CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Thirtieth meeting of the Animals Committee
Geneva (Switzerland), 16-21 July 2018

Sharks and rays (Elasmobranchii spp.)

CITES APPENDIX II IMPLEMENTATION ISSUES FOR THE THREE LISTED HAMMERHEAD SHARKS OF THE FAMILY SPHYRNIDAE DUE TO LOOK-ALIKE ISSUES WITH THE SIX REMAINING NON-LISTED SPECIES OF THE FAMILY

1. This document has been submitted by the Secretariat at the request of WWF International, WWF Pacific and TRAFFIC in relation to agenda item 20.*

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* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

1. Look-alike issues are a recognised problem in CITES implementation that was raised at the 28th meeting of Animals Committee in September 2015 (AC29 Com.9 (Rev. by Sec.)) as a species-specific matter with particular mention of hammerhead sharks, that is:

   Species-specific issues

   The Animals Committee recommends that the Standing Committee recognises problems of species identification, look-alike issues, and traceability raised by Parties at the Animals Committee, including for:

   ii) the hammerhead sharks, and urges Parties to endeavour to identify hammerhead sharks to species level in fisheries and landings data.

   It was subsequently raised at the 29th meeting of the Animals Committee in July 2017, in support of Resolution Conf. 12.6 (Rev CoP17) and improving the conservation status of sharks at the meetings of the Conference of the Parties:

   9. The Animals Committee recommends that Parties and regions share their experiences of developing non-detriment findings (NDFs) for sharks and rays, share these NDFs via the CITES Sharks and Rays Portal, identify gaps in capacity, and develop advice and recommendations on formulating national and regional NDFs for sharks and rays, taking into consideration (among other points):

   (iii) addressing look-alike issues

2. TRAFFIC and WWF contracted James Cook University, Australia to examine the information available in national fisheries and trade statistics, CITES export permit data, and other suitable data to evaluate the species-specific nature of information used by CITES parties related to the trade in Appendix II listed hammerhead species and evaluate the need for look-alike provisions to ensure suitable protection.

3. The James Cook University report (see appended document) noted the following observations on the consideration of Hammerhead look-alike species for listing on Appendix II:

   a) There is evidence that non CITES-listed hammerheads enter the fin trade. Recent work has shown that fins from *Eusphyra blochii* (Winghead Shark) and *Sphyrna tiburo* (Bonnethead Shark) are traded in Hong Kong. These species have fins that are very similar to those of CITES-listed hammerhead species. Fins of all hammerhead species are quite similar and it may not be possible to distinguish the three CITES-listed hammerhead species fins from other *Sphyrna* species and *Eusphyra* species.

   b) The specimens of the six non CITES-listed hammerhead species in the form in which they are traded resemble specimens of the three CITES-listed hammerhead species included in Appendix II under the provisions of Article II, paragraph 2 (a), such that enforcement officers who encounter specimens of CITES-listed species, are unlikely to be able to distinguish between them. The fins of all hammerhead species are morphologically similar and the majority are included together in trade.

   c) The aggregation of national fisheries and trade data show that the additional six non CITES-listed hammerhead species are generally grouped with the listed species, and it may benefit the implementation of the listing of the of the currently CITES-listed hammerhead species to include these additional six species within Appendix II of CITES for look-alike reasons.

   d) Since the inclusion within Appendix II of three hammerhead species in 2014, there is possible under-reporting of CITES trade in these hammerhead species. This may be due to illegal trade of CITES hammerhead fins with similar looking non-CITES hammerhead shark fins. The lack of inclusion of all hammerheads under Appendix II at the time of listing may have created an avenue for the movement of CITES-listed hammerheads, that look similar, with non CITES-listed hammerheads. If all hammerhead fin trade requires an export permit, this would remove the risk of trade of CITES species mixed with non CITES species. It may also discourage illegal trade and it would improve the protection for the CITES-listed hammerheads.

   e) There is a considerable lack of reporting of global capture production to species-specific level for hammerheads which raises concerns that trade in CITES-listed hammerhead species is not being adequately monitored by countries. The inclusion of all hammerhead species on Appendix II would provide

an impetus and encourage better reporting of species-specific captures and trade within countries as they will be required to report on species-specific catch trends in their Non-Detriment Findings.

The findings of this review highlight the need to consider implementation issues surrounding the existing CITES Appendix II listed hammerhead sharks. The findings suggest the need for further discussion around considering the merit in extending the number of CITES listed hammerhead shark species to include all nine Sphyrnidae species in Appendix II. This is on the basis that the six species of hammerheads currently not CITES-listed fulfil the criteria for inclusion under CITES Appendix II stipulated in Article II, paragraph 2b (look-alike clause) Criterion A in Annex 2b of Resolution Conf. 9.24 (Rev. CoP17).

CITES Appendix II implementation issues for the three listed Hammerhead Sharks due to look-alike issues with the six remaining non-listed species of Sphyrnidae.

