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Proposal for the uplisting of the great hammerhead shark *Sphyrna mokarran* from Annex III to Annex II of the Protocol concerning Specially Protected Areas and Wildlife (SPAW Protocol)

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From IUCN redlist website https://www.iucnredlist.org/species/39386/2920499

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I. Nomination Requirements

Requirements regarding species nomination are set forth in Specially Protected Areas and Wildlife (SPAW) Protocol Articles 11, 19, and guidelines and criteria adopted by the Parties pursuant to Article 21. The procedures to amend the annexes, contained in Article 11(4), state that "any Party may nominate an endangered or threatened species of flora or fauna for inclusion in or deletion from these annexes," and that, after review and evaluation by the Scientific and Technical Advisory Committee, the Parties shall review the nominations, supporting documentation and the reports of the Scientific and Technical Advisory Committee and shall consider the species for listing. Such a nomination is to be made in accordance with guidelines and criteria adopted by the Parties pursuant

to Article 21. As such, this nomination addresses the 2014 "Revised criteria for the listing of species in the Annexes of the Protocol Concerning SPAW and Procedure for the submission and approval of nominations of species for inclusion in, or deletion from Annexes I, II and III." Finally, Article 19(3) lists the type of information that should be included, to the extent possible, in reports relevant to protected species.

Article 1 of the SPAW Protocol defines Annex II as "the annex to the Protocol containing the agreed list of species of marine and coastal fauna that fall within the category defined in Article 1 and that require the protection measures indicated in Article 11(1)(b). The annex may include terrestrial species as provided for in Article 1(c)(ii)." Further, Article 11 of the Protocol specifies that "each Party shall, in cooperation with other Parties, formulate, adopt and implement plans for the management and use of such species…"

Listing of species can be justified based on a variety of criteria set out in the Revised criteria for the listing of species in the Annexes of the SPAW Protocol, in particular:

> *Criterion #1. For the purpose of the species proposed for all three annexes, the scientific evaluation of the threatened or endangered status of the proposed species is to be based on the following factors: size of populations, evidence of decline, restrictions on its range of distribution, degree of population fragmentation, biology and behaviour of the species, as well as other aspects of population dynamics, other conditions clearly increasing the vulnerability of the species, and the importance of the species to the maintenance of fragile or vulnerable ecosystems and habitats.*
>
> *Criterion #2. When evaluation of the factors enumerated above clearly indicates that a species is threatened or endangered, the lack of full scientific certainty about the exact status of the species is not to prevent the listing of the species on the appropriate annex.*
>
> *Criterion #4. When compiling a case for adding a species to the Annexes, application of the IUCN criteria in a regional (Caribbean) context will be helpful if sufficient data are available. The evaluation should, in any case, use best available information, and expertise, including traditional ecological knowledge.*
>
> *Criterion #5. The evaluation of a species is also to be based on whether it is, or is likely to be, the subject of local or international trade, and whether the international trade of the species under consideration is regulated under CITES or other instruments.*

Criterion #6. The evaluation of the desirability of listing a species in one of the annexes should be based on the importance and usefulness of regional cooperative efforts on the protection and recovery of the species.

Criterion #8. The listing of a taxonomic unit covers all the lower taxa within that unit. The lists should be prepared at the level of species; [...] higher taxa can be utilized in listing when there are reasonable indications that the lower taxa are similarly justified in being listed, or to address problems of misidentification caused by species of similar appearance.

II. Substantiated Nomination Requirements to Support Inclusion in Annex II

A.Article 19(3) – Information to be included in reports relevant to protected species, to the extent possible

a. Article 19(3)(a) – Scientific and Common Names of the Species

a.1. Scientific and common name of the species

Class : Elasmobranchii
Subclass : Neoselachii
Order: Carcharhiniformes
Family: Sphyrnidae
Genus/species: *Sphyrna mokarran* (Linnaeus 1758)
Common name: English: Great hammerhead shark Spanish: Tiburón martillo liso French: Grand requin marteau

a.2 Biological data

Sphyrna mokarran is the largest hammerhead shark. The first dorsal fin is very tall with a pointed tip and strongly falcate in shape, while the second dorsal is also high with a strongly concave rear margin. The origin of the first dorsal fin is opposite or slightly behind the pectoral fin axil with the free rear tip falling short to above the origin of the pelvic fins. The rear margins of the pelvic fins

are concave and falcate in shape, not seen in scalloped hammerheads. The posterior edge of the anal fin is deeply notched. The font margin of the head is nearly straight with a shallow notch in the center in adult great hammerheads, distinguishing it from *S. lewini* and *S. zygaena*. The teeth of this hammerhead are triangular and strongly serrated unlike *S. lewini*'s oblique cusps.

Great hammerhead sharks are viviparous with a reported maximum total size of 550 to 610 cm (Compagno et al. 2005), though 450 cm is more common for a mature adult (Last and Stevens 2009). Litter size ranges from 6 to 33 (maximum 42) and pups are born after 11 months gestation with females breeding only once every two years, thus increasing the species' susceptibility to population depletion (Stevens and Lyle 1989). Great hammerheads have one of the oldest reported ages for any elasmobranch (44 years) but grow at relatively similar rates to other large hammerhead species (Piercy et al. 2010). In waters off Australia, males reach maturity at a length of 7.4 feet (2.25 m) corresponding to a weight of 113 pounds (51 kg) and females are mature at a total length of 6.9 feet (2.10 m) corresponding to a weight of 90 pounds (41 kg) (Stevens and Lyle 1989).

a.3 Habitat

The habitat of *S. mokarran* ranges widely throughout the tropical waters of the world, from latitudes 40°N to 35°S (Last and Stevens 2009). It is apparently nomadic and migratory, with some populations moving towards the poles in the summer (Compagno 1984). It is a coastal-pelagic and semi-oceanic species of hammerhead found throughout the world's oceans in depths ranging from 1-300 m. (Ebert et al. 2013). It occurs close inshore and well offshore, over the continental shelves, in coastal zones near island terraces, and in passes and lagoons of coral atolls, as well as over deep water near land (Compagno et al. 2005) where it co-exists with the scalloped hammerhead, also an inhabitant of the tropic, and the smooth hammerhead, which favors cooler waters (Cliff 1995, Bass et al. 1975). Inshore areas are utilized by early life-stages of the species (Pikitch et al. 2005).

