

CoP18 Doc. 105.3

Annex 1

(English only / seulement en anglais / unicamente en inglés)



**Food and Agriculture
Organization of the
United Nations**

FIAF/R1255 (En)

FAO
Fisheries and
Aquaculture Report

ISSN 2070-6987

Report of the

**SIXTH FAO EXPERT ADVISORY PANEL FOR THE ASSESSMENT OF
PROPOSALS TO AMEND APPENDICES I AND II OF CITES
CONCERNING COMMERCIALY-EXPLOITED AQUATIC SPECIES**

Rome, 21–25 January 2019

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AND II OF CITES CONCERNING COMMERCIALY-EXPLOITED AQUATIC SPECIES

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Required citation:

FAO. 2019. *Report of the Sixth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially Exploited Aquatic Species, Rome, 21–25 January 2019.* FAO Fisheries and Aquaculture Report No. 1255. Rome. Licence: CC BY-NC-SA 3.0 IGO.

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ISBN 978-92-5-131315-2

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PREPARATION OF THIS DOCUMENT

This is the report of the Sixth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-Exploited Aquatic Species (Expert Panel), held at FAO headquarters from 21 to 25 January 2019.

The meeting of the Expert Panel was funded by the FAO Regular Programme with extra assistance from the Governments of Japan and the European Union.

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ABSTRACT

The Sixth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially Exploited Aquatic Species was held at FAO headquarters from 21 to 25 January 2019. The Expert Panel was convened in response to the agreement by the Twenty-Fifth session of the FAO Committee on Fisheries (COFI) on the terms of reference for an expert advisory panel for assessment of proposals to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and following endorsement from the Twenty-Sixth session of COFI to convene the Expert Panel for relevant proposals to future CITES Conference of the Parties.

The objectives of the Expert Panel were to:

- i. assess each proposal from a scientific perspective in accordance with the CITES biological listing criteria (Resolution Conf. 9.24 [Rev. CoP17]);
- ii. comment, as appropriate, on technical aspects of the proposal in relation to biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness for conservation.

The Expert Panel considered the following four proposals submitted to the eighteenth Conference of the Parties to CITES:

- CoP18 Prop. 42. Proposal to include the mako shark, *Isurus oxyrinchus* in Appendix II in accordance with Article II paragraph 2(a) and *Isurus paucus* in Appendix II in accordance with Article II paragraph 2(b). The Expert Panel assessment of Proposal 42 concluded that the available data do not provide evidence that the species meets the CITES Appendix II listing criteria.
- CoP18 Prop. 43. Proposal to include blackchin guitarfish *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus* in Appendix II in accordance with Article II paragraph 2(a) and inclusion of all other giant guitarfish, *Glaucostegus spp.* in accordance with Article II paragraph 2(b). The Expert Panel assessment of Proposal 43 concluded that there was insufficient evidence to make a decision in relation to CITES criteria, recommending that CITES Parties take note of the one example of extirpation, the widespread lack of management and the very high value of guitarfish fins in international trade.
- CoP18 Prop. 44. Proposal to include white-spotted wedgefish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* in Appendix II in accordance with Article II paragraph 2(a). If listed, this would include *Rhynchobatus cooki*, *Rhynchobatus immaculatus*, *Rhynchobatus laevis*, *Rhynchobatus luebberti*, *Rhynchobatus palpebratus*, *Rhynchobatus springeri*, *Rhynchobatus mauritaniensis*, *Rhina ancylostoma*, and all other putative species of the Rhinidae (wedgefish) family in Appendix II in accordance with Article II paragraph 2(b). The Expert Panel assessment of Proposal 44 concluded that there was insufficient evidence to make a decision in relation to CITES criteria, recommending that CITES Parties take note of the widespread lack of management and the very high value of wedgefish fins in international trade.
- CoP18 Prop. 45. Proposal to include the subgenus *Holothuria (Microthele)*: *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei* in Appendix II in accordance with Article II paragraph 2(a). The Expert Panel assessment of Proposal 45 concluded that the available data for *Holothuria fuscogilva* does not meet the CITES Appendix II listing criteria, that there was insufficient evidence to make a determination for *Holothuria nobilis*, but that *Holothuria whitmaei* does meet the CITES Appendix II listing criteria.

The report includes an assessment of each of the four proposals in-line with the objectives outlined above, highlighting the Expert Panel's determination of whether information on the species in question meet the CITES Appendix criteria, and noting biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness of a listing for conservation.

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ABBREVIATIONS AND ACRONYMS

| | |
|-------------|---|
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CMS | Convention on the Conservation of Migratory Species of Wild Animals |
| COFI | FAO Committee on Fisheries |
| CPUE | catch per unit of effort |
| EEZ | exclusive economic zone |
| EPO | Eastern Pacific Ocean |
| FAD | fish aggregating device |
| HKCSD | Hong Kong Census and Statistics Department |
| IATTC | Inter-American Tropical Tuna Commission |
| ICCAT | International Commission for the Conservation of Atlantic Tunas |
| IFS | Introduction from the Sea (provisions of CITES) |
| IPOA-Sharks | International Plan of Action for Conservation and Management of Sharks |
| ITQ | individually transferable quota |
| IUCN | International Union for Conservation of Nature |
| IUU | illegal, unreported and unregulated (fishing) |
| LEMIS | U.S. Fish and Wildlife Service Law Enforcement Management Information System |
| MPA | marine protected area |
| NDF | non-detriment findings |
| NPOA | National Plan of Action |
| NPOA-Sharks | National Plan of Action for Conservation and Management of Sharks |
| RFMO | regional fisheries management organization |
| TAC | total allowable catch |
| WCO | World Customs Organization |
| WCPFC | Western and Central Pacific Fisheries Commission |

INTRODUCTION

Background and purpose of the Expert Panel

1. The Fifth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially Exploited Aquatic Species was held in response to the agreement of the Twenty-Fifth Session of the FAO Committee on Fisheries (COFI) to the Terms of Reference for an expert advisory panel for assessment of proposals to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in February 2003. This agreement, to convene the Expert Panel for relevant proposals to future CITES Conference of the Parties, has received the endorsement of subsequent sessions of COFI. The Sixteenth Session of the Sub-Committee on Fish Trade of COFI (Republic of Korea, 4–8 September 2017) acknowledged the positive contribution made by FAO in convening the Expert Panel for the assessment of CITES proposals, and unanimously supported the convening of the Expert Panel for the assessment of proposals to CITES CoP-18, charged with listing or delisting commercially exploited aquatic species.
2. The FAO Expert Panel also falls within the agreement between CITES and FAO – as elaborated in the Memorandum of Understanding between the two organizations – for FAO to carry out a scientific and technical review of all relevant proposals for amendment of Appendices I and II. The results of this review are to be taken into account by the CITES Secretariat when communicating their recommendations on the proposals to the Parties to CITES.
3. The Terms of Reference agreed at the Twenty-Fifth Session of COFI are attached to this report as Appendix A. In accordance with those Terms of Reference, the Expert Panel was established by the FAO Secretariat, according to its standard rules and procedures and observing the principle of equitable geographical representation, and drawing from a roster of recognized experts.
4. The Expert Panel's task was to:
 - i) assess each proposal from a scientific perspective in accordance with the CITES biological listing criteria, taking account of the recommendations on the criteria made to CITES by FAO;
 - ii) comment, as appropriate, on technical aspects of the proposal in relation to biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness for conservation.
5. The Thirty-Third COFI (Italy, 9–13 July 2018) noted the need for the timely sharing of expert information on the status of species proposed for CITES listing amendments in order to enable sufficient time for country decision-making.
6. The Sixty-Ninth Standing Committee of CITES (Switzerland, 27 November–1 December 2017) noted the importance of Parties having access to the best available scientific information on species proposed for listing well in advance of the meeting of the Conference of the Parties, and encouraged Parties to consult with FAO as soon as possible when considering submissions of proposals for marine species. The CITES Secretariat was encouraged to consider ways to further enhance the communication of the FAO Expert Panel report.

The Expert Panel meeting

7. The Expert Panel met in Rome from 21 to 25 January 2019, hosted by FAO with funding from the FAO regular programme, with specific funding allocations from the Governments of Japan and the European Union. The agenda adopted for the meeting is included as Appendix B.
8. The Expert Panel consisted of seventeen members (core members and specialists on the species being considered, as well as on aspects of fisheries management and international trade). In addition, observers were invited to attend; two from the CITES Secretariat and one from the Western Australian Fisheries Department. Advice was also sought, as required, from FAO Staff expertise. The list of participants at the meeting (including proponents and observers and those invited who could not attend), is included as Appendix C.
9. The meeting was opened by Mr Manuel Barange, Director of the Fisheries and Aquaculture Department, who welcomed participants and provided some background information to the convening of the meeting of the Expert Panel, and the importance of its task. The welcome speech is included as Appendix D.
10. Mr Alastair Macfarlane was elected Chair of the Expert Panel, and three working groups were formed; the first for mako shark led by Ms Elizabeth Babcock; the second for guitarfish and wedgefish, led by Mr Maurice

Clarks and Mr John Pope; the third, for sea cucumbers, was jointly led by Mr Jeff Kinch and Mr Steve Purcell. Mr Marcelo Vasconcellos, Ms Monica Barone and Mr Kim Friedman from FAO assisted as rapporteurs, while Ms Manuela D'Antoni assisted with required artwork and Mr Fabio Carocci, former FAO employee, assisted in creating mapping products. Ms Safa Gritli provided general logistical and secretarial support.

11. The agenda of the meeting was adopted as tabled, and is attached to this report as Appendix B.

12. Mr Kim Friedman, FAO Senior Fisheries Resources Officer, made a presentation on the Expert Panel Terms of Reference and on the FAO interpretation of the CITES criteria for the inclusion of commercially exploited aquatic species in the CITES Appendices. A secondary presentation highlighted expert feedback on the Fifth Expert Panel reporting process, which was part of an on-going study to improve reporting and communication by FAO into the CITES listing amendment process.

13. Proponents of the four proposals for listing in CITES Appendices were invited to present to the Expert Panel either in person or via voice over internet protocol, and to answer any questions by panel participants for the purposes of clarification. Proponents were represented by the following individuals:

- CoP18 Prop. 42. Mr Hesiquio Benítez Díaz from Mexico (remote access) spoke on the proposal for inclusion of the mako shark, *Isurus oxyrinchus*.
- CoP18 Prop. 43. Mr Mamadou Diallo from Senegal (in person) spoke on the proposal for inclusion of the blackchin guitarfish *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus*. He was assisted by Ms Sarah Fowler (in person).
- CoP18 Prop. 44. Mr Daniel Fernando from Sri Lanka (remote access) spoke on the proposal for inclusion of the white-spotted wedgfish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis*.
- CoP18 Prop. 45. Ms Chantal Conand, MNHN, Mr Arnaud Horellou, MNHN and SA CITES France and Ms Marie Di Simone, MNHN Honorary spoke from France (remote access) on the proposal to include teatfish, *Holothuria (Microthele)*.

14. Mr Kim Friedman presented the methods used and the results of a preliminary assessment of the key criteria for each species. This work involved expert participants filling in an MS Excel file with information and preliminary thoughts on each proposal in advance, noting information relevant to the CITES criteria. These pre-liminary assessments (and related information sources) were used in the panel's deliberations between the 21–25 January 2019.

Proposals of commercial aquatic species for CoP 18

1. Evaluation of the proposals

The Expert Panel considered the following four proposals submitted to the CITES Eighteenth Conference of the Parties (proposals can be downloaded from the CITES website: <https://cites.org/eng/cop/18/prop/index.php>):

- CoP18 Prop. 42.** Proposal to include mako shark, *Isurus oxyrinchus* in Appendix II in accordance with Article II paragraph 2(a) and *Isurus paucus* in Appendix II in accordance with Article II paragraph 2(b).
- CoP18 Prop. 43.** Proposal to include blackchin guitarfish *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus* in Appendix II in accordance with Article II paragraph 2(a) and inclusion of all other giant guitarfish, *Glaucostegus* spp. in accordance with Article II paragraph 2(b).
- CoP18 Prop. 44.** Proposal to include white-spotted wedgfish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* in Appendix II in accordance with Article II paragraph 2(a). If listed, this would include *Rhynchobatus cooki*, *Rhynchobatus immaculatus*, *Rhynchobatus laevis*, *Rhynchobatus luebberti*, *Rhynchobatus palpebratus*, *Rhynchobatus springeri*, *Rhynchobatus mauritaniensis*, *Rhina ancylostoma*, and all other putative species of the Rhinidae (wedgfish) family in Appendix II in accordance with Article II paragraph 2(b).
- CoP18 Prop. 45.** Proposal to include the subgenus *Holothuria (Microthele)*: *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei* in Appendix II in accordance with Article II paragraph 2(a).

2. General comments and observations

2.1. Comments received by the FAO Secretariat from Members and Organizations

15. In accordance with the Expert Panels Terms of Reference, FAO Members and Regional Fishery Management Organizations (RFMOs) were notified of the proposals submitted that dealt with commercially exploited aquatic species and were informed that FAO would be convening the Expert Panel. They were invited to send any comments or relevant information to the FAO Secretariat for consideration by the panel. All information received from this call for information and datasets, scientific papers, reports and articles – were held on a shared document drive for use by all the Expert Panel participants.

16. Publicly available information sourced by FAO conveners and Expert Panel participants were shared among the Expert Panel, as well as with the IUCN-Traffic panel and the IUCN Shark Specialist Group (SSG, <https://www.iucnssg.org/>) on a shared document drive. Information was shared with IUCN and Traffic so that FAO could help ensure the best information available was accessible to all; similarly we hope that if any IUCN or Traffic staff noticed any missing documentation, they might return the favour of sharing information and data with the Expert Panel. Due to the time constraints on the assessment process, and the fact that securing sufficient resources to complete assessments can be a challenge, the development of more cooperative links between various assessment teams has the potential to offer CITES Parties clearer and more harmonized advice from UN and international organizations that have an interest in supporting the management and conservation of aquatic resources.

2.2. Interpretation of the Annex 2a criteria for the inclusion of species in Appendix II in accordance with Article II, paragraph 2(a) of the Convention

17. The Expert Panel applied the CITES Res. Conf. 9.24 (Rev. CoP17) criteria interpreted in accordance with the initial advice provided to CITES by FAO on criteria suitable for commercially exploited aquatic species and as applied since the Second Meeting of the Expert Advisory Panel in 2007. CITES Document CoP14 Inf. 64 – prepared by the FAO Secretariat and submitted to the Fourteenth Conference of the Parties to CITES in 2007 – also provides an explanation of the interpretation of Annex 2a criteria for the inclusion of species in Appendix II, as applied by the Expert Panel.

18. The Expert Panel also noted the conclusions of the “Workshop to review the application of CITES criterion Annex 2a (B) to commercially exploited aquatic species” (FAO, 2002; FAO, 2011), which confirmed the view expressed by FAO (2007) and in CoP14 Inf. 64; in other words that the same definitions, explanations and guidelines in Annex 5 of the Res. Conf. 9.24 (Rev. CoP17), including the ‘decline’ criteria, apply for both Criterion A and Criterion B of Annex 2a.

19. The Expert Panel was informed of the recommendations made by the CITES Animals Committee and Standing Committee in 2012 (SC62 Doc. 39, see Appendix D) regarding the application of Annex 2a criterion B and the introductory text to commercially exploited aquatic species, in particular the following:

“The Animals Committee finds that there are diverse approaches to the application of Annex 2a criterion B in Resolution Conf. 9.24 (Rev. CoP16). The Animals Committee finds that it is not possible to provide guidance preferring or favouring one approach over another. The Animals Committee recommends that Parties, when applying Annex 2a criterion B when drafting or submitting proposals to amend the CITES Appendices, explain their approach to that criterion, and how the taxon qualifies for the proposed amendment.”

2.3. General comments by the Expert Panel on the proposals

20. The Expert Panel welcomed presentations by the representatives of the four proposals. Both the presentations of the key issues outlined in the proposals and the opportunity to ask questions or make clarifications after the initial deliberations improved the Expert Panels ability to make informed assessments of the proposals.

21. With regards to the proposals themselves, the Expert Panel noted that the quality of evidence (data and information) provided to show that the species in question met the CITES Appendix II listing criteria was often particularly poor. Generally speaking the proposals would have benefited from a greater focus on presenting evidence that is related to the CITES criteria as articulated in Res. Conf. 9.24 (Rev. CoP17), as well as the inclusion of the best available information, rather than the selective inclusion of supporting information. Presentation of reliable indices, quantitative wherever possible, is central to determining whether species meet criteria for inclusion in the Appendices, and the basis for such indices should be presented clearly and concisely. Even where information is difficult to quantify, all efforts should be made to present the information

in a form that can be objectively assessed. Participants of this Expert Panel found comments from previous panels were still applicable to most proposals.

22. Most of the proposals relied to some extent on sources that are unpublished or difficult to access. The assessment of proposals would be easier if proponents provided access to copies of all source documents (in pdf format, or similar) along with references within their listing proposals. The Expert Panel gratefully acknowledges those proponents who provided copies of source materials during the meeting.

23. Assessing proposals against the listing criteria requires an assessment of the importance of international trade in driving exploitation and in affecting a species' status. Little information on the relative importance of international trade in driving exploitation was presented in some proposals. This is often due in part to the lack of information on the subject, resulting from the lack of species-level reporting or data collection.

24. As requested by the Thirty-Second Session of COFI in 2012, the Expert Panel made efforts to improve its comments on the technical aspects of proposals and their likely effectiveness for conservation, drawing on inputs from experts on trade, management and issues related to implementation of CITES provisions. However, the Expert Panel noted that the technical aspects involved in the implementation of CITES listings are context-specific and need to be considered on a case-by-case basis. To improve knowledge of these technical aspects, the panel welcomes the current effort to further understand implementation through the delivery of more empirical studies on the impacts and factors influencing the successful implementation of CITES listings of commercially exploited aquatic species (e.g. Friedman *et al.*, 2018).

25. The Chair of the Expert Panel, Mr Alastair Macfarlane, noted in a letter to FAO a number of issues which had an impact on the work of panel experts in their reviews. The letter highlighted the large workload that the Expert Panel was required to cover and the limited time available, suggesting FAO continue to work with CITES to normalize this process so that it is 'fit for purpose' (Appendix F).

2.4. For consideration when reading the reports

26. As in the previous panels, when considering the trends in abundance reported by the proposals, the Expert Panel attempted to evaluate the reliability of each source of information. This was done by assigning a score between zero (no value) and five (highly reliable) to each item of information used to demonstrate population trends. The criteria used to assign a score are included in Appendix E. The Expert Panel recommends that when conducting evaluations and using the reliability index, participants also consider the scientific quality of the references used, granting higher reliability to sources that have been subjected to a robust peer review.

FAO EXPERT ADVISORY PANEL ASSESSMENT REPORT: COP18 PROPOSAL 42

Species

Shortfin Mako shark, *Isurus oxyrinchus* and longfin Mako shark, *Isurus paucus*

Proposal

To include the mako shark, *Isurus oxyrinchus* in Appendix II in accordance with Article II paragraph 2(a) and *Isurus paucus* in Appendix II in accordance with Article II paragraph 2(b).

Assessment summary

| SPECIES | MEETS CITES CRITERIA | DOES NOT MEET CITES CRITERIA | OTHER |
|--------------------------|-------------------------|---------------------------------|-------|
| <i>Isurus oxyrinchus</i> | | ✓ | |

Shortfin mako shark are a wide-ranging, highly migratory species and globally distributed. The Panel considered this a low productivity species.

According to the stock assessments from the North Atlantic and North Pacific, the population numbers of shortfin mako sharks in these regions are in the millions. Given that the Expert Panel considered the productivity for the species as low, it follows that declines to 30 percent of historic levels (i.e. a decline of 70 percent) would meet the criteria for listing. In the North Atlantic, the population has declined to about 50 percent of historic levels and, based on projections from the stock assessments, may be at risk of dropping below 30 percent of historic levels in the next few decades if catches are not decreased well below recent levels. The Expert Panel noted that ICCAT has adopted a recommendation to reduce catches in the North Atlantic, which may in turn reduce further population decline. In the Mediterranean, the population has declined, but the extent of this decline is not well determined. For the South Atlantic, Indian, North Pacific and South Pacific oceans, the Expert Panel found no evidence that populations meet the CITES criteria, whether based on historical extent of decline or recent rates of decline. Mako sharks have lower productivity than other shark species; however, they are also relatively data-rich by comparison to other shark species. Viewed globally, and taking account of precautionary considerations (i.e. uncertainty, notably in terms of the precision of estimates), the available data do not provide evidence that the species meets the CITES Appendix II listing criteria.

Scientific assessment in accordance with CITES biological listing criteria

Species distribution

Shortfin mako sharks are a highly migratory species found throughout the world's oceans from 50°N to 50°S latitude (Figure 1). The population structure remains uncertain, most studies and applicable management measures are thus organized in line with the jurisdictional boundaries of the relevant scientific and management agencies. For this reason, the Expert Panel agreed to follow the geographic conventions of the proposal and assume populations are structured by ocean basin, i.e. North and South Atlantic, Mediterranean, Indian and North and South Pacific oceans.

