Inclusion of Mako Sharks *Isurus oxyrinchus* and *Isurus paucus* in Appendix II

Proponents: Bangladesh, Benin, Bhutan, Brazil, Burkina Faso, Cabo Verde, Chad, Côte d'Ivoire, Dominican Republic, Egypt, European Union, Gabon, Gambia, Jordan, Lebanon, Liberia, Maldives, Mali, Mexico, Nepal, Niger, Nigeria, Palau, Samoa, Senegal, Sri Lanka, Sudan and Togo

Summary: Shortfin Mako Shark *Isurus oxyrinchus* is a fast, large (4 m), widely distributed, migratory shark with low biological productivity. It can be found in all temperate and tropical ocean waters from 50°N (60°N in the North Atlantic) to 50°S. It is distributed across the following oceans: North Atlantic (14.5% of distribution), South Atlantic (12%), North Pacific (32.5%), South Pacific (22%), Indian Ocean (17.9%) and Mediterranean (1.1%).

Longfin Mako Shark *I. paucus* appears in similar waters, although its complete distribution remains unclear. Very little is known about its biology.

The primary threats to *Isurus oxyrinchus* and presumably *I. paucus* are directed and incidental catch in multi-specific fisheries found throughout its range. *Isurus oxyrinchus* is generally retained for its high-valued meat for both national and international markets, whilst its fins are mostly destined for the international market. Its meat is consumed all over the world and is considered a premium product. Fins from *I. oxyrinchus* have been observed in markets in Hong Kong SAR's main commercial centre, where this was reported as the fourth and fifth most abundant species in 1999-2000 and 2014-2015 respectively. *Isurus paucus* fins have also been observed in this market. Other products from this trade include liver oil, skin and teeth. The form in which species are traded (primarily meat) makes it hard to differentiate between species. Although it is possible to visually differentiate the fins of the two species using macro-morphology based on differences in the dermal denticles, it is reported that *I. paucus* fins are often combined in *I. oxyrinchus* and thresher (*Alopias* spp*.)* fin categories, due to a similarity in appearance and market value.

Isurus oxyrinchus is also the target of sport fishing and at risk of being caught in shark protection nets. Climate change may also be a threat to *I. oxyrinchus;* warming ocean waters may affect its spatial and temporal distribution.

Both species are considered to have low productivity. Global population sizes are unknown but may number in the millions. Various studies and sources have used a range of indicators to examine the trends in each of the ocean areas including spawning stock fecundity, spawning abundance, biomass and mortality. However, due to different datasets and methods used for analysis, these studies are often not directly comparable and therefore a percentage decline is not always possible to calculate. Available information has been examined for evidence of historical and recent declines in relation to the quantitative guidelines contained in the footnote to Annex 5 of *Res. Conf. 9.24 (Rev. CoP17)* for commercially exploited aquatic species. We take these guidelines to refer to the criterion 2aA. Information has also been examined for evidence of decreasing populations considered in relation to criterion 2aB.

The FAO Expert Advisory Panel examined available datasets for robust information on the extent of marked declines for *I. oxyrinchus* (for which more data are available) to determine if there have been historical and recent declines near to the guideline figures in the footnote to Annex 5 of *Res. Conf. 9.24 (Rev. CoP17)*. The Panel concluded that in none of the species' areas of distribution were there historical declines near to the guideline figures, however they did note that there was reliable evidence of historical population decreases in the North Atlantic, Mediterranean and North Pacific (combined distribution of 48.1%). They considered there was not enough reliable evidence for the South Atlantic and Indian Ocean to calculate the extent of decline. The Panel considered that the population of the South Pacific has historically been stable and possibly increasing in recent years.

The Panel determined that recent decreases in the North Atlantic were of between 23-32%. Although they acknowledged decreases in the Mediterranean, they found that the extent of decline was not well determined. They found data to determine recent declines for the South Atlantic and Indian Ocean

were not robust enough to calculate the extent of decline, but noted there were marginal increases (by 0.16% per year) in the North Pacific.

While there appear to be no historic or recent marked declines near to the guideline figures in the footnote to Annex 5, taking into consideration available datasets there is evidence that populations of *I. oxyrinchus* in the North Atlantic, South Atlantic, Mediterranean, Indian Ocean and North Pacific (making up 78% of the distribution) have all undergone historical decreases in population. In recent years the North Atlantic, Mediterranean and Indian Ocean (33.5% of distribution) populations have been decreasing. In the South Pacific there is general agreement that the population is likely increasing marginally, however in the North Pacific there is a lack of consensus over the trend, with some considering a possible continuing decline whereas others consider there to have been a marginal increase. There is a lack of data for the South Atlantic, but in the most recent IUCN Red List assessment it is accepted that the situation in the North Atlantic (decreasing population) is representative of the South Atlantic.

Less information is known on the population size of *Isurus paucus,* although it is considered the rarer of the two species; expert judgement suggests global declines would be similar to *I. oxyrinchus* as it is caught as target and incidental catch alongside *I. oxyrinchus* in offshore and high seas waters.

Recent global IUCN Red List assessments due to be published in March 2019 have categorised both species as Endangered.

Some range States have adopted a variety of legislative measures including quotas, finning bans, fishing gear restrictions, and area and season bans. Within the distribution of *I. oxyrinchus*, at least some areas are known to have stricter legislation in place, often in the form of recommendations or resolutions established by Regional Fisheries Management Organisations (RFMOs), including the banning of shark finning or the requirement for live *I. oxyrinchus* to be released.