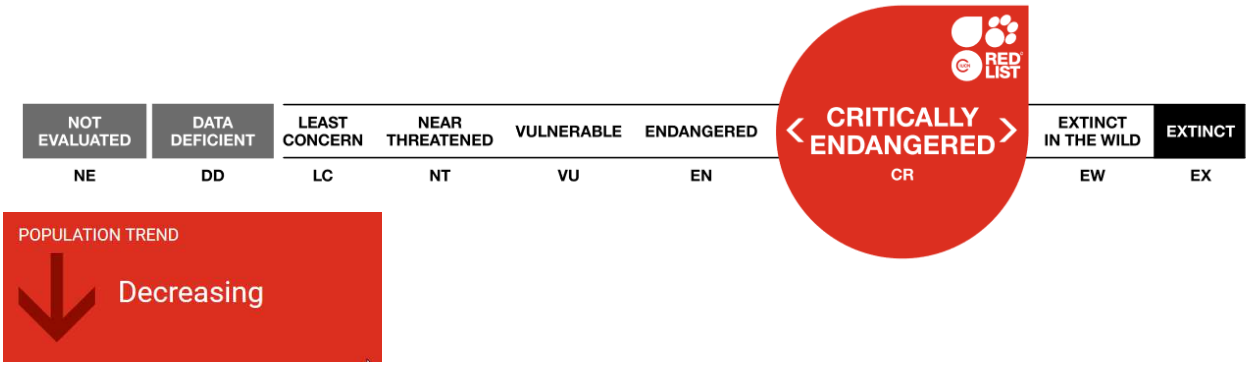
b. Article 19(3)(b) - Estimated Populations of Species and their Geographic Ranges

b.1. Size of Populations

There is very little information on the global population size of great hammerhead sharks, with only occasional mentions in historical records. Also for the Wider Caribbean Region, data on past and present great hammerhead shark abundance is scarce. Although more countries and regional fishery management organizations are working towards better reporting of fish catches down to species level, catches of great hammerheads have gone and continue to go unrecorded in many Caribbean countries. Also, many catch records that do include hammerhead sharks do not differentiate between the Sphyrna species or shark species in general. These numbers are also likely under-reported as many catch records reflect dressed weights instead of live weights or do not account for discards (example: where the fins are kept but the carcass is discarded). Thus, given this type of data, species-specific population trends for great hammerheads worldwide are not readily available.

b.2. Evidence of Decline

Fig 1. IUCN global status from https://www.iucnredlist.org/species/39386/2920499



In January 2021 a review paper was published in the paper *Nature* which analyses the trends in16 pelagic shark populations over the past 50 years. The authors found clear evidence of decline for all species studied which led them to conclude that the global abundance of oceanic sharks and rays has declined by 71%, the decline is directly linked to an increase in fishing pressure specifically an increase in long line and purse seine fisheries.

The Great Hammerhead shark was estimated to have decreased dramatically in global population size with a reduction above 80% in the last 3 generations. The authors do note that the Atlantic population of the species has increased since protection measures were introduced in 2005.

Species-specific population numbers for great hammerheads are rarely available (Camhi et al. 2009, Piercy et al. 2010). Due to the similar appearance and head shape among the species of hammerhead sharks, there is often confusion as to which hammerhead has been caught and catch numbers are typically reported at the genus level, e.g. *Sphyrna* as part of a complex (Camhi et al. 2009). Population levels of all large hammerhead sharks have registered significant declines in

virtually all oceans (Camhi et al. 2009) as their long migration routes commonly put them in contact with multiple coastal and continental shelf fisheries. Abundance trend analyses of global catch rate data specific to *S. mokarran* and to a hammerhead complex of *S. mokarran*, including *S. lewini* and *S. zygaena*, have reported large declines globally in abundance ranging from 60-99% over recent years, including the Western and Northwest Central Atlantic (Baum et al. 2003; Dudley and Simpfendorfer 2006; Dulvy et al. 2008; Ferretti et al. 2008). Additionally, a global study on reef sharks (including great hammerhead shark) by MacNeil et al. (2020) observed no sharks on almost 20% of the surveyed reefs and found that this depletion was strongly related to socio-economic conditions such as the size and proximity of the nearest market, poor governance and the density of the human population. Especially in densely-populated Caribbean countries such as Jamaica, Trinidad and Tobago and the Dominican Republic, sharks are generally absent. Concurrent declines in body size and the probability of encountering mature individuals suggests that apex shark populations are more vulnerable to exploitation than previously thought. The probability of recording mature females of scalloped hammerheads declined from 54% in 1997 to 14% in 2017, while probability of mature males declined from 82 to 55% over the same time-period. Significant declines were also recorded for female great hammerheads, This Australian example highlights the global and general vulnerability of large apex shark populations to exploitation, also in the Wider Caribbean Region.

