacific: *Manta spp.* fisheries have been observed in Indonesia in Lamakera and Lamalera (Nusa Tenggara), Tanjung Luar (Lombok), Cilacap (Central Java) and Kedonganan (Bali) (Dewar 2002, White *et al*. 2006, Barnes 2005). Most fisheries are targeted and have arisen or greatly increased over the past ten years. In and around the Wayag and Sayang Islands in Raja Ampat, Indonesia, where shark populations have collapsed, shark fishermen have reportedly begun to target *Manta spp*. (Donnelly *et al*. 2003). In Lamakera, when motorized boats replaced traditional dugout canoes to target *Manta spp*., catch rates increased by an order of magnitude above historic levels (Dewar 2002). Lamakera fishermen reported in 2002 that previously manta rays had occurred in the channel near the village, but were no longer seen nearshore, suggesting possible local extirpation of a reef manta population (Dewar 2002).

While peer reviewed sources have only reported landings of *M. birostris* in these locations, these sources pre-date the separation of the genus *Manta* from one species (*M. birostris*) to two species (*M. birostris* and *M. alfredi*). The proportion of each species in the landing is therefore unclear. Recent reports from Tanjung Luar, Lombok, however, indicate increased pressure on local *M. alfredi* populations (P. Hilton, pers. comm.). Dive operators and tourists have also reported seeing manta rays in fish markets close to known *M. alfredi* aggregation sites in Sangalaki, Borneo (E. Oberhauser, pers. comm.) and the Ende market in Flores near Komodo National Park (B. Pilkington-Vincett, pers. comm.).

There is anecdotal evidence of manta population declines and possible extirpations at three additional sites in Indonesia; Pulau Banyak, Lembeh Strait and Alor Island. Patrol staff at Yayasan Pulau Banyak off the west coast of Sumatra report that local fishermen catch manta rays as by-catch in gill nets and that manta sightings have become much less frequent, suggesting a possible population decline as a result of by-catch fishing pressure (S. Lewis, pers. comm.). In 1997 in the Lembeh Strait region of North Sulawesi, 1,424 manta rays were caught in large trap nets set in a migratory channel designed to catch pelagic fish and marine

mammals entering the mouth of the Lembeh Strait, just off the Tangkoko Nature Reserve (Anon 1997). Use of these nets was prohibited, but they were found to be in use again shortly afterwards (White et al 2006). Following a legal battle between the Indonesian Ministry of Environment and the Taiwanese company operating the trap net, the nets were permanently removed in 1998. Prior to deployment of the trap nets, Lembeh dive operators reported the presence of a resident manta ray population, and divers regularly snorkeled with mantas feeding in the channel (J. Friedlander, pers. comm.). However mantas have not been seen in the channel since this time (M. Erdmann, pers. comm.). Local Alor fishermen reported that approximately ten years ago off the west coast of Alor Island, in the channel between Alor and Pantar Islands, a local village started installing drift nets in the middle of the channel targeting mackerel. The nets were reportedly 50m wide and set at a depth of 18-20m. Manta rays were caught as by-catch in the nets and within five years mantas were no longer seen in the region, suggesting that the nets may have caused a population extirpation. Prior to the installation of these nets manta rays were reportedly seen commonly, usually at the surface in groups of two but sometimes in larger groups of 10-15 individuals. Despite a lack of photographic evidence, local fishermen reported that the mantas were approximately 3m from wing tip to wing tip thus suggesting that they were likely to have been *M. alfredi*. (M. Erdmann, pers. comm, S. Lewis, pers. comm.).

Indian Ocean: Targeted fisheries are reported Thailand (R. Parker, pers. comm.), the Philippines (Alava *et al*. 2002 – now legally prohibited), and several locations in Africa, including Tanzania and Mozambique, where annual landings of ~35-50 *M. alfredi* are reported from less than 5% of the coastline, (Marshall and Bennett 2010).

3.2 Habitat destruction (quality of the changes, quantity lost)

The loss of some coral reef habitats, which provide food, cleaning stations and reproductive areas, could have a negative impact on *Manta spp*. (Deakos 2010). Alterations to terrestrial ecosystems have also been shown to affect *Manta spp*. populations. At Palmyra Atoll in the Pacific, a study linked declines in the manta rays' planktonic food source to areas where native trees have been replaced by human propagated palms, revealing a complex interaction chain linking trees to manta rays (McCauley *et al*. 2012). *Manta spp*. are also likely to be susceptible to oil spills and pollution because of their wide-ranging near-shore habitat preferences (Notarbartolo di Sciara 2005, Handwerk 2010).