Analysis: *Isurus oxyrinchus* and *I. paucus* are both widely distributed, occurring in temperate and tropical ocean waters. *Isurus oxyrinchus* meat is utilized both locally and internationally and considered to be high value. Its fins have been observed in some of the largest fin markets. The species' low productivity place them at risk of overexploitation if stocks are overfished and unable to recover. There is no robust evidence of historic or recent marked declines for *I. oxyrinchus* that would meet the guidelines for listing under Annex 2aA. However, historical population decreases have been reported for *I. oxyrinchus* across large parts of its range (78%). Recent data suggest populations are continuing to decrease in 33.5% of its distribution (North Atlantic, Indian Ocean and Mediterranean), and if the condition of the North Atlantic is representative of the South Atlantic, this would add a further 12% of the species' distribution. The populations in the South Pacific appear to be stable or marginally increasing and there are differing opinions on the trend in the North Pacific. When considering the historic and recent trends in populations in conjunction with one another, overall it would appear that regulation of trade in *I. oxyrinchus* is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting. Therefore, *I. oxyrinchus* meets the criteria in Annex 2aB of *Res. Conf. 9.24 (Rev. CoP17)*.

Population trend data for *I. paucus* are limited but it is likely to be undergoing similar decreases to *I. oxyrinchus*, thus potentially also meeting the criteria in Annex 2aB of *Res. Conf. 9.24 (Rev. CoP17)*.

Some legislation and regulations are in place in some of the regions where population declines are occurring. The extent to which these are being implemented is unclear. Any CITES listing would reinforce the implementation of any existing legislation and management measures.

Fins of both species are sometimes mixed in the same market category and although it is possible to differentiate the fins due to differences in dermal denticles, *I. paucus* is commonly misidentified as *I. oxyrinchus*. Meat would be less readily identifiable to the species level and therefore enforcement officers who encounter specimens of CITES-listed species are unlikely to be able to distinguish

between species. Thus, if either species is considered to meet the criteria in Annex 2a, then the other species should be included in the Appendices in line with Annex 2bA.

Summary of Available Information

Text in non-italics is based on information in the Proposal and Supporting Statement (SS); text in italics is based on additional information and/or assessment of information in the SS

IUCN Global Category and Range

There are two species in the genus Isurus:

Shortfin Mako Isurus oxyrinchus

Global - Endangered A2bd (2018) ver 3.1. (Rigby et al*., 2019a, accepted for publication in the March 2019 Red List update)*

Regional - Mediterranean: Critically Endangered A2bd (2016) ver 3.1.
Regional - European: Data Deficient (2015) ver 3.1.

It has a worldwide distribution and is highly migratory with 64% (of 2,459 marked sharks) recaptured in the North Atlantic captured 500 km away from the tagging site and some up to 4,542 km away. It can be found in all temperate and tropical ocean waters from 50°N (60°N in the North Atlantic) to 50°S. *It is occasionally found close inshore where the continental shelf is narrow (Cailliet* et al., *2009). It is not normally found in waters below 16°C (Compagno, 2001). Isurus oxyrinchus* is found in the following FAO Fishing Areas: 21, 27, 31, 34, 37, 41, 47, 51, 57, 61, 67, 71, 77, 81 and 87. Its country occurrence is 143 countries.

Longfin Mako Isurus paucus

Global - Endangered A2d (2018) ver 3.1. (Rigby et al*., 2019b, accepted for publication in the March 2019 Red List update)*

Regional - Mediterranean: Data Deficient (2016) ver 3.1.
Regional - European: Data Deficient (2014) ver 3.1.

It appears to be a widely distributed species in tropical and warm temperate waters. However, at present records are sporadic and the complete distribution remains unclear. This is in part due to the confusion with the more common Isurus oxyrinchus. It is found in the following FAO Fishing Areas: 21, 27, 31, 34, 41, 47, 51, 57, 61,71, 77 and 81. Range countries/territories are Australia (New South Wales, Queensland), Brazil, Cuba, Ghana, Guinea-Bissau, Japan, Liberia, Madagascar, Mauritania, Micronesia, Federated States of, Morocco, Nauru, Portugal, Solomon Islands, Spain (Canary Is.), Taiwan Province of China, USA (Hawaiian Is., California, Florida) and Western Sahara (Reardon et al*., 2006).*

Biological and trade criteria for inclusion in Appendix II (Res. Conf. 9.24 (Rev. CoP 17) Annex 2a)

A) Trade regulation needed to prevent future inclusion in Appendix I

Biology

Isurus oxyrinchus is a species of large shark (~ 4 m), that is fast-swimming, reaching 70 km/hour. It is highly migratory and distributed in temperate and tropical ocean waters (50˚ N to 50˚ S). Their seasonal movements depend on food availability, water temperature and stages of growth of the species, it can sometimes be found on the coast.

Isurus oxyrinchus has low biological productivity according to the criteria of *Res. Conf. 9.24 (Rev. CoP17)*, with a natural mortality lower than 0.2 (0.072 to 0.223), an intrinsic growth rate lower than 0.14 (0.031 to 0.123); a Von Bertalanffy growth constant less than 0.15 (0.05 to 0.266), an average age of maturity greater than 8 years (up to 21 years), a maximum age greater than 25 years (up to 45 years) and a longer generation time than 10 years (25 years). Additionally, this species produces between 4 and 25 pups per litter with a gestation period of 12 to 25 months and reproduces every two or three years.

