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Agenda Item 24.1.1

PROPOSAL FOR THE INCLUSION OF ALL SPECIES OF SAWFISH (FAMILY PRISTIDAE) ON CMS APPENDICES I AND II

Summary

The Government Kenya has submitted a proposal for the inclusion of all species of sawfish (Family Pristidae) on CMS Appendices I and II for the consideration of the 11th Meeting of the Conference of the Parties (COP11), 4-9 November 2014, Quito, Ecuador.

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 Sawfishes, Family Pristidae, in Appendix I and Appendix II. Proposal for inclusion of *Anoxypristis cuspidata* (Narrow sawfish), *Pristis clavata* (Dwarf sawfish), *Pristis pectinata* (Smalltooth sawfish), *Pristis zijsron* (Green sawfish), *Pristis pristis* (Largetooth sawfish) in the Appendices of the Convention on the Conservation of Migratory Species of Wild Animals

B. PROPONENT: Government of Kenya

C. SUPPORTING STATEMENT:

1. Taxon

1.1 Class: Chondrichthyes, subclass Elasmobranchii
1.2 Order: Rajiformes
1.3 Family: Pristidae
1.4 Genus *Anoxypristis* and *Pristis*

- *Anoxypristis cuspidate*
- *Pristis clavata*
- *Pristis pectinata*
- *Pristis zijsron*
- *Pristis pristis*

1.5 Common names:

English	Sawfish
French	Poisson-scie
Spanish	Pez sierra, Pejepeine
Portuguese	Peixe-serra
Arabic	Sayyaf, Sayyafah (Oman)

2. Biological data

Historically, the Family Pristidae was thought to contain one mono-specific genus (Anoxypristis) and one genus (Pristis) of four to six species, grouped by similar morphological characteristics (IUCN 2013). However, recent work by Faria et al. (2013) using historical taxonomy, external morphology, and mitochondrial DNA (mtDNA) sequences (NADH-2 loci) proposed a new taxonomy that the sawfishes comprise five species in two genera. The former species *Pristis microdon* (Latham 1794), *Pristis perotteti* (Müller & Henle, 1841), and *Pristis pristis* (Linnaeus, 1758) are now regarded as one species *Pristis pristis* that has a circumtropical distribution. This is a departure from the CMS taxonomic reference Eschmeyer 1990 but this new taxonomy is now widely accepted, e.g. by the IUCN Red List and IUCN Shark Specialist Group. No changes are required for other species, which were demonstrated to be clearly defined and valid taxa: *Pristis clavata* (Indo-West Pacific), *Pristis pectinata* (Atlantic), *Pristis zijsron* (Indo-West Pacific), and *Anoxypristis cuspidata* (Indo-West Pacific, except for East Africa and the Red Sea).

Sawfishes have slightly flattened fairly shark-like body, ranging in maximum length from 3 m to over 7 m and a weight of up to one metric tonne, depending upon species. Like other shark-like rays, the gill slits are located on the underside of a flattened head and their most obvious characteristic is the long flattened snout (or saw), edged along both sides with large teeth. The saw may be used to stir prey up from the seabed and to attack mid water shoals of fishes, stun and kill it. All sawfishes are ovoviviparous, giving birth to very large live young (ranging in size from 60-90 cm TL). Litter size (where known) ranges from 1 to 20 pups, with litters probably produced every year (for narrow sawfish and the Indo-West Pacific subpopulation of largetooth sawfish) or every other year (smalltooth and Atlantic subpopulation of the largetooth sawfish). The age at maturity varies among species but is typically around 7.5 to 10 years for the *Pristis* and 3 years for *Anoxypristis* (Dulvy et al. in press). All species live the majority of their life in shallow marine coastal waters down to a maximum depth of around 100 m, they typically live in extremely shallow marine and estuarine waters less than 10 m deep (Carlson *et al.* 2013), and they are usually associated with mangroves or seagrasses (Simpfendorfer, 2007; Moore, 2014).

However the juveniles tend to be found in very shallow coastal and estuarine euryhaline waters often associated with mangroves or seagrass. Juvenile sawfishes spend considerably more time in rivers and estuaries (Poulakis et al. 2013) . Largetooth penetrates far into river systems and can be found 1000 km inland in the Amazon river (Fernandez-Carvalho 2013). They may use different habitats for different stages in their life cycles (e.g. *P. pectinata* in southern Africa moves from the sea into estuaries to pup).

2.1 Distribution and Range States (current and historical)[1]

Species	**Distribution**
Anoxypristis cuspidata Narrow sawfish	Historically a relatively common euryhaline or marginal large-bodied sawfish of the Indo-Pacific Region. It is found in inshore and estuarine environments. Native to Australia (Northern Territory, Queensland, Western Australia); Bangladesh; India; Indonesia; Iran, Islamic Republic of; Malaysia; Myanmar; Papua New Guinea; Sri Lanka. Possibly extinct in Viet Nam.
Pristis clavata Dwarf sawfish	East Indo-West Pacific. Native to Australia (Northern Territory, Queensland, Western Australia). Possibly extinct in India; Indonesia; Malaysia; Papua New Guinea; France (Réunion).
Pristis pectinata Smalltooth sawfish	Wide-ranging, but highly disjunct. Native to Bahamas; Belize; Cuba; Honduras; Sierra Leone; United States. Possibly extinct in Angola; Antigua and Barbuda; Barbados; Benin; Cameroon; Congo; Côte d'Ivoire; Dominica; France (Guadeloupe, Martinique); Equatorial Guinea; Gabon; Gambia; Ghana; Grenada; Guinea; Jamaica; Liberia; Netherlands (Netherlands Antilles, Aruba); Nigeria; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Senegal; The Democratic Republic of the Congo; Togo; Trinidad and Tobago; United Kingdom (Anguilla, British Virgin Islands, Cayman Islands, Turks and Caicos Islands; Montserrat); Uruguay; United States of America (Puerto Rico, US Virgin Islands)
Pristis zijsron Green sawfish	Indo-West Pacific. Native to Australia (New South Wales - Possibly Extinct, Northern Territory, Queensland, Western Australia); Bahrain; Eritrea; Indonesia; Kenya; Malaysia; Papua New Guinea; Qatar; Sudan; Timor-Leste; United Arab Emirates. Possibly extinct in Mauritius; France (Réunion); South Africa; Thailand.
Pristis pristis Largetooth	Circumtropical. Native to Australia (Northern Territory, Queensland, Western Australia); Bangladesh; Belize; Brazil; Colombia; France (French Guyana); Guinea-Bissau; Guyana; Honduras; India; Madagascar; Mozambique; Nicaragua;