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Report: April 2018

Report to WWF and TRAFFIC

Summary
Three species of hammerhead sharks (*Sphyrna lewini*, *Sphyrna mokarran* and *Sphyrna zyga*ena) were listed within Appendix II of CITES in 2014 following a supporting vote of the Parties for their inclusion at the CITES CoP16, Thailand 2013. Consequently, international trade has required parties to produce Non-Detriment Findings (NDFs) if issuing CITES Export Permits for the species. However, most nations do not report data on fishery landings or trade of hammerhead sharks at the species level, using a single hammerhead category, or even more general shark categories.

The aggregation of fisheries and trade data suggests that the additional six non CITES-listed hammerhead species are grouped with the listed species and so should therefore be included within Appendix II of CITES for look-alike reasons to ensure that all currently CITES-listed hammerhead species receive the appropriate level of protection.

Recommendation:

The listing of Sphyrnidae hammerhead sharks on Appendix II be revised to include all species of hammerheads sharks. The six species of hammerheads currently not CITES-listed fulfil the criteria for inclusion under CITES Appendix II stipulated in Article II, paragraph 2b (look-alike clause), that is, Criterion A in Annex 2b of Resolution Conf. 9.24 (Rev. CoP17).

It is suggested that the two genera (*Sphyrna* and *Eusphyra*) of hammerhead sharks be listed in Appendix II as this will encompass all current and potential future species.

Background
On 14 September 2014, the Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES) Conference of the Parties listing of the three species of hammerhead sharks on Appendix II came into effect: *Sphyrna lewini* Scalloped Hammerhead, Sphyrna *mokarran* Great Hammerhead and *Sphyrna zygaena* Smooth Hammerhead.

Sphyrna lewini was included in Appendix II in accordance with Article II 2(a) of the Convention and satisfying Criterion A in Annex 2a of Resolution Conf. 9.24 (Rev CoP17), that is, the species may be threatened with extinction unless trade is strictly regulated.

Sphyrna mokarran and *S. zygaena* were proposed for inclusion in Appendix II in accordance with Article II 2(b) (look-alike clause) of the Convention and satisfying Criterion A in Annex 2b of Resolution Conf. 9.24 (Rev. CoP17). That is, the fins of these two species resemble those of *S. lewini* such that enforcement officers who encounter specimens of CITES-listed *S. lewini* are unlikely to be able to distinguish between them and for effective trade protection of CITES-listed *S. lewini*, the other species are also listed.

Article II 2(b):

> *(b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.*

Annex 2b of Resolution Conf. 9.24 (Rev. CoP17):

> *Species may be included in Appendix II in accordance with Article II, paragraph 2 (b), if either one of the following criteria is met:*
> *A. The specimens of the species in the form in which they are traded resemble specimens of a species included in Appendix II under the provisions of Article II, paragraph 2 (a), or in Appendix I, so that enforcement officers who encounter specimens of CITES-listed species are unlikely to be able to distinguish between them.*

As a result, any international trade in these species require Parties to produce Non-Detriment Findings (NDFs) in order to issue CITES Export Permits. However, most nations do not report data on fishery landings of hammerhead sharks at the species level, using a single hammerhead category, or even more general shark categories. This has raised a number of issues:

1. Given that species-specific data are required for the production of NDFs, concerns have emerged that current approaches to data collection are not sufficient to support the NDF process.

2. The aggregation of data suggest that the six non CITES-listed hammerhead species are grouped with the three listed species and so should therefore be included within Appendix II of CITES for look-alike reasons to ensure that all currently CITES-listed hammerhead species receive the appropriate level of protection.

There is evidence that non CITES-listed hammerheads enter the fin trade. Recent work has shown that fins from *Eusphyra blochii* (Winghead Shark) and *Sphyrna tiburo* (Bonnethead Shark) are traded in Hong Kong (Fields *et al.* 2018). These species have fins of a similar appearance to those of CITES-listed hammerhead species (Abercrombie and Chapman 2008; Sander 2009; Heupel *et al.* 2016).

Look-alike issues are a recognised problem in CITES implementation that was raised at the 28th meeting of Animals Committee in September 2015 (AC29 Com.9 (Rev. by Sec.)) as a species-specific matter with particular mention of hammerhead sharks, that is:

> *Species-specific issues*
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> *The Animals Committee recommends that the Standing Committee recognises problems of species identification, look-alike issues, and traceability raised by Parties at the Animals Committee, including for:*
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> *ii) the hammerhead sharks, and urges Parties to endeavour to identify hammerhead sharks to species level in fisheries and landings data.*

It was subsequently raised at the 29th meeting of the Animals Committee in July 2017, in support of Resolution Conf. 12.6 (Rev CoP17) with regard to improving the conservation status of sharks at the meetings of the Conference of the Parties:

> *9. The Animals Committee recommends that Parties and regions share their experiences of developing non-detriment findings (NDFs) for sharks and rays, share these NDFs via the CITES Sharks and Rays Portal, identify gaps in capacity, and develop advice and recommendations on formulating national and regional NDFs for sharks and rays, taking into consideration (among other points):*
>
> *(iii) addressing look-alike issues*

Purpose

This document aims to examine the information available in fisheries and trade statistics, CITES export permit data, and other suitable data to evaluate the species-specific nature of information used by CITES parties related to the trade in Appendix II listed hammerhead species and evaluate the need for look-a-like provisions to ensure suitable protection.