Isurus spp. are ovoviviparous and oophagous, that is, live offspring are born and feed on infertile eggs during gestation. Like other lamnid sharks, *Isurus oxyrinchus* uses a circulatory heat exchange system to maintain the temperature of its muscles and viscera above that of the surrounding seawater, which allows for a higher level of activity.

Isurus paucus has a litter size of 2-8 and a maximum size of 427cm (Castro et al., 1999; Compagno, 2001).

Population size
The global population size for *Isurus oxyrinchus* is unknown. Different assessments have considered independent stocks. *There are oceanic stock assessments available (North Atlantic, South Atlantic, North Pacific and Indian) that can provide estimates of biomass and/or spawning stock biomass (Barreto,* in litt*., 2019). Information on* Isurus paucus *appears to be even more limited.*

Population trends
Globally
Isurus oxyrinchus
The latest IUCN Red List assessment (Rigby et al., *2019a, accepted for publication in the March 2019 Red List update) reports that steep population declines have occurred in the north and south Atlantic, with declines also evident, though not as steep in the north Pacific and Indian Oceans. The south Pacific population appears to be increasing but with fluctuating catch rates. The weighted global population trend estimated a median decline of 46.6%, with the highest probability of a 50-79% population reduction over three generation lengths (72-75 years), and therefore* Isurus oxyrinchus *was assessed as Endangered in the new Red List Assessment.* Previously (2004) it was assessed as being Vulnerable.

Isurus paucus
The latest IUCN Red List assessment (Rigby et al.*, 2019b, accepted for publication in the March 2019 Red List update) reports that limited population trend data indicates strong declines and it is suspected to have undergone a population reduction of 50-79% globally over the last three generations (75 years), similar to its congener, Isurus oxyrinchus. Isurus paucus is therefore assessed as Endangered in the new Red List Assessment. Previously (2006) it was assessed as being vulnerable (Reardon* et al., *2006).*

Various studies and sources have used a range of indicators to examine the trends in each of the ocean areas including spawning stock fecundity, spawning abundance, biomass and mortality. The results of these are summarised in Table 1, and discussed in more detail below.

Table 1. *Isurus oxyrinchus population trends for oceans, sourced from FAO Expert Advisory Panel report* (FAO, 2019), SS**, original source*** and accepted IUCN Red List assessments**** reporting the indicator used, time period and original source.*

Ocean (% of distribution)	***Indicator***	***Extent of decline***	***Time period***	***Source***
North Atlantic (14.5%)	*Spawning stock fecundity*	*Historical: 50%** *Recent (2006-2015): 32%**	*1950-2015*	*ICCAT, 2017*
	Spawning stock fecundity	*Historical: 39%*** *Recent (2006-2015): 32%*** *Annual: 4%*** *Projected 10 year: 60% ***	*1950-2015*	*ICCAT, 2017*
	Biomass	*Declining*****	*1950-2017*	*ICCAT, 2017*
	CPUE	*43%****	*1986-2005*	*Cortes et al., 2007*
	CPUE	*34%****	*1992-2005*	*Baum and Blanchard, 2010*
South Atlantic (12%)	*Spawning stock fecundity*	*Uncertain****	*1950-2015*	*ICCAT, 2017*
	Biomass	*IUCN RLA considers decrease in N. Atlantic population trends representative of S. Atlantic*****		*ICCAT, 2017*
	CPUE	*99% declines between 1979-1997 and 1998-2008* *17% increase between 1998-2009 and 2008-2011****	*1979-2011*	*Barreto et al., 2016*
North Pacific (32.5%)	*Spawning abundance*	*Historical: depletion to 58% (CI:30~86%) of unfished or 42% decline** *Recent (2007-2016): Increasing by 0.16% per year**	*1975-2016*	*ISC, 2018*

	Spawning abundance	*Historical: 16.4%** Recent (2006-2016): Increase of 1.8%** Annual: Increase of 0.18%***	*1975-2016*	*ISC, 2018*
	Spawning abundance	*Declining*****	*1975-2016*	*ISC, 2018*
	Spawning potential ratio (SPR)	*SPR in 2003=20% which is less than Biological Reference Point SPR=35%****	*1990-2003*	*Chang and Liu, 2009*
	Fishing mortality	*Fishing mortality in 2003=0.066/year>Biological Reference Point=0.045/year****	*1990-2003*	*Chang and Liu, 2009*
	Abundance	*Infer decreasing trend****	*1995-2005*	*Tsai et al., 2011*
	Abundance	*Infer decreasing trend****	*1995-2010*	*Tsai et al., 2014*
	CPUE	*69% over time period or 7% per year****	*1996-2009*	*Clarke et al., 2013*
	CPUE	*Stable population****	*2000-2010*	*Rice et al., 2015*
	CPUE	*Increasing trend****	*2006-2014*	*Kai et al., 2017*
South Pacific (22%)	*CPUE*	*Trends not significant****	*1996-2009*	*Clarke et al., 2013*
	CPUE	*Possibly declining between 2009-2013 but trend unreliable****	*2009-2013*	*Rice et al., 2015*
	CPUE	*Three datasets having a "nil" trend and one having an increasing trend****	*1993-2013*	*Francis et al., 2014*
	CPUE	*Increasing trend*****	*1995-2013*	*Francis et al., 2014*
Indian Ocean (17.9%)	*Biomass*	*Historical: 26%** Recent (2005-2015): 18.8%** Annual: 2.1%** Projected 10 year: 41.6%***	*1970-2015*	*Brunel et al., 2018*
	Biomass	*Declining*****	*1971-2015*	*Brunel et al., 2018*
	CPUE and mean weight	*Declining abundance****	*1964-1988*	*Romanov et al., 2008*
	CPUE	*Decline from 1994-2005 and subsequent increase until 2010****	*1994-2010*	*Kimoto et al., 2011*
	CPUE	*High variability until 2008, followed by increasing trend until 2016****	*2000-2016*	*Coelho et al., 2017*
Mediterranean (1.1%)	*Different indices of shark abundance*	*Historical: declines to over 90%****	*Multiple time periods*	*Ferretti et al., 2008*