Species productivity

LOW PRODUCTIVITY

There are numerous published estimates of life history parameters for shortfin mako sharks (Table 1). The methods used to age shortfin mako sharks, based on vertebral rings, were revised in the early 2000s and suggest that one band pair is deposited in vertebrae per year (Campana *et al.*, 2005; Natanson *et al.*, 2002). Validation studies based on radio-bomb carbon in the Atlantic also suggest that one band pair is deposited per year (Ardizzone *et al.*, 2006). The Expert Panel therefore considered age and growth papers from the 1980s and 1990s to be unreliable.

New information about the periodicity of the formation of growth bands in the vertebrae of mako sharks (obtained from direct validation studies by tagging sharks with Oxytetracycline), indicated that at least in the northeastern Pacific two growth band pairs form annually in juvenile sharks, changing to a single growth band pair after perhaps five years of age (Wells *et al.*, 2013, Kinney *et al.*, 2016). However, data in the Western Pacific are inconsistent with a deposition rate of two pair of bands per year for a few years (Semba *et al.*, 2009). Although age determination and related population parameters from this region are still uncertain, for stock assessment purposes a meta-analytical approach was used to combine several available data sets from the Pacific Ocean (Takahashi *et al.*, 2017).

Despite such inconsistencies among ageing studies, nearly all the modern papers support a low productivity for this species in all ocean basins. In particular, recent ecological risk assessments in the Atlantic (Cortes *et al.*, 2015) evaluated the available life history data and found that the shortfin mako shark is one of the least productive of the pelagic shark species. The Expert Panel thus confidently concluded that the species has a low productivity.

Population numbers

Estimates of population numbers of shortfin mako sharks are not available for all regions. However, the assessments available for the North Atlantic and North Pacific indicate current numbers of about 1 million and 8 million individuals respectively (the Expert Panel extracted these numbers from the full computer outputs available for the age-structured assessments conducted by ICCAT, 2017 and ICS, 2018).

Trends and application of the decline criterion

Fishing is believed to be the only anthropogenic source of mortality for mako shark (shortfin mako and longfin mako). Mako shark is a common bycatch species in tuna fisheries in all oceans, which is reported in tuna and swordfish longline fisheries in the Atlantic and in tuna longline and purse seine fisheries in the Pacific and Indian Oceans (proposal). They are also targeted in some fisheries in the North Atlantic and eastern North Pacific.

Under the CITES criteria for commercially exploited aquatic species (Res. Conf. 9.24 Rev. CoP16), a decline to 15–20 percent of the historical baseline for a low-productivity species might justify consideration for an Appendix I listing. Being “near” this level might justify consideration for a listing in Appendix II; for a low-productivity species this would mean 20–30 percent of the historical level (15–20 percent + 5–10 percent precautionary measure).

Where possible, the panel estimates the historical extent of decline from the unfished population level. Such estimation requires some form of defensible stock assessment to cover earlier historical periods for which abundance index data are not available.¹ More simplistic forms of retroactive extrapolation of trends are not considered by the Expert Panel to be defensible; this is because catch, effort and population dynamics (e.g. responses to environmental or density dependence) will have been different earlier in time, leading to differences in the rates of change.

The results given below for the recent rate of decline refer to the most recent ten-year period for the abundance index concerned, consistent with the preference stated in the CITES listing criteria, though results may also be given for longer periods in addition.

A number of abundance indices and two recent stock assessments are available from different parts of the range, but the indices are of varying reliability for this species. The Expert Panel noted that mako sharks have been under-reported in historical catch data. They noted that the two stock assessments discussed below have addressed historical under-reporting with catch reconstructions and trade data. However, the effect of under-reporting on catch rate series (if present) is more difficult to address because changes in reporting over time may introduce bias into some of the indices, as discussed below. The information evaluated by the Expert Panel regarding population trends in different oceanic regions is summarized below and in Table 2.

¹ Example: the North Atlantic shortfin mako shark population assessment (ICCAT, 2017) provides examples of such approaches to estimate abundance prior to the commencement of fishing. The assessment approach used for North Pacific shortfin mako shark population (ISC 2018) provides another example.

Atlantic Ocean

In summary, in the Atlantic Ocean, the population has declined to about 50 percent of historic levels, and may be at risk of declining below 30 percent of historic levels in the next few decades if catches are not decreased well below current levels. In the South Atlantic there is no evidence that the population is depleted below 30 percent of the historic level. In the Mediterranean, abundance has decreased, but the extent of decline is not well determined.

North Atlantic

For the North Atlantic, population biomass trajectories have been estimated using several types of stock assessment models (ICCAT, 2017). These estimates vary between models in absolute terms (i.e. when expressed in tonnes), but the associated estimates of population trends over time (i.e. percentage changes over given period) are consistent among the models and well estimated, with better precision than estimates in absolute terms. Thus, the assessment models provide good estimates of historical extent and recent rate of population decline. The panel focused on the estimate of spawning stock fecundity from the age-structured stock assessment model (Stock Synthesis), because age-structured models are more accurate than surplus production models for long-lived species with a high age at maturity. From the age-structured model, the estimated historical decline in spawning stock fecundity from 1950 (which was the unfished level) to 2015 was 50 percent (i.e. to 50 percent of the historical, unfished level), while the recent decline (from 2006 to current in 2015) was 32 percent. All the assessment models were broadly consistent, finding historical declines in total biomass of 47 percent to 60 percent, i.e. to a current level of 40 percent –53 percent of the level in 1950, which corresponds to 34 percent to 50 percent of the estimated unfished level and recent declines of 23 percent –32 percent (Figure 2).

The mako shark proposal also estimated trends in abundance using standardized CPUE from the U.S. longline fishery ending in 2000 (Baum *et al.*, 2003) or 2005 (Baum and Blanchard, 2010; Cortes *et al.*, 2007). These older datasets are not appropriate for calculating recent rates of decline because they are now dated. The same U.S. longline dataset was reanalyzed in 2017 and used as one of the inputs for the ICCAT assessment (ICCAT 2017 Data Meeting Report). The trend in this dataset was consistent with the results of the ICCAT assessment, with a historical decline (1986–2015) of 53 percent (to 47 percent of the 1986 level) and a recent decline of 24 percent. The other indices used in the assessment were generally consistent in showing recent declines.

The proposal further cited a mark-recapture study in the Northeast Atlantic that estimated fishing mortality rates as five times greater than the maximum sustainable rate (Byrne *et al.*, 2017). This study had also been discussed in the ICCAT stock assessment meeting, where it was noted that the results were for juvenile sharks in a limited spatial area (ICCAT, 2017). Nevertheless, the panel considered that this study provided evidence that fishing mortality rates are quite high for parts of the population, which adds support to the hypothesis that the stock is declining.

In general, the available data are consistent with a population that has decreased in abundance and is continuing to decline. Although the decrease in abundance up to 2015 does not fall below the threshold of 30 percent of the historical level, the panel considered whether it is likely that the population will fall below this threshold in the near future, if the recent trend continues. The projections calculated during the ICCAT assessment show that continued population decreases are likely, unless there is a substantial decrease in catches (ICCAT, 2017). Projections were computed by ICCAT for the Bayesian Surplus Production (BSP) model only, and these projections all showed that catches around the current level (about 3000 tonnes) would cause the population to decline, and that catches would need to be reduced below 1000 tonnes to prevent overfishing ($F > F_{MSY}$), and below 500 tonnes to allow rebuilding (ICCAT, 2017) (Figure 3). Catches at the current level or above about 2000 tonnes might cause a decline to 30 percent of the historical level in ten or more years. However, if catches declined with abundance (i.e. if the fishing mortality rate was constant), then the rate of decline would be slower. The ICCAT working group was unable to conduct projections for the age-structured model, but considered that that model would probably give more pessimistic outcomes because it incorporates a lag in population growth caused by the high age at maturity. The ICCAT working group plans to update and refine the age-structured model in May 2019, so that it can be used to make projections, which are expected to be more accurate than the production model projections. Because of these considerations, the panel considered that the projections conducted at the 2017 assessment are uncertain. Nevertheless, the projections provide the best available estimate of the expected future change in abundance.

Whether the population continues to decline depends on current and future catches. Beginning in mid-2018, ICCAT recommended that member nations release any shortfin mako sharks that are alive when caught (ICCAT Resolution 17-08 BYC). Because the survival of live-released shortfin mako sharks is thought to be around 70 percent (Campana *et al.*, 2016; ICCAT 2017) in longlines, this recommendation is expected to reduce total mortality. However, this recommendation only came into effect in mid-2018. Thus, it will not be known whether this measure has been successful in reducing catches until catch data have been reported for several more years. Considering that the catches would have to be reduced by more than about 65 percent to stop the decline (which would in turn require nearly all sharks taken at present to be released alive, based on current best estimates for their subsequent survival rate), the population may be at risk of being depleted below 30 percent of the historic level at some time over the next few decades if catches are not reduced further. The extent of this risk cannot be quantified without knowing how catches will be affected by the new recommendation for live release.

South Atlantic

For the South Atlantic, the stock assessment is considered highly uncertain owing to the poor quality of the data (ICCAT 2017). The CPUE series generally show an increase over the last 15 years, while the catches and effort have also increased (Figure 4). Increasing catches are expected to cause the population to decline in most circumstances, so these data are unlikely to be consistent with the assumed population dynamics of the species. One explanation, which certainly accounts for some though not necessarily all of this effect, is an increasing efficiency in the reporting of these catches. The ICCAT working group therefore considered the assessment highly uncertain, and conducted no projections. Nevertheless, the assessment found that the population may be experiencing overfishing (fishing mortality higher than the target of F_{msy}) and may be overfished (biomass below the target of B_{msy}). Due to the uncertainty in the assessment, the known low productivity of shortfin mako sharks, and the chance that the population might be depleted, the ICCAT working group concluded that catches should not increase above current levels. There is no direct evidence that the population is depleted below 30 percent of the historic level.

The panel also reviewed an analysis by Barreto *et al.* (2016b), which analysed CPUE data from multiple fishing fleets in the South Atlantic. Barreto *et al.* (2016b) found that standardized catch rates in a recent time period (2007–2012) were lower than separately standardized catches in the early time period (1978–1997). However, the conclusions that Barreto *et al.* (2016b) draw from these analyses of substantial decline is flawed; this is because the standardization analysis was applied to each of three time periods separately, with different standardization variables, so that the resultant abundance indices are not comparable between time periods and hence cannot be used to infer the extent of decline over the entirety of the period they cover. Thus, the panel did not consider these results informative in regard to estimation of either the historical extent or the recent rate of decline.

No other data on trends were available for the South Atlantic

Mediterranean

In summary, the abundance in the Mediterranean has decreased, but the extent of decline is not well determined.

There is no stock assessment for the Mediterranean. Ferretti *et al.* (2008) present a meta-analysis of time series of different indices of shark abundance in the Mediterranean, which in broad terms supports the existence of a decline. However, a number of these series comprise only catch or sightings information, and only the bycatch of pelagic longline fisheries for swordfish enable effort to be taken into account in developing the abundance index. Only two series (for the Ionian Sea and Spanish Mediterranean waters) provide information on lamnids with reasonable precision, and both do indeed clearly indicate declines of over 90 percent. However, only the latter case pertains to the shortfin mako shark species alone. Furthermore, for both cases the decline is not steady, but precipitous over a period of one or a few years only, which suggest that other factors have some influence on these data in addition to fishing.

IUCN lists the species as critically endangered in the Mediterranean in part because of reports that this previously common species is now rare. It is not known whether there is a distinct population in the Mediterranean or whether the Mediterranean is a nursery area for the North Atlantic population (Calliet *et al.* 2009). An experimental longline survey in the Gulf of Gabes in 2016 found that shortfin mako

shark were the second most common shark species caught; this implies that the species is still present in Tunisia, although no information is available on trends (Bradai *et al.*, 2017).

The panel concluded that the abundance of the species in the Mediterranean has decreased, but the extent of decline is not well determined.

Indian Ocean

In summary, based on the available information, the Panel found that there is insufficient evidence to justify that the Indian Ocean shortfin mako population meets the CITES historical extent of decline or recent rate of decline criteria.

The IOTC Scientific Committee has noted that considerable uncertainty remains over the relationship between abundance, the standardized CPUE series, and total catches over the past decade. The Expert Panel considered and discussed the estimated stock decline mentioned in the proposal. The first reference showed that historical data indicate an overall decline in nominal CPUE and mean weight of mako sharks (Romanov *et al.*, 2008) (Figure 5). It noted that the Romanov study, shows a highly variable trend in average weight, while the hook rate trend is also relatively flat (apart from a peak in the late 1960s). Thus the result quoted in the proposal refers to a nominal CPUE which does not account for factors other than population abundance, which may be influencing catch rate.

Other CPUE series not considered by the proposal have also been presented to the Indian Ocean Tuna Commission (IOTC). The Japanese standardized CPUE series (Figure 6) suggest that the biomass declined from 1994 to 2003, but subsequently increased until 2010 though with substantial fluctuations (Kimoto *et al.*, 2011). The standardized CPUE series of shortfin mako catches by the Portuguese longline fleet in the Indian Ocean shows substantial variability between 2000–2016, with a declining trend until 2004 and an increasing trend in more recent years (Coelho *et al.*, 2017) (Figure 7).

No formal stock assessment has been conducted for species in the Indian Ocean. A preliminary study was presented to the 2018 IOTC Working Party on Ecosystems and Bycatch (WPEB) by Brunel *et al.* (2018), which is the second reference provided in the proposal to substantiate population declines in the Indian Ocean. The authors of that document state that: “Due to the considerable amount of uncertainty in the estimates, management advice is not clear from this preliminary work.” The WPEB further noted that most assessments for data-limited species in the IOTC region have similar patterns of increasing catch and CPUE. These patterns persist even for species with varied life history strategies (low and high resilience to fisheries) which is biologically unlikely. Therefore, it is not suitable to consider this preliminary assessment as providing reliable indications of current or past stock status.

Pacific Ocean

In summary, the Panel found no evidence for either the North or South Pacific that shortfin mako populations meet the CITES historical extent of decline or recent rate of decline criteria. The Panel considers that this finding is robust both in terms of the uncertainties considered in the pertinent studies as well as with regard to other information sourced and assessed by the Panel. The rationale for reaching specific conclusions is described in more detail below.

The Expert Panel reviewed a number of studies (Table 2) including all of the primary studies referenced in Section 4.4 “Population Trends” of the proposal provided. As summarized in Table 2 and described below, some of these references were found to have been superseded by more recent analyses. The proposal references Nakano and Clarke (2006) as reporting a > 30 percent decline in reported catches from the Pacific; however, as this study is for the Atlantic, the Expert Panel concluded that they provide no information on population trends in the Pacific. In addition to the references cited in the proposal, the panel also reviewed other pertinent studies including working papers that contributed to the recent North Pacific shortfin mako assessment.

The Expert Panel followed the same approach as the proposal in considering North Pacific and South Pacific shortfin mako separately. Although the species is found throughout both temperate and tropical waters of both hemispheres, the panel noted that catch rates for this species are highest north of 20°N and south of 20°S, suggesting that the core habitat is in temperate and sub-tropical waters (Rice *et al.*, 2015, Figure 21;

Kai *et al.*, 2017, Figure 6). This resulted in the Expert Panel giving less weight to trends derived from data in tropical waters (i.e. between 20°N and 20°S).

North Pacific

The Expert Panel considered that the recent North Pacific shortfin mako assessment (ISC, 2018) provided the best available assessment of trends for the North Pacific population; it noted that this assessment aimed to account for the entire northern hemisphere population (i.e. both the Western and Central as well as the Eastern Pacific), considering biological data (prepared through dedicated workshops), catch data from 1975–2016, in addition to catch and size indices from 17 fisheries for integration into an age-structured population dynamics model. The assessment was undertaken collaboratively by scientists from Canada, Japan, the Republic of Korea, Mexico, Taiwan Province of China and the United States of America, and was presented to and endorsed by the Western and Central Pacific Fisheries Commission. It was considered by the Expert Panel to be spatially and temporally comprehensive, up-to-date and well-reviewed by scientists familiar with the fisheries.

The ISC (2018) assessment drew conclusions from a base case model which included five abundance indices, each assigned either high or medium [priority] on the basis of comprehensiveness, duration, relevance to core habitat and observer coverage (ISC, 2018, Figure ES2):

- Japan distant water and offshore shallow-set longline (high)
- Hawaii shallow-set longline (medium)
- Mexican Ensenada observer longline (medium)
- Japanese deep-set research and training vessel longline (medium)
- Taiwanese large-scale longline (medium)

In addition to the base case, six alternative scenarios were also explored to examine key uncertainties. The Expert Panel agreed with the ISC abundance index selections and also examined ISC rationale for excluding the Hawaii deep-set longline fishery abundance index, which is based on observer data and was characterized as showing a stable trend (ISC, 2017). This rationale – that the deep-set fishery is outside the species' core habitat – was considered reasonable.

The age-structured model integrated the biological, catch and size information to produce a time series of spawning abundance from 1975–2016 (ISC, 2018, Figure ES4). The results indicated that the current spawning abundance relative to unfished levels is 58 percent [95 percent CI=30–86; range of 51–68 percent across alternative scenarios (ISC, 2018, Table ES3)]. The model accounted for the fact that the population had been fished for some time prior to 1975 (ISC, 2018, p. 32). Therefore, the panel considered that the assessment's best estimate of depletion to 58 percent (95 percent CI= 30 percent–86 percent) of its baseline represented the historical extent of decline. Based on these considerations, the Expert Panel was confident that the best available scientific evidence indicates that the North Pacific shortfin mako does not meet the CITES Appendix II criteria for historical extent of decline.

To consider the recent rate of decline, the Expert Panel applied a log-linear regression to spawning abundance estimates for 2007–2016, as given in ISC (2018). As noted in the assessment, this trend increases slightly, the Expert Panel considered this to be a likely consequence of the large decrease in catch levels from the 1980s to the present. The linear trend computed by the panel (Table 3) was an annual rate of increase of 0.16 percent (95 percent confidence interval of 0.09 to 0.23 percent). Based on these considerations, the Expert Panel was confident that the best available scientific evidence indicates that the North Pacific shortfin mako does not meet the CITES Appendix II criteria for recent rate of decline.

In considering the future condition of the population the Expert Panel noted the ISC (2018, Figure ES8) conclusions that the population will gradually increase if fishing mortality does not increase over recent levels (2013–2015). The Expert Panel noted that North Pacific fishing effort in the shortfin mako core habitat has been decreasing since 2008 (Figure 8), and considered the ISC (2018) prediction of a gradual stock increase to be reasonable, assuming that current levels of fishing effort do not increase.

The Expert Panel also reviewed other studies containing information on North Pacific shortfin mako population trends (Table 2). Clarke *et al.* (2013) and Rice *et al.* (2015) analysed data for the genus *Isurus* due to a lack of species-specific observer data in the early part of the time series and the possibility of misidentification. These two studies used the same observer-based dataset. Although the latter study's time

series might appear to be longer and consequently preferred, the Expert Panel noted that in the case of the North Pacific, Rice *et al.* (2015) lacked data for Regions 1 and 2 (20°N to 50°N) from 2012 onwards. Hence, for recent years their study captured data from the tropical North Pacific only, which is not core habitat for shortfin mako. Furthermore, the majority of North Pacific data analysed by both Clarke *et al.* (2013) and Rice *et al.* (2015) derives from the Hawaii longline fishery observer programme. These data were reanalysed by US scientists in 2017, using an approach that the Expert Panel considered to be sound, and showed a stable trend from 1995–2016 (ISC, 2017). A portion of these data were included in the base case scenario for the ISC North Pacific assessment (ISC 2018) (see discussion above). Therefore, the Expert Panel considered that the information in Clarke *et al.* (2013) and Rice *et al.* (2015) was superseded by the ISC (2018) assessment.

The Expert Panel also reviewed three studies of North Pacific shortfin mako population trends based on data from the small-scale longline fishery based in Taiwan, Province of China: Chang and Liu, 2009; Tsai *et al.* (2011) and Tsai *et al.* (2014). The Expert Panel considered that these studies did not meaningfully contribute to the information in ISC (2018) for several reasons. First, the component of the North Pacific shortfin mako population considered in these three studies is a part only of the population considered in the ISC (2018) assessment (which considers the longline fleet operating on a large spatial scale, see Tsai *et al.* (2017)). Second, the Expert Panel noted that these studies were based on landings data, rather than catch per unit effort, as logbooks were not required to record sharks by species until 2005, and landings data are not reliable as indices of abundance. Third, some methodological questions arose concerning these studies. The Expert Panel noted that Chang and Liu (2009) and Tsai *et al.* (2011) used variants of VPA, but without any external “tuning” information as is customarily and additionally provided to such age-structured analyses in the form of independent survey estimates of abundance or CPUE series. Without such information, trends estimated from such analyses will be poorly determined and thus unreliable. The Tsai *et al.* (2014) study is a refined version of a Leslie matrix approach, which effectively estimates population growth rates from the difference between birth and death rates. While in this case there is good information on the former, estimates of the latter rely on general relationships with other life-history parameters, which typically yield values with poor precision when checked across species. As a result, the estimates of growth rate provided in this paper are unlikely to be reliable.