Chin and Kyne (2007) estimated that mobulid rays (Genus *Manta*; Genus *Mobula*) 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. In the Republic of Maldives, over a three year period (2009-2012), despite intensive directed research, there were no recorded pregnancies amongst a subpopulation of over 659 individually identified mature female *M. alfredi* (G. Stevens in prep). This scarcity of pregnancies correlates directly with un-seasonally weak monsoonal winds in the region, which should drive the nutrient upwellings that lead to the rich productivity of the Archipelago upon which the manta ray directly depend (Anderson *et al*. 2011, G. Stevens pers. comm.). These broad scale fluctuations in the productivity of the Maldivian waters are reflected in catch rates of the local tuna fishery, which have been linked to wider climatic patterns such as the El Niño Southern Oscillation (ENSO) (Anderson 1999).
Other habitat threats that affect *Manta spp*. populations include marine debris such as, ghost nets and plastics, and pollution from vessels.

3.3 Indirect threats

Manta spp. are a bycatch of myriad fisheries targeting other species throughout the Atlantic, Pacific, and Indian Oceans, but are most frequently bycaught in purse seines, gillnets, and longlines (all commonly used in tuna fisheries). Bycatch data are collected in only a few fisheries and, when they are, *Manta 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*).

Numbers of animals released alive are only rarely recorded, while visual identification field guides for *Manta* and *Mobula spp.* have only recently been published (G. Stevens, 2011). As such, *Manta 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.).

M. alfredi are also threatened by entanglement (in phantom nets, mooring lines, anchor lines and fishing lines), boat strikes and sport fishing-related injuries. Additional threats include habitat destruction, pollution, climate change, oil spills and ingestion of marine debris such as micro plastics (Couturier *et al.* 2012).

3.4 Threats connected especially with migrations

See new additions to migrations section

3.5 National and international utilization

All utilisation and trade in the products of *Manta* 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. All available information, however, indicates that fisheries are trending from bycatch to more targeted operations primarily to supply gill plates to Asian markets (Fernando and Stevens in prep, Heinrichs *et al.* 2011, Setiasih *et al.* in prep., Dewar 2002, Marshall *et al*. 2011b,c). For example, fishermen in Sri Lanka used to avoid setting their nets where *Manta spp*. were known to occur, and any rays caught incidentally were released, often alive, at sea. Following the rapid growth of the gill plate trade over the past decade, however, fishermen now land all *Manta spp*. and have recently begun removing the gill plates at sea, discarding the remaining low-value carcass (D. Fernando, pers. comm.).

The ~35-50 *M. alfredi* are taken annually in southern Mozambique (Marshall and Bennett 2010) are used domestically for consumption although their meat is not considered valuable or even the preferred diet of local fishing communities. There is no documented domestic use of *Manta spp*. gill plates in the three largest *Manta spp*. fishing range States (Indonesia, Sri Lanka and India) (Heinrichs *et al*. 2011, Fernando and Stevens in prep, Setiasih *et al.* in prep.). The relatively low-value meat of *Manta* 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, Marshall *et al*. 2011b,c, Booda 1984, C. Anderson, pers. comm., D. Fernando pers. comm.).

Small numbers of *M. birostris* and *M. alfredi* are also caught and transported to aquariums for use in large display tanks in the US, Bahamas, Portugal, Japan, Singapore and South Africa.

Uchida (1994) reported the number of surviving days for manta rays in captivity from 1 to 1,943.

An analysis of *Manta* tourism relative to fisheries value in Indonesia, home to the largest fishery for *Manta spp.* until protective legislation came into effect in March 2014, estimated tourism revenues in excess of USD 15 million per year compared with fishery revenues of ~USD 442 thousand annually (O'Malley *et al*. 2013). Dive tourism in Yap is focused almost exclusively on *Manta* ray encounters, with an annual value estimated at USD 4 million (B. Acker, unpubl.). Tourism operations focused on viewing marine megafauna such as manta rays bring millions of dollars in revenue annually primarily to local communities (Norman and Caitlin 2007, Pine et al. 2007, Brunnschweiler 2009, Tibirica et al. 2009, Jones et al. 2009, Graham 2004, Martin and Hakeem 2006, Hara et al. 2003, Topelko and Dearden 2005). In the Maldives, for example, direct revenue from manta dive and snorkel excursions was estimated to generate over USD 8.1 million per year during 2006–2008 (Anderson *et al*. 2010).