North Atlantic (14.5% of the total distribution of the species)
The ICCAT (International Commission for the Conservation of Atlantic Tunas) carried out the most recent evaluation of the North Atlantic stock in 2017, with data from 1950 to 2015 and used four models (Bayesian Surplus Production Model, Just Another Bayesian Biomass Assessment model, Catch only Monte-Carlo and Stock Synthesis 3). The combined probability of all models being in a state of overexploitation while still experiencing overfishing is 90%.

Based on the spawning stock fecundity (SSF) generated by the Stock Synthesis 3 model (table 7 of ICCAT, 2017) the SS estimated that there is a historical decrease of 39% (1,126,000 average SSF of 1950-1960 against 686,600 average SSF of 2006-2015), a recent decrease of 32.1% (822,000 SSF in 2006 and 558,000 SSF in 2015) with an annual decrease rate of 4.2%. Using the 4.2% decrease rate and starting at 558,000 SSF, an estimated projected 10-year decrease of 60% of the historical baseline was reported (1,126,000 average SSF of 1950-1960 versus 443,758 average SSF of 2016-2025).

In the latest IUCN Red List assessment (accepted for publication in the March 2019 Red List update) the trend analysis of the north Atlantic modelled biomass for 1950-2017 (68 years) from ICCAT, 2017 revealed annual rates of decline of 1.2%, consistent with an estimated mean decline of 60% over three generation lengths.

Satellite telemetry was used as a tool to document fishing interactions and quantify the fishing mortality of *Isurus oxyrinchus* in the northern Atlantic Ocean. During 2013 to 2016 in the Yucatan peninsula, Mexico and in Maryland, the USA, a total of 40 sharks were tracked. The MARK model was used to estimate the survival probability of sharks annually, which is formulated as a generalized linear model (GLM), which allows modeling survival based on variables at the individual level (e.g. size, age, sex). The outcome of the modelling estimated fishing mortality between 0.19-0.56, 5-18 times higher than the estimated mortality in the maximum sustainable yield ranging from 0.031-0.038. *This implies the North Atlantic stock of* Isurus oxyrinchus *is currently experiencing overfishing (i.e. F > Fmsy). Thus, if the level of fishing mortality observed is representative of the western North Atlantic population, it is likely to be unsustainable (Byrne et al., 2017).*

A 43% decline in relative abundance has been observed for Isurus *spp. between 1986 and 2005 from a logbook data analysis (Cortes* et al*., 2007). This decline was largely driven by a 21% decline in the first 3 years of the series (1986-1988), followed by an increase in 1989, and a progressive decline from 1989 to 1999, after which the series progressively started increasing until 2005 (Cortes* et al*., 2007).*

Isurus spp. standardized catch rates were estimated to have declined, although the trend (instantaneous rate = −0.032) equating to a 34% decline (95%CI: 1–56%) between 1992 and 2005, was only marginally significant and imprecisely estimated. The estimated decline for Isurus oxyrinchus, which accounted for 79% of all recorded Isurus spp., was slightly greater (instantaneous rate = −0.040, 95% CI: −0.005 to −0.074, p = 0.026) (Baum & Blanchard, 2010).

South Atlantic (12% of the total distribution of the species)
The ICCAT (2017) carried out the most recent assessment of the South Atlantic stock, with data from 1950 to 2015 and using three models (Bayesian Surplus Production Model, Just Another Bayesian Biomass Assessment model and Catch only Monte-Carlo). The combined results of the model indicate a 19% probability that the stock is overfished and that it experiences overfishing. The evaluation group of ICCAT SCRS considered that the results of the state of the stock for the South Atlantic are highly uncertain. They concluded that, despite this uncertainty, it is likely that in recent years the number of females in the stock may be below the expected level of maximum sustainable yield and that the fishing mortality already exceeds the expected mortality in the maximum sustainable yield.

Due to unreliable stocks assessments, the latest IUCN Red List assessment (accepted for publication in the March 2019 Red List update) report that the results from the north Atlantic would be representative of the south Atlantic for the trend analysis.