In summary, the Expert Panel considered that the ISC assessment offered a more robust methodology to account for the trends in the proportion of the shortfin mako population referenced in these three studies, by incorporating standardized catch rates and broader and more recent (2005–2016) data coverage; as such the ISC assessment was considered to provide much more reliable outputs.

South Pacific

The Expert Panel noted that there is no existing stock assessment for the South Pacific shortfin mako and therefore catch rate indicators provide the best available information to estimate the extent of any stock decline. Similar to the North Pacific, the core habitat for the South Pacific shortfin mako was considered to be south of 20°S (see Rice *et al.*, 2015; Figure 21). Three studies were reviewed by the panel: Clarke *et al.*, 2013; Rice *et al.*, 2015 and Francis *et al.*, 2014 (Table 2).

As explained above, Clarke *et al.* (2013) was found to have been superseded by Rice *et al.* (2015), which uses the same dataset with a longer time series. The Expert Panel considered that Rice *et al.* (2015) offers a useful broad-scale view of the population trends in the South Pacific. However, the panel noted some issues with the methodology, which may have failed to account properly for the influence of area in the catch rate standardization (see Rice *et al.*, 2015; Table 8). Another shortcoming is that the study lacked data for a large portion of the region of interest (Region 6) in the final year of the analysis (2014) (see Rice *et al.*, 2015; Table 2 and Figure 91) and the panel noted the authors’ caution that data for 2014 were incomplete (see Rice *et al.*, 2015; Executive Summary). Taken together with the absence of an area factor in the analysis, this means that the standardized estimate for 2014 is not reliable. When computing historic and recent rates of decline the Expert Panel decided to exclude the 2014 data point for these reasons. The Expert Panel found that the entire time series (1996–2013) showed an increasing trend of 1.3 percent per annum (95 percent CI of -0.01 percent to 3.6 percent), with the most recent and reliable ten years (2004–2013, i.e. 2014 excluded) an increasing trend of 2.2 percent p.a. (95% CI of -1.7% to 6.0%) (Table 3). Although the confidence interval for both trends includes negative values indicating some possibility that the population may in fact be decreasing, this is considered to be small and an insufficient basis for concluding that the South Pacific shortfin mako population meets the CITES Appendix II listing criteria for either the historical extent or recent rate of decline.

The Expert Panel also reviewed data from Francis *et al.* (2014) on catch rate indicators for the shortfin mako population in New Zealand waters. Although the area covered by this study is small relative to Rice *et al.* (2015), it was considered important to contrast the two results because: a) while Rice *et al.* (2015) included some data from New Zealand in their study, the coverage by area and year are different; and b) the Francis *et al.* (2014) study provides a very consistent time series focused on specific fisheries which is advantageous insofar as it allows for greater confidence in relation to its comparability over time when determining a population trend. Francis *et al.* (2014) provides four population trends based on logbooks from the domestic fishery (north and south), logbooks from the Japanese fishery in the south, and observer data (Figure 9). The authors characterize three of the time series as having a “nil” trend, whereas the northern domestic fishery is characterized as having an increasing trend. The Expert Panel fit log-linear regressions to all years for all four series; in addition, it computed a trend for the whole of the observer series (1993–2013) as well as the last ten years (2004–2013) (Table 3). Only the domestic southern fishery showed a median negative trend (-9.1 percent per year), although the confidence interval is large and the fit is not statistically significant. The fit to the entire length of the observer series is also not significant, although it does show some possibility that the trend may be decreasing (median of 1.2 percent with 95 percent CI of -1.3 percent to 3.6 percent). Each of the other fits is significant and indicates an increasing population trend (Table 3). The Expert Panel considered that the data in Francis *et al.* (2014) supports that from Rice *et al.* (2015) in concluding that the South Pacific shortfin mako population does not meet the CITES Appendix II listing criteria for either the historical extent or recent rate of decline.

As a final consideration to address extent of decline, the Expert Panel examined whether the identified population trends are consistent with trends in overall longline fishing effort in the South Pacific. Figure 10 shows the overall longline effort trend south of 20°S (i.e. the core habitat for South Pacific shortfin mako) and indicates that average fishing effort in the most recent ten years has been considerably higher than in the past. As available data thus indicate that South Pacific shortfin mako have been able to increase slightly under current levels of fishing effort, it seems unlikely that the population would have been severely depleted by the lower level of fishing effort in previous years.

With regard to shortfin mako population trends in the southern hemisphere of the Eastern Pacific, the Expert Panel noted a paper by Bustamante and Bennett (2013) which provides some information on the Chilean fishery but does not contain information on population trends. The Expert Panel was thus unable to draw any conclusions about shortfin mako population trends from this study.

Modifying risk factors

The Expert Panel considered whether there were any biological characteristics of shortfin mako sharks that would modify their probability of being depleted to the point where they would meet the criteria for listing. The low productivity of the species is considered in the species productivity section above. That the species is circumglobal and wide-ranging is a positive modifying factor; a study in the southern hemisphere by Corrigan *et al.* (2018) found that genetic and telemetry data together suggest that shortfin mako populations may be genetically homogenous across large geographical areas as a consequence of few reproductively active migrants, although spatial partitioning exists.

Shortfin mako sharks are commonly caught as bycatch on longline sets targeting swordfish or tunas, so it is not likely that longline vessels could avoid catching the species. However, preliminary studies in the Atlantic Ocean have indicated that releasing animals brought to the vessel alive could be a potentially effective measure to reduce fishing mortality, owing to a relatively high post-release survival of about 70 percent (Campana *et al.*, 2016, Coehlo *et al.*, 2017).

The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 (Murua *et al.*, 2018) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery by combining the biological productivity of the species and its susceptibility to each fishing gear type. Shortfin mako sharks received the highest vulnerability ranking (No. 1) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and has a high susceptibility to longline gear. Shortfin mako sharks were estimated to be the fourth most vulnerable shark species in the ERA ranking for purse seine gear, but had lower levels of vulnerability than to longline gear because of the lower susceptibility of the species to purse seine gear.

The ecological risk assessment (ERA) conducted for the Atlantic Ocean (Cortes *et al.* 2015), which was based on the arithmetic mean vulnerability index (this did not show preferential correlation with the productivity or susceptibility indices), concluded that both longfin and shortfin mako sharks were among the most vulnerable shark species in the Atlantic, with the highest susceptibility values corresponding to shortfin mako (*I. oxyrinchus*).

Summary of evaluation and assessment of biological listing criteria

According to the stock assessments from the North Atlantic and North Pacific, the population numbers of shortfin mako sharks in these regions are in the millions. Given that the Expert Panel considered the productivity for the species as low, it follows that declines to 30 percent of historic levels (i.e. a decline of 70 percent) would meet the criteria for listing. In the North Atlantic, the population has declined to about 50 percent of historic levels and, based on projections from the stock assessments, may be at risk of declining below 30 percent of historic levels in the next few decades if catches are not decreased well below recent levels. The Expert Panel noted that ICCAT has adopted a recommendation to reduce catches in the North Atlantic, which may in turn reduce further population decline. In the Mediterranean, the population has declined, but the extent of decline is not well determined. For the South Atlantic, Indian Ocean, North Pacific and South Pacific, the Expert Panel found no evidence that populations meet the CITES criteria for either historical extent of decline or recent rate of decline. Mako sharks have lower productivity than other shark species; however, they are also relatively data-rich compared to other shark species. Viewed globally, and taking account of precautionary considerations (i.e. uncertainty, including precision, of estimates), the available data do not provide evidence that the species meets the CITES Appendix II listing criteria.

Comments on technical aspects relating to management, trade and likely effectiveness of implementation of a CITES listing

Management comment

Management regimes/measures related to governance, population monitoring and compliance, currently adopted

International/Regional:

- The FAO IPOA-Sharks underscores the responsibilities of fishing and coastal states in sustaining shark populations, ensuring the full utilization of sharks that are retained and improving shark data collection and monitoring (see Appendix G, especially points 3).
- The formally adopted FAO Port State Measures Agreement sets out port state measures to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing. This agreement requires that any inspections conducted on fishing vessels entering ports should include verification that all species exploited have been taken in compliance with international law, international conventions and measures adopted by RFMOs (see Appendix G, especially points 5i).
- All Tuna RFMOs have adopted certain management measures. These include measures such as prohibitions on finning, encouraging the live release of sharks (in non-targeting fisheries) to reduce fishing mortality, as well as the mandatory collection and submission of data for these species. Management measures for shortfin mako sharks specifically, which include requirements for live release if possible, have been adopted by ICCAT in the North Atlantic as that stock is currently declining as a result of excessive fishing mortality (see Appendix G, especially points 5ii).
- Some Tuna-RFMOs have already included oceanic, pelagic and highly migratory elasmobranchs in the scope of their Conventions, while ICCAT is amending the scope of its Convention so that they are included (see Appendix G, especially points 4, 5i).
- ICCAT plans to conduct a future assessment with; projections based on the Stock Synthesis model; this approach is likely to provide improved advice as it takes into account the biological characteristics of shortfin mako sharks, such as a distinctive growth by sex (which the production model fails to do).

- With reference to the lack of species-specific management action for shortfin mako shark by tuna regional fisheries management organizations stated in the proposal, the Expert Panel noted that their evaluation of the available data in the Western and Central Pacific, found that there is no evidence of a steady decline over the past decade in catch rates of mako sharks in either the North or South Pacific. The Western and Central Pacific Fisheries Commission has considered these studies, but given the results, no party has raised the need for management action for the Commission's consideration. A stock assessment for the South Pacific has been scheduled in the WCPFC Shark Research Plan for 2021. To the best of the Expert Panel's knowledge, management action for the shortfin mako has not yet been considered necessary for debate in CCSBT or IATTC. In the Indian Ocean, the IOTC Scientific Committee has stated that despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for shortfin mako sharks. ICCAT has considered and adopted a management measure for shortfin mako in the North Atlantic on the basis of recent stock assessment results, as described in Sections of this report related to population trends.
- In 2010 and 2011, the General Fisheries Commission for the Mediterranean (GFCM) adopted ad-hoc measures to reduce the bycatch of pelagic sharks, including mako sharks. In 2012, the GFCM banned finning in the Mediterranean and Black Sea and also prohibited the capture and sale of mako and other sharks listed in Annex II of the SPA/BD Protocol of the Barcelona Convention concerning specially protected areas and biological diversity in the Mediterranean.
- Some tuna RFMOs require that catches of sharks are recorded and reported annually at the species level. This is complemented by observer programmes and the reporting of discards (see Appendix G, especially points 5ii, iii).
- There are research programmes on sharks at regional and national levels; these include shortfin mako sharks.

National measures:

- Some states implement regional management measures (see above) through national plans of action and or finning controls, which may include requiring fins to be attached and/or the prohibition of finning. Mako shark is generally fully utilized when caught (see Appendix G, especially points 3).
- Some states have fully protected shortfin mako sharks throughout their EEZs (see Appendix G, especially points 3).
- Some States require catches of shortfin mako sharks, as an individual species, to be recorded and reported annually (see Appendix G, especially points 3).
- Some states limit shortfin mako mortality through annual total allowable catches (TACs) as well as placing a limit on the number or size of mako sharks caught in non-commercial, including recreational fisheries (see Appendix G, especially points 3, 5ii).
- MPAs and other spatial measures to protect sharks and their critical habitats have been established in several EEZs.
- Temporal management measures, such as periods when no fishing is permitted (e.g. three months every year in Mexico and some Central American countries) have also been established to protect sharks, largely during their reproductive periods. They are more susceptible to being caught in coastal areas in such periods, as in the case of the shortfin mako shark in northwestern Mexico.
- Catches of specifically shortfin mako sharks are reported to FAO by a small number of states only; others include shortfin mako shark catches within their reports of shark and ray catches.

Comment on anticipated change (positive and negative) in these management measures (and requirement for additional management), if species were listed under App II of CITES

- A requirement for conducting non-detriment findings (NDFs) would address the need to determine and take all sources of mortality into account (see Appendix G, especially points 4).

- An Appendix II listing may generate additional information such as trade data that can assist fisheries managers to assess fishing mortality rates. The reporting of shortfin mako shark catches, where landing is permitted, would be improved in some cases (see Appendix G, especially points 5iii).
- Appendix II listing could assist in improving compliance by providing an impediment to the trade of shortfin mako shark products illegally obtained from fisheries in which retention bans are in place, owing to the requirement to supply CITES documentation (see Appendix G, especially points 4).
- All catches landed from the high seas would require Introduction from the Sea Certification or Export Permits which require NDFs and legal acquisition findings, or the corresponding requirements under Introduction from the Sea. This applies not only to landings for commercial purposes but also to the movement of samples collected for scientific purposes (see Appendix G, especially points 4, 5i).
- Ongoing work by FAO and CITES on the implementation and effect of listing is described in Annex G of this report.

Trade comment

Shortfin mako shark is utilized in a variety of product forms in domestic markets and international trade, including as meat for human and animal (domestic pet) consumption, livers, cartilage, fins and skin (Clarke *et al.*, 2013; Appendix G, especially points 5iii).

The Expert Panel noted that the presence of shortfin mako fins and meat in international trade is well documented based on the references cited in the proposal. The Panel acknowledges that shark fin continues to be a highly valued commodity primarily amongst Asian consumers both in Asia and elsewhere. Additional information available to the Expert Panel noted that total global trade quantities are traditionally gauged by means of quantities imported by Hong Kong SAR; on this basis the market declined rapidly from a peak in 2003, falling sharply again after 2011 (Shea and To, 2017). A number of factors may have contributed to this second drop (Dent and Clarke, 2015), but it appears likely that new austerity regulations aimed at curbing conspicuous consumption by mainland Chinese government officials is a major factor (Jeffreys 2016, Fabinyi 2017). Quantities imported into Hong Kong SAR appear to have settled at 2012 levels, i.e. nominally at about half of the post-2003 volumes, through 2016 (Shea and To, 2017; HKCSD, unpublished data).

At the same time as the Chinese market has apparently been suppressed, Southeast Asian markets appear to be gaining influence either as processors, traders and/or consumers (Dent and Clarke 2015; Eriksson and Clarke 2015). The ongoing complexity and dynamism of the trade, along with traditional and continuing lack of transparency issues, make it difficult to quantify market sizes and shares which means that more precise trend information is unavailable.

Currently there is no culturing of mako sharks in aquaculture and it is unlikely that as a species they are suitable for aquaculture in currently developed aquaculture systems.

Trade (market transparency, documentation and level of IUU)

- In general, there are no specific catch or trade documentation schemes for sharks. Existing general catch documentation systems in some countries could facilitate the issuing of legal acquisition findings (e.g. EU Catch Certification requirements).
- Identifying sharks and shark products at a species level in international trade is severely constrained. There is finite capacity in the commonly used World Customs Organization (WCO) harmonized system (HS) of tariff classification which means that only a limited range of products derived from mako sharks, such as dried shark fin, could be identified in future amendments to the harmonized system. The earliest that such amendments might be implemented, assuming adoption in the World Customs Organization, would be 2027.
- Trade in mako shark either as fresh or frozen whole fish or the meat of mako shark cannot be identified at a species level, owing to limitations in the numerical structure of the harmonized system.²

² http://www.wcoomd.org/en/faq/harmonized_system_faq.aspx#q9.

- There are historical and current efforts by authorities and organizations other than Customs administrations to monitor the species composition of the shark fin trade and these may continue to provide insights. Other regulatory requirements related to traceability and transparency in the trade and marketing of fisheries products in certain countries require species and fisheries' origin identification of fish at the point of sale to consumers (see Appendix G, especially points 5ii).
- A CITES Appendix II listing applies only to international trade in listed species and their products. Domestic trade in mako sharks and their products would be unaffected by listing in CITES Appendix II. Landing and selling mako sharks could therefore continue in domestic markets without any changes to current practices.

Comment on anticipated change (positive and negative) in trade related issues, if species were listed under Appendix II of CITES

- The CITES provisions on trade in specimens of species listed in Appendix II require an export permit by the exporting country, which shall only be granted if the national CITES authorities are satisfied that: 1) the export is not detrimental to the survival of the species in the wild; and 2) the specimens were not obtained in contravention of the national laws of that state.
- Should shortfin mako be listed in Appendix II, the extension of the listing to longfin mako shark on the basis of the 'look-alike' provision in the proposal will require the same considerations and export permitting permissions for that species.
- The trade will be recorded in the CITES trade database, and this will improve overall trade information (see Appendix G, especially points 5iii).
- States' abilities to make NDFs for highly migratory species is limited in the absence of region-wide assessments, as evidenced by difficulties encountered in making NDFs for shark species that have already been listed. Under these conditions the following outcomes can occur.
 - trade in the species and its products ceases;
 - trade continues without proper CITES documentation (also known as "illegal trade"); and/or
 - trade continues with inadequate NDFs.
- There may be specific challenges for some long line fleets trans-shipping in port or at sea because non-target species, including mako sharks, are often not separated from target tuna catches until final landing at the destination port. CITES export certification – including Introduction from the Sea certification – for mako sharks caught in the high seas beyond national jurisdiction would require cargo separation to ensure that the product consigned can be reconciled against certificates.
- The implementation of previous listing decisions for sharks has taken some time. Some of the delays are a result of legislative processes, while there can be a lag of three or more years in the collection and transmission of trade data to the CITES Secretariat. Some administrations are having to implement new administrative procedures to provide and manage Introduction from the Sea certification to permit the landing of listed species from high-seas fisheries.

Basis for Article II paragraph (2b) ('look-alike') Appendix II listing of *I. paucus*

As indicated in the CITES listing criteria (Resolution Conf. 9.24 Rev. CoP15), the listing of *I. paucus* could be justified if the parts and derivatives of these species in trade resemble those of the listed Appendix II species (*I. oxyrinchus*) to such an extent that enforcement officers were unable to distinguish them.

The proposal cites Clarke *et al.* (2006) to argue that longfin mako sharks should be listed alongside shortfin mako sharks as look-alikes because, "most traders reported that they placed these fins in the same category as shortfin mako". In fact, Clarke *et al.* (2006) states that "some traders mentioned infrequent mixing [of shortfin mako] with the less abundant longfin mako". Of 69 Qing Lian samples collected, 6 were genetically identified as longfin mako. Traders also mentioned that longfin mako fins are sometimes mixed with thresher shark fins (Clarke *et al.*, 2006). The Expert Panel understands the situation to be that the majority of traders, though perhaps not all, can distinguish between shortfin and longfin mako fins and that there is in fact a market name

for low-quality Lamnid fins potentially including longfin mako (Qing Hua). However, they will not always treat these fins separately as commodities, particularly when there is no difference in commercial value. For example, the longfin mako pectoral and thresher pectoral fins have similar value and are co-mingled; in contrast, the longfin mako dorsal and shortfin mako dorsal fins may have similar values and thus may be combined. The condition and quality (e.g. size) of the fins may also determine whether traders consider shortfin and longfin mako fins as separate products (Clarke, pers. comm.). The proposal does not clearly address the question of whether shortfin and longfin mako can be easily distinguished by enforcement officials, but the Expert Panel deems that the difficulties for enforcement officials' identification would be similar to those for fins of other species already listed on Appendix II of CITES: in other words, with the proper tools the species can be distinguished.

The Expert Panel found no evidence that longfin mako meat appears in international trade. However, some of the scientific studies reviewed noted that some data sets (e.g. observer data in the early years of observer programmes) did not reliably distinguish between shortfin and longfin mako catches (Clarke *et al.*, 2013; Rice *et al.*, 2015). Although these species in whole form are quite distinctive due to the difference in pectoral fin length, processed carcasses would likely to be difficult to separate. Again, this is similar to issues associated with shark species already listed on CITES Appendix II.

Likely effectiveness for conservation of a CITES Appendix II listing: summary comment in relation to technical aspects of biology, ecology, management and trade.

Shortfin mako shark (and by virtue of being a look-alike species, longfin mako shark) is being proposed for CITES Appendix II listing in accordance with Article II paragraph 2(a) of the Convention, on the basis of meeting Criterion A in Annex 2a of Resolution Conf. 9.24 (Rev. CoP16), which states: 'It is known, or can be inferred or projected, that the regulation of trade in the species is necessary to avoid it becoming eligible for inclusion in Appendix I in the near future'.

It is difficult to draw clear conclusions regarding the effectiveness of existing and future management and trade measures owing to the lack of data available to assess these measures (see Appendix G, especially points 5iv). However, it is noted that if properly implemented, a CITES Appendix II listing would be expected to result in better monitoring and reporting of catches entering international trade from shortfin mako shark populations. Improved monitoring should enable new or enhanced assessments of stock status and the subsequent adoption of management measures that ensure the sustainability of harvests where these are still permitted. Harvests from international waters would fall under the 'Introduction from the Sea' (IFS) provisions of the CITES Convention. These would require CITES documentation at the species level for specimens entering the jurisdiction of a state from international waters, along with a NDFs indicating that the harvest was sustainable and consistent with relevant measures under international law.

Listing would also provide an additional control to ensure that products entering international trade are derived from legal and sustainable fisheries. A CITES Appendix II listing, if implemented effectively, could also act as a complementary measure for regulations implemented by fishery management authorities; in particular, where RFMOs have adopted measures encouraging the live release of shortfin mako sharks. It should be noted that states' abilities to make NDFs for highly migratory species is limited in the absence of region-wide assessments, as evidenced by difficulties encountered in making NDFs for shark species that have already been listed. Under these conditions the following outcomes can occur: previous trade ceases, trade continues without proper CITES documentation (i.e. illegal trade) and/or trade continues with inadequate NDFs.