[1] IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 18 April 2014.

sawfish	Pakistan; Panama; Papua New Guinea; Sierra Leone; Somalia; Suriname. Possibly extinct in Angola; Benin; Cambodia; Cameroon; Congo; Côte d'Ivoire; Ecuador; Equatorial Guinea; Gabon; Gambia; Ghana; Guatemala; Guinea; Lao People's Democratic Republic; Liberia; Malaysia; Mexico; Nigeria; Peru; Senegal; Seychelles; Singapore; South Africa; Thailand; The Democratic Republic of the Congo; Togo; United States; Uruguay; Venezuela, Bolivarian Republic of.

Sawfishes used to be widespread in tropical to warm temperate shallow, nearshore marine habitats and estuaries, large rivers and some lakes. Their distribution was presumably once continuous in suitable habitat, but is now severely fragmented with sawfish locally extinct from from large parts of their former range and remaining populations seriously depleted. Sawfish habitats are still widespread, although some (particularly estuaries, coral reefs and mangrove areas) are now reduced in area and quality in parts of their range and access to some rivers and lakes lost through dam construction.

Although the precise geographic range of sawfishes in the first half of the 20th Century is unknown, there is sufficient evidence for a serious constriction in the range of the entire Family as a result of population depletion or local extinction. For example, *Pristis pristis* (the 'common' sawfish) no longer occurs in Europe or the Mediterranean and may be close to extinction in West Africa. Several populations have been eliminated from rivers, the presumed result of a combination of factors including over-exploitation, pollution from a variety of sources, construction of dams or other riverine developments.

2.2 Population estimates and trends

It is difficult to determine the number or size of most remaining populations at the present time, but all known populations of sawfishes are in unfavourable status, primarily as a result of exploitation (target and bycatch) and, to a lesser extent, habitat loss and degradation. Many populations are extinct or possibly extinct from large areas of their former range, with no or only very few observations since the 1960s. Interviews with fishers (structured and unstructured) have been undertaken in several states in recent years to obtain information on recent and historic catches (e.g. Doumbouya 2004, Saine 2004, Fowler *et al*. 2002). In most range states, these species are now only very sporadically recorded (only a few specimens per decade); most populations are likely to be extremely small, if still present at all. These are highly distinctive species, very vulnerable to capture in fishing gear, and are extremely likely to be remembered and reported if present in catches. The acute rarity of sawfishes today contrasts with reports of these species being common in inshore waters at the end of the 19th Century and in the early 20th Century (Goode 1884, Henshall 1895, Jordan and Evermann 1996, Bigelow and Schroeder 1953). A target fishery in Lake Nicaragua was able to remove an estimated 60,000–100,000 sawfishes between 1970 and 1975 before it collapsed (Thorson 1976a).

A recent analysis of historic records combined with a comprehensive review of the literature has allowed a reconstruction of the historic and current range of each of the five sawfishes (Dulvy et al. accepted). The Extent of Occurrence of each species was estimated by assuming a maximum depth distribution of 100m. Historically, the globally distributed largetooth sawfish had the largest geographic range, spanning 7,188,400 km^2, followed by Narrow, Green, Dwarf and smalltooth sawfishes (Figure 3). Three species have undergone severe reductions in geographic range size: smalltooth sawfish (81% decline), dwarf sawfish (70% decline), and largetooth sawfish (61% decline; Figure x). The other two species have undergone substantial declines: green sawfish (38% decline) and narrow sawfish (30% decline) (Dulvy et al. accepted).

The smalltooth sawfish is potentially at greatest risk among sawfish species because it has undergone the greatest range contraction (81% decline) and has the smallest and most fragmented remaining geographic range (Dulvy NK et al. accepted). This species originally had the smallest historical geographic range, and is the only species endemic to the Atlantic Ocean. The dwarf sawfish was historically found in at least five countries and are now only Extant in Australia. It is Possibly Extinct in India, Malaysia, Indonesia, and Papua New Guinea.

Outside of the Extant range of sawfishes, there are large areas (>25%) within which sawfish presence could not be confirmed (Presence Uncertain), and hence substantial areas exist where extinction is likely to have occurred (Possibly Extinct), including: 70% of the historical range of dwarf sawfish, 18% for largetooth sawfish, 14% for smalltooth sawfish, 7% for green sawfish, and 5% for narrow sawfish (Figure x).

The narrow sawfish was historically found in 22 countries, but is now classified as Presence Uncertain in 12, and Possibly Extinct in one (Vietnam). Green sawfish was historically present in 37 countries, and is now classified as Presence Uncertain in 24, but is now Possibly Extinct in South Africa and Thailand. Once found in 47 countries, the smalltooth sawfish it is now considered Extant in only 6 countries, Presence Uncertain in 14, and Possibly Extinct in 27. Formerly present in 76 countries, the largetooth sawfish is now Extant in only 20 countries, Presence Uncertain in 27, and Possibly Extinct in 29.