Barreto et al*., 2016 identified three temporal phases of exploitation of* Isurus oxyrinchus *on longlines in the South Atlantic. Using generalised linear mixed models to standardise catch rates and identify trends in each of the three phases (1979-1997, 1998-2008 and 2008-2011). Steep declines of 99% in the average CPUE were observed between 1979-1997 and 1998-2008, with a 16.97% increase between 1998-2008 and 2008-2011. They observed extremely low catch rates in 1998-2008 and 2008-2011, suggesting that the population of* Isurus oxyrinchus *is depleted in the South Atlantic.*

North Pacific (32.5% of the total distribution of the species)
The ISC SWG (International Scientific Committee Shark Working Group) evaluated the stock of *Isurus oxyrinchus* with the best scientific information available to date, with data from the North Pacific, provided by the USA, Japan, Taiwan Province of China and Mexico of catches (1975 to 2016) that were standardized. They used the Stock Synthesis 3 from which a base model was generated, and a sensitivity analysis was carried out to determine the possible weaknesses of this modelling. Based on this, six scenarios were also modeled that address the identified weaknesses (e.g. increasing catch data for the period with greater uncertainties by 1975-1993). As a result of the base model (which is consistent with the different modelled scenarios), it was determined that there is a more than 50% probability that the stock is not in overfishing conditions (the current spawning abundance, 910,000 sharks is 36% higher than the expected spawning abundance in the maximum sustainable yield 633,700 sharks) and overexploitation does not exist (the impact of current fishing, 0.16, is less than the expected impact on maximum sustainable yield, 0.26). The predictive power of the model for the future is limited and uncertain. However, three scenarios were run projecting the behaviour of the stock to 10 years with which it is estimated that if the average catches of 2013-2015 are maintained or reduced by 20%, the abundance of females may increase. Based on the spawning abundance generated by the model (Table 7 of the publication ISC, 2018) the SS estimated that there is a historical decrease of 16.4% (1,024,000 average spawning

abundance from 1975-1985 against 855,700 spawning abundance average of 2006-2016), a recent increase of 1.8% with an annual increase rate of 0.18% (844,800 spawning abundance in 2006 and 860,200 spawning abundance in 2016).

In the latest IUCN Red List assessment (accepted for publication in the March 2019 Red List update) the trend analysis of the modelled spawning abundance for 1975-2016 (42 years) from ISC, 2018 revealed annual rates of the decline of 0.6%, consistent with a median decline of 36.5% over three generation lengths.

Until 2018, the trends and state of the North Pacific stock had been evaluated mainly in a regional manner, with short time series and with different approximations. Based on information from the Taiwan Province of China longline fleet for the years 1990 to 2004, an assessment of the Pacific Northwest stock was conducted through a virtual population analysis. They observed a decrease trend from 2000, finding that the Potential Spawning Rate (SPR) had reached a level of 20% in 2003, being lower than the biological reference point (BRP SPR = 35%) and fishing mortality (F) in 2003 exceeded the BPR of current mortality (F2003 = 0.066/year, BRP F35% = 0.045/year). In this evaluation, it was concluded that the population could have been overexploited and recommended a 32% reduction in fishing efforts. Later, for the same fishery, a different group with the same information, but updated (1995-2005), included an analysis of the uncertainty in their estimates of the BRP and the same group in 2014 used a matrix demographic analysis by stages. They also concluded that the abundance of the stock of the Northeast Pacific was decreasing under fishing conditions during the study periods. A study using generalized linear models to standardize the catch rates of the longline fisheries of the Central and Northeast Pacific and making use of biological indicators, identified a recent rate of significant decrease in the catch rate for *Isurus spp.* of 7% per year during 1996-2009 (equivalent to approximately 69% for the 15-year period analyzed). However, the study indicates that the performance of the standardization model for *Isurus spp.* (North and South Pacific), was the worst compared to the models for the other shark species studied; therefore, the trends are less reliable. A study published in 2015 concluded that, based on CPUE data, catch rates were relatively stable in the North Pacific during 2000 and 2010, although they acknowledge the lack of data in some years, without being able to infer during the last 4 years. Conversely, a study published in 2017 developed a linear delta-generalized disaggregated by size and space-temporarily mixed model to analyze the catch rates of *Isurus oxyrinchus* in the Japanese Pacific Northwest and Central Pacific fishery during 2006-2014. They found that, as of 2008, the capture rates showed an increasing trend.

South Pacific (22% of the total distribution of the species)
In the South Pacific, changes in abundance for *Isurus oxyrinchus* were not significant (1996-2009) and the performance of the standardization model for the species (north and south) was worse than for the other shark species studied; therefore, their tendencies are less reliable. A study published in 2015 indicated that *Isurus oxyrinchus* in the South Pacific may have been decreasing for the past five years (2009-2013), however, the same authors argue that they are based on relatively few data and therefore, the trend estimated can be unreliable.

In Francis et al., *2014 population trends of* Isurus oxyrinchus *in New Zealand waters are based on logbooks from the domestic fishery (north and south), logbooks from the Japanese fishery in the south and observer data. Although it was difficult to determine trends due to wide and overlapping confidence intervals for the models covering the southern fishing grounds (i.e. TLCER Japan South, TLCER Domestic South and approximately two-thirds of the observer data), all datasets indicated peak catches during the period 2011–2013. One of the datasets (i.e. the TLCER North) suggests, on the basis of non-overlapping confidence intervals, that mako catch rates have increased between 2005 and 2012, but then dropped in 2013; however, the 2013 values are higher than values observed in the mid 2000s.*

In the latest IUCN Red List assessment (accepted for publication in the March 2019 Red List update) a trend analysis using data from Francis et al., 2014 indicated annual rates of increase of 0.5% consistent with a median increase of 35.2% over three generation lengths (72 years).