Species of hammerhead sharks

There are currently nine species of hammerhead sharks (Table 1). The IUCN Red List status of the six species not listed on Appendix II are: two are threatened (Endangered and Vulnerable), one is Near Threatened, one is Least concern, one is Data Deficient, and one is Not Evaluated as it has only recently been described (IUCN 2018). The Least Concern species, *S. tiburo*, is now considered to be a species complex that may comprise at least two separate species from the Caribbean and Atlantic respectively, with further work required to definitively resolve the taxonomic uncertainty (Naylor *et al.* 2012; Fields *et al.* 2016). If *S. tiburo* is designated as two or more species, the Red List threatened status of the two *S. tiburo* species will need to be reassessed.

Table 1: Species of hammerhead shark, IUCN Red List status, distribution and maximum size.

Species	Common name	Red List Status	Distribution	Max. size (cm)
Sphyrna lewini	Scalloped Hammerhead	Endangered	Worldwide warm temperate and tropical	370-420
Sphyrna mokarran	Great Hammerhead	Endangered	Worldwide tropical seas	550-610
Sphyrna zygaena	Smooth Hammerhead	Vulnerable	Worldwide tropical and temperate seas	370-400

Sphyrna tiburo	Bonnethead Shark	Least Concern	West Atlantic, East Pacific	150
Sphyrna corona	Scalloped Bonnethead	Near Threatened	East Pacific	92
Sphyrna media	Scoophead Shark	Data Deficient	West Atlantic, East Pacific	150
Sphyrna tudes	Smalleye Hammerhead	Vulnerable	West Atlantic	122-150
*Sphyrna gilberti**	Carolina Hammerhead	Not Evaluated	Northwest Atlantic	>69
Eusphyra blochii	Winghead Shark	Endangered	Indo-West Pacific	180

* this species is recently described and not possible to visually differentiate from *S. lewini* without precaudal vertebral counts (Quattro *et al.* 2013)

Global capture production data

The FAO global capture production data[1] indicate that there is limited reporting of hammerhead at species level to FAO by countries. The large majority of reported hammerhead catches are reported as a single aggregated category "Hammerhead sharks, etc. nei." (Table 2). It is unknown if some catches of hammerheads are included in more general shark catch categories. There are capture records since the 1950s in the Hammerhead sharks, etc. nei category with no species-specific records until the 1990s. Since the 1990s, only four species of hammerheads have been reported in the global capture statistics- *S. lewini*, *S. mokarran*, *S. zygaena* and *S. tiburo*; the other 5 species of hammerheads have never been reported in the global capture data. Despite this, four of the five species are known to be taken in fisheries (Saldaña-Ruiz *et al.* 2017; Fields *et al.* 2018; IUCN 2018). After the CITES listing of three hammerhead species came in to effect in 2014, all three CITES-listed species have been reported as captured along with *S. tiburo,* with the largest quantities reported for *S. zygaena* (Table 2). The quantity of hammerhead reported in the aggregated category was approximately 23 and 15 times the quantity of the combined reported data for the four individual species in 2014 and 2015, respectively (Table 2). As the CITES-listed species dominate the global catches of hammerheads (CITES 2013a), it is evident that the CITES-listed hammerhead species are being grouped with non CITES-listed hammerhead in the single aggregated category.

Table 2: Global capture production data (tonnes); nei = not elsewhere indicated; data for 2016 not available. Source: (FAO 2017a).

Species	2014	2015
S. zygaena	176	280
S. lewini	55	129
S. mokarrran	20	40
S. tiburo	10	4
Total	261	453
Hammerhead sharks, etc, nei	5,975	6860
Total reported hammerhead catches	**6,236**	**7,313**

Global trade statistics

No countries report trade specifically in hammerhead fins at a species level (FAO 2017b). The global trade database does not report the species of any shark being traded for fins (Dent and Clarke 2015). All shark fins are reported in a number of commodity forms, that are mainly dried or frozen categories. Shark meat is also not reported by species with the exception of one species, *Lamna nasus* (Porbeagle shark) (FAO 2017b). The global trade flow for all shark fins has remained at similar quantities in 2014 and 2015 with no data available for 2016 (Table 3).

[1] This should be live weight, but some countries provide landed weight.

Table 3: Traded quantity of shark fins by trade flow (tonnes) Source: (FAO 2017b)

Trade flow	2014	2015
Export	11,101	12,481
Import	13,901	13,496
Reexport	2,154	1,921

CITES trade data

CITES Parties provide export and import permits at the species-specific level for hammerhead species. However, there appears to be limited trade records since 2014 for the CITES-listed hammerheads (CITES 2018). Over the period 2014-2017 (available data as of April 2018) there were 121 CITES trade records with the majority for *S. lewini* (n = 63), followed by *S. mokarran* (n = 34), *S. zygaena* (n = 22) and *Sphyrna* spp. (n = 2). Twenty-three countries had issued export permits.

The majority of the stated trade purpose was commercial (n = 59), followed by circus or travelling exhibition (n = 24), scientific (n = 21), educational (n = 9), personal (n = 6), law enforcement (n = 1) and zoo (n = 1).