Furthermore, in most long-term shark fisheries evaluation studies worldwide, hammerhead shark declines were among the most drastic of any species assessed (Baum and Blanchard 2010), and hammerheads declined the fastest of any species in Ferretti et al. (2008).

As a result of these fishing pressures, and in response to significant population declines, the IUCN recognizes great hammerheads as “Critically endangered” worldwide with a “decreasing” population trend (Rigby et al. 2019). Regionally, the species is Endangered in the Northwest Atlantic, Gulf of Mexico and Critically Endangered in the Eastern Atlantic - while the South Atlantic stock data, which the IUCN didn't use due to low catch rates and large confidence intervals, showed a 61.7% decline in CPUE from 1998-2008 of all hammerheads (Sphyrna spp.). This information is based on the most recent pelagic longline surveys conducted by NOAA.

The IUCN assessment of Great Hammerhead shark has the following text on the status of the Atlantic subpopulation (which includes the Caribbean) of this species: “Second, more recent data (1994–2017) are available from the Northwest Atlantic and Gulf of Mexico comprising two of the time-series underlying the Jiao et al. (2011) stock assessment (J. Carlson unpubl. data). Both time-series indicate this population has begun to increase soon after the implementation of management

after 2005 (NMFS 2006). The annual fisheries-independent bottom longline surveys (Grace and Henwood 1998) were conducted throughout the northern Gulf of Mexico and Southeast Atlantic by the National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories; called the NMFS Mississippi bottom longline shark survey (NMFS-LL-SE; Ingram et al. 2005). These data exhibit an increase in CPUE from 2005 onwards. Additionally, the commercial shark bottom longline fishery is active in the U.S. Atlantic Ocean from around North Carolina to Florida and throughout the eastern Gulf of Mexico (BLLOP) (Morgan et al. 2009). These data exhibited an increasing but variable trend. Both time-series taken together for 1994–2017 (24 years) demonstrated a median increase and the highest probability of an increase over three generation lengths (74.4 years)."

b.3. Restrictions on its Range of Distribution

It is a migratory species (see habitat section) with little restriction on its range of distribution.

c. Article 19(3)(c) - Status of Legal Protection, with Reference to Relevant National Legislation or Regulation

The great hammerhead shark should benefit from legislation enacted by French Polynesia (2006), Palau (2003, 2009), Maldives (2010), Honduras (2011), The Bahamas (2011), Tokelau (2011), and the Marshall Islands (2011) to prohibit shark fisheries throughout their Exclusive Economic Zones. Shark finning bans implemented by 21 countries, the European Union, and nine RFMOs could also help reduce some shark mortality (Camhi et al., 2009).

Many countries in the Caribbean have protected areas where no shark fishing is allowed : Cocos Island (Costa Rica), Malpelo Sanctuary (Colombia), the marine reserve of Galapagos Islands (Ecuador), the British Virgin Islands (2014), Yarari Sanctuary in the Caribbean Netherlands (2015), St. Vincent & Grenadines (2019), the Cayman Islands (United Kingdom) and the Dominican Republic.

c.1 Bahamas

The Bahamas banned the sale, import, and export of sharks, shark parts, and shark products within its waters.

c.2. Honduras

Honduras has declared a moratorium on shark fishing in the country's waters.

c.3. St Maarten

In October 2011, the Government of St. Maarten issued a temporary moratorium on shark fishing within the Man of War Shoal Marine Park, which prohibits the taking and landing of all shark species and requires immediate release of incidentally caught sharks under penalty of a maximum of 500,000 Antillean Guilders or 3 months in prison. In June 2016 St. Maarten's Prime Minister announced the inclusion of St. Maarten's waters in the Sanctuary with a prohibition on all commercial shark fishing.

c.4. Colombia

Through Resolution 1743 of 2017, among other actions, the exercise of industrial fishing directed at chondrichthyans is prohibited throughout the territory, allowing a percentage of incidental capture of up to 35%. Likewise, the prohibition of the use of steel wires in longlines and not to make modifications of baits or to use other unspecified methods that are aimed for attracting cartilaginous fish to the fishing operation.

c.5. Kingdom of the Netherlands

The great hammerhead shark is protected by the EU Council Regulation no. 2018/120 of 23 January 2018. This regulation states that it is prohibited to hold, tranship and / or land *S. mokarran* in European Union waters and on European vessels in ICCAT area.

c.6. Republic of France

The great hammerhead shark is protected by the EU Council Regulation no.2020/123 of 27 january 2020. This regulation states that it is prohibited to hold, tranship and / or land *S. mokarran* in European Union waters and on European vessels in ICCAT area.

No species of shark or ray is protected under the Environmental Code in Guadeloupe and Saint-Martin. Only management measures for sea fishing exist at the local level, as presented below.

a- Recreational fishing

It is regulated by decree 971-2019-08-20-003 regulating the exercise of recreational sea fishing in Guadeloupe and Saint-Martin. Fishing for sharks and rays of all species is prohibited at all times and in all places.

b- Professional fishing

Professional sea fishing is governed by order 2002/1249 / PREF / SGAR / MAP of August 19, 2002 regulating coastal sea fishing in the waters of the Department of Guadeloupe (pj2). This decree also applies to St-Martin, which was still a municipality of Guadeloupe in 2002.