Mediterranean (1.1% of the total distribution of the species)
A study in 2008 conducted an evaluation with bibliographic information of the Adriatic Sea fishery (76 records of *Isurus oxyrinchus*, *Lamna nasus*, *Sphyrna tudes* and *S. zygaena* from 1827 to 2000), the Spanish fleet catching swordfish of the Mediterranean (1991-1992) and the longline fleet of the Ligurian Sea (1990-1997). With this information they applied generalized linear models, with which they estimated a decrease greater than 96% of the baseline. *The meta-analytical estimate of the rate of decline was >99.99% for biomass (IRD: –0.15; CI 95%: –0.21, –0.10; time range: 106 years) and abundance (IRD: –0.12; CI 95%: –0.22, –0.03; time range: 135 years) (Ferretti et al., 2008). It should be noted that catch rates were very low even at the beginning of the data series, with an average of 0.2 sharks per 1,000 hooks (Walls & Soldo, 2016).* The species *Isurus oxyrinchus* was classified as Critically Endangered in a 2016 regional assessment, based on (i) inadequate management

resulting in continuous (or increasing) fishing pressure, (ii) the high value of its meat and fins, (iii) the sensitive life history of the species, (iv) absence of records of some areas located in the Mediterranean Sea, (v) evidence of large declines in other regions and (vi) captures of juveniles in a probable area of nurseries. *Isurus oxyrinchus* was considered common throughout the Mediterranean Sea, currently the species is rarely found. The last known sighting of the species in the Mediterranean was in Malta in 2005 and it was reported that the species has not registered in the Adriatic Sea since 1972. A decrease of the regional population of at least 80% in the last three generations (75 years) was calculated according to the available data and it was expected that this trend would continue given the lack of management and current fishing levels.

Indian Ocean (17.9% of the total distribution of the species)
A preliminary stock assessment was conducted using reduced information, mainly catch rates of the longline fleet of European Union countries. Two models were applied, a Bayesian Schaefer-type production model and another one analyzing only the trends of the catches, reporting that the current exploitation rate exceeds the exploitation levels where the Maximum Sustainable Yield (MSY) obtained since 1990 estimated that the rate of fishing mortality F has a value much higher than the expected fishing mortality rate in the maximum sustainable yield Fmsy (F2015 / Fmsy = 2.57). It was concluded that *Isurus oxyrinchus* in the Indian Ocean has overfishing (its fishing mortality is 2.57 times greater than the Fmsy value), but it is not overfished.

Based on the proportions of Biomass / Bmsy generated by the Schaefer model (Figure 6B of the publication Brunel et al., 2018) the SS estimated that there is a historical decrease of 26% (1.6 B / Bmsy average from 1970-1980 against 1.1 B / Bmsy average from 2005-2015), a recent decrease of 18.8% with an annual decrease rate of 2.1% (1.31 B / Bmsy in 2005 against 1.06 B / Bmsy in 2015). Using the 2.1% decrease rate and starting from a value of 1.06 B / Bms, a projected 10-year decrease of 41.6% of the historical baseline was estimated (1.6 B / Bmsy average of 1970-1980 against 0.93 B / Bmsy average of the 2015-2025).

In the latest IUCN Red List assessment (accepted for publication in the March 2019 Red List update) a trend analysis of the biomass for 1971-2015 (45 years) from Brunel et al*., 2018 revealed annual rates of decline of 0.9% consistent with a median decline of 47.9% over three generation lengths (72 years).*

A study examined the incidental catch of longlines during a research program on longline fisheries of tuna in the western equatorial Indian Ocean (1964-1988). They identified *Isurus oxyrinchus* as the second most frequent shark species caught, and a major decline in catches and mean weight for all principal shark species.

A study from the Japanese longline fleet showed trends in standardised longline Isurus oxyrinchus *CPUE with a gradual decreasing trend, with some unnatural up and down from 1994 to 2005, turning into a steady increase to 2010 (Kimoto* et al., *2011).*

A study of the Portuguese pelagic longline fishery in the Indian Ocean between 2000 and 2016 found CPUE to have high variability in the early years until 2008, followed by a general increasing trend in the more recent years until 2016 (Coelho et al., *2017).*

A review of the species in a regional assessment of elasmobranchs in the Arabian Sea and adjacent waters published in 2017 assigned *Isurus oxyrinchus* a near threatened status for the area. The authors found that the available standardized CPUE data suggested a variable abundance, but that there was little evidence of a significant population reduction. However, they noted that there was evidence of decreases in the average size of individuals in countries such as Oman, and estimated that, given the intensive pelagic fishing in the region and the high susceptibility of the species to the longline fishing gear, purse seines and drift nets, it was suspected that *Isurus oxyrinchus* had presented population decrements of 20-30% in the last three generations (75 years).

B) Regulation of trade required to ensure that harvest from the wild is not reducing population to level where survival might be threatened by continued harvest or other influences
The main threat to *Isurus oxyrinchus* is fishing, since it is caught as a directed and incidental catch in multispecific fisheries throughout its range, particularly in pelagic longlines, targeting tuna, billfish and swordfish in national and international waters. *Isurus oxyrinchus* is valued for its high-quality meat, and fins. Because of this, it is discarded less frequently than other pelagic sharks. Its liver oil is considered of average quality. *Isurus oxyrinchus* is a target of sport fishing in the USA, New Zealand and some European countries.