The commercial records were mostly for trade of fins (n = 47), followed by live (n = 6), meat (n = 1), specimens (n = 2), tails (n = 1), bone carvings (n = 1) and unspecified (n = 1).

For the traded fins, the majority of records (n = 40) had specified a weight (kg) while the remainder recorded the number of fins. This is based on the assumption that where no unit is recorded, the quantity represents the total number of specimens (CITES 2013b). As it is difficult to estimate weights from numbers of fins, only the traded fins reported by weight were examined further. The majority of fins traded were from *S. lewini*, except for in 2015 where *S. zygaena* accounted for the greatest proportion of traded fins (Table 4).

Table 4: Weight of fins traded (exported and imported) (tonnes) of CITES Hammerhead species from CITES Trade Database. Source: (CITES 2018)

Species	**2014**		**2015**		**2016**	
	Import	Export	Import	Export	Import	Export
S. lewini	29.8	4.4	8.4	6.9	9.1	8.0
S. mokarrran	0.0	1.2	3.6	8.9	5.9	4.8
S. zygaena	0.0	0.5	7.7	12.2	10.4	10.0
Sphyrna spp.	0.0	0.0	0.0	0.2	0.0	0.0
Total	29.8	6.1	19.7	28.2	25.4	12.8

CITES trade data vs global capture production of hammerheads

To determine if the quantity of hammerhead traded fins (CITES database) equated to the expected volume of fins based on the volume of hammerheads captured (FAO capture production), a coarse estimate of the equivalent whole weight of CITES database traded fins was made. The exported quantity in the CITES database was logically appropriate to use as that would be assumed to be exported from capture production. It is unknown whether the CITES database weight of fin is for dried or frozen, or a combination of both product forms. Conversion factors of frozen or dried fin to whole weight vary by species but average conversion factors are 3% for wet fin to whole weight and 1.3% for dry fin to whole weight (Biery and Pauly 2012).

The CITES database exported quantity of total hammerhead fins in 2014 (6.1 t) and 2015 (28.2 t) equated to 203 and 940 whole weight tonnes in 2014 and 2015 using the frozen fin to whole weight conversion, and 469 t and 2169 t in 2014 and 2015 using the dry fin to whole weight conversion. The FAO data reported total capture of hammerheads in 2014 and 2015 was 6,236 t and 7,313 t respectively (Table 2). This is greater than the CITES equivalent estimated whole weight exported quantities. In addition, the FAO capture production for sharks in the fin trade has been estimated to be under-reported by a factor of three to four (Clarke *et al.* 2006b). This suggests that the CITES reported exported trade in equivalent whole weight of hammerheads is substantially less than the FAO reported capture of hammerheads.

Some hammerhead fins may not be exported immediately after animals are captured, however the discrepancies are much greater than would be expected if not all fins were traded the same year as captured. Some fins may not be exported due to countries preparing NDFs and not issuing export permits. Not all hammerheads captured

may be finned, however the fins are of high commercial value and it is likely that unless there are national or Regional Fisheries Management Authority regulations prohibiting their removal, the fins of most captured hammerheads will be removed and traded internationally (CITES 2013a; FAO 2013). Hammerhead fins are among both the dominant shark species in the fin trade and the preferred species for shark fin soup (Clarke *et al.* 2006a; Dent and Clarke 2015; Fields *et al.* 2018). Some of the reported global capture of hammerhead may be used in domestic meat consumption and could account for some of the discrepancy between capture and exported trade, however hammerhead sharks are preferred for their fins rather than meat (Dent and Clarke 2015) and the large discrepancy is unlikely to be entirely due to domestic meat consumption.

Some of the volume of hammerhead fins may be from other non CITES-listed hammerhead species. *Eusphyra blochii* is heavily fished in its range and its fins known to be traded (Fields *et al.* 2018) but is unlikely to account for the large discrepancy in captured hammerheads and whole weight equivalent of exported fins. The *S. tiburo* fins are also traded internationally as they have been recorded in the Hong Kong markets, although their trade, similar to *E. blochii* is in relatively smaller volumes than that of the three CITES-listed species (Fields *et al.* 2018). The other three *Sphyrna* species are taken in inshore fisheries and their fins are likely to be traded but their restricted distributions and small size suggest that their fins would be less common in trade and unlikely to account for the weight discrepancy (Abercrombie *et al.* 2005; Saldaña-Ruiz *et al.* 2017; IUCN 2018). As *S. gilberti* cannot be easily visually distinguished from *S. lewini* there is no information on the capture or trade.