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Tables and figures

Table 1. Information for assessing productivity of shortfin Mako shark. M: male; F: female.

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | COMMENTS |
|-------------------|--------|-------------------------------------|---|---|---|
| Natural mortality | Low | 0.128 | North Pacific | ISC-SWG, 2018 | Estimated from an empirical equation based on the maximum age for cetaceans (Hoenig, 1983) and the maximum age is given based on the method of bomb-radiocarbon (Ardizzone, 2006) that is a robust methodology. |
| Natural mortality | Low | 0.072 | North Pacific | Calliet <i>et al.</i> , 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been revised in recent years. |
| Natural mortality | Low | 0.089–0.203 (M), 0.077–0.244 (F) | North Pacific | Chang and Liu, 2009 | Four empirical equations (Hoenig, 1983; two equations: Jensen 1996; Peterson and Wroblewski, 1984) were used to estimate the values. However, the key biological parameters used to estimate the values were estimated based on the biological data collected from the limited area in the water near Taiwan, Province of China. |
| Growth | Low | K: 0.05 | North Pacific | Ribot-Carballal <i>et al.</i> , 2005 | Study based on overestimated amount of growth band pairs. Sampling covers also a low range of the artisanal fisheries in the northwestern Mexican Pacific. |
| Growth | Low | K:0.128 (F), 0.174 (M) | North Pacific | ISC-SWG 2018; ISC-SWG, 2018; Takahashi <i>et al.</i> , 2017 | Due to the uncertainties in the age determination, a meta-analytic approach for estimating growth was adopted by the SHARKWG (Takahashi <i>et al.</i> , 2017). This approach treated data from the western north Pacific as having a constant band pair deposition rate and data from the eastern Pacific as having a band pair deposition rate that changes from 2 to 1 band pairs per year after age 5. This approach allowed to produce a single growth model for the northern stock that included data collected from across the basin. |
| Growth | Medium | K: 0.215 (M), 0.158 (F) | North Pacific | Calliet <i>et al.</i> , 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been revised in recent years. |
| Growth | Low | K: 0.05 (F), 0.056 (M) | North Pacific | Chang and Liu, 2009 | Same comments as that for K in Chinese Taipei estimated by Chang and Liu (2009) |
| Growth | Low | K: 0.09 (F), 0.16 (M) | North Pacific (Western and Central North) | Semba <i>et al.</i> , 2009 | Same comments as that for K in North Pacific estimated by ISC (2018) |
| Time to maturity | Medium | 7 to 8 (M) | North Pacific | Calliet <i>et al.</i> , 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been adjusted in recent years. |
| Time to maturity | Low | 12 (M), 18 (F) | North Pacific | Chang and Liu, 2009 | The weak point is that the values were estimated based on the biological data collected from the limited area in the water near Taiwan, Province of China. |
| Longevity | Low | 31 | North Pacific | ISC-SWG, 2018 | The method of bomb-radiocarbon (Ardizzone, 2006) that is the robust methodology to estimate the longevity. |
| Longevity | Low | 45 | North Pacific | Caillet <i>et al.</i> , 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been revised in recent years. |

Table 1. (continued).

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | COMMENTS |
|---|--------|---------------------------------|----------------|-----------------------------------|--|
| Natural mortality | Low | 0.1–0.24 (M), 0.09–0.16 (F) | South Pacific | Bishop <i>et al.</i> , 2006 | The inherent difficulty in estimating M, author suggested that M is most likely in the range 0.1–0.15, indicating a low level of natural mortality and productivity. |
| Growth | Low | K: 0.09 | South Pacific | Bustamante and Bennet, 2013 | No value in the paper. |
| Growth | Low | K: 0.076–0.087 | South Pacific | Cerna and Licandeo, 2009 | The results for both sexes showed that the L_{∞} was close to the maximum size observed (L_{max}) off Chilean waters (330 and 285 cm TL, for females and males respectively), indicating that the VBGM well represented the growth of this species in the study area. |
| Growth | Low | K: 0.013– 0.052 | South Pacific | Bishop <i>et al.</i> , 2006 | The author mentioned that there are several possible reasons for the poor fit of the Von-Bertalanffy model to young age classes. |
| Time to maturity | Low | 9 to 10 (M), 20 to 21 (F) | South Pacific | Francis, 2016 | The output of Bishop <i>et al.</i> (2006) is superseded by this study. However, there is still large uncertainty in the aging remained. |
| Time to maturity | Low | 7 (M), 19 (F) | South Pacific | Bishop <i>et al.</i> , 2006 | Differences in growth rates calculated using differences assumed band deposition rates are large uncertainties. |
| Longevity | Low | 29– 32 | South Pacific | Bishop <i>et al.</i> , 2006 | Longevity is reasonable because the value is the almost same as that estimated from the Bomb Radiocarbon (Ardizzone 2006). |
| Intrinsic rate of population growth (r) | Low | 0.031 – 0.06 | North Atlantic | Cortés, 2017 | Methodology is likely reasonable, however, the values are likely too small because the BSPM provided a higher values than these values (ICCAT, 2017). |
| Growth | Low | K: 0.054 | North Atlantic | Cortés <i>et al.</i> , 2017 | The data has an issue because the original paper referred by Cortes <i>et al.</i> , 2017 is inaccessible. |
| Growth | Low | K: 0.087 (M), 0.125 (F) | North Atlantic | Natanson <i>et al.</i> , 2006 | Multiple types of data was used. Vertebral centra of 258 specimens (118 males, 140 females), ranging in size from 64 to 340 cm fork length (FL) were compared with data from 22 tag–recaptured individuals (74–193 cm FL) and length–frequency data from 1822 individuals (1035 males, 787 females; 65–215 cm FL). Annual bandpair deposition, confirmed by a concurrent bomb radiocarbon validation study, was used as the basis for band interpretation. |
| Growth | Medium | K: 0.266 (M), 0.203 (F) | North Atlantic | Pratt and Casey, 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been revised in recent years. |
| Time to maturity | Low | 18 (average age at maturity) | North Atlantic | Cortés <i>et al.</i> , 2017 | The methodology is uncertain because the original paper referred by Cortes <i>et al.</i> , 2017 is inaccessible. |
| Time to maturity | Low | 8 (M), 18 (F) | North Atlantic | Natanson <i>et al.</i> , 2006 | Same comments as that for K (Natanson <i>et al.</i> , 2006) |

Table 1. (continued).

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | COMMENTS |
|-------------------------------------|------------|----------------------------------|---|---------------------------------|--|
| Longevity | Low | 21 (M), 38 (F) | North Atlantic | Natanson <i>et al.</i> , 2006 | Same comments as that for K (Natanson <i>et al.</i> , 2006) |
| Longevity | Low | 32 (F) | North Atlantic | Cortés <i>et al.</i> 2017 | The methodology is uncertain because the original paper referred by Cortes <i>et al.</i> , 2017 is inaccessible. |
| Longevity | Medium | 4.5 (M), 11.5 (F) | North Atlantic | Pratt and Casey, 1983 | Study based on methodology of age reading on vertebrae that underestimated ages. The methodology has been revised in recent years. |
| Longevity | Medium | 16 (M), 19 (F) | North Atlantic | Cliff <i>et al.</i> , 1990 | This information could not be found in the paper. |
| Growth | Low | K: 0.04–0.13 (M), 0.04– 0.13 (F) | South Atlantic | Barreto <i>et al.</i> , 2016a | The ranges of estimates are wide due to the different assumptions of the band pair deposition. |
| Time to maturity | Low-Medium | 3–6 (M), 7 - >12 (F) | South Atlantic (Western Central Atlantic, off Northeast Brazil) | Barreto <i>et al.</i> , 2016a | Just referred to the maturity at size by Natanson (2006) and estimated the value using the growth curve estimated in this paper. |
| Longevity | Low-Medium | 19–28 (F), 16–23 (M) | South Atlantic (Western Central Atlantic, off Northeast Brazil) | Barreto <i>et al.</i> , 2016a | Just referred to the maturity at size by Natanson (2006) and estimated the value using the growth curve estimated in this paper. |
| Intrinsic rate of population growth | Low | 0.066–0.123 | South Atlantic | Cortés, 2017 | The data has an issue because the original paper referred by Cortes <i>et al.</i> , 2017 is inaccessible. |
| Growth | Low | K: 0.113 | Indian Ocean | Groeneveld <i>et al.</i> , 2014 | |
| Time to maturity | Low | 7 (M), 15 (F) | Indian Ocean | Groeneveld <i>et al.</i> , 2014 | |
| Generation time | | 25 | Indian Ocean | Jabado <i>et al.</i> , 2017) | |

Table 2. Information on shortfin mako shark trends from different oceanic regions (also see Figure 11).

| AREA | COVERAGE | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENCE PERIOD | CONFIDENCE | COMMENT | SOURCE |
|---------------|---|--------------------------|---|--|------------------|------------|---|-----------------------------|
| Pacific Ocean | North Pacific, including Western, Central and Eastern Pacific | Spawning abundance | longline | Depleted to 58% (CI: 30–86%) of unfished. Recent (2007–2016): Increasing by 0.16% per year | 1975–2016 | 5 | Best available information on population trends. | ISC, 2018 |
| Pacific Ocean | North Pacific | CPUE | longline | NA | 1996–2009 | NA | Superseded by ISC, 2017 – see text | Clarke <i>et al.</i> , 2013 |
| Pacific Ocean | North Pacific | CPUE | longline | NA | 2000–2010 | NA | Superseded by ISC, 2017 – see text | Rice <i>et al.</i> , 2013 |
| Pacific Ocean | North Pacific | Spawning potential ratio | Small-scale longline fishery based in Taiwan, Province of China | NA | 1990–2003 | NA | Methodological issues when determining a population trend, superseded by ISC (Tsai <i>et al.</i> , 2017; ISC, 2017; 2018) | Chang and Liu, 2009 |
| Pacific Ocean | North Pacific | Population growth rate | Small-scale longline fishery based in Taiwan, Province of China | NA | NA | NA | Methodological issues when determining a population trend, superseded by ISC (Tsai <i>et al.</i> , 2017; ISC, 2017; 2018) | Tsai <i>et al.</i> , 2011 |
| Pacific Ocean | North Pacific | Population growth rate | Small-scale longline fishery based in Taiwan, Province of China | NA | NA | NA | Methodological issues when determining a population trend, superseded by ISC (Tsai <i>et al.</i> , 2017; ISC, 2017; 2018) | Tsai <i>et al.</i> , 2014 |
| Pacific Ocean | South Pacific | CPUE | longline | NA | 1996–2009 | NA | Superseded by Rice <i>et al.</i> , 2015 – see text | Clarke <i>et al.</i> , 2013 |

Table 2. (continued).

| AREA | COVERAGE | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENCE PERIOD | CONFIDENCE | COMMENT | SOURCE |
|---------------|-----------------------------------|-----------|----------|---|------------------|------------|--|------------------------------|
| Pacific Ocean | South Pacific | CPUE | longline | Historical: Increasing by 1.3% (95% CI of -0.01% to 3.6%) per year (but not statistically significant) Recent (2004–2013): Increasing by 2.2% (95% CI of -1.7% to 6.0%) per year (but not statistically significant) | 1996–2013 | 4 | Despite data gaps provides a reasonable large-scale indicator of population trends | Rice <i>et al.</i> , 2015 |
| Pacific Ocean | South Pacific, New Zealand waters | CPUE | longline | Historical: Increasing by 0.09% (95% CI of -0.14% to 0.32%) (but not statistically significant) Recent (2004–2013): Decreasing in one fishery by 7.3% per year (but not statistically significant) and increasing in three other fisheries (statistically significant) | 1993–2013 | 4 | Provides a very consistent time series focused on specific fisheries which is advantageous when determining a population trend | Francis <i>et al.</i> , 2014 |

Table 2. (continued).

| AREA | COVERAGE | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENCE PERIOD | CONFIDENCE | COMMENT | SOURCE |
|----------------|--------------------------------|--------------------------|----------|--|------------------|------------|--|-----------------------------|
| Atlantic Ocean | North Atlantic | Spawning stock fecundity | longline | Historical: 50% Recent (2006–2015): 32% | 1950–2015 | 5 | The panel focused on the estimate of spawning stock fecundity from the age structured stock assessment model (Stock Synthesis), because age structured models are more accurate than surplus production models for long-lived species with a high age at maturity. | ICCAT, 2017 |
| Atlantic Ocean | North Atlantic | CPUE | longline | NA | 1986–2000 | NA | Older datasets are not appropriate for calculating recent rates of decline because they are now dated. Same U.S. longline dataset was re-analyzed in 2017 and used as one of the inputs to the ICCAT assessment. | Baum <i>et al.</i> , 2003 |
| Atlantic Ocean | North Atlantic | CPUE | longline | NA | 1992–2005 | NA | Older datasets are not appropriate for calculating recent rates of decline because they are now dated. Same U.S. longline dataset was re-analyzed in 2017 and used as one of the inputs to the ICCAT assessment. | Baum and Blanchard, 2010 |
| Atlantic Ocean | North Atlantic, Gulf of Mexico | CPUE | longline | NA | 1986–2005 | NA | Older datasets are not appropriate for calculating recent rates of decline because they are now dated. Same U.S. longline dataset was re-analyzed in 2017 and used as one of the inputs to the ICCAT assessment. | Cortes <i>et al.</i> , 2007 |

Table 2. (continued).

| AREA | COVERAGE | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENC E PERIOD | CONFIDENC E | COMMENT | SOURCE |
|----------------|--|--------------------------------------|-----------------------------------|---|---|-------------|--|-------------------------------|
| Atlantic Ocean | South Atlantic | Biomass | longline | Uncertain | 1950–2015 | 3 | Assessment highly uncertain due to issues with data quality | ICCAT, 2017 |
| Atlantic Ocean | South Atlantic | CPUE | Longline, multiple fishing fleets | NA | Comparison 1978–1997 and 2007–2012 | 2 | Abundance indices are not comparable between these time periods | Barreto <i>et al.</i> , 2016b |
| Mediterranean | Ionian Sea and Western Mediterranean (Spain) | Different indices of shark abundance | longline | Historical: declines to over 90% | Different time periods, ranging from 22 to 55 years | 3 | Decline not steady but precipitous over few years; other factors may be having influence on data | Ferretti <i>et al.</i> , 2008 |
| Indian Ocean | Indian Ocean | CPUE and mean weight | | Declining abundance | 1964–1988 | 2 | Nominal CPUE which does not account for factors, other than population abundance, that may be influencing catch rate | Romanov <i>et al.</i> , 2008 |
| Indian Ocean | Indian Ocean | CPUE | Longline | Decline from 1994 – 2003 and subsequent increase until 2010 | 1994–2010 | 4 | Standardized CPUE could be useful for assessment | Kimoto <i>et al.</i> , 2011 |
| Indian Ocean | Indian Ocean | CPUE | longline | Decline until 2004 and increase in more recent years | 2000–2016 | 2 | Authors say data not representative because of fleet movement | Coelho <i>et al.</i> , 2017 |

Table 3. Trends estimated from graphics presented in various studies of North and South Pacific mako population indices digitized using a web-based tool, then checked and fit with a log-linear regression using Excel. Those for which the 95 percent confidence interval of the slope does not fall below zero are shaded in yellow.

| Reference | Time Series | Slope | SE | 95% CI | P value | Statistically Significant? |
|---|-------------|--------|--------|------------------|---------|----------------------------|
| <i>North Pacific</i> | | | | | | |
| ISC (2018) Table ES1 | 2007–2016 | 0.0016 | 0.0003 | 0.0009 to 0.0023 | 0.0008 | Yes |
| <i>South Pacific</i> | | | | | | |
| Rice <i>et al.</i> , 2015 Figure 40 | 1996–2013 | 0.013 | 0.011 | -0.001 to 0.036 | 0.244 | No |
| Rice <i>et al.</i> , 2015 Figure 40 | 2004–2013 | 0.022 | 0.017 | -0.017 to 0.060 | 0.233 | No |
| Francis <i>et al.</i> , 2014 TLCER Japan South Figure 22 | 2006–2013 | 0.201 | 0.060 | 0.054 to 0.349 | 0.016 | Yes |
| Francis <i>et al.</i> , 2014 TLCER Domestic South Figure 23 | 2006–2013 | -0.091 | 0.087 | -0.304 to 0.121 | 0.338 | No |
| Francis <i>et al.</i> , 2014 TLCER Domestic North Figure 24 | 2006–2013 | 0.205 | 0.034 | 0.122 to 0.289 | 0.001 | Yes |
| Francis <i>et al.</i> , 2014 Observer Data Figure 25 | 1993–2013 | 0.012 | 0.012 | -0.013 to 0.036 | 0.337 | No |
| Francis <i>et al.</i> , 2014 Observer Data Figure 25 | 2004–2013 | 0.059 | 0.016 | 0.023 to 0.096 | 0.006 | Yes |

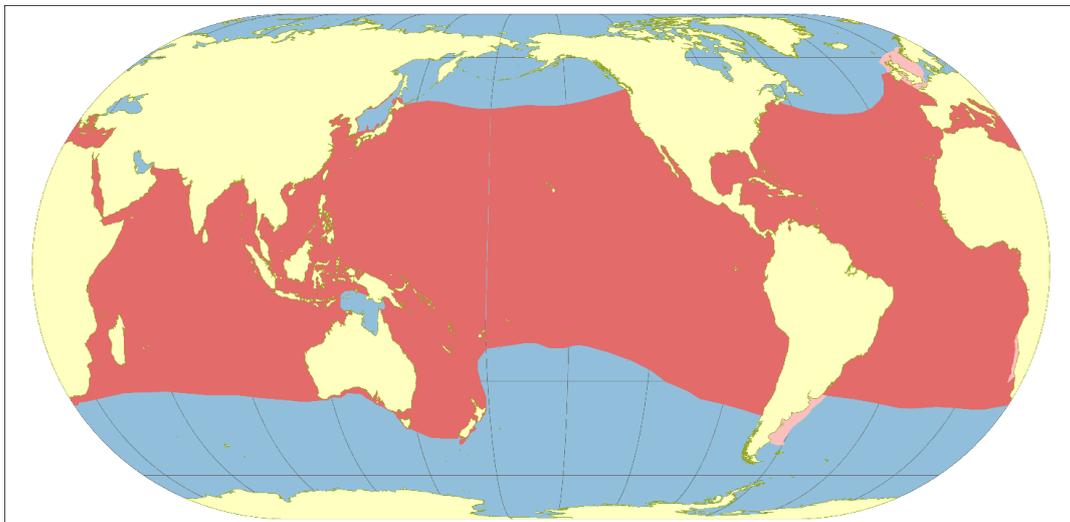
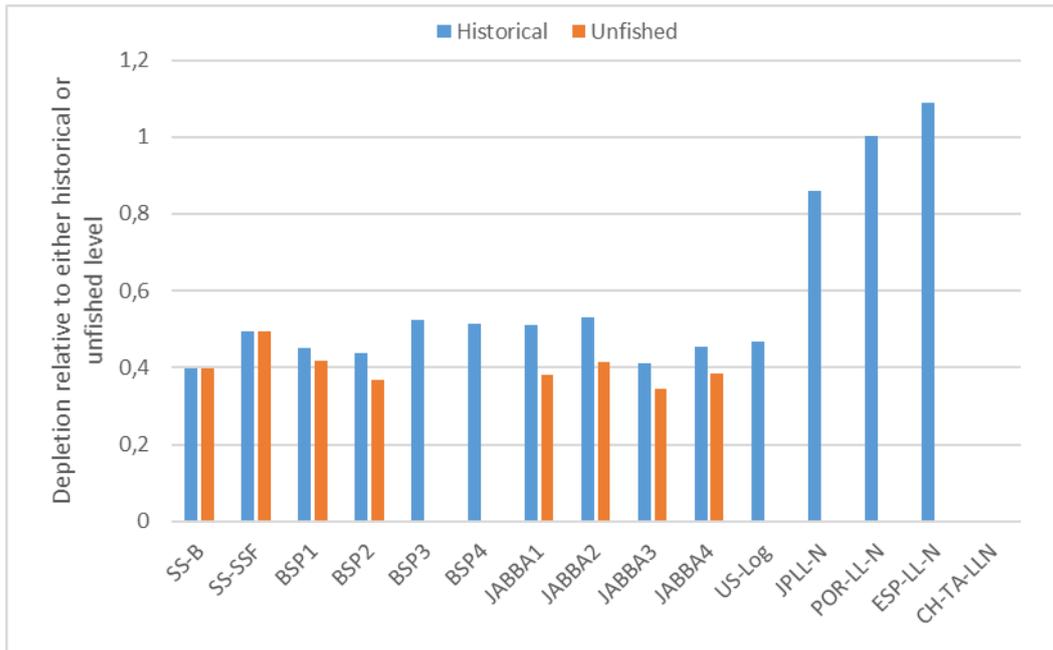
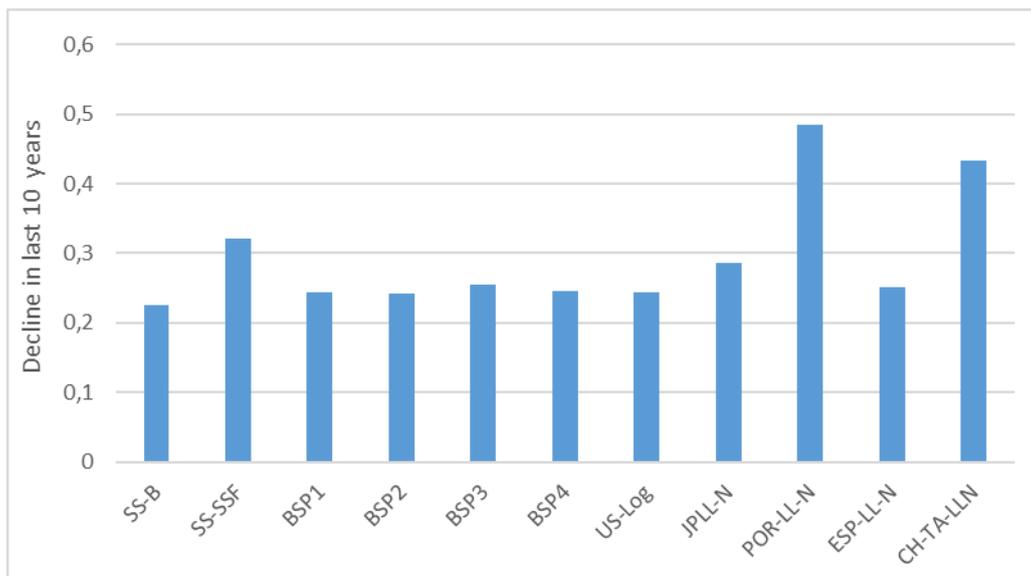


Figure 1. Distribution of *Isurus oxyrinchus*.