Fins
Estimates of the average declared value of global imports of shark fins have been reported. These were ~ USD 22.5 /kg from 2000 to 2011, reaching USD 25.6 /kg in 2011. *Isurus oxyrinchus* is the fourth (in 1999-2000) or fifth (in 2014-2015) most abundant species observed in the shark fin trade through Hong Kong SAR's main commercial center. *Isurus paucus has also been observed in this market, although only making up 0.08% of the*

sample (Fields et al., 2018). Isurus oxyrinchus *fins are found in the "Qing lian" fin category which* Isurus paucus *was sometimes mixed with (Clarke* et al*., 2006).* Isurus paucus *was also found in the "Wu gu" fin category which was supposed to be for thresher shark species* Alopias spp*. (Clarke* et al*., 2006).*

Using commercial data on weight, fin sizes marketed and trade name of *Isurus oxyrinchus*, together with statistical and Bayesian analysis of DNA to obtain missing records, it was estimated that *Isurus oxyrinchus* fins represent at least 2.7% of the world trade in fins from 1999-2001, may be higher given its presence in other commercial categories, reaching up to 1 million mako sharks (*Isurus spp.*= 40,000 t of the two species combined) captured annually. Between 2014 and 2015, a genetic analysis of processed fin clips and by products of fin preparation in Hong Kong SAR found that 0.2 to 1.2% of reported samples were *Isurus oxyrinchus*. Regarding the global volume of shark fin trade reported in Hong Kong SAR, in 2012 it decreased by 22% from the average recorded between 2008-2010, but the reported total average of fin volume traded in Hong Kong SAR remains at least 6,000 metric tons between 2012-2015.

Meat
Isurus spp. meat is of high quality (it is known as "veau de mer" in Europe) and it is used fresh, dried, salted, frozen and smoked for human consumption all over the world. Its price is USD 22-44 /kg in American supermarkets and it is a premium product in Japan. In Spain, *Isurus spp.* meat in wholesale markets is double the cost of blue shark meat (~ USD 14.17 /kg fresh, versus USD 7.63 /kg for blue shark, and USD 5.21 /kg versus USD 4.42 /kg frozen). This is considered high-end in Venezuela. In some areas, *Isurus spp.* meat is used as animal feed and fish meal. In Mexico, the highest commercial value of *Isurus spp.* products is reflected in the meat, which is more valued compared to that of other sharks in the market (~ USD 1/kg), followed by the caudal peduncle (for export) and subsequently the rest of the fins of the species, it is also registered that all the derivatives of the species are used, including the jaw and the heads for decoration and ornament.

Isurus spp. has the highest wholesale price of shark meat for Namibian shark exports USD 2-3 /kg. *Isurus spp.* meat and fins has been found in the Singapore market, probably imported. There are reports of Japanese companies producing 240 t/year of frozen *Isurus spp.* fillets for export to Italy and Spain.

Other products
Isurus oxyrinchus oil is extracted to obtain vitamins; the skin is processed as leather, the jaws and teeth are used for ornaments. The jaws are sold to tourists in countries such as Sudan. Most of these by-products are of low value, are commercialized in small quantities and are not recorded in trade statistics.

Extent of trade
According to FAO's global catch production statistics (1981-2016), total landings of *Isurus oxyrinchus* increased by 69% from 2004-2009 (54,155 t total in the period) to 2010-2016 (*91,989 t total in the period, reported in the SS as 45,956*). In the period from 2010 to 2016, the Atlantic contributed 50% of the total catches (45,956 t total for the period), the Pacific with 34% (31,838 t total) the Indian Ocean with 15% (14,043 t total) and the Mediterranean with less than 1% (152 t total). In these periods, the average catches per year were 9,025 t in the period from 2004 to 2009 and 12,141 t/year between 2010 and 2016 (*calculated at 13,141 t/year for this analysis*). Spain, Taiwan Province of China and Portugal represent 62% of the annual catches reported to FAO between 2006 to 2016 (35%, 15% and 12% respectively).

Vulnerability
An ecological risk assessment (ERA) concluded that *Isurus oxyrinchus* was the second shark species most vulnerable to the Atlantic longline fisheries, and the most vulnerable in the Indian Ocean. In 2015, the ERA was reviewed, finding that *Isurus oxyrinchus* were the most vulnerable to pelagic longline fisheries in the Atlantic Ocean and are among the most vulnerable species (vulnerable to catch and mortality) from the biological point of view.

The breeding areas identified to date have been the product of fishery-dependent data, which is why there is likely to be direct exploitation pressure on them.

In terms of fishing gear, *Isurus oxyrinchus* have a post-release survival of up to 70% (depending on management and release time), higher than other shark species, making it feasible to implement measures of selective fishing management. In southeastern Australia, it was estimated that *Isurus oxyrinchus* caught by recreational fishermen on the southeastern coast of Australia (n = 30) had a survival rate of 90%.

Inclusion in Appendix II to improve control of other listed species

A) Specimens in trade resemble those of species listed in Appendix II under Res. Conf. 9.24 (Rev. CoP17) Annex 2 a or listed in Appendix I

Isurus paucus is very similar in appearance to *Isurus oxyrinchus*, although it has longer pectoral fins. *Isurus spp.* are grouped for the catch, landings and trade data, although a study differentiated the fin clips of the two species in 2017. *Isurus paucus* is the rarest species, its habitat and behavior are little known, but it is thought to have a more tropical distribution in oceanic waters. Of the two species, *Isurus paucus* is less abundant, but according to a study in 2006, most traders reported that they placed these fins on the same market category as *Isurus oxyrinchus* and the thresher sharks (*Alopias spp.* listed in Appendix II of CITES), due to its similarity in appearance and market value.