CITES trade data vs total fin trade data

Three species of hammerhead (*S. lewini*, *S. mokarran* and *S. zygaena*) collectively formed 5.9% and 4 % of the fin imported in Hong Kong in 1999-2001 and 2014, respectively (Clarke *et al.* 2006a; Fields *et al.* 2018). The percentage of hammerhead fin imported globally may not be the same as that traded in the Hong Kong markets, yet these markets represent a significant proportion of fin trade and may be used as a guide to the species composition of fin imported globally (Clarke 2008). If it is assumed that the three species of hammerhead collectively represent 4% of the global fin imported trade of 13,901 t and 13,496 t in 2014 and 2015, respectively (Table 3), this equates to 556 t and 540 t of the three species of hammerhead fin imported globally in 2014 and 2015, respectively. This is far greater than the amount of hammerhead fin trade reported as imported in the CITES trade database, that is 29.8 t and 19.7 t in 2014 and 2015, respectively (Table 4). If trade in these CITES-listed hammerhead fins has continued at the previous rates, this does not appear to be reflected in the CITES trade database and there may be under-reporting. Alternatively, the CITES data may be indicative of CITES permits not being issued for the CITES-listed hammerhead fins.

Summary fisheries and trade data

In summary, the comparison of CITES trade database fin weights to global capture production and trade data must be done with caution as the CITES trade database does not report the fin product form and average conversion factors have been used to estimate whole weights. However, comparisons provide the general indication that:

a) CITES reported trade of equivalent whole weight of hammerhead is less than the global reported hammerhead capture production

b) there may be under-reporting of fins traded from CITES-listed hammerhead species in the CITES trade database.

There are a number of potential reasons for the possibility of under-reporting of trade in CITES hammerhead fins.

1. Some Parties may be capturing hammerheads and holding fins while NDFs are undertaken. However, this is unlikely to account for the large quantity of unreported fins. All CITES members that trade in CITES listed hammerhead species should have an NDF as part of the regulations for trade of the products. There is no requirement to make an NDF publicly available and thus it is not possible to determine whether Parties have completed an NDF for the hammerhead species when an export permit has been issued. Some countries have publicly available NDFs and these are among the countries reporting fin trade in the CITES database.

2. Some CITES-listed hammerhead fins may be exported without the required documentation. Illegal trade of fins may be occurring. In Hong Kong, since 2014 there have been more than 20 cases of seizures of hammerhead shark fin imports suspected of being regulated CITES hammerhead species (Hong Kong 2018). Details were not available on whether those seizures were of mixed CITES and non CITES hammerhead species, but in other operations in Hong Kong, consignments have been found to have a mixture of CITES and non CITES shark fins (Hong Kong 2018).

The evidence of illegal trade in listed hammerhead species adds weight to the consideration of controlled trade of all hammerhead species through listing on Appendix II. The lack of inclusion of all hammerheads under Appendix II at the time of listing may have created an avenue for the movement of CITES-listed hammerheads, that look similar, with non CITES-listed hammerheads. If all hammerhead fin trades require an export permit, this would remove the risk of trade of CITES species mixed with non CITES hammerhead species, it may also discourage illegal trade and it would improve the protection for the currently CITES-listed hammerheads.

3. A lack of reporting of fins that originate from the high seas. The CITES-listed hammerheads are taken in tuna longline and purse seine fisheries that operate across countries' Exclusive Economic Zones and on the high seas (Casper *et al.* 2005; Denham *et al.* 2007; CITES 2013a). It would be expected that at least some fins in trade would be from the high seas, yet no fins are reported as coming from the high seas in the CITES trade database. Fins from the high seas require an Introduction from the Sea certificate from a Management Authority of the State of introduction (available at: https://www.cites.org/eng/prog/ifs.php). There are only two CITES trade database records that cite Introduction from the Sea as the origin of the specimens and these were for bones sourced from the wild and from pre-convention specimens (CITES 2018). Hammerheads can be legally retained on tuna and purse seine vessels in all but one of the high seas areas under Regional Fisheries Management Organisation's that regulate tuna fishing - the Atlantic Ocean (BMIS 2018). The International Commission for the Conservation of Atlantic tunas (ICCAT) has prohibited retention of hammerhead sharks of the family Sphyrnidae (except for *S. tiburo*); ICCAT 2010 Recommendation 10-07 (BMIS 2018).

NDFs

Three Parties have made their NDFs for hammerheads publicly available: Australia, United States of America (USA) and Sri Lanka (available at: https://cites.org/eng/prog/shark). Other countries that have produced an NDF for hammerheads but that are not publicly available are New Zealand and Peru, both for *S. zygaena*. Panama has issued a negative NDF for all sharks and rays, and NDFs for hammerheads are under development in Colombia and Indonesia (CITES 2017). Whether other Parties may have undertaken or be in the process of completing NDFs for hammerheads is unknown.

Australia and New Zealand based their species-specific NDFs on reported captures of each species in their waters. In Australia, the recording of hammerhead to species level in commercial logbooks has improved over time and the fisheries observer data enabled disaggregation of general hammerhead catch to species level (Koopman and Knuckey 2014). The USA based the NDF on the hammerhead complex (Scalloped, Smooth and Great) which is regulated under a single hammerhead shark fisheries quota, based on a Scalloped Hammerhead stock assessment. The reason the complex was used was stated as due to difficulties in separating the three species, particularly when processed. Sri Lanka issued an NDF for *Sphyrna* species, although national species-specific catch levels were available and there was high confidence in the species identification. Species-specific NDFs are possible where the fisheries catch data is reported at the species level. The CITES listing provides an impetus to improve national species-specific level of reporting as national CITES authorities use fisheries catch data to inform NDFs.