2a) Current depletion relative to beginning of time series (historical) or relative to unfished levels.



2b) Decline in last 10 years.

Figure 2. Depletion (a) and decline over the last 10 years (b) in the North Atlantic (ICCAT, 2017) calculated from the age-structured model (biomass (tons):SS-B, spawning stock fecundity (number):SS-SSF), the Bayesian Surplus Production Model (biomass (tons): BSP1-4), the JABBA model (biomass (tons):JABBA1-4), and the indices used in the assessment (ICCAT, 2017 data report, US-Log, JPLL-N, POR-LL-N, ESP-LL-N and CH-TA-LL-N). Recent depletion could not be calculated for the JABBA models. The Ch-TA-LL-N series was not used to calculate historical depletion because it extends for less than 10 years. Depletion relative to unfished could not be calculated for two of the BSP models, or for any of the CPUE series.

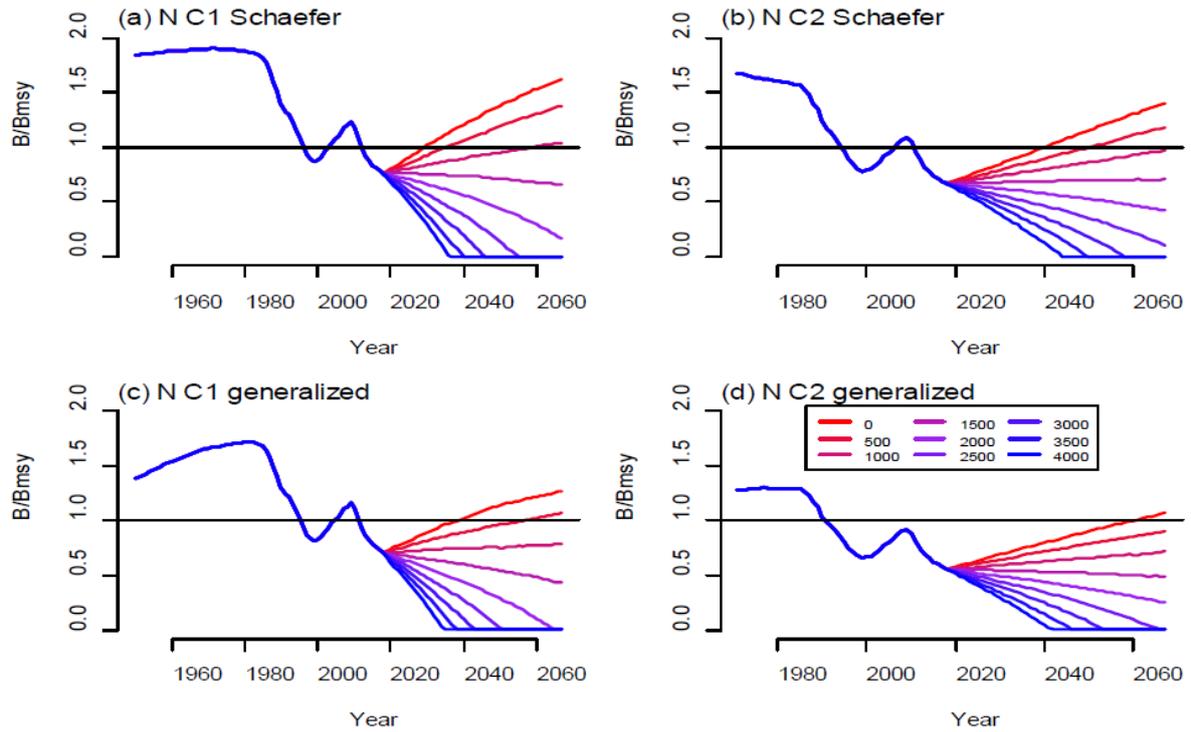


Figure 3. Projections from the Bayesian Surplus Production models for the North Atlantic (ICCAT, 2017) for different future annual catches given in tonnes. The four panels are alternative scenarios with slightly different input assumptions (ICCAT, 2017).

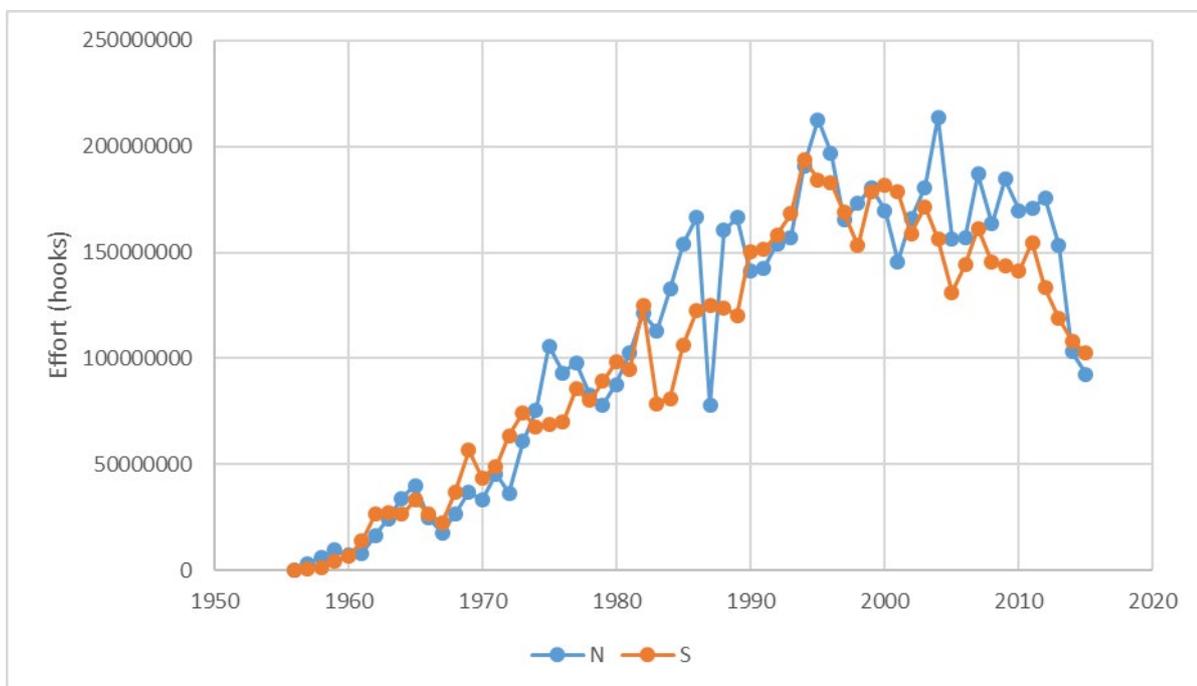


Figure 4. Total fishing effort in the Atlantic, from ICCAT task II data (Accessed online January 22, 2019).

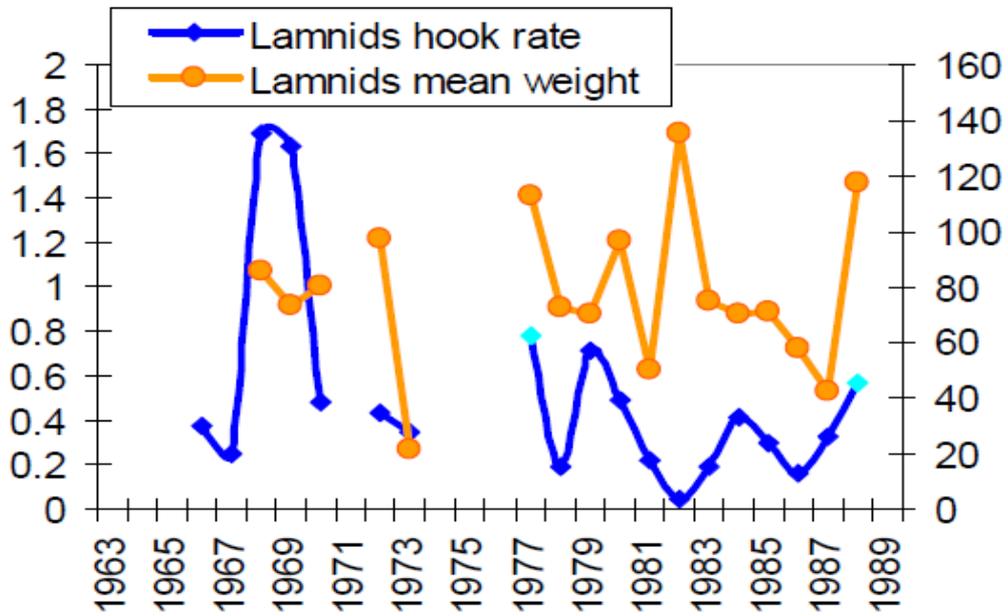


Figure 5. Nominal CPUE (hook rate, ind. per 1000 hooks) and mean weight of individuals caught for lamnid shark (*Isurus* spp.) (Source: Romanov *et al.*, 2008).

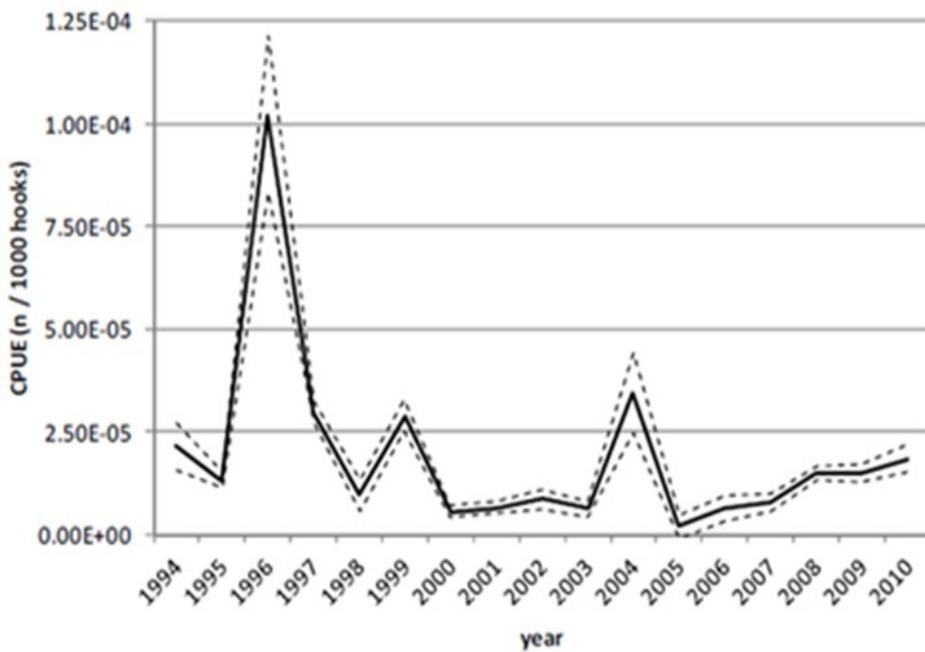


Figure 6. Shortfin mako shark: Standardized longline CPUE series for shortfin mako shark in the Indian Ocean for the Japanese fleet (1994–2010). The dotted line represents the confidence intervals (Source: Kimoto *et al.*, 2011).

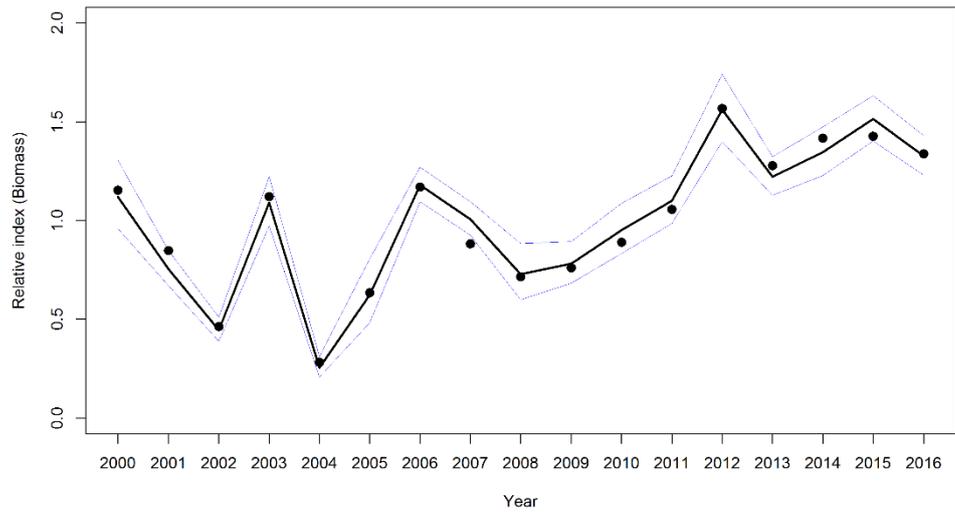


Figure 7. Shortfin mako shark: Standardized longline CPUE series for shortfin mako shark in the Indian Ocean for the EU-Portugal fleets (2000–2016). The solid line refers to the standardized index and the black dots to the nominal CPUE series (Source: Coelho *et al.*, 2017).

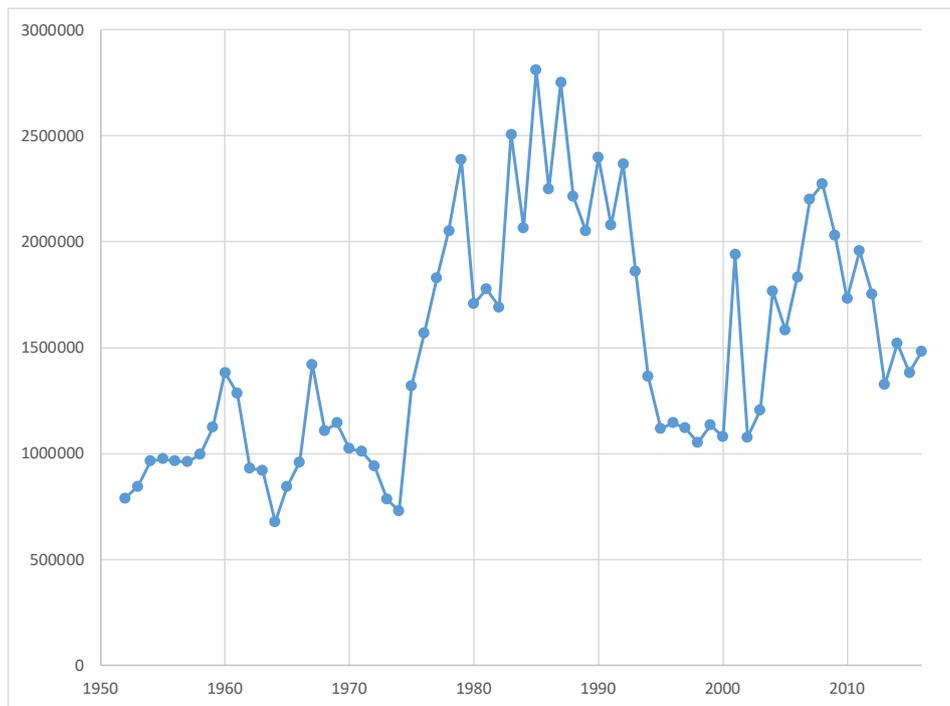


Figure 8. Pacific longline effort north of 20°N in hundred hooks, 1952–2016 (SPC, 2019).

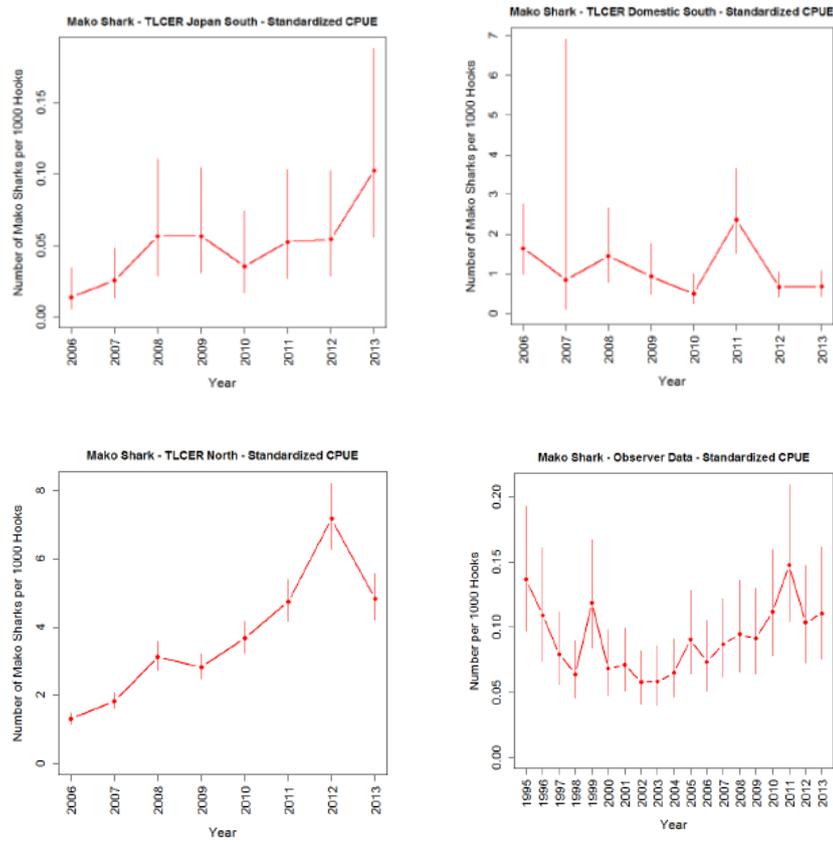


Figure 9. Abundance indices for shortfin mako for four fisheries in New Zealand (Francis *et al.*, 2014).

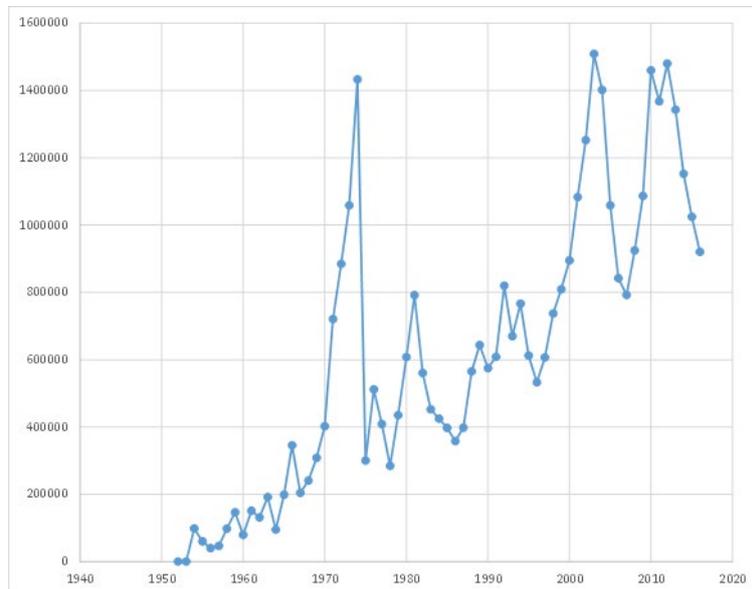


Figure 10. Pacific longline effort levels south of 20°S in hundred hooks, 1952–2016 (SPC, 2019).