This text does not provide for any specific measure for Elasmobranchs.

c.7. United States

The United States manages the commercial and recreational harvest of sharks, including great hammerhead sharks. Through its extensive regulations (e.g., permits, minimum sizes, quotas), the United States primarily coordinates the management of highly migratory species (HMS) fisheries in Federal waters (domestic) and the high seas (international), while individual states establish regulations for HMS in state waters. Under the Shark Conservation Act of 2010, the United States requires, with one exception, for all sharks to be landed with their fins naturally attached (81 FR 42285, June 29, 2016). Additionally, a number of U.S. states prohibit the sale or trade of shark fins (Somma, pers. comm.).

The United States has implemented domestic measures consistent with CITES to regulate trade in this species. Any export from or import into the United States must be accompanied by the appropriate CITES documentation. In addition, the United States has domestic regulations to implement all of the ICCAT provisions in ICCAT fisheries (50 CFR 635, August 29, 2011).

c.8 International protection status

There is little regulation of trade in Sphyrnidae, and the extent of illegal trade activities is unknown. Most Regional Fisheries Management Organisations' (RFMO) regulations and some national laws prohibit finning sharks at sea (discarding the carcass and transhipping the fins at sea). With the exception of finning sharks at sea, there is little control of trade in great hammerhead (however, see 2010 ICCAT provision below). Other countries have an outright ban on the trade of sharks.

In March 2013 the great hammerhead shark was added to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II. However, its implementation was delayed 18 months (September 2014) and two countries filed reservations (Guyana, Yemen) (CITES 2014). Great hammerheads are also targeted for their characteristic large fins. The CITES permit may shift this and it should be assessed if global fin count has gone down.

S. mokarran was also listed on Annex I, Highly Migratory Species, of the UN Convention on the Law of the Sea, which urges States to cooperate over their management. NOAA Fisheries Service HMS Division has also identified Florida's coastal waters as Essential Fish Habitat (EFH) for many species of sharks. This includes *S. mokarran,* which was recently added by the Florida Fish and Wildlife Conservation Commission (FWC) to the list of shark species prohibited from harvest in Florida state waters.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) lists the species in Appendix II which covers migratory species that have an unfavourable conservation status and that require or would benefit from specialized international agreements for their conservation and management. The species is also included in Annex 1 of the Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU) that was established under the umbrella of CMS as specialized agreement focussing on migratory chondrichthyan species (49 Signatories as of September 2020).

In May 2013, during the Summit of Caribbean Political and Business Leaders on Necker Island in the British Virgin Islands, a number of governments agreed to the urgent need to create protections for sharks and rays across the whole Caribbean region within two years. The Bahamas, the British Virgin Islands, the Dominican Republic, Grenada, Jamaica, Puerto Rico, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines committed to increasing region-wide protections.

ICCAT members are prohibited from retaining onboard, transhipping, landing, storing, selling, or offering for sale any part or whole carcass of hammerhead sharks from the family Sphyrnidae (except S. tiburo) taken in the Convention area in association with ICCAT fisheries. Further, hammerhead sharks caught in ICCAT fisheries must be promptly released unharmed to the extent practicable. Developing coastal States that catch hammerhead sharks for local consumption, however, are exempt from these requirements provided they submit their catch data to ICCAT. Notwithstanding, ICCAT calls on developing coastal States qualifying for this exemption to not increase their catches of Sphyrnidae (except S. tiburo) and requires them to take the necessary measures to ensure that Sphyrnidae will not enter international trade and to notify ICCAT of such

measures. Taking these requirements in total, therefore, there should be no international trade of hammerhead sharks of the family Sphyrnidae, with the possible exception of S. tiburo, caught by ICCAT members (or those with cooperating status who are subject to the same requirements) in ICCAT fisheries. To date, however, ICCAT has not been able to conduct a comprehensive review of the implementation of this measure. Despite clear requirements, processes, and procedures to do so, reporting by parties on their domestic implementation of ICCAT's measures for hammerhead sharks has been spotty and little independent information is available to assess compliance. This contributes to the difficulty in determining the level of international trade that may be occurring contrary to ICCAT's requirements. It is therefore possible that some ICCAT parties may be exporting or importing these products and have failed to implement and enforce domestic regulations to monitor or prevent such trade. Furthermore, not all potential importing and exporting countries are members of ICCAT or have cooperating party status. These countries may not be aware of ICCAT's hammerhead measures and, as non-members, would not be obligated to comply with them in any case.

d. Article 19(3)(d) - Ecological Interactions with Other Species and Specific Habitat Requirements

d.1 Migration

The species is listed on Annex I, Highly Migratory Species, of the UN Convention on the Law of the Sea. The great hammerhead shark is not usually found in aggregations like other members of the Sphyrnidea family, but rather it is nomadic and migratory in its worldwide coastal-pelagic tropical range. A recent study (Hammerschlag et al., 2011) revealed that during a 62 day journey an individual travelled 1,200 km from the coast of South Florida (USA) to the mid-Atlantic off the coast of New Jersey (USA). The evidence that great hammerhead sharks are capable of traveling such large distances in a relatively short time also indicates that the species could potentially be migrating into international waters. In the Bahamas, the species has been observed using designated locations or stop-offs along what are believed to be migratory paths for these animals.

They are also seasonal residents in local areas (up to 5 months) and have high levels of site fidelity, since many individuals yearly return to the same sites in the Bahamas and Florida waters (Guttridge et al., 2017) and the Northern Gulf of Mexico (Drymon and Wells, 2017).

e. Article 19(3)(e) - Management and Recovery Plans for Endangered and Threatened Species

e.1. Colombia

There is the “National Action Plan for the Conservation and Management of Sharks, Rays and Chimeras of Colombia (PAN - Tiburones Colombia)”, as the Policy instrument that establishes the guidelines for the conservation and sustainable management of the species of sharks, rays and chimeras in the marine and continental waters of the country and interact with tourist and cultural activities and the different fisheries on an artisanal and industrial scale. Its objectives include the following:

● Identify and evaluate the threats to the populations of sharks, rays and chimaeras in Colombia, associated with the extraction of individuals from their natural environment and the deterioration or modification of critical habitats.