Three sawfishes, *P. pristis, P. pectinata* and *P. zijsron,* are listed on the IUCN Red List of Threatened Species as Critically Endangered globally while *P. clavata* and *A. cuspidata* are listed as Endangered.

Although the status of two species has recently been changed from Critically Endangered to Endangered, sawfishes are still among the world's most threatened families of marine fishes. Three of the five sawfish species are currently assessed as Critically Endangered with an 'extremely high risk of extinction in the wild', while the remaining two are assessed as Endangered with a 'very high risk of extinction in the wild. All five species (and their constituent subpopulations, where relevant) were considered to have undergone past population reductions based on 'a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality' and 'actual or potential levels of exploitation' (that is, they meet the IUCN Red List criteria A2cd) (IUCN, 2012). For the Critically Endangered species, the qualifying decline threshold is ≥80%, and for the Endangered species, ≥50%, over a period of three generation-lengths. The justification for each Red List Assessment is provided in.

The only populations thought not to be in immediate danger of extinction are those in largely unfished coastal waters and rivers or subject to strong protections, for example, in Northern Australia and on the Gulf coast of Florida, USA. Researchers from the Mote Marine Laboratory, Florida, USA, estimated that the Florida sawfish population numbers a 'couple of thousand' individuals. Chapman et al. (2011) estimated the effective population size of Florida *Pristis pectinata* from 142–955 individuals (95% C.I., with point estimates of ~250-350), which suggests a total breeding population size in the low hundreds to low thousands based on the ratio of effective to total population size in large elasmobranchs (Portnoy et al. 2009). In addition, Australian populations of *Pristis clavata*, *Pristis pristis* (formerly *Pristis microdon*) and *Pristis zijron* are listed as Vulnerable under Australia's Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, 2014a,b,c) which means that fishers are meant to avoid catching them and

Pristis pectinata and *Pristis pristis* are listed on the USA Endangered Species Act making it illegal to catch or harm them.

Anoxypristis cuspidata:
IUCN status: Endangered
(D'Anastasis et al. 2013)
The Narrow Sawfish (Anoxypristis cuspidata) is the most productive sawfish species, reaching maturity early (2–3 yr) and having intrinsic rates of population increase >0.27 yr-1, making it less susceptible to fishing pressure than other sawfish species. However, it does have the highest post release mortality of all sawfish species. While the current population size and its historic abundance are unknown, it persists in most of its range states, but in substantially lower numbers than historically. Like other sawfishes, the toothed rostrum and demersal occurrence makes Narrow Sawfish extremely susceptible to capture in gillnets and demersal trawl nets. The species has been affected by commercial net and trawl fisheries, which operate in inshore areas of its range, reductions in habitat quality and coastal development, the impacts of which have cumulatively led to population decline.

Despite a lack of quantitative data to support declines, current information indicates that Narrow Sawfish across its Indo-West Pacific range are considerably more rare than historically recorded. Declines of between 50 and 70% over three generation lengths (~18 years) are suspected and have primarily been attributed to ongoing capture in commercial net and trawl fisheries, with the Narrow Sawfish being particularly susceptible given it has poor post-release survival.].

The previous assessment of this species was Critically Endangered. However, given the new information that has become available since the last assessment and the fact that the more dramatic declines have happened outside of the three generation period (~18 years), the species now meets the criteria for an Endangered listing (representing a non-genuine change in status based on new information available since the time of the last assessment).

Pristis pristis
IUCN status Critically Endangered:
(Kyne et al. 2013)

All subpopulations have undergone significant population declines and the species is now apparently extinct in many former range states. In most others, recent records are rare (e.g., there have been very few records in the Eastern Atlantic in the last decade). In the Western Atlantic, current records indicate that Largetooth Sawfish can only be regularly encountered today in the Amazon River basin, the Rio Colorado-Rio San Juan area in Nicaragua, and possibly some remote areas of French Guiana, Suriname, and Guyana. In the Indo-West Pacific, northern Australia represents a globally important remaining population centre. Overall, a population reduction based on a reduction in extent of occurrence (EOO) of ≥80% over a period of three generations (i.e., 1960s to present) is inferred. Despite protection in some range states (e.g., Australia, India, Brazil, United States, Mexico; it is possibly extinct in the latter two range states), threats are ongoing and the species is assessed globally as Critically Endangered.

Pristis pectinata
IUCN status: Critically Endangered
(Carlson et al. 2013)

The Smalltooth Sawfish (Pristis pectinata) has been wholly or nearly eliminated from large areas of its former range in the Atlantic Ocean by fishing (trawl and inshore netting) and habitat modification. Negative records from scientific surveys, anecdotal fisher observations, and fish landings data over its historic range infer a population reduction of ≥95% over a period of three generations (i.e., 1962 to present). The remaining populations are now small, and fragmented. The species can only be reliably encountered in the Bahamas (where suitable habitat is available) and the United States (Georgia south to Louisiana). It is rare but present in Honduras, Belize, Cuba, Sierra Leone, and possibly Guinea-Bissau and Mauritania. Threats to Smalltooth Sawfish still exist today in areas where sawfish are unprotected and habitat modification (mangrove removal) and inshore netting still occurs.