The dorsal fins of *Isurus oxyrinchus* and *Isurus paucus* are similar; both are dark grayish brown, have a short free tail tip, and are very erect due to the steep angle of the anterior border. The second dorsal and anal fins are extremely small. *The pectoral fins differ considerably in size between the two species (Barreto, in litt., 2019)*, and are shorter than the length of the head, and their ventral surface is uniform white or light in color, with no obvious dark markings. There are strong lateral keels on the caudal peduncle. The caudal fin is crescent shaped, with symmetrical upper and lower lobes. Despite the similarity it presents with *Isurus paucus*, the fins of *Isurus oxyrinchus* are easy to visually identify whether fresh or dry, since there are differences in the dermal denticles of the two species.

Additionally, these two species differ in the lower jaw with 11-13 rows of teeth in *Isurus paucus* and over 13 rows in *Isurus oxyrinchus*.

However, since both species are traded for the value of their meat (more than 90% of the total volume of their body), most of the volume traded will be difficult to identify.

Additional Information

Threats

As noted above, the main threat to *Isurus oxyrinchus* (*and presumably Isurus paucus*) is fishing, since it is caught as a directed and incidental catch in multispecific fisheries throughout its range, particularly in pelagic longlines, targeting tuna, billfish and swordfish in national and international waters.

Isurus oxyrinchus is also a target of sport fishing in the USA, New Zealand, South Africa and some European countries.

Other threats include incidental catch in bather protection in the South East Indian Ocean, with reports of a small number of individuals caught annually in shark nets off the beaches of KwaZulu-Natal.

Finally, because temperature is an important environmental factor for the spatial and temporal distribution of *Isurus oxyrinchus*, the use and distribution of its habitat would likely be affected by the warming of ocean waters as a result of climate change.

Conservation, management and legislation

National

Range States have adopted a variety of national instruments, some applied through laws and regulations on fisheries and trade, others through wildlife legislation or other environmental legislation.

International

General measures across all sharks have been adopted by Regional Fisheries Management Organizations (RFMOs) in the form of recommendations or resolutions which contracting parties must then implement and report. Almost all have adopted a ban on the practice of finning (cutting shark fins and discarding the body at seas), and members require that their vessels do not have fins that add more than 5% of the weight of sharks on board, until the first landing point.

Isurus oxyrinchus is considered a highly migratory species in Annex I (adopt measures for the conservation of species) of the United Nations Convention on the Law of the Sea (UNCLOS) and Appendix II (species conserved through agreements) of the Convention on Migratory Species. In turn, several RFMOs recommend their Parties to a number of measures such as improving data collection and having population and risk assessments.

Isurus oxyrinchus is listed in Annex 3 of the Berne Convention on the Conservation of European Wildlife and Natural Habitats (species that need protection but can be exploited in exceptional cases) and is one of the 20 sharks and rays listed in the Annex II of the Protocol on Specially Protected Areas and Areas of Biological

Diversity in the Mediterranean (under the Barcelona Convention). The General Fisheries Commission for the Mediterranean (GFCM) adopted the list in Recommendation GFCM / 36/2012 / 3. Likewise, the Contracting Parties and Cooperators (CPC) were requested to protect these species from fishing activities and release them. They cannot be retained on board, transshipped, disembarked, stored, exhibited or sold. The recommendation, I / OAT 17/08, requires (with some exceptions and conditions) that vessels promptly release live *Isurus spp.* retained in the North Atlantic; dead sharks can be preserved, and in some cases also live sharks over a minimum size. Records should be retained and sent to ICCAT, and landings should not exceed the previous average of vessels for *Isurus oxyrinchus*. The current measure will be evaluated and will expire on December 31, 2019. The scientific advice for this overfished stock is that harvest should not exceed an annual catch of 500 t, to stop overfishing and begin to rebuild the stock. The measures adopted will probably result in catches well above this minimum. The recommendation is oriented towards the conservation of *Isurus oxyrinchus* stock of the North Atlantic, considering that it is caught in association with ICCAT fisheries and presents a state of overexploitation and overfishing.

In 2008, the CMS proposal to include *Isurus oxyrinchus* in Appendix II identified a number of national protection measures, including: incidental catch and recreational bag limits - South Africa; management under a quota system - New Zealand; regulation of fishing gear for artisanal fisheries - Chile; commercial quotas, limited entry and time closings, and recreational bag limits - United States Atlantic; closure of the directed longline fishery, recreational fishing limits in California and catch guidelines for California, Oregon and Washington - United States Pacific; COSEWIC assessment as an "at-risk" species, catch and incidental catch limits, license limits, fishing gear restrictions, area and season bans, single hook and recreational dump - Canadian Atlantic; limited closures of entry and time - Pacific of Canada.

Potential risk(s) of a listing

There is currently legislation in place in its range where population trends are declining. It is unclear whether this legislation is having a conservation benefit yet *as it is difficult to assess the extent to which they are being implemented and the extent to which they are reducing declines*. However, any CITES listing should be careful not to have a detrimental affect on the current legislation or be seen as replacing current legislation.

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