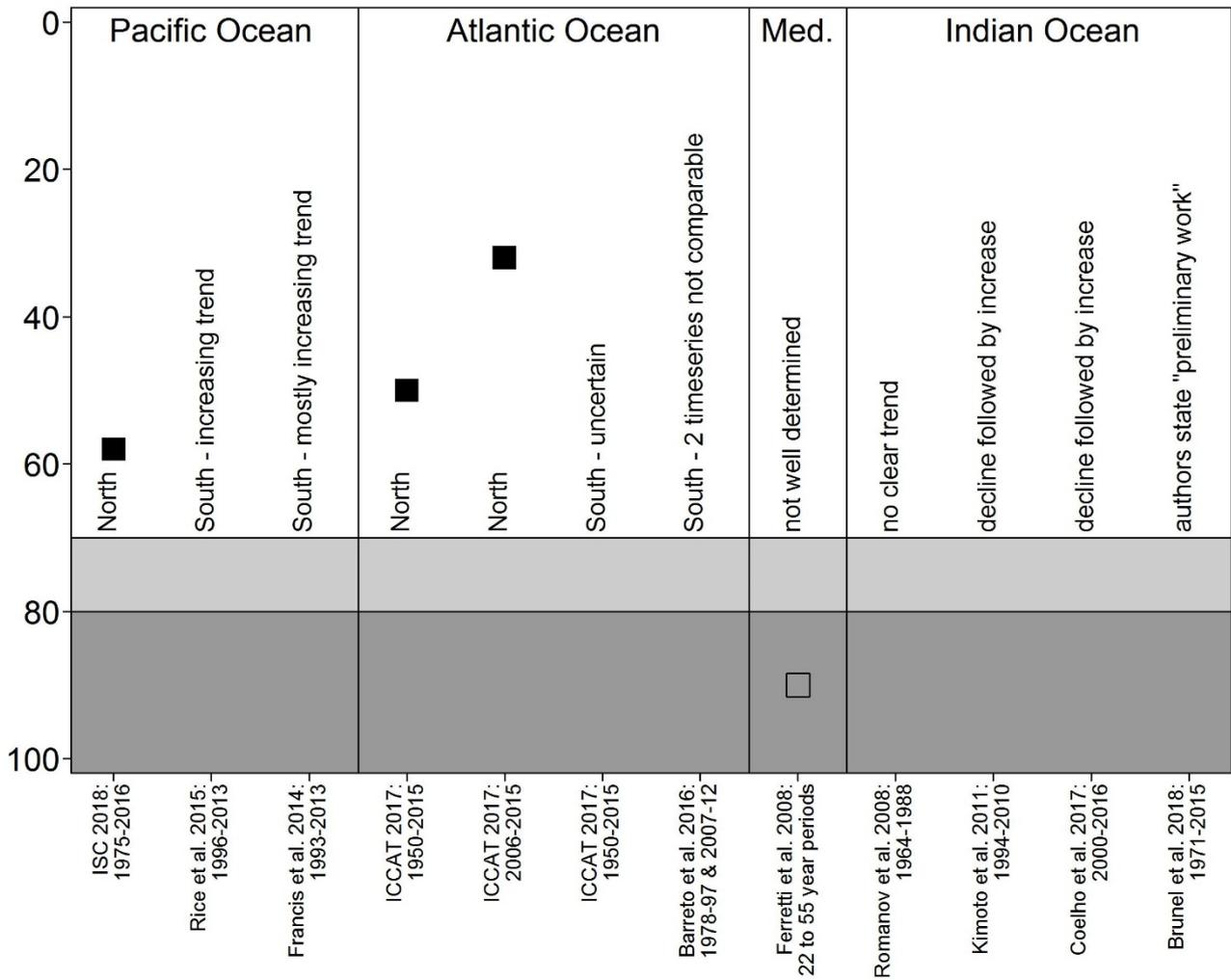


Figure 11. Estimated percentage declines from available survey information for shortfin mako. Dark band is a marked decline for a species of low productivity (80 percent of baseline), with 5–10 percent subtracted as a precautionary buffer (light band). The graph shows a filled square where the Expert Panel determined the information was reliable and quantifiable. Other studies are shown with comments or an unfilled square. See Table 2 for further information on all of these sources of information.

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Species

Blackchin guitarfish, *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus*

Proposal

Proposal to include blackchin guitarfish *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus* in Appendix II in accordance with Article II paragraph 2(a). If listed, this would result in the inclusion all other giant guitarfish, *Glaugostegus* spp. in accordance with Article II paragraph 2(b).

| SPECIES | Meets CITES Criteria | Does Not Meet CITES Criteria | Other |
|---|-------------------------|---------------------------------|---------------------------|
| Blackchin guitarfish, <i>Glaucostegus cemiculus</i> and sharpnose guitarfish, <i>Glaucostegus granulatus</i> | | | Insufficient evidence* |

* Insufficient evidence of declines to make a judgement in relation to CITES criteria (CITES Res. Conf. 9.24. Rev. CoP17).

Assessment summary

The Blackchin guitarfish, *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus* are both considered to be species of low to medium productivity. The Blackchin guitarfish, *G. cemiculus* and other guitarfish have been extirpated in the northwestern Mediterranean part of their range. Elsewhere there is local evidence of long-term declines in guitarfish catch in Senegal, but wider scale numerical evidence is lacking. The panel considers decline in *G. cemiculus* is likely but could not establish its general extent either in the short or long term.

The same is the case for the sharpnose guitarfish, *G. granulatus*. There is evidence for a short-term catch decline of 94 percent in Chennai, India but broader numerical evidence of a decline is lacking. The panel considers that decline in *G. granulatus* is likely but could not establish its general extent either in the short or long term.

Thus for both *G. cemiculus* and *G. granulatus* the panel considers it uncertain whether they meet the criteria for CITES listing. The panel notes that *G. cemiculus* has been extirpated in the heavily fished northwestern Mediterranean shelf, but had no information for the full species range.

In considering whether to list these species, the Expert Panel recommends that CITES Parties take note of the extirpation, the widespread lack of management and the very high value of the products (fins) in international trade.

Listing would likely encourage appropriate local management measures and help lead to better documentation of the catch and effort for all sharks and rays caught in coastal areas. Such initiatives of course have considerable cost and it is also possible, given the high value of fins from these species that fishing might continue unabated and a significant proportion of the catch would then be fished on an IUU basis.

If the named species are listed under Appendix II in due course, listing of the remaining members of the *Glaucostegus* spp genus in Appendix II under 'look-alike' provisions would be appropriate, given the similarities across the taxon and the inherent identification difficulties.

The Expert Panel noted that there is no evidence that traders differentiate between species of wedgefishes and guitarfishes in the fin trade. The Expert Panel suggests that CITES Parties should carefully consider whether there is a lookalike problem between guitarfishes and wedgefishes.

Scientific assessment in accordance with CITES biological listing criteria

Species distribution

Glaucostegus cemiculus occurs in the eastern Atlantic from Portugal to Angola, including the Mediterranean Sea, mostly in the south and eastern coasts (Capapé, 1989; Séret *et al.*, 2016; see Figure 1). *Glaucostegus granulatus* is found in the northwestern Indian Ocean, from the Gulf to Myanmar (Séret *et al.*, 2016; see Figure 2).

Species productivity

Glaucostegus cemiculus

The following published life-history parameters for *G. cemiculus* (from the Mediterranean and Black Sea region and West Africa) suggest low productivity. These are:

- The length at maturity for this species: in the range of 138 cm in West Africa (Valadou, *et al.* 2006) and 138 cm for female, 112 cm for male in the Mediterranean (Enajjar *et al.*, 2012);
- the number of young per year: commonly 2–4; up to 12 in West Africa (Valadou, *et al.*, 2006); 5–12 in the Mediterranean (Capapé and Zaouali, 1994).

However, other life-history parameters for *G. cemiculus* (all from the Mediterranean region) suggest a medium productivity. These are:

- The von Bertalanfy K [0.272 y⁻¹ for males and 0.202 y⁻¹ for females (Enajjar *et al.*, 2012)]
- The time to maturity [Males: 2.89 years, Females: 5.09 years (Enajjar *et al.*, 2012)]

Overall productivity is therefore classified as low to medium (Table 1). The extirpation (see below) of this species in parts of its former range suggest that its life history does not allow it to sustain a high level of exploitation.

Glaucostegus granulatus

Less information could be found on life history parameters for *G. granulatus*, but those located are broadly similar to those for *G. cemiculus* and suggest a similar classification of low to medium productivity. The life history parameters located were:

- litter size: 6–10 pups; reproduce once a year, Eastern Indian Ocean (Séret *et al.*, 2016)
- generation time: 13 years, Western Indian Ocean (Jabado *et al.* 2017)
- maximum length: 229 cm (Séret *et al.*, 2016).

Overall productivity is therefore classified as low to medium (Table 2).

Trends and application of the decline criterion

The proposal argues for high levels of decline in both species.

Mediterranean and Black Sea

The evidence for extirpation of *G. cemiculus* in the northwestern Mediterranean Sea is provided by historical records of the former presence of this species in the region (e.g. Notarbartolo DiSciara *et al.* 2016; Psomadakis *et al.*, 2009) coupled with its current absence from markets in the area (Notarbartolo DiSciara *et al.*, 2016; also the MEDITS fishing surveys from 1948 to 2015 [Matta, 1958]). Further evidence is provided by – Relini *et al.* (2000 ; 2003 ; 2010a ; 2010b), Bertrand *et al.* (2000), Baino, *et al.* (2001), Tserpes, G., *et al.* (2012), Serena *et al.* (2013), Ferretti *et al.* (2013), Serena *et al.* (2014), and Ramirez Amaro *et al.* (2015) – all of which provides strong support for its extirpation in this area.

Eastern Central Atlantic

Evidence for declines in *G. cemiculus* elsewhere in its range is as follows. Fishing effort seems to have increased on the coast of West Africa: Diop and Dossa (2011) report global captures in artisanal and industrial shark fisheries increasing from about 13 000 tonnes in 1995 to about 30 000 tonnes in 2005 before dropping

to 19 000 tonnes in 2007. These changes were largely driven by the emergence of an artisanal shark fishery. There are very few specific catch statistics for guitarfish and none seem specific to *G. cemiculus*. The only catch series in the area for guitarfish are from Senegal. Notarbartolo Di Sciara *et al.* (2016), refer to a decrease in overall landings and comment that a reduction in the size of specimens landed has been observed. They report that landings in Senegal have decreased from 4 050 tonnes in 1998 to 821 tonnes in 2005, quoting unpublished data from the Ministry of Maritime Economy and International Maritime Transport. The Ministry kindly provided an update of unpublished catch statistics for guitarfishes from 2004 to 2017. These have continued without any clear trend at a level of about 1000 tonnes except for one anomalously low catch in 2014. This suggests a decline in catch in Senegal of about 75 percent between 1998 and 2017. The Expert Panel was unaware of any CPUE series for this or other areas. Notarbartolo Di Sciara *et al.* (2016), quoting Litvihov (1993), suggest that earlier trawl survey results for this species in the West Africa area are uninformative. The Expert Panel noted that a Nansen survey has been conducted in Nigeria but the panel only had access to one year of data. There are, according to the proposal and to Notarbartolo Di Sciara *et al.* (2016), widespread anecdotal reports of declines in the species, but these were impossible for the panel to quantify.

Thus, while the Expert Panel suspected that declines in populations of this species have occurred it was unable to establish a clear measure of this decline.

Eastern Indian Ocean

The situation with *G. granulatus* is broadly similar to that of *G. cemiculus* above. There are indications that fishing effort for this species in this region has increased substantially and there are widespread anecdotal reports of population declines (Jabado *et al.* 2017). There is one species-specific catch series from Chennai, India (Mohanraj *et al.*, 2009) which shows an exponential decline in catch of *G. granulatus* with an annual rate of decline of nearly 50 percent. Thus, over the five years of this report (2002–2006) catches decreased by 94 percent. This is a concerning but local decline. The Expert Panel is also aware that Thailand commenced surveys of sharks and ray catches on its Andaman Sea coastline in 2013–2014. This survey is at the species level and also contains effort information, but no time series has been reported as yet. The Expert Panel is unaware of any time series of CPUE or survey time series from the distribution area of this species.

Pacific Ocean, Western Central

Glaucostegus spp catch data reported to the Panel from Indonesia show an increasing trend in bottom gillnet catches between 2009 and 2016 (DGCF, 2017).

Therefore, while the Expert Panel suspects that declines in populations of this species have occurred, it was unable to quantify with any certainty the extent of this decline in the distribution overall (Table 3 and Table 4).

Modifying risk factors

Guitarfish have inshore distributions and may be susceptible to coastal degradation processes. The behaviour also makes them particularly susceptible to fishing pressure. Thus, the Expert Panel considers that fishing pressure is likely to prove the greater concern. In much of the range of the two species fishing pressure appears to be generated by mixed fisheries, however both Enajjar *et al.* (2012) – in the case of Tunisia – and Diop and Dossa (2011) in the case of Western Africa – suggest that *G. cemiculus* is targeted in some fisheries and the high value of guitarfish fins might encourage this. An additional risk factor for these species is the general paucity of specific catch and associated effort statistics over their range. These deficiencies risk the species decline going unrecorded or unnoticed.

Summary of evaluation and assessment of biological listing criteria

The Blackchin guitarfish, *G. cemiculus* and the sharpnose guitarfish, *G. granulatus* are both considered to be species of low to medium productivity. The Blackchin guitarfish, *G. cemiculus* and other guitarfish have been extirpated in the northwestern Mediterranean part of their range. Elsewhere there is local evidence of long-term declines in guitarfish catch in Senegal but broader numerical evidence is lacking. The Expert Panel considers a decline in *G. cemiculus* likely but could not establish its general extent either in the short or long term.

The same is the case for the sharpnose guitarfish, *G. granulatus*. There is evidence for a short-term catch decline of 94 percent at Chennai, India, but broader numerical evidence is lacking. The panel considers a decline in *G. granulatus* likely but could not establish its general extent either in the short or long term.

The panel therefore considers it uncertain whether either *G. cemiculus* or *G. granulatus* meet the criteria for CITES listing.

Comments on technical aspects relating to management, trade and likely effectiveness of implementation of a CITES listing

The following comments respond to statements in the proposal related to management and trade and are not a comprehensive summary of the management regimes or trade of Gaucostegidae species. The Expert Panel was satisfied that Gaucostegidae are widely traded internationally and command a high price. The scope of the proposal includes all Gaucostegidae species for 'look-alike' reasons, i.e. species whose specimens in trade look like those of species listed for conservation reasons (see Article II, paragraph 2 of the CITES Convention).

Management comment

Currently adopted management regimes/measures related to governance, population monitoring and compliance

International management:

- The FAO IPOA-Sharks applies to chondrichthyans and therefore also applies to Gaucostegidae; it underscores the responsibilities of fishing and coastal states for sustaining chondrichthyan populations, ensuring full utilisation of retained species and improving data collection and monitoring (see Appendix G, especially points 3);
- The adopted FAO Port State Measures Agreement is an agreement on port state measures to prevent, deter and eliminate IUU fishing. This agreement requires that any inspections conducted on fishing vessels entering ports should include verification that all species exploited have been taken in compliance with international law, international conventions and RFMO measures (see Appendix G, especially points 4).

Regional management:

- *G. cemiculus* and *G. granulatus* occupy coastal habitats and are caught in local and artisanal, mixed-species fisheries. *G. cemiculus* is listed in the Annex II List of Endangered or Threatened Species of the Protocol Concerning Specially Protected Area and Biological Diversity in the Mediterranean, of the Barcelona Convention (SPA/BD). The General Fisheries Commission for the Mediterranean (GFCM) adopted a measure related to the shark species listed in Annex II of the SPA/BD Protocol, as a result of which *G. cemiculus* cannot be retained on board, transhipped, landed, transferred, stored, sold or displayed, or offered for sale.
- Due to by-catch issues, the same type of fishing gear is operative in the coastal areas targeting RFMO-target species (in which guitarfish are included); the same practices should therefore be applied to guitarfish under the RFMOs, which require catches of sharks to be recorded and reported annually, whether in groups or as individual species. This is complemented by observer programmes and discard reporting.
- There are general research efforts on sharks and rays at the regional and national levels that could apply to guitarfish (see Appendix G, especially points 3).

National measures:

- In some West African countries guitarfish are caught as bycatch of permitted fishing for white fish and shrimp. Catches are registered in records of catches of sharks and rays, but no distinction is made. The panel was informally told that there were wedgefish species found along with guitarfish.

- In response to concerns that foreign flagged vessels permitted to fish in the EEZs of some West African states were excessively targeting sharks, including guitarfish, access to EEZs has been withdrawn. Coastal and artisanal fishers in that region have noted an absence of guitarfish in their local catches.
- MPAs and other spatial measures to protect marine ecosystem are established in several EEZs. For example, Guinea, Guinea-Bissau, and Sierra Leone ban shark fishing (including for guitarfish) in their Marine Protected Areas. Mauritania ban shark fisheries in the Banc d'Arguin National Park (Diop and Dossa, 2011).
- Good practice on using by-catch reduction devices (BRDs) attached to trawl nets, such as existing TEDs (Turtle Excluding Devices) can be effective in reducing guitarfish bycatch (see Appendix G, especially points 5ii).
- Some states implement regional management measures (above) through national action plans that include prohibiting the retention of guitarfish. Finning controls and fins-attached landing requirements have little relevance however as guitarfish are landed intact in coastal fisheries and are fully utilized (see Appendix G, especially points 3).
- Requirements to record all landings by species at time of landing would assist long-term stock assessment and effective management (see Appendix G, especially points 5ii).

Comments on anticipated positive and negative changes in these management measures, as well as requirements for additional management, if species were listed under Appendix II of CITES.

- It was not possible to evaluate the effectiveness of the above measures, both regionally and nationally, as there was no reported data on the implementation or effectiveness known to the Expert Panel (see Appendix G, especially points 5iv);
- Appendix II listing may generate additional information that can assist fisheries managers to assess fishing mortality rates (see Appendix G, especially points 5iii). Reporting of *Gaucostegidae* species catches, where landing is permitted, would be improved in some cases. However, it is apparent to the Expert Panel that some Southeast Asian range states' responses to earlier CITES Appendix II listing decision have simply been to refuse permits to land listed species and to ban trade;
- Appendix II listing could assist in improving compliance by providing an impediment to trading in *Gaucostegidae* products illegally obtained from fisheries where regulations prohibit catch and/or retention, given the requirement to supply CITES documentation to importing countries' border authorities.

Trade comment

The Expert Panel noted that these species are retained when captured incidentally. Retained catch is utilized for local consumption and international trade in their fins. The species' fins are widely traded on Asian markets, and constitute an important component of overall shark fins traded (Giles *et al.*, 2016; Wainwright *et al.*, 2018). The Expert Panel acknowledges that shark fin continues to be a highly valued commodity primarily among Asian consumers both in Asia and elsewhere.

Additional information available to the Expert Panel noted that total global trade quantities are traditionally gauged by means of quantities imported by Hong Kong SAR; on this basis the market declined rapidly from a peak value in 2003 and again fell sharply after 2011 (Shea and To, 2017). A number of factors may have contributed to this second drop (Dent and Clarke, 2015), but it appears likely that new austerity regulations aimed at curbing conspicuous consumption by mainland Chinese government officials are a major factor (Jeffreys 2016, Fabinyi 2017). Imported quantities into Hong Kong SAR appear to have stabilized at 2012 levels, i.e. nominally at about half of the post-2003 volumes, through 2016 (Shea and To, 2017; HKCSD, unpublished data).

At the same time as the Chinese market has apparently been suppressed, Southeast Asian markets appear to be gaining influence either as processors, traders and/or consumers (Dent and Clarke, 2015; Eriksson and Clarke, 2015). Wainwright *et al.* (2018) recorded the presence of guitarfish fins in the Singaporean market. The ongoing complexity and dynamism of the trade, in addition to a traditional and continuing lack of transparency,

make it difficult to quantify market sizes and shares: more precise trend information is therefore unavailable. This is reflected in a new findings that *Glaucostegus* spp. species are appearing in the Singaporean market (Wainright *et al.*, 2018).

The Expert Panel noted that there is no evidence that traders differentiate between species of wedgefishes in the fin trade. Furthermore, the trade category “QUN” is suspected to contain species from both the Rhinidae and Glaustegidae families. The Expert Panel therefore suggests that CITES Parties should carefully consider whether there might be a lookalike problem between wedgefishes and guitarfishes.

There is currently no culturing of guitarfish in aquaculture and it is unlikely that as a species they are suitable for aquaculture in currently developed aquaculture systems.

Trade market transparency, documentation and level of IUU

- The Expert Panel noted evidence in the references supplied that guitarfish fins were the most frequently traded product form.
- There are no specific catch or trade documentation schemes for guitarfish. Existing general catch documentation systems in some countries could facilitate the issuing of legal acquisition findings, such as the EU’s Catch Certification requirements.
- Identifying sharks and shark products in international trade at a species level is severely constrained. There is a finite capacity in the commonly used World Customs Organization (WCO) harmonized system (HS) of tariff classification which means that only a limited range of products derived from guitarfish, such as dried fins, could be identified in future amendments to the harmonized system. The earliest that such amendments might be implemented, assuming adoption in the World Customs Organization, would be 2027. It should be noted that the number of species in the Glaucostegidae family would overwhelm the HS system capacity to identify dried fins at a species level (http://www.wcoomd.org/en/faq/harmonized_system_faq.aspx#q9).
- Ongoing and past efforts by authorities and organizations (other than customs administrations) have monitored the species composition of the shark fin trade and these may continue to provide further insights.
- A CITES Appendix II listing applies only to international trade in listed species and their products. Domestic trade in guitarfish and their products would be unaffected by listing in CITES Appendix II. The landing and selling of guitarfish in domestic markets could therefore continue without any changes to current practices.