● Determine and develop a regulatory and normative framework that allows the proper management and management of sharks, rays and chimeras in Colombia.

● Structure and guide an efficient program for the surveillance and control of fishing or other activities that impact sharks, rays and chimeras of marine and continental waters, by the competent entities.

e.2. Kingdom of the Netherlands

e.3. Republic of France

There are several ongoing projects that should be emphasized :

- establishment of the list of species present,
- development of identification sheets on state of knowledge on biology,
- state of fishing activity on these species in Guadeloupe- sensitization of marine stakeholders (via participatory sciences in particular via a network of observers), including the animation of a network of observers, the Reguar network
- identification of coastal nursery areas

One of the study projects, based on the use of baited cameras, was part of an international project that resulted in publication in the scientific journal Nature in 2020.

The improvement of knowledge on elasmobranchs aims to establish red lists of this group of species, a necessary prerequisite for the implementation of farm management measures at the national or local level. The intentions at the local level being to intervene on fishing regulations when the threat is linked to this activity, otherwise to set up protection under the environmental code when other threats are identified (disturbance of individuals, alteration of habitats…). The CSRPN of Guadeloupe has undertaken an initial analysis of candidate species for protection. The Kap Natirel association has issued recommendations for the management of these species in the Antilles.

The challenges of preserving Elasmobranchs in Guadeloupe have also been taken into account since 2017 in the fishery control plan and the preservation of the marine environment with clearly displayed dedicated objectives, on the proposal of the DEAL.

In 2017, the sea control services received theoretical training in the challenges of preserving Elasmobranchs and their identification, delivered by the kap Natirel association alongside the DEAL.

e.4. United States

Data is limited on the population status of great hammerhead sharks. In 2014, NMFS completed an Endangered Species Act Status Review Report that found that the great hammerhead shark would be unlikely to be at risk of extinction (Miller et al., 2014). Because great hammerhead has not been listed under the ESA, the United States has not developed a recovery plan. The United States is currently working on a stock assessment for all hammerhead sharks, which should be completed in 2022.

g. Article 19(3)(g) - Threats to the Protected Species, their Habitats and their Associated Ecosystems, Especially Threats which Originate Outside the Jurisdiction of the Party

g.1. Harvesting threats

Due to the distinctive head shape of this genus, it is typical for catches to be reported at the genus level, Sphyrna spp. Therefore, it is rare to find population statistics specific to one species of hammerhead shark. Usually great hammerheads comprise <10% of the sphyrnid catch, see Román Verdesoto and Orozco-Zöller (2005) and Amorim et al. (1998) for examples of commercial non-directed shark fisheries; Castillo-Geniz et al. (1998), Robinson and Sauer (2011), and Doukakis et al. (2011) for examples of artisanal shark fisheries; and Dia et al. (2012), Dudley and Simpfendorfer (2006), and White et al. (2008) for other examples where data are not from a fishery, or the fishery is not identified. Although higher great hammerhead proportions have been identified in a few other fisheries (see Venezuelan longline fleet bycatch data – 47%, Arocha et al. 2002; observed U.S. BLL catch - 32% from 1994-2011, Carlson personal communication; and observed NTONL bycatch - 34%; Field et al. 2013), the majority of the sphyrnid catch remains dominated by the more abundant and susceptible schooling scalloped hammerhead shark.

S. mokarran is taken by target and bycatch, fisheries (Dudley and Simpfendorfer 2006, Zeeberg et al. 2006, Kolmann et al. 2017, Feitosa et al., 2018) and is regularly caught in the tropics, with longlines, fixed bottom nets, hook-and-line, and possibly with pelagic and bottom trawls. Their morphology, in particular the large body and the laterally expanded head, facilitate its capture by nets (Gallagher et al., 2014). In addition, Sphyrnids are highly vulnerable to stress, and often die after capture, even if they are returned to the water alive (Gallagher et al., 2014).

Bonfil (1994) gives an overview of global shark fisheries. This species is mentioned specifically with reference to fisheries in Brazil, the Eastern United States and Mexico; however, Sphyrna spp. are mentioned in the majority of tropical fisheries cited. There is also evidence for large-scale fisheries bycatch of *S. mokarran* in the Greater Caribbean region (Feitosa et al., 2018, Kolmann et al., 2017). Also, data from Guatemala observed sex ratios of caught *S. mokarran* were female-skewed and that individuals were often recorded at sizes below known maturity (85.1%), suggesting the large-scale absence of mature *S. mokarran* in Guatemalan waters (Hacohen-Domené et al., 2020). In Guyana nearly 30% of the total sample diversity at local fish markets was represented by

two species of Hammerhead Sharks (*Sphyrna mokarran* and *S. lewini*), both listed as Endangered by the International Union for Conservation of Nature (IUCN). 10.6% of the sharks was identified as *S. mokarran*, so fisheries/bycatch of these species is a real problem (Kolmann et al., 2017).

g.2 Habitat destruction

It has been shown that sharks on reefs in the Wider Caribbean Region mostly occur in areas with low human population density or in a few places where strong fishing regulations or conservation measures have been implemented (Bakker et al., 2017).