Pristis zijsron
IUCN status: Critically Endangered
(Simpfendorfer 2013)

While the current population size and historic abundance is unknown, it is suspected as having declined in all of its range states. In Australian waters, its range has been well documented to have contracted significantly. Like all sawfishes, the toothed rostrum and demersal occurrence makes Green Sawfish extremely susceptible to capture in gillnets and demersal trawl nets. Historically, the population has been negatively affected by commercial net and trawl fisheries which operate in inshore areas throughout most of its range, the cumulative impacts of which have led to population declines. This species is now protected by no-take status in some range states (e.g. Australia, Bahrain, India), is listed on Appendix I of CITES, and is protected by some areas that are closed to fishing; but these actions alone will not be sufficient to ensure its survival in most regions. Despite a lack of quantitative data to support declines, available information indicates that populations of Green Sawfish are considerably rarer than historically across its entire range. Australia has some of the last remaining viable populations of Green Sawfish in the world, albeit at significantly reduced levels. Declines in the population are suspected to exceed 80% over three generation lengths (~44 yr), and it is possible that there has been localised extinction in a number of range states due to intensive fishing, reducing its extent of occurrence, and supporting its listing as Critically Endangered.

Pristis clavata
IUCN status: Endangered
(Kyne et al. 2013)

Despite uncertainty regarding the extent of the species' wider historical range, it can be considered 'possibly extinct' outside of Australia with the disappearance of the species probably occurring outside of the last three generation period (pre-1960s; considering that there are no confirmed records since the 1800s). All sawfish species that occur in Australian waters have undergone significant, albeit largely unquantified, declines, although the current population size and historical abundance of Dwarf Sawfish is unknown. While specific management measures are now in place in Australia, including full species protection, education of fishers about safe release

practices, and fishery-specific management, threats are ongoing and there is no information to suggest that the population is recovering from previous declines. Declines of 50-80% are inferred from capture in continuing commercial fisheries, with the Dwarf Sawfish particularly susceptible given its restricted inshore occurrence and relatively limited global range; it is therefore assessed as **Endangered**. Some remote regions of northern Australia do however have little commercial fishing activities with some relatively small inshore areas closed to commercial fishing. This may provide localised refugia for Dwarf Sawfish, but until such time that viable populations can be verified, it is assumed that the species is continuing to decline, given that threats are ongoing.

The previous assessment for this species was Critically Endangered. However, given the new information that has become available since that last assessment and the fact that the more dramatic declines have happened outside of the three generation period (~49 years), the species now meets the criteria for an Endangered listing (representing a non-genuine change in status based on new information available since the time of the last assessment).

All sawfish populations have undergone serious declines, demonstrated by a significant reduction in captures or complete disappearance from their original range. These declines are attributed to depletion by target, bycatch, artisanal and recreational fisheries, with continued bycatch from seriously depleted populations continuing to drive the remnants of the population down long after commercial target fishing has become economically unviable and ceased. Because gill nets entangle sawfish rostra so efficiently, the widespread use of cheap durable monofilament nets since the mid 20th Century is thought to be responsible for the most recent declines. With a few exceptions, the overall pattern is for relatively large (or at least reliable) catches before the 1950's, followed by a steep decline until the 1970's, then very infrequent, if any, records into the 1980's and to the present. This pattern is particularly evident in southeast Asia and West Africa (Robillard and Seret 2006), and probably elsewhere. Early fisheries records in the eastern United States (National Marine Fisheries Service, 2009) demonstrate that the decline here began much earlier – this may also be the case in other regions, but data are lacking elsewhere. The strictly protected southern USA population of *Pristis pectinata* appears to have stopped declining and may now have stabilised at extremely low numbers (a few thousand animals, or less than 5% of its size at the time of European settlement (Simpfendorfer 2002; Carlson et al. 2007)) as a result of a gill net ban in large marine protected areas on the Florida coast and legal protection in Florida and Louisiana coastal waters.

According to the FAO online database, FIGIS, sawfish landings were recorded between 1962 and 2001, with a worldwide peak of 1759t in 1978. Most landings were from South America. A strong decline in reported landings took place between 1884 and 1995, partly masked by estimates of landings by FAO (it is unclear how these estimates were reached), despite some landings declared by Pakistan between 1987 and 1995, reaching 84 t in 1990. In West Africa, Liberia declared some landings between 1997 and 2000, ranging from 41 to 48 t. Landings are now only recorded sporadically and in very small quantities in world fisheries.

There are very few quantitative records of the declines from original population numbers because catch records are incomplete throughout most of the species' range in the 19th Century and early 20th Century, when the greatest declines are likely to have occurred. Decline data are, however, available from the target fishery in Lake Nicaragua, Nicaragua

(Thorson 1974, 1976a, 1976b, 1980, 1982, 1987, McDavitt 2002 a) and from the east coast of the USA (National Marine Fisheries Service 2009, Simpfendorfer 2000, 2002).

Pristis pristis (formerly P. perotteti) were extremely abundant in Lake Nicaragua in the 1960s. A target fishery was developed in 1970 with governmental encouragement and the establishment of two fishing companies and a processing plant. Warnings in 1973 of an impending population crash were not heeded (Thorson 1982). By 1975, an estimated 60,000–100,000 sawfish had been harvested (Thorson 1976a). Four boats were still exclusively fishing for sawfish in the early 1980s, with one fisherman reporting catches of 150–250 sawfishes per week (McDavitt 2002 a). The fishery collapsed in the 1980s and the government instituted a temporary moratorium on targeted fishing for the species. In 1998, a former sawfish fisherman reported a bycatch of between four and six sawfishes a year (McDavitt 2002 a).

Adams and Wilson (1996) examined the reduction in populations of *Pristis pectinata* in the USA, concluding that both population and range have been severely reduced. In the late 19th Century, one fisherman reported catching 300 sawfish in his nets in the Indian River Lagoon, Florida, USA (Evermann and Bean 1898), but Snelson and Williams (1981) reported the local extinction of sawfish from this formerly important site. The portion of the population that used to disperse north along the eastern coast of the USA as far as New York has been completely lost. The Gulf of Mexico population was also severely reduced, with isolated and very small populations perhaps totalling a couple of thousand individuals remaining in Texas, Louisiana and Florida, compared with estimates of hundreds of thousands in the late 1800s. Bycatch rates in Louisiana shrimp trawlers declined steeply during the late 1950s and early 1960s. Simpfendorfer (2002) estimated that the U.S. population was less than 5% of its size at the time of European settlement.