Comments on anticipated positive and negative changes in trade-related issues, if species were listed under Appendix II of CITES

- CITES provisions on the trade of specimens of species listed in Appendix II require an export permit by the exporting country, which shall only be granted if the national CITES authorities are satisfied that: 1) the export is not detrimental to the survival of the species in the wild; and 2) the specimens were not obtained in contravention of the national laws of that state.
- Should *G. cemiculus* and *G. granulatus* be listed in Appendix II, the extension of the listing to all other species in the Glaucostegidae family, on the basis of the ‘look-alike’ provision in the proposal, will require the same considerations and export permitting for all species in the family.
- The legal trade will be recorded in the CITES trade database, and this will improve overall trade information.
- States’ abilities to make NDFs for highly migratory species is limited in the absence of region-wide assessments, as evidenced by difficulties encountered in making NDFs for shark species that have already been listed. Under these conditions the following outcomes can occur:
 - trade in the species and its products ceases;
 - trade continues without proper CITES documentation (also known as “illegal trade”); and/or
 - trade continues with inadequate NDFs.

- The implementation of previous listing decisions for sharks has taken some time. Some of the delays are a result of legislative processes, but there can also be a lag of three or more years in the collection and transmission of trade data to the CITES Secretariat.

Likely effectiveness for conservation: summary comments in relation to technical aspects of biology, ecology, management and trade.

It is difficult to draw clear conclusions regarding the effectiveness of existing and future management and trade measures owing to the lack of data available to assess these measures (see Appendix G, especially points 5iv). However, if properly implemented, a CITES Appendix II listing could be expected to result in better monitoring and reporting of catches entering international trade. Improved monitoring should enable new or enhanced assessments of stock status and the subsequent adoption of management measures, ensuring the sustainability of harvests where these are still permitted. Harvests from international waters would fall under IFS provisions of the CITES Convention. These would require catch documentation at the species level for specimens entering the jurisdiction of a state from international waters, along with a NDF indicating that the harvest was sustainable.

The listing of the species of the genus *Glaucostegus* spp. would assist in resolving the look-alike issues across the genus.

Noting the lack of *Glaucostegus* spp. fishery information across many range states, and the limited ability to make NDFs as evidenced by the situation encountered for shark and ray species that have already been listed, under such conditions the following outcomes may occur:

- previous trade ceases;
- trade continues without proper CITES documentation also known as ‘illegal trade’; and/or
- trade continues with inadequate NDFs.

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Tables and figures

Table 1. Information for assessing productivity of *Glaucostegus cemiculus* (*bracketed status ratings are based upon Musick, 1999).

| PARAMETER | STATUS* | INFORMATION | AREA | SOURCE | CONFIDENCE | COMMENTS |
|-------------------------------------|---------|--|--|----------------------------------|------------|--|
| L50 maturity | LOW | M:138.1 F; 153.3 | Area 34 (Atlantic, Eastern Central) | Valadou, <i>et al</i> 2006 | 2 | Total sample 1373 females but many immature so mature sample size unknown.. Published Paper |
| No of young (litter size) | LOW | Up to 12 | Area 34 (Atlantic, Eastern Central) | Valadou, <i>et al.</i> , 2006 | 2 | Total biological sample 1373 females but many immature so mature sample size unknown. Published Paper |
| Gestation period | LOW | 5–8 months | Area 34 (Atlantic, Eastern Central) | Seck <i>et al.</i> , 2004 | 2 | Sampled catch 6 females. Published Paper |
| L50 maturity | | M: 111.8 F: 138.1 | Area 37 (Mediterranean and Black Sea) | Enajjar <i>et al.</i> , 2012 | 2 | Sampled catch 513. Published paper. |
| No of young (litter size) | (LOW) | 5–12 | Area 37 (Mediterranean and Black Sea) | Capapé and Zaouali, 1994 | 2 | Sample 170 females. Published Paper |
| Gestation period | LOW | 8 months | Area 37 (Mediterranean and Black Sea) | Capapé and Zaouali, 1994 | 2 | Ditto |
| Growth (Von Bertalanffy parameters) | MEDIUM | M: $TL_{\infty} = 179$ cm, $k = 0.272$ y ⁻¹ and $t_0 = -0.71$ F: $TL_{\infty} = 198.7$ cm, $k = 0.202$ y ⁻¹ and $t_0 = -0.81$ | Area 37 (Mediterranean and Black Sea) | Enajjar <i>et al.</i> , 2012 | 2 | Sampled catch 513. Published paper. |
| time to maturity | MEDIUM | M: 2.89 years F: 5.09 years | Area 37 (Mediterranean and Black Sea) | Enajjar <i>et al.</i> , 2012 | 2 | Sampled catch 513. Published paper. |
| Generation time | MEDIUM | 5–10 year | Area 37 (Mediterranean and Black Sea) | Proposal | 0 | The Panel could not find this information in the reference indicated in the proposal. This might be a construct based upon Enajjar <i>et al.</i> , 2012. |

Table 2. Information for assessing productivity of *G. granulatus*.

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | SCORE | COMMENTS |
|---------------------------|--------|-------------|------------------------------------|--|-------|--|
| no of young (litter size) | LOW | 6–10 pups | Area 57 (Indian Ocean, Eastern) | Séret <i>et al.</i> , 2016; Proposal (quoting Prasad, 1951) | 0 | Séret <i>et al</i> 2016 is a book chapter. Prasad (1951) paper focus on the histology of egg cases, describing an approximate number of eggs found in three species of the order Rhinopristiformes. But the annual pup production is not mentioned. |
| generation time | LOW | 13 years | Area 51 (Indian Ocean Western) | Jabado <i>et al.</i> , 2017 | 1 | Not primary reference, |
| TL max | NA | 229 cm | NA | Séret <i>et al.</i> , 2016 | 1 | Not primary reference |

Table 3. Information on guitarfish trends from different oceanic regions.

| SPECIES | AREA | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENCE PERIOD | REFERENCES | SCORE | COMMENTS |
|----------------------|---------------------------------------|-----------|---------|-------------------------------|------------------|---|-------|---|
| <i>G. granulatus</i> | Area 51 (Indian Ocean, Western) | other | mixed | 50–80 percent | na | Jabado <i>et al.</i> , 2017 | 2 | From Proposal partly based on Mohanraj and partly on Anecdotal info |
| <i>G. cemiculus?</i> | Area 34 (Atlantic, Eastern Central) | landing | mixed | 80 percent | 1998–2005 | Diop and Dossa, 2011 | 2 | As quoted in Notarbartolo DiSciara <i>et al.</i> , 2016; IUCN, 2016. Not clear if it is all Guitar fish or just a single species. |
| <i>G. granulatus</i> | Area 57 (Indian Ocean, Eastern) | landing | trawl | 94 percent | 2002–2006 | In Jabado, 2018 referring to Mohanraj, 2009 | 2 | Recalculation of decline on end to end reduction from trawl data from Mohanraj, 2009. Shows concerning near 50 percent reductions per year in catch of trawls but little info in gillnets or H&L. |
| <i>G. cemiculus</i> | Area 34 (Atlantic, Eastern Central) | landing | mixed | 50 percent | 1998–2005 | Notarbartolo DiSciara, 2016 | 2 | From proposal. Anecdotal? |
| <i>G. cemiculus</i> | Area 37 (Mediterranean and Black Sea) | other | trawl | Evidence if historic presence | | Psomadakis <i>et al.</i> , 2009 | 1 | Note <i>G. cemiculus</i> mentioned specifically as present in bay of naples |

Table 4. Other Datasets Considered.

| SPECIES | AREA | INDICATOR | FISHERY | EXTENT OF DECLINE (%) | REFERENCE PERIOD | REFERENCES | SCORE | COMMENTS |
|--------------------------|---------------------------------------|-----------|----------------|-------------------------|------------------|---|-------|---|
| <i>G. cemiculus</i> | Area 37 (Mediterranean and Black Sea) | other | survey | evidence of extirpation | 1948–2015 | Presence/Absence in north and western Mediterranean. See text above with references | 5 | Zero observations of guitarfish over period and extent of MEDITS surveys of northern Mediterranean. |
| <i>Guitarfish</i> | Area 34 (Atlantic, Eastern Central) | catches | mixed | 12 percent | 2004–2017 | Direction des Pêches Maritimes, 2017 | 2 | Looks like extension of series of Diop and Dossa, 2011 |
| <i>Glaucostegus spp.</i> | Area 71 (Pacific, Western Central) | landing | Bottom gillnet | Increasing | 2009–2016 | DGCF, 2017 | 2 | New data provided at meeting |



Figure 1. Distribution of *Glaucostegus cemiculus* (Source: Serét *et al.*, 2016 – modified).

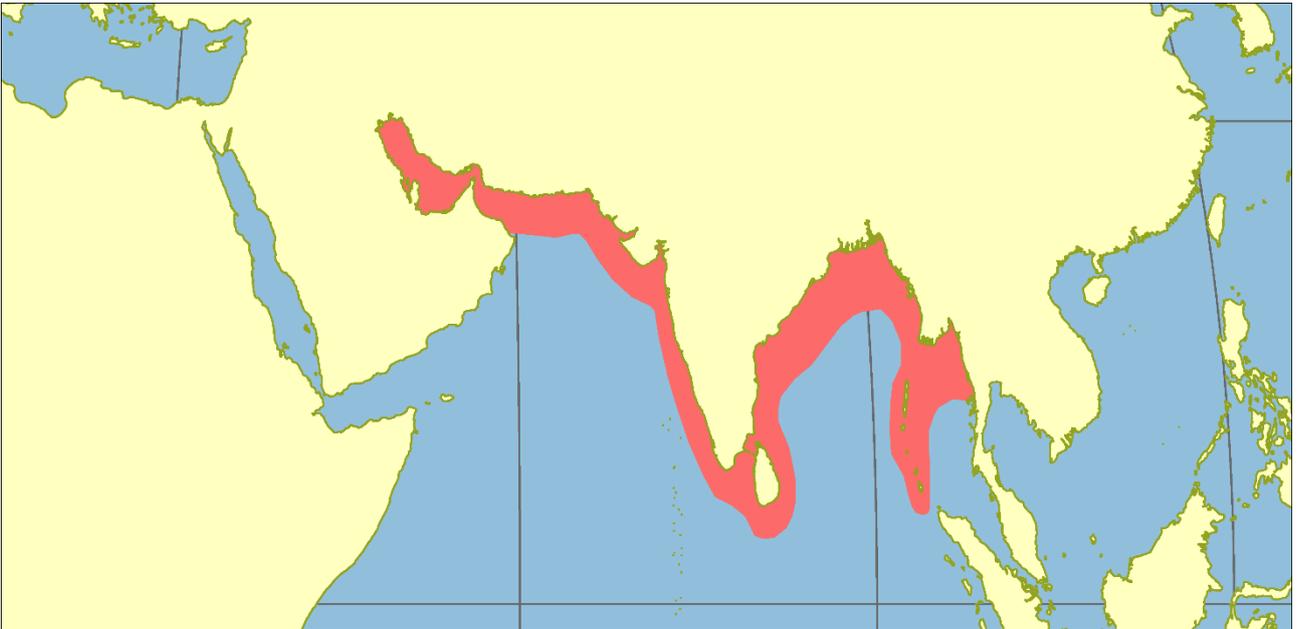


Figure 2. Distribution of *Glaucostegus granulatus* (Source: Serét *et al.*, 2016 – modified)

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Species

White-spotted wedgefish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis*.

Proposal

To include white-spotted wedgefish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* in Appendix II in accordance with Article II paragraph 2(a). If listed, this would include *Rhynchobatus cooki*, *Rhynchobatus immaculatus*, *Rhynchobatus laevis*, *Rhynchobatus luebberti*, *Rhynchobatus palpebratus*, *Rhynchobatus springeri*, *Rhynchobatus mauritaniensis*, *Rhina ancylostoma*, and all other putative species of the Rhinidae (wedgefish) family in Appendix II in accordance with Article II paragraph 2(b).

| SPECIES | MEETS CITES CRITERIA | DOES NOT MEET CITES CRITERIA | OTHER |
|--|-------------------------|---------------------------------|---------------------------|
| <i>Rhynchobatus australiae</i> <i>Rhynchobatus djiddensis</i> | | | Insufficient evidence* |

* Insufficient evidence of declines to make a judgement in relation to CITES criteria (CITES Res. Conf. 9.24. Rev. CoP17).

Assessment summary

The white-spotted wedgefish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* are both considered to be species of low to medium productivity. Both of the proposed wedgefish species are wide-ranging in the Indo-Pacific region, but no population estimates are available. The information provided in the proposal on trends in populations across the species' range was limited, and not sufficient to allow the panel to determine whether the species qualified globally under the decline criteria for an Appendix II listing. The panel had access to two additional series of catches, from India and Indonesia, which displayed strong declines. These data were considered insufficient to change the conclusion above.

In considering whether to list these species, the Expert Panel recommends that CITES Parties take note of the widespread lack of management of the fisheries taking the species and the very high value of the products (fins) in international trade.

Listing would likely encourage appropriate local management measures and help lead to better documentation of the catch and effort for all sharks and rays caught in coastal areas. Such initiatives of course have considerable cost and it is also possible, given the high value of fins from these species that fishing might continue unabated and that an appreciable proportion of the catch would then be fished on an IUU basis.

If the named species are in due course listed under Appendix II, listing of the remaining members of the Rhinidae family in Appendix II under 'look-alike' provisions would be appropriate, given the similarities across the taxon and the inherent identification difficulties. This extension would extend to eight species and the range would then include western Africa.

The Expert Panel noted that there is no evidence that traders differentiate between species of wedgefishes and guitarfishes in the fin trade. The Expert Panel suggests that CITES Parties should carefully consider whether there is a lookalike problem between wedgefishes and guitarfishes.

Scientific assessment in accordance with CITES biological listing criteria

Species distribution

R. australiae is widespread in the Indo-West Pacific, ranging from Mozambique, Thailand, Taiwan, Province of China and Indonesia to eastern Australia. *R. djiddensis* occurs in the western Indian Ocean, from South Africa to Oman, including the Red Sea and the Gulf (Giles *et al.*, 2016; Last *et al.*, 2016) (Figure 1 and Figure 2).

Species productivity

LOW TO MEDIUM PRODUCTIVITY

Biological information is limited for both species, with very little available for *Rhynchobatus djiddensis*. Both are large-bodied, viviparous species distributed in the Indo-Pacific region. Giles *et al.* (2016) noted that patterns of genetic differentiation in *R. australiae* did not provide evidence for substantial demographic connectivity among Australia, Southeast Asia and the Andaman Sea.

The published information available suggests that the species both have low productivity (Table 1 and Table 2). This information is presented in Table 1. In addition to published work, the Expert Panel had access to an unpublished Ph.D thesis for the *Rhynchobatus* species complex from Western Australia (White, 2014). This study suggested a medium level of productivity. However, that study was considered to be of lower reliability because the data were pooled across several species and the study was unpublished.

The only primary study on the fecundity of *R. australiae* suggests a range of 7–19 pups (White and Dharmadi, 2007). This level of fecundity is classified as indicative of low productivity by Musick (1999). White and Dharmadi (2007) and a forthcoming study (Simeon *et al.*, 2019), both show that maturity occurs at a large proportion of maximum size, which is indicative of low productivity.

An unpublished Ph.D. thesis from Western Australia presents age and growth estimates for the *Rhynchobatus* species complex, including *R. australiae* (White, 2014). The sample size was small, the results possibly biased and confounded by having several species in the dataset. This study suggests longevity of 12–18 years, a von Bertalanffy growth coefficient $K=0.41$ and intrinsic rate of population growth $r=0.24$ (White, 2014). The longevity estimates were used by the panel to derive natural mortality estimates, using the Tanaka (1960) method, of $M=0.24–0.36$. The results from White (2014) imply a medium level of productivity, though the panel considers these results to have lower confidence.

For *R. djiddensis* the information is even more sparse, with only one published study, by Van der Elst (1988).

Trends and application of the decline criterion

Under the CITES criteria for commercially exploited aquatic species Res. Conf. 9.24 Rev. CoP16, a decline to 15–20 percent of the historical baseline for a low-productivity species might justify consideration for an Appendix I listing. For listing in Appendix II, being “near” this level might justify consideration for a listing, which for a low-productivity species would be 20–30 percent of the historical level (15–20 percent + 5–10 percent as a precautionary measure).

Northern Indian Ocean

Mohanraj *et al.* (2009) present catches in tonnes from bottom trawlers from Chennai, Tamil Nadu, India for *R. djiddensis*. These data are summarized in Table 3. They show an exponential decline over the 5-year period. The catch in 2006 was 12 percent of that in 2002. No information on effort is available to standardize this index.

Eastern Indian Ocean

Simeon *et al.* (2019, forthcoming) presents total catches for Indonesian waters for all members of the *Rhynchobatus* genus. These data are presented in Figure 3. The decline is around 90 percent, given that the catch in 2015 is about 10 percent of that in 2005. Again, no information on effort is available to standardize this index.

The available data considered by the panel to be reliable is indicative of strongly declining trends, but pertains to only two regions of restricted size (Table 4). However, in the context of the overall distribution of the species, the data presented by the proponents is insufficient to determine whether population trends meet the criteria for listing on Appendix II.

Modifying risk factors

These species are taken as a component of mixed fisheries, rather than as targets. Therefore, fishing effort would be expected to continue essentially unchanged, even as the the wedgefish stocks decline. This would result in increasing fishing mortality. This can be considered as a factor that increases risk.

Habitat degradation and modification are likely additional reasons for the declines in abundance and distribution of Rhinidae worldwide. Their dependence on inshore habitats, such as seagrass and coral reef ecosystems which are subject to reductions globally due to anthropogenic impacts, makes them highly susceptible to habitat loss and degradation. This can be considered as a factor that increases risk.

These species' large size and body morphology makes them particularly vulnerable to entanglement in static gears. This can be considered as a factor that increases risk.

Summary of evaluation and assessment of biological listing criteria

The whitespotted wedgefish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* are both considered to be species of low to medium productivity. Both of the proposed wedgefish species are wide-ranging in the Indo-Pacific region, but no population estimates are available. The information provided in the proposal on trends in populations across the species' range, was limited, and not sufficient to allow the panel to determine whether the species qualified globally under the decline criteria for an Appendix II listing. The panel had access to two additional series of catches, from India and Indonesia, which displayed strong declines. These data were considered insufficient to change the conclusion above.

Comments on technical aspects relating to management, trade and likely effectiveness of implementation of a CITES listing

The following comments respond to statements in the proposal relating to management and trade and are not a comprehensive summary of management regimes or the trade of *Rhynchobatus* species. The Expert Panel was satisfied that *Rhynchobatus* are widely traded internationally and command a high price. The scope of the proposal includes all *Rhynchobatus* species for 'look-alike' reasons, i.e. species whose specimens in trade look like those of species listed for conservation reasons (see Article II, paragraph 2 of the CITES Convention).

Management comment

Currently adopted management regimes/measures related to governance, population monitoring and compliance

International management:

- The FAO IPOA-Sharks applies to chondrichthyans and therefore also applies to *Rhynchobatus*. It underscores the responsibilities of fishing and coastal states to sustain chondrichthyan populations, ensuring full utilisation of retained species and improving data collection and monitoring (see Appendix G, especially points 3).
- The obligations which the 'Convention on the Conservation of Migratory Species of Wild Animals' CMS places on its 123 member parties require them to fully protect *Rhynchobatus australiae*. CMS includes *Rhynchobatus australiae* in Appendix II of its Convention. In December 2018 both species were listed on the CMS shark Memorandum of Understanding, which can assist with the implementation of these proposed CITES Appendix II listings thanks to the collaborative work of its signatories (see Appendix G, especially points 5vi).
- The adopted FAO Port State Measures Agreement acts to prevent, deter and eliminate IUU fishing. This agreement requires that any inspections conducted on fishing vessels entering ports includes verification that all species exploited have been taken in compliance with international law, international conventions and measures of RFMOs.
- The Strategic Plan for Biodiversity 2011–2020 adopted by the 10th Conference of the Parties (COP) to the Convention on Biological Diversity (CBD), stated that:
 "By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape."

Regional management:

- The coastal habitat of these species and they are caught in local and artisanal fisheries implies. There have not been regional scale initiatives for their management to date.

- All Tuna RFMOs have adopted prohibitions on finning and encourage the release of live sharks: this could be applied to wedgefish due to its high value in trade (see Appendix G, especially points 3; 5iii).
- At its CoP12 the CMS Parties urged members to facilitate regional cooperation towards the conservation and key habitats of shared stock populations of *Rhynchobatus australiae* (see Appendix G, especially points 5vi).
- Due to by-catch issues, the same type of fishing gear operated in the coastal areas targeting RFMO-target species while wedgefish are included; the same practices should be applied to wedgefish under the RFMOs and require catches of sharks as a group or as individual species to be recorded and reported annually. This is complemented by observer programmes and discard reporting;
- There are research efforts on sharks and rays at the regional and national levels that include wedgefish.