Coastal ecosystems that serve as nurseries for multiple species of sharks including hammerheads face both environmental and anthropogenic threats to their integrity (Knip et al. 2010; Barker et al., 2017). Environmental threats include fluctuations in temperature and salinity due to rising water temperatures and other climate change factors (Masselink et al. 2008) while fishing practices (Pauly et al. 1998) and habitat degradation and loss caused by human settlement initiatives including dredging, construction, pollution and deforestation are among the major man made threats to coastal shark populations (Suchanek 1994; Vitousek et al. 1997). This decline of great sharks from coastal ecosystems has caused trophic cascades with marked ecological consequences (Baum et al. 2003).

g.3 National and international utilisation

g.3.a National utilization

According to Vannuccini (1999), countries documented to consume hammerhead meat (usually salted or smoked) include Mexico, Mozambique, Philippines, Seychelles, Spain, Sri Lanka, China (Taiwan), Tanzania, and Uruguay. In other regions recreational and sport fisheries target great hammerheads. Great hammerheads are highly prized in the recreational sector, particularly for those interested in obtaining records (Gallagher et al. 2017; Shiffman et al. 2014; Shiffman et al., 2020).

g.3.b Fins

Hammerhead sharks, *S. mokarran* in particular, have been noted as a favored target species due to the size of their fins (CITES, 2013). Hammerhead shark fins are highly desired in the international trade because of the fin size and high needle (ceratotrichia) count (Rose 1996). According to Japanese fin guides (Nakano 1999), *S. zygaena* fins, which are morphologically similar to *S. lewini*,

are thin and falcate with the dorsal fin height longer than its base. Because of the higher value associated with the larger triangular fins of hammerheads, traders sort them separately from carcharhinid fins, which are often lumped together. Abercrombie et al. (2005) reported that traders stated that hammerhead fins were one of the most valuable fin types on the market. Using commercial data on traded weights and sizes of fins, the Chinese category for hammerhead shark fins, coupled with DNA and Bayesian statistical analysis to account for missing records, Clarke et al. (2006a,b) estimated that between 1.3 and 2.7 million sharks of these species, equivalent to a biomass of 49,000–90,000t, are taken for the fin trade each year.

The fact that this species has such high market value likely leads to high retention rates of *S. mokarran* caught incidentally as bycatch. Less than 10% of great hammerheads survive capture (IUCN, 2014) – many of that 10% are likely killed and stripped of their fins so that fishers can take advantage of the incidental profit. Hammerhead sharks have been documented in illegal, unreported and unregulated (IUU) fishing activities.

g.4. Hypothetical threats

g.4.a. Mercury contamination

A 35 year old study by Lyle (1984) indicated that *S. mokarran* had the highest concentrations of mercury in muscle tissue (>4 mg kg-1) in Australian waters than any other shark species tested. As the largest hammerhead, often reaching over 20 feet, and a very long-lived species, often living 20-30 years, great hammerheads are particularly susceptible to mercury accumulation and have been observed with exceptionally high levels of mercury in their tissue (Lyle 1984). Lyle (1986) also determined that great hammerhead embryos have levels of mercury contamination near the health limits for human seafood consumption. Anthropogenic climate change will also raise ocean temperatures and cause great hammerheads to absorb more mercury than they would in cooler waters, thus subjecting them to severe health problems associated with high levels of mercury in the body. Increasing amounts of airborne mercury rise from Chinese power plants, cross the Pacific Ocean, and deposit on or near American shores (Geiger 2011). This trend suggests that the biological effects of mercury on great hammerhead sharks will only increase. High levels of arsenic, a compound with carcinogenic potential, have also been reported in hammerheads (Storelli et al. 2003).

However, Storelli et al. 2003 hypothesized that these apex predators can handle higher body burdens of these anthropogenic toxins due to the large size of their livers which “provides a greater

ability to eliminate organic toxicants than in other fishes" or may even be able to limit their exposure by sensing and avoiding areas of high toxins (like during K. brevis red tide blooms) (Flewelling et al. 2010). Currently, the impact (and prevalence) of toxin and metal bioaccumulation in great hammerhead shark populations is unknown.

g.4.b. Climate change

Climate change will continue to cause the destruction of important great hammerhead coral reef habitat through bleaching events and other impacts associated with increased concentrations of greenhouse gases in the atmosphere.

Chin et al. (2010) conducted an integrated risk assessment for climate change to assess the vulnerability of great hammerhead sharks, as well as a number of other chondrichthyan species, to climate change on the GBR. The assessment examined individual species but also lumped species together in ecological groups (such as freshwater and estuarine, coastal and inshore, reef, shelf, etc.) to determine which groups may be most vulnerable to climate change. Great hammerhead sharks were considered in both the "coastal and inshore" ecological group and the "shelf" ecological group. The assessment took into account the in situ changes and effects that are predicted to occur over the next 100 years in the GBR and assessed each species' exposure, sensitivity, and adaptive capacity to a number of climate change factors. The resulting vulnerability rankings for each species were then collated to calculate the relative vulnerability of the ecological groups. . . . Of the 133 GBR shark and ray species, the assessment identified 30 as being moderately or highly vulnerable to climate change. Great hammerhead sharks, however, were ranked as having a low overall vulnerability.

B. Article 21 – Establishment of Common Guidelines or Criteria

a. Article 21 criterion 2 - Precautionary principle

'When evaluation of the factors enumerated above clearly indicates that a species is threatened or endangered, the lack of full scientific certainty about the exact status of the species is not to prevent the listing of the species on the appropriate Annex.'

b. Article 21 criterion 3 - levels and patterns of use and the success of national management programmes

‘With particular reference to listing in Annex III, the levels and patterns of use and the success of national management programmes should be taken into account.’

c. Article 21 criterion 5 - local or international trade

‘The evaluation of a species is also to be based on whether it is, or is likely to be, the subject of local or international trade, and whether the international trade of the species under consideration is regulated under CITES or other instruments.’

d. Article 21 criterion 6 - Usefulness of Regional Cooperative Efforts

‘The evaluation of the desirability of listing a species in one of the Annexes should be based on the importance and usefulness of regional cooperative efforts on the protection and recovery of the species.’