Aggregated hammerhead data makes the NDF production more difficult but it can still be done. The biological vulnerability and conservation concern can be collated at the species level and if there is no catch or trade data at the species level, the NDF process can proceed but with the application of the precautionary approach (Mundy-Taylor *et al.* 2014). This can lead to a negative NDF or a positive NDF with conditions. Both outcomes can include conditions that include approaches to improve species-specific catch and trade data.

The considerable lack of reporting of global capture production to species-specific level for hammerheads raises concerns that trade in CITES-listed hammerhead species is not adequately monitored by countries. An examination of trade records in the CITES database and FAO global capture data indicated that some countries are recording species-specific export of hammerhead fins to CITES but are not reporting species-specific hammerhead catches to FAO. The inclusion of all hammerhead species as look-alike species on Appendix II should encourage better reporting of species-specific captures and trade within countries as they will be required to report on species-specific catch trends in the Non-Detriment Findings.

Fin identification

Fins are the main product from hammerheads in international trade (CITES 2013a). Fins from all hammerhead species have a characteristic shape that is much taller than broad and a dull brown or light grey colour that distinguishes them from fins from other shark species (Abercrombie and Chapman 2008). However, separating the species of hammerheads based on their fins is difficult. Fin identification guides indicate that *S. lewini* and *S. zygaena* first dorsal fins are visually almost indistinguishable while the *S. mokarran* first dorsal fin is distinct from the other two species (Abercrombie and Chapman 2008; Abercrombie *et al.* 2013; Marshall and Barone 2016). The fin traders in Hong Kong can separate hammerhead fins from other shark species, and usually group *S. lewini* and *S. zygaena* together and separate from *S. mokarran* (Clarke *et al.* 2006a).

The non CITES-listed *E. blochii* dorsal fins are very similar in height, fin shape and colour to those of *S. mokarran,* and in height and fin shape to *S. lewini*, and it is difficult to differentiate the three species (Abercrombie and Chapman 2008; Heupel *et al.* 2016; Marshall and Barone 2016). Due to similarities of *S. lewini* and *S. zygaena*, it would also be difficult to visually distinguish *E. blochii* from *S. zygaena*. The *S. tiburo* dorsal fins are typical of hammerheads fins in that they are tall and brown (Sander 2009). The fins of the other *Sphyrna* species, *S. tudes*, *S. media* and *S. corona* are also of the same general tall and thin shape as the CITES-listed hammerhead species (Ebert *et al.* 2013). As *S. gilberti* cannot be visually distinguished from *S. lewini*, except by precaudal vertebral counts, it is assumed the fins are visually similar.

The FAO analysis of the listing proposal for the three CITES-listed hammerhead species acknowledged the difficulty in species identification and that even experts, such as fin traders in Hong Kong, could not distinguish between *S. lewini* and *S. zygaena* (FAO 2013). *Eusphyra blochii* is unable to be easily differentiated from these two species or *S. mokarran*, while *S. tiburo* and the other *Sphyrna* species are also visually similar to the fins of the CITES-listed species. The FAO and IUCN/TRAFFIC analyses of the listing proposal recognised that fins of all hammerhead species are quite similar and it may not be possible to distinguish the proposed three hammerhead species fins from other *Sphyrna* species and *Eusphyra* species (IUCN and TRAFFIC 2012; FAO 2013). It was considered that enforcement officers with general knowledge and even identification materials would have difficulty in identifying hammerhead fins in trade to species level (FAO 2013). It also stated in the FAO analysis "*it is not clear why the other species in the family Sphyrnidae were not proposed to be listed as "look-alikes*""(FAO 2013)(page 40). The FAO analysis of the listing proposal accepted that there were look-alike issues. The physical similarity of all hammerhead fins is evident and there is the ability to address the look-alike issues by the listing the additional six hammerhead species under the CITES look-alike provisions to benefit the protection of CITES-listed species.

Conclusion

Since the listing of the three hammerhead species in Appendix II, it is evident that there is likely to be illegal trade of these species. Some of this may occur because of the movement of CITES-listed hammerheads with non CITES-listed hammerheads, that look very similar. Regulated trade of all hammerhead species would reduce the risk of this occurring and improve protection for the CITES- listed species. The aggregation of fisheries national hammerhead catch data prevents adequate monitoring of the capture of CITES-listed hammerhead species. CITES listing can provide an impetus to record capture at species level and improve the catch data for specimens entering international trade because species-specific NDFs are required, hence a listing of all hammerhead species could encourage and improve monitoring of the CITES-listed species of conservation concern. Improvements to trade records at the species level are needed to better monitor species trade flows. There is on-going collaborative work to expand the Harmonized custom codes for shark and ray species and product categories and some Parties have adopted national species-specific custom codes (Decision 17.213 and SC69 Doc. 50; https://cites.org). CITES listing of all hammerhead species may encourage more Parties to move towards national species-specific trade records through the requirement to record trade at the species level.