Figure 1 shows all records of sawfish landings, worldwide, from the FAO FIGIS database.

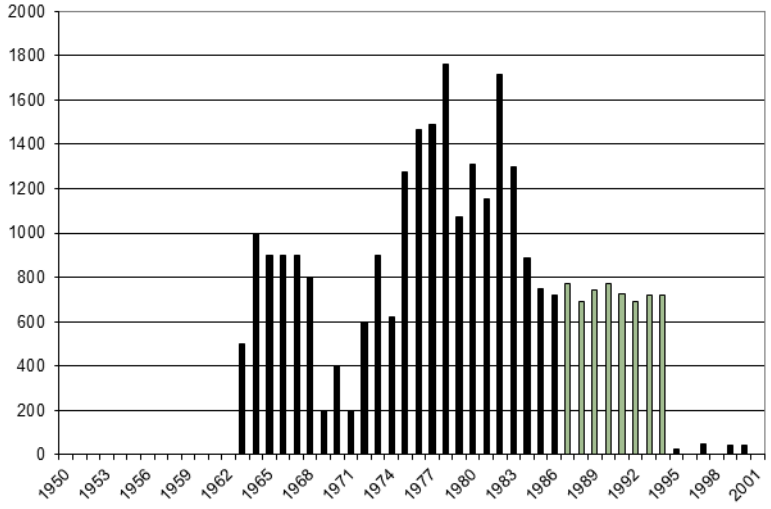

Figure 1. World sawfish landings (metric tonnes), 1950-2001.

(Source: FAO FIGIS capture production database. N.B. 1988-94 records are FAO estimates, not reports from fishing states.)

Table 5 (Annex 3) lists examples of known declines in sawfish populations by species. In most cases, however, the precise identity of species formerly present in areas where sawfishes have now extinct or possibly extinct is unknown, so this table is necessarily very incomplete. Table 3 (Annex 3) presents overall trends in populations of Family Pristidae by region and/or range state.

2.3 Habitat

Sawfishes usually occur in depths of less than 10 m (occasionally to 50 m) in tropical to warm temperate (warmer than 16-18^{o}C) inshore waters, estuaries, rivers and lakes (depending upon species). They are thought to spend most time on or near the bottom but are sometimes seen swimming at the surface. The shallow coastal, brackish and freshwater habitats of sawfishes are often associated with high levels of human activity, which may result in degradation or loss of habitat through, for example, pollution, prey depletion, and coastal or riverine developments, including mangrove clearance, canal development and construction of seawalls (Simpfendorfer 2002). Populations in freshwater and estuaries are particularly seriously affected by constraints on availability of suitable habitat, because of widespread fisheries (use of fishing nets is virtually incompatible with sawfish populations, because their rostra are so vulnerable to entanglement), deteriorating water quality (temperature, flow rates and water levels, dissolved and suspended material from agricultural and logging operations, salinity and oxygen fluctuations) and construction of dams and weirs that prevent migration. Examples include the effects of mining operations, including cyanide spills, e.g. in the Fly River (Papua New Guinea) and several South American river catchments, and dam construction, e.g. on the Chaophraya River, Thailand (Compagno and Cook 1995a,b,c).

2.4 Migrations

The serious depletion of sawfish populations now makes it uncertain as to the extent the remaining populations of some of these species still migrate across country boundaries. Such migrations are likely to have been far more obvious in the past when populations were larger.

Sawfishes are also now so rare that it is difficult to undertake research into their population structure and movements in the majority of the remaining fractions of their former range. However, and examination of the recent and historical literature can be used to infer that sawfishes were migratory with a high likelihood that a significant proportion could, cyclically and predictably, cross one or more national jurisdictional boundaries.

Bigelow and Schroeder (1953) reported that the smalltooth sawfish *Pristis pectinata* population in US Atlantic waters included a migratory segment that moved seasonally along the coast, as far north as New York when temperatures warmed in summer, returning south to Florida as temperatures cooled in the autumn. They considered that this migratory segment of the population was composed only of mature individuals. Similar temperature-driven migrations were hypothesised to occur in the Gulf of Mexico (Simpfendorfer 2002, Adams and Wilson 1996, Fernandez-Carvalho et al 2013). Twelve *P. pectinata* tracked with pop-off satellite archival tags generally remained in coastal waters within the region where they were initially tagged (South Florida or Bahamas), travelling an average of 80.2 km from deployment to pop-up location (Carlson et al. 2014). The shortest distance moved was 4.6 km and the greatest 279.1 km, averaging 1.4 km per day. Seasonal movement rates for females were significantly different with the greatest movements in autumn and winter, suggesting that seasonal migrations do occur in at least some areas of a scale that may allow crossing of national boundaries. Similar migrations used to occur along the South American coast to Uruguay, where sawfishes have not been seen for many decades, and presumably also occurred in Mediterranean and European coastal waters and off the coast of southern Africa (Ebert and Stehmann 2013). There are numerous records of largertooth and smalltooth sawfish from the Mediterranean over the past 500 years. These include adult and juvenile specimens. While there is a risk that many records may have a risen as a result of extensive international trade, records of captures of juveniles and adults in the western Mediterranean Sea suggest that there were vagrant individuals, possibly straying from West Africa, or that there were resident

populations of both species or a combination of the two. Narrow sawfish may have ranged as far north as Honshu, Japan (Last and Stevens 1994, Compagno and Last 1999, Compagno et al. 2006, Van Oijen et al. 2007). Sawfish populations have been seriously depleted for many decades and are now so rarely recorded that it is generally no longer possible to observe these seasonal coastal migrations into higher latitudes during the summer.