Great hammerhead sharks perform large-scale return migrations (3030 km) across international borders, indicating the importance of regional protection (Caribbean-wide) of the species and habitat (Guttridge et al., 2017).

III. Discussion points and recommendations

As developed in section 1 of the document, the listing of species is to be justified based on a variety of criteria set out in the Revised criteria for the listing of species in the Annexes of the SPAW Protocol.

In particular, regarding the evidence of decline (criterion #1 in the guidelines) “*the scientific evaluation of the threatened or endangered status of the proposed species is to be based on the following factors: size of populations, evidence of decline, restrictions on its range of distribution, degree of population fragmentation, biology and behavior of the species, as well as other aspects of population dynamics, other conditions clearly increasing the vulnerability of the species, and the importance of the species to the maintenance of fragile or vulnerable ecosystems and habitats”*.

Criterion #2 states that: *"When evaluation of the factors enumerated above clearly indicates that a species is threatened or endangered, the lack of full scientific certainty about the exact status of the species is not to prevent the listing of the species on the appropriate annex"*. Criterion #4 states the importance of considering the IUCN red list listing for the Caribbean region, criterion #5 the interest of alignment with CITES and other international instruments and criterion #6 the importance and usefulness of regional cooperative efforts on the protection and recovery of the species.

Given the current trends, all authors and most experts advocate an Appendix II listing for *S. mokarran,* as they consider it meet the criteria (annex1) and offer an unequivocal statement of concern for the species and commitment towards population rebuilding strategies, as well as provide support for the Caribbean nations already protecting their sharks. As we know so little about its current status and distribution in the Wider Caribbean Region, listing this species could reduce threats to these animals.

Three other experts of the group consider that Annex II listing is not justified. For one, there is lack of data/evidence supporting a conclusion that the species is in decline globally and within the Caribbean region. There is no information about population size, restrictions on its range of distribution, or population fragmentation (criterion #1). The amount of data/evidence available at this time is insufficient to warrant a precautionary approach. In addition another precise that listing is not warranted considering that there is evidence of successful national-level management strategies (US range) and that data show that the great hammerhead has increased in the West Atlantic demonstrating that management measures could work. She precises it makes also sense to keep all hammerheads on the same Annex (this rationale is not shared as other experts consider that on the contrary misidentification caused by species of similar appearance would be a good reason to uplist all species of hammerhead in Annex II).

This species is already listed in Annex III, Boerder et al. (2019) conclude that (1) many species with known migration routes (such as *S. mokarran*) behavior, and philopatry can benefit from spatial protection; but (2) spatial protection alone is insufficient and should be integrated with effective fisheries management to protect and rebuild stocks of highly migratory species. They suggest tailoring spatial protection to the biology of large pelagic fishes, including improved protection for aggregation sites and migration corridors. These features currently appear to be an important—yet overlooked— opportunity to safeguard depleted and recovering stocks and protect pelagic biodiversity.

Furthermore, for great hammerheads, their alternating of coastal and pelagic zones makes their management complex, however recent data suggested that the North Atlantic population of this species is showing signs of recovering in the Northwest Atlantic (Pacoureau et al 2021), very likely due to quotas that have been strictly enforced throughout their US range according to the US experts. Other source suggests that at least for the stock in the Northwestern Atlantic—prohibiting their catch in the US waters would protect over 90% of their core habitat (Graham et al. 2016). Therefore, time-area closures of core great hammerhead habitat might be effective (Gallagher et al., 2018) and management measure would be all the more effective applied at the regional level as *S. mokarran* regularly migrates between the EEZs of different Range States and into the high seas (Boerder et al., 2019).

As most of the region's fisheries are based on trawls and gill-netting, there is considerable potential for increasing bycatch levels for hammerheads. Data suggests more effective inspections and severe law enforcement at landing and trading sites are urgent in Guyana to ensure the protection of such a remarkable species (Kolmann et al., 2017).

Additionally, opportunities for the conservation of reef sharks remain: shark sanctuaries, closed areas, catch limits and an absence of gillnets and longlines were associated with a substantially higher relative abundance of sharks (MacNeil et al., 2020). These results reveal several policy pathways for the restoration and management of (reef) shark populations, from direct top-down management of fishing to indirect improvement of governance conditions. Shark populations will only have a high chance of recovery by engaging key socio-economic aspects of tropical fisheries.

Lastly, extensive global fishing, coastal development, and increasing demand for protein from the sea to support a growing human population all present seemingly insurmountable threats to the survival of the great hammerhead shark. Proactive, precautionary policy decisions are needed to attenuate the steep declines in the species' populations witnessed over the past few decades.

IV. **Conclusion**

Great hammerhead population data in the Wider Caribbean region is generally absent in scientific literature. Great hammerhead shark populations are threatened by the destruction and modification of their habitats and ranges, the overutilization of the species for commercial purposes, a high propensity for contaminate absorption, and the lack of adequate regulatory mechanisms. In particular, great hammerhead shark populations have suffered tremendous commercial fishing

pressure from both target and bycatch fisheries (IUCN 2014). In addition to extremely high bycatch mortality in incidental fisheries, great hammerheads are also targeted for their characteristic large fins, which are prized in Asian seafood markets. This decline and susceptibility has led to a global effort to enhance the species' management and conservation.