Globally, the direct economic impact of *Manta spp*. dive tourism is estimated at USD 140 million per year (O'Malley *et al*. 2013). Meanwhile, tourism opportunities in a number of range States have still not been explored. These existing and potential tourism revenues are significantly greater than the estimated value of USD 5 million per year for the global *Manta spp.* gill plate trade (Heinrichs *et al*. 2011). The development of high value community-based whale shark tourism in the former fishing range States of the Philippines and Indonesia illustrates the potential for *Manta* tourism to provide long-term, sustainable income to many coastal communities, if short-term boom and bust fisheries are avoided.

4. Protection status and needs

4.1 National protection status

While the capturing and killing of manta rays is banned in several countries, most of these laws define "Manta ray" as "*M. birostris*", leaving few legal protections for *M. alfredi*. Currently only Indonesia, the state of Yap (Federated States of Micronesia), the U.S. states / territories of Hawaii, Florida, Guam and the Commonwealth of the Northern Mariana Islands, and the Australian Indian Ocean territories Christmas Island and Cocos Keeling Islands have laws protecting both *Manta* species. Yap's Manta Ray Sanctuary and Protection Act 2008 establishes a sanctuary, which covers 8,234 square miles, taking in 16 islands and 145 islets and atolls, out to 12 miles offshore, specifically protecting its primarily reef manta ray population and its habitat. The Republic of Maldives bans exports of all ray species and their body parts and has created two marine protected areas (MPAs), specifically identified for protection because of their importance as areas of critical habitats for the Maldives population of reef manta rays and the occasional transient oceanic manta ray. In Western Australia, manta rays (both species), whilst not targeted, are protected from any fishing (Fisheries Act) and disturbance or harassment (DEC Act) within marine parks only. Other range States protect *Manta* rays in relatively small marine park zones.

Effectiveness of these measures varies, with reports of illegal fishing of *Manta spp*. in Mexico and the Philippines (Graham *et al.* 2012, S. Heinrichs, pers. comm., Marshall *et al*. 2011c, GMA TV, May 2012). *Manta spp*. (primarily *M. alfredi*) are also targeted in the Komodo Marine Park, near Lamakera, Indonesia, despite regulations forbidding fishing (H. Dewar, pers. comm.).

4.2 International protection status

At the last Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in March 2013, the proposal by the governments of Brazil, Colombia and Ecuador to add the genus *Manta*, including *M. birostris, M. alfredi* and any putative Manta species, to Appendix II was adopted. No other international protections are in place for *M. alfredi*.

Manta alfredi is listed as Vulnerable on the IUCN Red List of Threatened Species with a decreasing population trend.

4.3 Additional protection status

At the 10th CMS CoP in November 2011 the proposal of Ecuador to add *M. birostris* to CMS Appendices I and II was adopted. While the recently separated species, *M. alfredi*, was not included in Ecuador's proposal, Norway, the host country, suggested that this species be listed at the next Conference of the Parties. Despite the Appendix I and II listing of *M. birostris*, Manta species have not yet been added to Annex I of the CMS Sharks MoU.

5. Range states (See Annex I)

6. Comments from range states

Fiji: Fiji does not have a targeted or subsistence fishery for Manta Ray species, but notes that the Manta ray species are caught as by-catch within the Purse seine Fisheries within the Western-Central Pacific Ocean. Manta 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 Manta Ray dive tourism (primarily *M. alfredi)* 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.

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 their CITES Appendix II listing in September-2014, but including them on the appendices of CMS would help support more comprehensive international protection. The devil 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 Manta and Mobula Rays. Even though the CMS is non-binding and voluntary, it is a strong indicator of countries showing willingness to take leadership in their conservation.

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ANNEX I. Distribution Map and Table