Pristis pristis is also thought to migrate regularly between marine and freshwater habitats, for example, recorded over 1,300 km upstream from the mouth of the Amazon River and in Lake Nicaragua. These migrations patterns are generally unknown, but may be associated with breeding activity and hence seasonal in nature. They can be halted by the construction of dams and weirs or by serious pollution that makes transits through rivers and estuaries impossible.

As part of the AFRICASAW Programme, the CSRP, DRDH and the FLMNH are working together to assess the status of Pristidae in Western Africa. AFRICASAW has developed a sub-regional alerting network in order to intervene rapidly and efficiently in case of bycatch, in close collaboration with National Fisheries and/or Environment Ministries. In field surveys, the team was able to confirm the actual presence of sawfishes (Pristis spp.) in Guinea-Bissau, Sierra Leone and Guinea. The most relevant captures have taken place, since 2010, in the Rio Cacine, in South of Guinea-Bissau, some of which were reported within less than 5km from the border with Guinea (Jung et al, 2013).

3. Threat data

3.1 Direct threats

The principal threat to the sawfishes is from target and utilised bycatch (or byproduct) fisheries. Their long tooth-studded saw makes them extraordinarily vulnerable to entanglement in any sort of net gear. Bycatch mortality in net fisheries was the major reason for the decline of the smalltooth sawfish *Pristis pectinata* in the United States (Seitz and Poulakis 2006). There have been some large-scale target sawfish fisheries: in Lake Nicaragua in the 1970s, in the south-eastern United States in the 19th and early 20th Century, and possibly in Brazil from 1960s to 1980s (bycatch is still landed in this range State). Populations are now so depleted, however, that commercial targeting of sawfish stocks is no longer economic. Most sawfishes have been and still are killed in broad-spectrum commercial and artisanal fisheries, particularly set net and trawl fisheries that target a very wide range of fishes and invertebrates. Sawfishes are retained in these fisheries, just as they were in former target fisheries, because of the very high value of their products (particularly meat, fins and rostral saws, also liver oil and skin). They are also targeted or bycatch and retained opportunistically for the same reasons. Sawfish fins occur but are now extremely rare in the Asian dried shark fin trade and may have once had their own trade name given their value (D. Chapman pers obs).

Trophy angling for very large specimens has been reported (Simpfendorfer 2005, McClenachan 2009).

3.2 Habitat loss/degradation

Habitat degradation and loss threatens some species, particularly those reliant upon estuaries and freshwater for any part of their life cycle, where human development pressures are often high. Construction of dams and weirs may prevent migration of *Prisits pristis* up and downstream. Water quality is affected by agricultural run-off, logging and mining operations, and discharges from industrial developments and settlements.

A new emerging large-scale threat is the development of ocean-connecting canals through prime sawfish habitat. The most recent proposed development is of an Inter-Oceanic Nicaragua Canal, similar to the Panama Canal (Hammick 2013, Watts 2013). The proposed route is through the San Juan River and Lake Nicaragua. Their habitats previously harboured one of the largest and best known freshwater sawfish populations and offer an important conservation and restoration opportunity (Thorson 1976, 1982b).

3.3 Indirect threats

Stevens *et al*. (2005) reviewed the potential impacts of high levels of endocrine-disrupting organochlorine contaminants (OCs) on some elasmobranchs, including reduced fertility. The bioaccumulation and biomagnification of these pollutants may also pose an indirect threat to sawfishes. Persistent pollutants in the marine environment taken up in food or from sediments (such as heavy metals and slowly degraded organic chemicals) bioaccumulate in the tissues of marine animals, particularly long-lived animals. When predators feed on prey that have themselves accumulated pollutants such as methylmercury and polychlorinated biphenyls (PCBs), the concentrations of these substances are increased further up the food chain. Some of the highest levels of bioaccumulated OCs recorded in marine organisms occur in elasmobranchs. Species confined to the inshore marine environment, where high levels of pollution occur as a result of discharges from coastal industries and rivers, are likely to accumulate the highest levels of contamination in their tissues.

The low reproductive capacity of sawfishes (their slow growth, late maturity, and small litter size) means that depleted stocks will be very slow to recover and poses an additional indirect threat to species whose populations have been so severely depleted. Simpfendorfer (2000) estimated an intrinsic rate of increase of 0.08 to 0.13 *per annum*, and a population doubling time for *P. pectinata* of between 5.4 and 8.5 years under ideal conditions (no fisheries mortality, no population fragmentation, no habitat modification and no inbreeding depression arising from the genetic consequences of a small population size). Estimates for *P. perotteti* (now *P. pristis*) under the same circumstances were intrinsic rates of increase from 0.05 to 0.07 *per annum* and population doubling times of 10.3 to 13.6 years. He noted that the life history of these species makes any significant level of fishing unsustainable and that recovery from any population decline would be slow (taking decades to a point where extinction risk will be low, or centuries to recover to pre-European settlement levels in the USA). Carlson *et al*. (2007) reported a small increase in abundance of about 5% per annum in *P. pectinata* in the Everglades National Park, Florida, where this species' US centre of abundance occurs and it is protected from gill netting.