The specimens of the six non CITES-listed hammerhead species in the form in which they are traded resemble specimens of the three CITES-listed hammerhead species included in Appendix II under the provisions of Article II, paragraph 2 (a), such that enforcement officers who encounter specimens of CITES-listed species, are unlikely to be able to distinguish between them. The fins of all hammerhead species are morphologically similar and the majority are included together in trade.

The six species of hammerhead sharks currently not CITES-listed fulfil the criteria for inclusion under Appendix II stipulated in Article II, paragraph 2b (look-alike clause), that is, Criterion A in Annex 2b of Resolution Conf. 9.24 (Rev. CoP14). It is recommended that the listing of Sphyrnidae hammerhead sharks on Appendix II be revised to include all species of hammerheads sharks. It is recommended that the two genus of hammerhead sharks (*Sphyrna* and *Eusphyra*) be listed as this will encompass all current and potential future species.

Acknowledgement

The preparation of this paper was supported by WWF and TRAFFIC. We thank WWF HK for provision of the information pertaining to HK seizures of fins.

References

Abercrombie, D., and Chapman, D. (2008) Identifying shark fins: oceanic whitetip, porbeagle and hammerheads. The PEW Environment Group and Stony Brook University. http://www.pewtrusts.org/en/research-and-analysis/reports/2012/02/16/identifying-shark-fins-oceanic-whitetip-porbeagle-and-hammerheads

Abercrombie, D.L., Clarke, S.C., and Shivji, M.S. (2005) Global-scale genetic identification of hammerhead sharks: Application to assessment of the international fin trade and law enforcement. *Conservation Genetics* 6(5), 775-788. doi: 10.1007/s10592-005-9036-2

Abercrombie, D.L., McAllister, M.K., Chapman, D.D., Gulak, S.J.B., and Carlson, J.K. (2013) Visual identificatoin of fins from common elasmobranchs in the Northwest Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-643. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. https://repository.library.noaa.gov/view/noaa/8631

Biery, L., and Pauly, D. (2012) A global review of species-specific shark-fin-to-body-mass ratios and relevant legislation. *Journal of Fish Biology* 80(5), 1643-1677. doi: doi:10.1111/j.1095-8649.2011.03215.x

BMIS (2018) Bycatch Management Information System. Common Oceans, Food and Agriculture Organization of the United Nations, Western Central Pacific Fisheries Commission. Available at https://www.bmis-bycatch.org/ Downloaded on 18 April 2018.

Casper, B.M., Domingo, A., Gaibor, N., Heupel, M.R., Kotas, E., Lamonaca, A.F., Perez-Jimenez, J.C., Simpfendorfer, C., Smith, W.D., Stevens, J.D., Soldo, A., and Vooren, C.M. (2005) *Sphyrna zygaena.* The IUCN Red List of Threatened Species. Version 2015.4 *Sphyrna zygaena.* The IUCN Red List of Threatened Species. Version 2015.4. Available at www.iucnredlist.org Downloaded on 18 April 2018.

CITES (2013a) Consideration of proposals for amendment of Appendices I and II. CoP16 Prop.43 Available at https://www.cites.org/eng/cop/16/prop/E-CoP16-Prop-43.pdf Downloaded on 15 December 2015.

CITES (2013b) A guide to using the CITES Trade Database. Version 8. United Nations Environment Programme. World Conservation Monitoring Centre. https://trade.cites.org/

CITES (2017) Responses to Notification to the Parties No. 2017/31. Revised 6th July 2017. AC29 Doc. 23 Annex 1. CITES. https://cites.org/com/ac/29/index.php

CITES (2018) CITES Trade Database Available at https://trade.cites.org/ Downloaded on 10 April 2018.

Clarke, S.C., Magnussen, J.E., Abercrombie, D.L.M., M.K., and Shiva, M.S. (2006a) Identification of Shark Species Composition and Proportion in the Hong Kong Shark Fin Market Based on Molecular Genetics and Trade Records. *Conservation Biology* 20(1), 201-211. doi: doi:10.1111/j.1523-1739.2005.00247.x

Clarke, S.C., McAllister, M.K., Milner-Gulland, E.J., Kirkwood, G.P., Michielsens, C.G.J., Agnew, D.J., Pikitch, E.K., Nakano, H., and Shivji, M.S. (2006b) Global estimates of shark catches using trade records from commercial markets. *Ecology Letters* 9(10), 1115-1126. doi: 10.1111/j.1461-0248.2006.00968.x

Denham, J., Stevens, J., Simpfendorfer, C.A., Heupel, M.R., Cliff, G., Morgan, A., Graham, R., Ducrocq, M., Dulvy, N.D., Seisay, M., Asber, M., Valenti, S.V., Litvinov, F., Martins, P., Lemine Ould Sidi, M., Tous, P., and Bucal, D. (2007) *Sphyrna mokarran.* The IUCN Red List of Threatened Species. Version 2015.4 *Sphyrna mokarran.* The IUCN Red List of Threatened Species. Version 2015.4. Available at www.iucnredlist.org Downloaded on 18 April 2018.