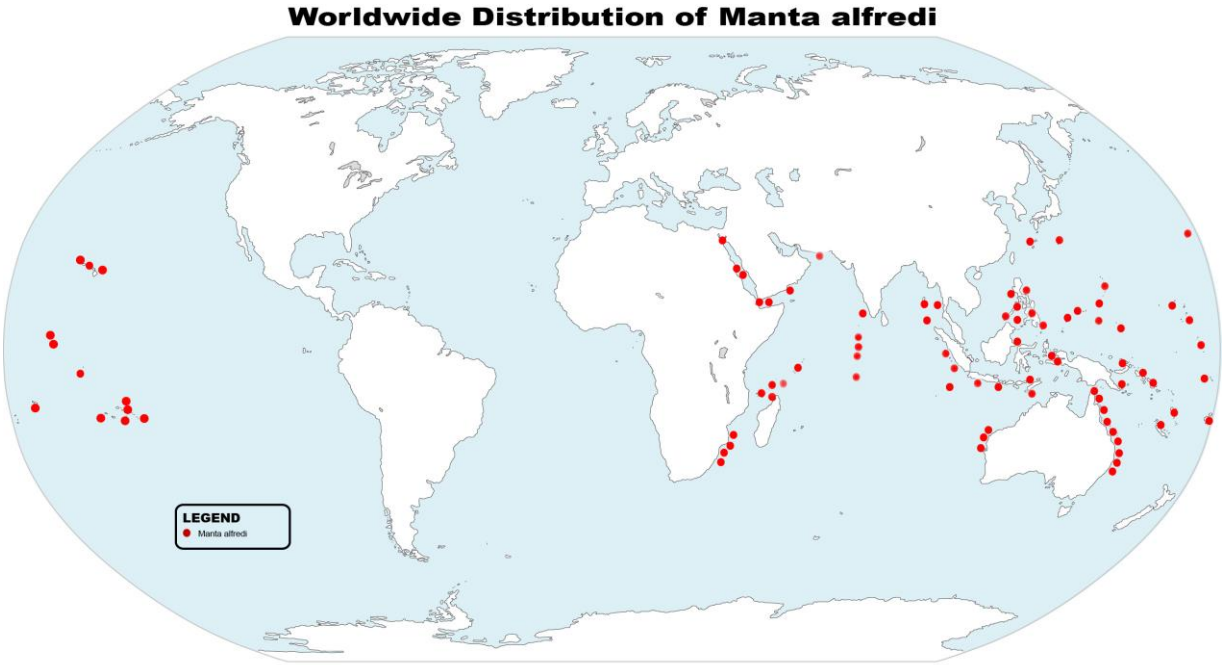

Figure from Marshall et al. 2011b

Distribution Table – Manta alfredi Range States and FAO Fisheries Areas

Range States and FAO Fisheries Areas	*Manta alfredi*
FAO Fisheries Areas	51, 57, 71, 77, 81
South Africa (Eastern Cape Province, KwaZulu-Natal, Western Cape Province)	x
Mozambique	x
Madagascar (Nosy Be)	x
Comoros - Mayotte (France)	x
Egypt - Sinai (African part)	x
Saudi Arabia	x
Sudan	x
Djibouti	x
Yemen	x
Oman	x
Seychelles (Inner Island Group, Amirante Islands, Farquhar Group, Aldabra Group)	x
Chagos Archipelago (British Indian Ocean Territory)	x
Maldives	x
Pakistan	x
India (Lakshadweep & Andaman Is. - *M. alfredi & M. birostris* - Andhra Pradesh, Goa, Gujarat, Kerala, Maharashtra, Tamil Nadu - *M. birostris* only)	x
Thailand	x
Malaysia	x
Indonesia (Sumatra, Bali, Komodo, Flores, Irian Jaya, Java, Lombok, Alor, Borneo, Sulawesi)	x
Cocos (Keeling) Islands (Australia)	x
Australia (New South Wales, Northern Territory, Queensland, Western Australia)	x
Philippines (Monad Shoal, Tubbataha Reef, Pamilacan, Apo Reef, Gigdup Shoal, Ticau & Masbate)	x
Ryukyu & Nampo-shoto Archipelagos' (Japan)	x
Northern Mariana Islands (Saipan) & Guam (US)	x
Federated States of Micronesia (Yap, Pohnpei)	x
Palau	x
Papua New Guinea (Bismarck Archipelago, North Solomon's, Main Island Group)	x
Solomon Islands	x
New Caledonia (France)	x
Vanuatu	x
Marshall Islands	x
Fiji	x
Tuvalu	x
Tonga	x
Cook Islands	x
Kiribati (Christmas Island)	x
Line Islands - Jarvis, Palmyra & Kingman (US)	x
Hawaiian Islands (US)	x
French Polynesia - Society, Marquises & Tuamotu Islands	x

ANNEX II. *Manta alfredi* legal protective measures

***Manta alfredi* legal protective measures**		
Location	**Species**	**Legal Protection / Conservation Measure**
International		
CITES Appendix II	*Manta spp.*	Listing of the genus *Manta* on Appendix II of the Convention on International Trade in Endangered Species (CITES), 2013
National		
Indonesia	*Manta spp.*	KepMen National Protective Legislation, 2014
Maldives	*Manta spp.*	Exports of all ray products banned 1995
Yap (FSM)	*Manta spp.*	Manta Ray Sanctuary and Protection Act 2008
State		
Florida, USA	Genus *Manta*	FL Admin Code 68B-44.008 – no harvest
Guam, USA Territory	All ray species	Bill 44-31 prohibiting possession/sale/trade in ray parts 2011
Hawaii, USA	*Manta spp.*	H.B. 366 2009 – no harvest or trade
Raja Ampat Regency, Indonesia	*Manta spp.*	Shark and Ray Sanctuary Bupati Decree 2010