3.4 Threats connected especially with migrations

Sawfishes that require particular habitats at different stages of their life history (e.g. rivers, lakes, estuaries or areas of mangroves) are threatened by coastal and riverine developments that prevent them from migrating to these critical habitats (and sawfishes are amphidromous, moving between the sea and estuarine and freshwater habitats). The construction of dams and weirs on rivers is a serious threat to *Pristis pristis* in freshwater. Fishers may in the past have been able to take advantage of sawfish migrations to feeding or breeding grounds in order to target this species, but this may now be unusual because of the rarity of these species. The other significant problem associated with sawfish migrations is that these species are only protected by a very few range States. Any national conservation initiative intended to prevent these Endangered and Critically Endangered species from being driven further towards extinction is unlikely to be successful if sawfishes are not protected during their seasonal migrations through other range States' waters. This is a particular problem when the population

is distributed along a coastline that is divided into a large number of small countries (e.g., the Central American Caribbean, Western Africa) and less so when the population occurs in one country with a large coastline (e.g., USA, Australia). The remaining "strongholds" for sawfish occur in the USA and Australia, countries with a large coastline that have strong protectionist legislation encompassing the entire distribution of one or more sawfish populations, coupled with large tracts of minimally altered sawfish habitat. Small coastal nations could emulate this approach by establishing and enforcing the same protective legislation and habitat conservation in a coordinated manner.

3.5 National and international utilisation

Sawfishes are valuable for their meat (for national utilization and export), for fins that enter international trade to Asia, where they are highly valued, and for the toothed rostra that are valuable as curios, for traditional medicine, and for cock-fighting spurs.

The meat is white and tender, particularly in juveniles, and is one of the most valuable and preferred of all elasmobranchs (sharks and rays) sold in the city of Belém, Pará State, Brazil (Charvet-Almeida 2002) and caught by Guinéan fishers (Doumbouya 2004). A large individual can yield several hundred kg of valuable meat (Last and Stevens 1994). The rostral saws can be very valuable as curios (particularly those from the largest specimens). In North Brazil (Pará State) Charvet-Almeida (2002) reports that large saws (>1.5 m) are ordered by buyers before fishing starts and may be worth up to US$ 300 to the fisherman, depending upon size. Doumbouya (2004) notes that Guinéan fishers used to target sawfishes for their rostra and meat. When foreign fishers started fishing in Guinéan waters they targeted sawfishes for their rostra and their fins. Large saws are likely to be exported because of the international demand for these rare and unusual products as marine curios. There is a significant market in Chinese Taipei for sawfish saws that are part of the ceremonial equipment/weapons of spirit mediums (there are an estimated 23,000 of these mediums in Taiwan). The small saws, from newborn and juvenile sawfish, are sold as curios, or ground up as a local treatment for asthma (in Brazil), or exported for use in traditional Chinese medicine.

There has also been a market for live sawfish to put on display in public aquaria. Recent genetic analyses have shown that Australia's populations of freshwater sawfish are more vulnerable to such removals than previously thought, particularly females, due to strong female philopatry, which divides the Australian populations into several sub-populations that are unlikely to be replenished from other populations (Whitty *et al*., 2009; Phillips *et al*., 2009; Phillips *et al*., 2011; Phillips, 2012).

Trophy angling has been reported.

4. Protection status and needs

4.1 National protection status

The Nicaraguan government imposed a temporary moratorium on targeted fishing for sawfishes in Lake Nicaragua in the early 1980s (Thorson 1982), after the population collapsed following intensive fishing in the 1970s. The aim was to allow the population to recover, but no such recovery has occurred (McDavitt 2002 a). It appears that even bycatch mortality is sufficient to prevent population growth.

Indonesia enacted legislation to protect sawfishes (and five other freshwater fish species) in Lake Sentani, West Papua, following severe depletion of populations in a gill net fishery (Kyne et al 2013).

The USA listed *Pristis pectinata* on the US Endangered Species Act in 2003, following earlier protection in the State waters of Florida and Louisiana and protection under the USA Atlantic & Gulf Coasts Fishery Management Plan since 1997. This remnant population in the Gulf of Mexico is considered to have survived because of the benefits of large marine and coastal protected areas, including the establishment of the Everglades National Park in 1947, and as a result of a number of conservation measures during the 1990s, including species protection in Florida and Louisiana and a ban on all forms of entangling fishing nets in Florida State waters (Simpfendorfer 2002). A Recovery Plan has been adopted for this species (NMFS 2006). The decline in this population may have ceased as a result of these measures.

Australian populations of *Pristis clavata*, *Pristis pristis* (formerly *Pristis microdon*) and *Pristis zijron* are listed as Vulnerable under Australia's Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Department of the Environment, 2014a,b,c). *Anoxypristis cuspidata* and *Pristis pectinata* are not protected under the EPBC Act. A recovery plan for the three listed sawfish species (together with two species of freshwater sharks) is currently in development.

India's Ministry of Environment and Forests has protected all sawfishes under the Wildlife Protection Act (WPA) 1972 since 2001.

The take of all sawfishes is also banned in Mexico.

Brazil's National List of Threatened Aquatic Organisms and Fish (Ministério do Meio Ambiente 2004) includes *P. pectinata* and *P. perotteti* on Annex 1, Threatened Species, meaning that catches of largetooth and smalltooth sawfishes are prohibited.

Sawfish are protected in the Exclusive Economic Zone in Guinea and Senegal and in Marine Protected Areas in Mauritania and Guinea-Bissau (S.V. Fordham pers. comm. 2012).

The sawfishes are of high cultural and symbolic importance in some West African States (Robillard and Seret 2006).

4.2 International protection status

In 2007, all species of sawfish were proposed by the governments of Kenya and the United States of America for listing on the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). *Pristis microdon* was listed on Appendix II (with an annotation restricting international trade to live specimens for public aquaria) and all other species were listed on Appendix I. Trade in saws is continuing through e-bay, despite this listing.

At the last Conference of the Parties to CITES in March 2013, the proposal by the government of Australia to transfer *Pristis microdon*, now a subpopulation of *Pristis pristis* (Kyne et al. 2013), from Appendix II to Appendix I was adopted by consensus, thus banning international trade in all species of sawfish.