Dent, F., and Clarke, S.C. (2015) 'Stae of the global market for shark products. FAO Technical Paper 590.' (Food and Agriculture Organization of the United Nations: Rome) pp

Ebert, D.A., Fowler, S., and Compagno, L. (2013) 'Sharks of the world. A fully illustrated guide.' (Wild Nature Press: Plymouth) pp 528.

FAO (2013) Report of the fourth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, Rome, 3–8 December 2012. Report No. R1032. FAO Fisheries and Aquaculture. www.fao.org/3/a-ap999e.pdf

FAO (2017a) Fishery and Aquaculture Statistics. Global capture production 1950-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017 Available at www.fao.org/fishery/statistics/software/fishstatj/en. Downloaded on 2 April 2018.

FAO (2017b) Fishery and Aquaculture Statistics. Global Fisheries commodities production and trade 1976-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2017. Available at www.fao.org/fishery/statistics/software/fishstatj/en Downloaded on 2 April 2018.

Fields, A.T., Fischer, G.A., Shea, S.K.H., Zhang, H., Abercrombie, D.L., Feldheim, K.A., Babcock, E.A., and Chapman, D.D. (2018) Species composition of the international shark fin trade assessed through a retail-market survey in Hong Kong. *Conservation Biology* 32(2), 376-389. doi: doi:10.1111/cobi.13043

Fields, A.T., K.A., F., Gelsleichter, J., Pfoertner, C., and Chapman, D.D. (2016) Population structure and cryptic speciation in bonnethead sharks *Sphyrna tiburo* in the south-eastern U.S.A. and Caribbean. *Journal of Fish Biology* 89(5), 2219-2233. doi: doi:10.1111/jfb.13025

Heupel, M., White, W., Chin, A., and Simpfendorfer, C. (2016) Exploring the status of Australia's hammerhead sharks. Research Plan 1- 2015. Progress report to 30 December 2015. National Environmental Science Programme, Marine Biodiversity Hub, Australia. https://www.nespmarine.edu.au/document/exploring-status-australia%E2%80%99s-hammerhead-sharks

Hong Kong (2018) LCQ16: Regulation of the trading in shark food products. The Government of the Hong Kong Special Administrative Region. Press Releases. In 'The Government of the Hong Kong Special Administrative Region. Press Releases.')

IUCN (2018) IUCN Red List of Threatened Species. Version 2017.3 IUCN Red List of Threatened Species. Version 2017.3. Available at www.iucnredlist.org Downloaded on 18 April 2018.

IUCN, and TRAFFIC (2012) IUCN/TRAFFIC Analyses of the proposals to amend the CITES Appendices at the 16th meeting of the Conference of the Parties. Prepared by IUCN Global Species Programme and Species Survival Commission andTRAFFIC Available at http://www.cites.org/sites/default/files/common/cop/16/inf/E-CoP16i-14.pdf Downloaded on 17 April 2018.

Koopman, M., and Knuckey, I. (2014) Advice on CITES Appendix II shark listings. Fishwell Consulting. , Department of Sustainability, Environment, Water, Population and Communities.

http://www.environment.gov.au/biodiversity/wildlife-trade/publications/non-detriment-finding-five-shark-species

Marshall, L.J., and Barone, M. (2016) SharkFin Guide. Food and Agriculture Organisation of the United Nations, Rome. http://www.fao.org/ipoa-sharks/tools/software/isharkfin

Mundy-Taylor, V., Crook, V., Foster, S., Fowler, S., Sant, G., and Rice, J. (2014) CITES Non-detriment findings guidance for shark species. 2nd, revised version. A framework to assist Authorities in making Non-detriment Findings (NDFs) for species listed in CITES Appendix II. Report prepared for the Germany Federal Agency for Nature Conservation (Bundesamt fur Naturschutz, BfN). CITES Non-detriment findings guidance for shark species. 2nd, revised version. A framwork to assist Authorities in making Non-detriment Findings (NDFs) for species listed in CITES Appendix II. Available at https://cites.org/eng/prog/shark/Information_resources_from_Parties_and_other_stakeholders Downloaded on 10 November 2015.

Naylor, G.J.P., Caira, J.N., Jensen, K., Rosana, K.A.M., White, W.T., and Last, P.R. (2012) A DNA sequence–based approach to the identification of shark and ray species and its implications for global elasmobranch diversity and parasitology. *Bulletin of the American Museum of Natural History*, 1-262. doi: 10.1206/754.1

Quattro, J.M., Driggers Iii, W.B., Grady, J.M., Ulrich, G.F., and Roberts, M.A. (2013) Sphryna gilberti sp. nov., a new hammerhead shark (Carcharhiniformes, Sphyrnidae) from the western Atlantic Ocean. *Zootaxa* 3702(2), 159-178. doi: 10.11646/zootaxa.3702.2.5

Saldaña-Ruiz, L.E., Sosa-Nishizaki, O., and Cartamil, D. (2017) Historical reconstruction of Gulf of California shark fishery landings and species composition, 1939–2014, in a data-poor fishery context. *Fisheries Research* 195, 116-129. doi: https://doi.org/10.1016/j.fishres.2017.07.011

Sander, E. (2009) A guide to the small coastal sharks Available at http://www.sharkid.com/sharkguides.html Downloaded on 17 April 2014.