The IUCN red list assessment from 2018 lists Great Hammerhead Shark as critically endangered globally (Rigby et al. 2019), however the additional information provided with the assessment outlines that the North Atlantic population of this species is showing signs of increase. It would be recovering in the Northwest Atlantic, due to quotas that have been strictly enforced throughout their US range (Pacoureau et al., 2021).

Experts have not reached a consensus : according to almost all authors and most experts of the group, it is of great importance to list the species in the Annex II of the SPAW Protocol considering the species meets key criteria and also based on the fact they consider evidence of recovery for the Atlantic population are not significant compared to their global collapse and secondly considering the most recent IUCN assessment for the global population evaluated as Critically Endangered. Three experts disagree considering there is not sufficient information to support the listing, and that Annex II is not the only way to protect a species under SPAW. All experts clearly agree that as the species is under major threats, the regional management of the species should be improved and commitments already taken respected.

V. Annexes

Annex 1. Criteria evaluation for the Great Hammerhead shark

		Concerns Annexes I, II and III						
Criteria evaluation for the: Great Hammerhead shark Sphyrna mokarran listing under the Annex II								
SPAW Article	**Criterion number**	**Criterion**	**Criterion details**	**Presence of information in the proposal report**	**Information quotes**	**Literature**	**1 is the criterion relevant for this species R/NR 2 is it possible to obtain the information O/NO)**	**If relevan Criterion validation Yes/ No**

			Size of population	Y	Species-specific population data for great hammerheads worldwide are not readily available. The population is recovering in the Northwest Atlantic, due to quotas that have been strictly enforced throughout their US range	Pacoureau et al., 2021	R, NO	Y
			Evidence of decline	Y	The Great Hammerhead shark was estimated to have decreased dramatically in global population size with a reduction above 80% in the last 3 generations. The authors do note that the Atlantic population of the species has increased since protection measures were introduced in 2005. Furthermore, in most long-term shark fisheries evaluation studies worldwide, hammerhead shark declines were among the most drastic of any species assessed (Baum and Blanchard 2010), and hammerheads declined the fastest of any species in Ferretti et al. (2008).	NMFS 2006 Pacoureau et al. 2021 Baum and Blanchard 2010 Rigby et al. 2019	R	Y
			Restriction on its range of distribution	N	It is a migratory species (see habitat section) with little restriction on its range of distribution.		NR	
			Degree of population fragmentation	N			NR	
			Biology and behavior	N	It is nomadic and migratory in its worldwide coastal-pelagic tropical range			
			Other population dynamics	N				
			Conditions increasing the vulnerability of the species	Y	According to Japanese fin guides (Nakano 1999), S. zygaena fins, which are morphologically similar to S. lewini, are thin and falcate with the dorsal fin height longer than its base. Because of the higher value associated with the larger triangular fins of hammerheads, traders sort them separately from carcharhinid fins, which are often lumped together. Abercrombie et al. (2005) reported that traders stated that hammerhead fins were one of the most valuable fin types on the market.	Abercrombie et al. (2005) Nakano 1999	R	Y
21	#1	The scientific evaluation of the threatened or endangered status of the speces is to be based on these factors :	Importance of the species to the maintenance of fragile or vulnerable ecosystems and habitats	N				

	#2	Precautionary principle (when criteria 1 gives indication that the species is threatened or endangered, the lack of full scientific certainty about the exact status of the species is not to prevent the listing of the species on the appropriate annex)		Y			R	Y
	#4	Application of the IUCN criteria in a regional (Caribbean) context will be helpful if sufficient data are available	IUCN category for the Caribbean	Y	The IUCN red list assessment from 2018 lists Great Hammerhead Shark as critically endangered globally	Rigby et al. 2019	R	Y
21	#5	Is the species the subject of local or international trade AND is the international trade regulated under CITES or other instruments ?		Y	The great hammerhead shark was added to CITES Appendix II in 2013 Abercrombie et al. (2005) reported that traders stated that hammerhead fins were one of the most valuable fin types on the market Globally between 1.3 and 2.7 million sharks of these species, equivalent to a biomass of 49,000–90,000t, are taken for the fin trade each year.	CITES 2014 Abercrombie et al. 2005 Clarke et al. 2006a,b	R	Y
21	#6	Importance and usefulness of regional and cooperative efforts on the protection and recovery for species		Y	Time-series indicate this population has begun to increase soon after the implementation of management after 2005.	NMFS 2006	R	Y
21	#7	Endemism of the species (and importance of regional cooperation for its recovery)		N			NR	
21	#8	Listing as a taxonomic unit . Higher taxa (than species) can be utilized in listing when there are reasonable indications that the lower taxa are similarly justified in being listed, or to address problems of misidentificatio n caused by species of		Y			R	Y/N

		similar appearance. In the case of Annex III, higher taxa can also be used to simplify the list.						
21	#10	Listing as an "appropriate measure to ensure the protection and recovery" of fragile ecosystems/habitats where they occur		N			NR	
11 (a)	#	Presence of the species in another annex of the SPAW Protocol		Y				
11 (4,a) – 19 (3)	#	Information demonstrating the applicability of the appropriate SPAW listing criteria		N				
	#	Does the species benefit from another protection tool ?		Y	*S. mokarran* was also listed on Annex I, Highly Migratory Species, of the UN Convention on the Law of the Sea The Convention on the Conservation of Migratory Species of Wild Animals (CMS) lists the species in Appendix II The species is also included in Annex 1 of the Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU)			

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