Sawfishes are protected to some degree in 16 of the 93 historical range states: Australia, Bahrain, Bangladesh, Brazil, Guinea, India, Indonesia, Malaysia, Mexico, Nicaragua, Qatar, Senegal, South Africa, Spain, U.A.E., and the U.S.

The U.S. protects largetooth and smalltooth sawfishes under the federal Endangered Species Act (ESA), although only smalltooth sawfish is found there today. The ESA has prompted strict prohibitions on possession and harm, as well as measures to mitigate mortality of bycatch and conserve smalltooth sawfish critical habitat (Norton *et al.*, 2012). Australia provides

similar protections under the *Environment Protection and Biodiversity Conservation Act* and state/territory legislation but has yet to extend national protection to the narrow sawfish. The protections in the 14 other range countries also would benefit from harmonization (protecting all species present), while enforcement is often inadequate.

In 2010, largetooth sawfish and smalltooth sawfish were added to Annex II of the Barcelona Convention Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean. States that are Party to the Convention are required to ensure that they provide maximum protection for, and aid the recovery of, these species. Subsequently, the General Fisheries Commission for the Mediterranean (GFCM) adopted measures in 2012 to confer protection from fishing activities on these Annex II species.

4.3 Additional protection needs

There is no question that these species require strict protection throughout as much of their range as possible, if they are not to be driven to extinction (IUCN/CMS 2007). These Endangered and Critically Endangered migratory sawfish species would benefit from legal protection in those range States that have not yet adopted such measures in order to address the threat of unsustainable exploitation. CMS Appendix I and II listings would yield significant benefit for one of the most threatened groups of chondrichthyan fishes if it resulted in strict protection being extended to larger numbers of sawfishes in larger numbers of range States and increased cooperation between range states in particular with regard to collaborative research and monitoring to fill gaps in knowledge related to population status, structure and movements. It would also be appropriate and consistent for sawfishes to be considered within the Memorandum of Understanding (MOU) on the Conservation of Migratory Sharks. This would serve to increase cooperation between range states. An Appendix II listing would indicate this need. Bycatch, particularly in nets, will then remain the greatest threat to these species and should be addressed to ensure that the sawfishes are not driven to extinction. Regulation of net gear in critical sawfish habitats and other coastal and freshwater reserves where sawfish occur will yield significant benefits for these species.

5. Range States

See Annex

6. Comments from Range States

7. Additional Remarks

8. References

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Annex: Range States

	CMS status	***Anoxypristis cuspidata***	***Pristis clavata***	***Pristis pectinata***	***Pristis pristis***	***Pristis zijsron***
Angola	Party			X	X	
Antigua& Barbuda	Party			X		
Australia	Party	X	X		X	X
Bahamas	Non-Party			X		
Bahrain	Non-Party					X
Bangladesh	Party	X			X	
Barbados	Non-Party			X		
Belize	Non-Party			X	X	
Benin	Party			X	X	
Brazil	Non-Party				X	
Cambodia	Non-Party				X	
Cameroon	Party			X	X	
Colombia	Non-Party				X	
Congo Dem Rep	Party			X	X	
Congo Rep	Party			X	X	
Costa Rica	Party				X	
Cote d'Ivoire	Party			X	X	
Cuba	Party			X		
Dominica	Non-Party			X		
Ecuador	Party				X	
Equatorial Guinea	Party			X	X	
Eritrea	Party					X
France	Party		X France (Réunion)	X (Guadaloupe, Martinique)	X (French Guiana)	X France (Réunion)
Gabon	Party			X	X	
Gambia	Party			X	X	

	CMS status	***Anoxypristis cuspidata***	***Pristis clavata***	***Pristis pectinata***	***Pristis pristis***	***Pristis zijsron***
Ghana	Party			X	X	
Grenada	Non-Party			X		
Guatemala	Non-Party				X	
Guinea	Party			X	X	
Guinea Bissau	Party				X	
Honduras	Party			X	X	
India	Party	X	X		X	
Indonesia	Non-Party	X	X			X
Iran	Party	X				
Jamaica	Non-Party			X		
Kenya	Party					X
Lao People's Democratic Republic	Non-Party				X	
Liberia	Party			X	X	
Madagascar	Party				X	
Malaysia	Non-Party	X	X		X	X
Malta	Party				Extinct	
Mauritius	Party					X
Mexico	Non-Party				X	
Mozambique	Party				X	
Myanmar	Non-Party	X				
Netherlands	Party			X (Aruba & Curaçao)		
Nicaragua	Non-Party				X	
Nigeria	Party			X	X	
Pakistan	Party				X	
Panama	Party				X	
Papua New Guinea	Non-Party	X	X		X	X

	CMS status	*Anoxypristis cuspidata*	*Pristis clavata*	*Pristis pectinata*	*Pristis pristis*	*Pristis zijsron*
Peru	Party				X	
Portugal	Party				Extinct	
Qatar	Non-Party					X
St. Kitts & Nevis	Non-Party			X		
St. Lucia	Non-Party			X		
St. Vincent & the Grenadines	Non-Party			X		
Senegal	Party			X	X	
Seychelles	Party				X	
Sierra Leone	Non-Party			X	X	
Singapore	Non-Party				X	
Somalia	Party				X	
South Africa	Party				X	X
Sudan	Non-Party					X
Suriname	Non-Party				X	
Thailand	Non-Party				X	X
Togo	Party			X	X	
Trinidad & Tobago	Non-Party			X		
United Arab Emirates	Non-Party					X
United Kingdom	Party			X (Anguilla, Montserrat)Turks & Caicos)	Extinct (Gibraltar)	
Uruguay	Party			X	X	
United States of America	Non-Party			X	X	
Venezuela	Non-Party				X	
Viet Nam	Non-Party	X				