National measures:

- There are a few instances of management at the national level. *Rhynchobatus djiddensis* is listed on Schedule 1 of the Bangladesh Wildlife Protection Act, 2012, and on India's Wildlife Protection Act 1972, which prohibits the hunting, trade and any other form of exploitation of these species. Pakistan has regulations banning the catching of these species (Jabado and Spaet, 2017), while two of Pakistan's maritime provinces, Sindh and Balochistan, have banned the catching, landing and marketing of all guitarfish (CITES, 2018), as well as a complex of wedgefishes including *R. australiae*. This species is also subject to management in a mixed fishery in Australia (White *et al.*, 2014). In Western Australia, there is statewide prohibition of shark and ray landing in non shark-targeted fisheries, which applies to fishing permits, effort and catch limits, gear restrictions, spatial closures; (McAuley *et al.*, 2016). It should be noted that the species is negligible in catches in Western Australia.
- MPAs and other spatial measures implemented to protect the marine ecosystem, including wedgefish, are established in several EEZs.
- Good practice on using By-catch Reduction Devices (BRDs) such as existing TEDs (Turtle Excluding Devices) attached to trawl nets must be promoted and further developed (see Appendix G, especially points 5ii).
- Some states implement regional management measures (above) through national action plans and/or finning controls, including requiring fins to be attached and prohibiting the retention of wedgefish (see Appendix G, especially points 3).
- All commercially exploited aquatic species include by-catch; wedgefish and other shark and ray species must therefore be properly recorded and reported annually. If appropriate, Catch Documentation should be developed and applied to support long-term stock assessment and effective management.

Comments on the anticipated positive and negative changes in these management measures, and requirements for additional management, if species were listed under Appendix II of CITES.

- It was not possible to evaluate the effectiveness of the above measures, both regionally and nationally, as there was no reported data on the implementation or effectiveness known to the Expert Panel.
- Appendix II listing may generate additional information that can assist fisheries managers to assess fishing mortality rates. The reporting of Rhinidae species catches, where landing is permitted, would be improved in some cases. However, it is apparent to the Expert Panel that some Southeast Asian range states' responses to earlier CITES Appendix II listing decision have simply been to refuse permits to land listed species and ban trade (see Appendix G, especially points 5ii).
- Appendix II listing could assist in improving compliance by providing an impediment to trading in Rhinidae products that are illegally obtained from fisheries where regulations prohibit catch and/or retention, by virtue of the requirement to supply CITES documentation.
- All catches landed from the high seas would require IFS or Export Permits, which require NDFs and legal acquisition findings or the corresponding requirements under IFS. This applies not only to

landings for commercial purposes but also to the taking of samples for scientific purposes (see Appendix G, especially points 4).

Trade comment

The Expert Panel noted that these species are retained when captured incidentally. Retained catch is utilized for local consumption and international trade in their fins. There is some evidence of targeting, such as in Zanzibar (Schaeffer, 2004). The species' fins are widely traded on Asian markets and constitute an important component of overall shark fins traded (Giles *et al.*, 2016; Wainright *et al.*, 2018; Fields *et al.*, 2017). The Expert Panel acknowledges that shark fin continues to be a highly valued commodity primarily amongst Asian consumers both in Asia and elsewhere.

Additional information available to the Expert Panel noted that total global trade quantities are traditionally gauged by means of quantities imported by Hong Kong SAR, and on this basis the market declined rapidly from a peak value in 2003 and fell sharply again after 2011 (Shea and To, 2017). A number of factors may have contributed to this second drop (Dent and Clarke, 2015), but it appears likely that new austerity regulations aimed at curbing conspicuous consumption by mainland Chinese government officials is a major factor (Jeffreys 2016, Fabinyi, 2016). Imported quantities into Hong Kong SAR appear to have stabilized at 2012 levels, i.e. nominally at about half of the post-2003 volumes, through 2016 (Shea and To, 2017; HKCSD, unpublished data).

At the same time as the Chinese market has apparently been suppressed, Southeast Asian markets appear to be gaining influence either as processors, traders and/or consumers (Dent and Clarke, 2015, Eriksson and Clarke, 2015). Ongoing complexity and dynamism in the trade, along with traditional and continuing lack of transparency issues, make it difficult to quantify market sizes and shares and therefore more precise trend information is not available.

The Expert Panel noted that there is no evidence that traders differentiate between species of wedgefishes in the fin trade. Furthermore, the trade category "QUN" is suspected to contain species in both Rhinidae and Glaustegidae families. Thus, the panel suggests that CITES Parties should consider carefully whether there might be a lookalike problem between wedgefishes and guitarfishes.

Currently there is no culturing of wedgefish in aquaculture and it is unlikely that they are species suitable for aquaculture in currently developed aquaculture systems.

Trade market transparency, documentation and level of IUU

- The Expert Panel noted evidence in the references supplied that *Rhynchobatus* fins were the most frequently traded product form.
- There are no specific catch or trade documentation schemes for *Rhynchobatus*. The general catch documentation systems that exists in some countries could facilitate the issuing of legal acquisition findings, such as the EU's Catch Certification requirements.
- Identifying sharks and shark products in international trade at a species level is severely constrained. There is a finite capacity in the commonly used World Customs Organization (WCO) harmonized system (HS) of tariff classification which means that only a limited range of products derived from wedgefish, such as dried fins, could be identified in future amendments to the harmonized system. The earliest that such amendments might be implemented, assuming adoption in the World Customs Organization, would be 2027. It should be noted that the number of species in the Rhinidae family would overwhelm the capacity of the HS system to identify dried fins at a species level (http://www.wcoomd.org/en/faq/harmonized_system_faq.aspx#q9; also see Appendix G, especially points 5ii).
- Ongoing and past efforts by authorities and organizations (other than customs administrations) have monitored the species composition of the shark fin trade, and these may continue to provide insights.
- A CITES Appendix II listing applies only to international trade in listed species and their products. Domestic trade in wedgefish and their products would be unaffected by listing in CITES Appendix II. Landing and selling wedgefish in domestic markets would therefore continue without any changes to current practices

Comments on the anticipated positive and negative changes in trade-related issues, if species were listed in App II of CITES

- CITES provisions on trade in specimens of species listed in Appendix II require the issuance of an export permit by the exporting country, which is only granted if the national CITES authorities are satisfied that: 1) the export is not detrimental to the survival of the species in the wild; and 2) the specimens were not obtained in contravention of the national laws of that state.
- The trade will be recorded in the CITES trade database, which improves overall trade information (see Appendix G, especially points 5iii).
- States' abilities to make NDFs for the range of fisheries from which *Rhynchobatus* may be obtained in the absence of region-wide assessments, as evidenced by difficulties encountered in making NDFs for shark and ray species that have already been listed. Under these conditions the following outcomes can occur:
 - previous trade ceases;
 - trade continues without proper CITES documentation also known as 'illegal trade'; and/or
 - trade continues with inadequate NDFs.
- The implementation of previous listing decisions for sharks has taken some time. Some of the delays are a result of legislative processes, but there can also be a lag of three or more years in the collection and transmission of trade data to the CITES Secretariat.

Likely effectiveness for conservation: summary comment in relation to technical aspects of biology, ecology, management and trade.

It is difficult to draw clear conclusions regarding the effectiveness of existing and future management and trade measures owing to the lack of data available to be able to assess these measures (see Appendix G, especially points 5iv). However, if properly implemented, a CITES Appendix II listing could be expected to result in better monitoring and reporting of catches entering international trade. Improved monitoring should enable new or enhanced assessments of stock status and the subsequent adoption of management measures ensuring the sustainability of harvests where these are still permitted. Harvests from international waters would fall under IFS provisions of the CITES Convention. These would require catch documentation at the species level for specimens entering the jurisdiction of a state from international waters, along with a NDF indicating that the harvest was sustainable.

The listing of the Rhinidae family would assist in resolving the look-alike issues across the taxon. It should be noted that states' abilities to make NDFs for highly migratory species is limited in the absence of region-wide assessments, as evidenced by difficulties encountered in making NDFs for shark and ray species that have already been listed. In the case of *R. australiae*, following Giles *et al.* (2016), the patterns of genetic differentiation did not provide evidence of substantial demographic connectivity among Australia, Southeast Asia and the Andaman Sea and the authors suggest that a separate assessment of the species in each of these regions may be appropriate.

Noting the lack of *Rhynchobatus* fishery information across many range states, and the limited ability to make NDFs as evidenced by the situation encountered for shark and ray species that have already been listed, under such conditions the following outcomes may occur:

- previous trade ceases;
- trade continues without proper CITES documentation also known as 'illegal trade'; and/or
- trade continues with inadequate NDFs.

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Tables and figures

Table 1. Information for assessing productivity of *Rhynchobatus australiae*.

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | CONFIDENCE | COMMENTS |
|-------------------------------------|--------|-------------------|---------------------------------|--|------------|--|
| L50 maturity | Low | 110–130 cm TL (m) | Area 57 (Indian Ocean, Eastern) | White and Dharmadi, 2007 | 5 | Published study |
| L50 maturity | Low | 173 cm TL (m) | Area 57 (Indian Ocean, Eastern) | Simeon <i>et al.</i> , 2019.in press | 4 | Agrees with previous study, maturity at large proportion of maximum size |
| L50 maturity | Low | 232 cm TL (f) | Area 57 (Indian Ocean, Eastern) | Simeon <i>et al.</i> , 2019.in press | 5 | Agrees with previous study, maturity at large proportion of maximum size |
| No of young (litter size) | Low | 7–19, mean = 14 | Area 57 (Indian Ocean, Eastern) | White and Dharmadi, 2007 | 5 | Published study |
| Longevity (Tmax) | Medium | 12–18 years | Area 57 (Indian Ocean, Eastern) | White, 2014 | 3 | For the species complex, possibly biased |
| Growth (Von Bertalanffy parameters) | Medium | K = 0.41 | Area 57 (Indian Ocean, Eastern) | White, 2014 | 1 | For the species complex, possibly biased |
| Intrinsic rate or increase r | Medium | r = 0.24 | Area 57 (Indian Ocean, Eastern) | White, 2014 | 1 | For the species complex, possibly biased |
| Natural mortality | Medium | M = 0.24 – 0.36 | Area 57 (Indian Ocean, Eastern) | White, 2014, based on method of Tanaka, 1960 | 1 | For the species complex, possibly biased |

Table 2. Information for assessing productivity of *Rhynchobatus djiddensis*.

| PARAMETER | STATUS | INFORMATION | AREA | SOURCE | CONFIDENCE | COMMENTS |
|--------------|--------|---------------|--------------------------------|--------------------|------------|--|
| L50 maturity | | 150 cm TL (m) | Area 51(Indian Ocean, Western) | van der Elst, 1988 | 3 | Not a primary reference, maximum size 310 mm |

Table 3. Catches (tonnes) of *Rhynchobatus djiddensis* from bottom trawlers Chennai, Tamil Nadu, India.

| 2002 | 2003 | 2004 | 2005 | 2006 | Average |
|------|------|------|------|------|---------|
| 115 | 68 | 12 | 23 | 14 | 47 |

Table 4. Information on wedgefish trends from different oceanic regions.

| SPECIES | AREA | INDICATOR | FISHERY | EXTENT OF DECLINE % | REFERENCE PERIOD | REFERENCES | CONFIDENCE | COMMENTS |
|--------------------------|----------------------------------|-----------|-------------------------------|-------------------------|-------------------|---|------------|---|
| <i>Rhynchobatus</i> spp. | Area 57 (Indian Ocean, Eastern) | catches | mixed | 91% | 2005–2015 | Simeon <i>et al.</i> 2019, in press. | 2 | Reliable series, for <i>R. australiae</i> and other species in the species complex. No effort |
| <i>R. australiae</i> | Area 51 (Indian Ocean, Western) | other | mixed | 50–80% | three generations | Jabado <i>et al.</i> , 2017 | 1 | Trend unsubstantiated |
| <i>R. australiae</i> | Area 57 (Indian Ocean, Eastern) | other | bottom gillnet | NA | NA | Giles <i>et al.</i> , 2016; White <i>et al.</i> , 2014; White and McAuley, 2003 | 1 | Information lacking in general on trend |
| <i>R. australiae</i> | Area 57 (Indian Ocean, Eastern) | effort | mixed | N boats from 500 to 100 | three generations | Chen, 1996 | 0 | Information lacking in general on trend |
| <i>R. australiae</i> | Area 57 (Indian Ocean, Eastern) | landings | trawls and bottom gillnets | significant | 2004–2010 | Jabado <i>et al.</i> , 2017 | 1 | Anecdotal reports. Information lacking in general on trend |
| <i>R. australiae</i> | Area 57 (Indian Ocean, Eastern) | landings | trawl | 80% | 2000–2011 | CITES AC30 Inf.12 | 0 | Information lacking in general on trend |
| <i>R. djiddensis</i> | Area 51 (Indian Ocean, Western) | catches | longlines | 88% | 2002–2006 | Mohanraj <i>et al.</i> , 2009 | 2 | Reliable series, but no effort |
| <i>R. djiddensis</i> | Area 51 (Indian Ocean, Western) | landings | Bottom gillnets and longlines | NA | 2000–2005 | Pierce <i>et al.</i> , 2008 | 1 | Information lacking in general on trend |
| <i>R. djiddensis</i> | Area 51 (Indian Ocean, Western) | catches | Gillnets and lonlines | NA | 2004 | Schaeffer, 2004 | 1 | Information lacking in general on trend |
| <i>R. djiddensis</i> | Area 51 (Indian Ocean, Western) | other | mixed | NA | 2011 | Hopkins, 2011 | 1 | Information lacking in general on trend |

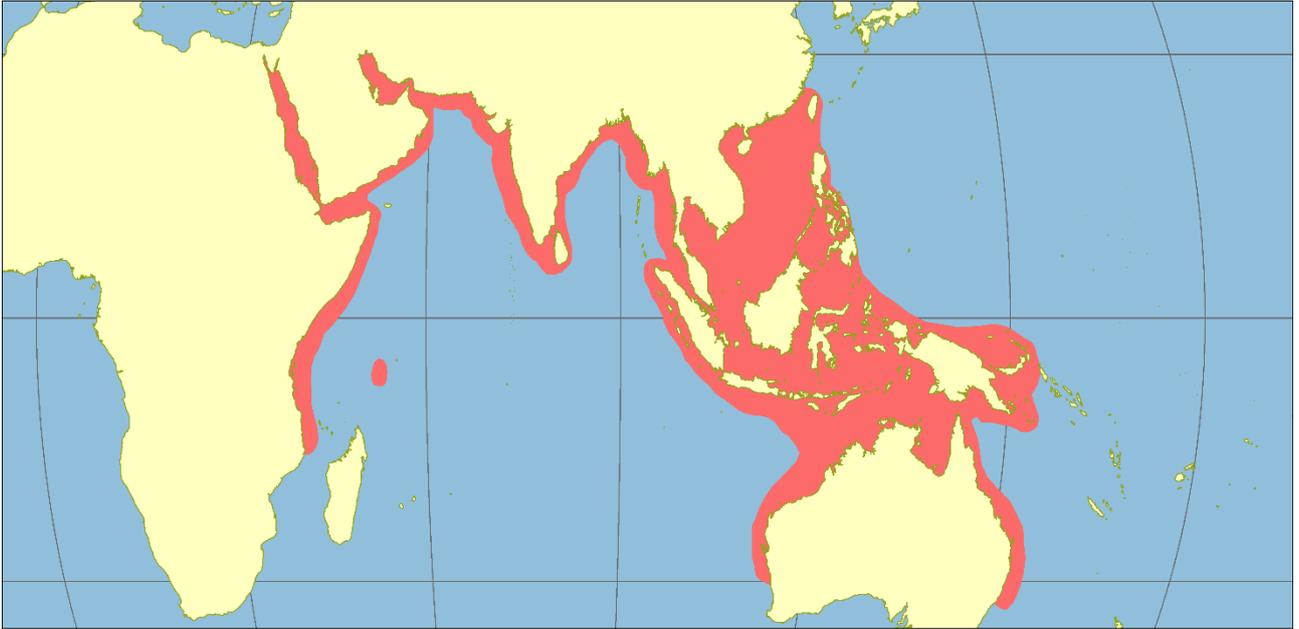


Figure 1. Distribution of *Rhynchobatus australiae* (Source: Last *et al.*, 2016 - modified).



Figure 2. Distribution of *Rhynchobatus djiddensis* (Source: Last *et al.*, 2016 - modified).

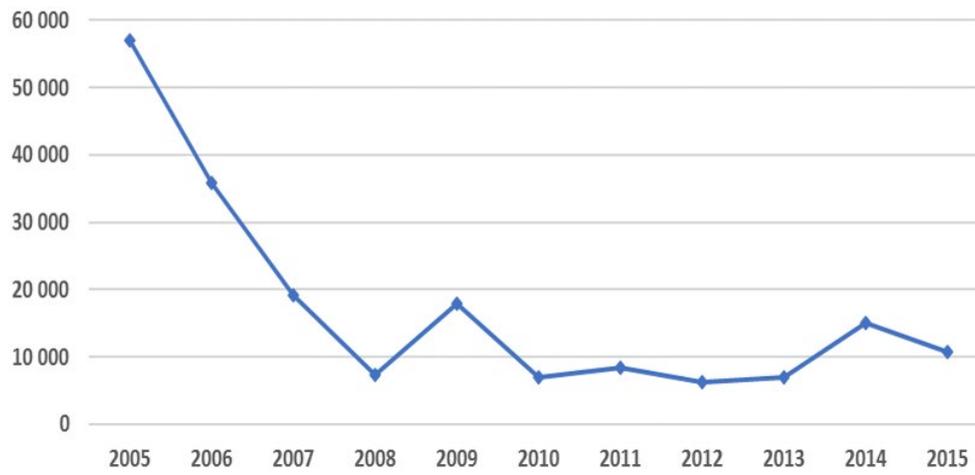


Figure 3. Total catches (tonnes) of *Rhyncobatus* species from Indonesian waters in the period 2005–2015. Redrawn from Simeon *et al.*, 2019 (forthcoming).

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Species

Three species belonging to the genus *Holothuria* (subgenus: *Microthele*): *Holothuria (Microthele) fuscogilva*, *Holothuria (Microthele) nobilis* and *Holothuria (Microthele) whitmaei*.

Proposal

To include three species belonging to the genus *Holothuria* (subgenus: *Microthele*): *Holothuria (Microthele) fuscogilva*, *Holothuria (Microthele) nobilis* and *Holothuria (Microthele) whitmaei* in Appendix II, in accordance with Article II paragraph 2 (a) of the Convention.

| SPECIES | MEETS CITES CRITERIA | DOES NOT MEET CITES CRITERIA | OTHER |
|---|-------------------------|---------------------------------|---------------------------|
| <i>Holothuria (Microthele) fuscogilva</i> | | ✓ | |
| <i>Holothuria (Microthele) nobilis</i> | | | Insufficient evidence* |
| <i>Holothuria (Microthele) whitmaei</i> | ✓ | | |

* Insufficient evidence of declines to make a judgement in relation to CITES criteria (CITES Res. Conf. 9.24. Rev. CoP17).

Assessment summary

High-value teatfish sea cucumbers have a long history of appearing in international trade, with demand in Asian markets expanding rapidly in recent decades. These slow-moving marine benthic invertebrates are found across coastal habitats in the tropical and subtropical waters of the Indo-Pacific, where they are collected by hand in artisanal and small-scale coastal fisheries. Sold mostly as whole dried animals – called beche-de-mer, trepang, gamat and balat – fishing is recognized as the most significant pressure on sea cucumber populations across their range. Noting that many basic biological parameters for sea cucumbers remain unknown, the Expert Panel determined that teatfish species have low productivity.

Information on the status of teatfish stocks shows they have been resilient to species extirpation across their range, although declines in densities of teatfish (individuals per hectare) were commonly reported from time-series and snap-shot studies. Marked declines were recorded, and the loss of teatfish from some survey locations within countries has been documented. This is a concern as the sustainability of teatfish stocks is linked to maintaining effective population sizes for successful reproduction, in order that so-called ‘depensatory effects’ occurring at low stock densities do not result in negative population growth. More promisingly, the Expert Panel also noted some examples of recovery of overfished teatfish stocks; however the rebuilding of stocks required multiple years and recovery was variable across locations.

The high market value of these species and the ability of artisanal fishers to keep harvesting, even at low density, were modifying risk factors for all teatfish, with *H. whitmaei* and *H. nobilis* recognized as being at particular risk because they are found in such shallow waters.

To date national management measures and enforcement of regulations have been unable to stabilize production, with boom-and-bust fishing cycles characterizing these fisheries in most Indo-Pacific countries. Considering the available information on productivity and declines in the abundance of teatfish, and taking into account other factors; – such as their vulnerability to fishing and their ability to recover from fishing pressures – the Expert Panel considered each species against the CITES Appendix II listing criteria.

The Expert Panel determined that:

For *Holothuria fuscogilva*, apart from localized cases of severe decline, the available information **did not meet the listing criteria** for CITES Appendix II.

For *Holothuria nobilis* the available **information was insufficient** to determine this species’ status in relation to the listing criteria for CITES Appendix II at this time. However, *H. nobilis* is a sister species to *H. whitmaei* with many similar life-history attributes.

For *Holothuria whitmaei* the available information **met the listing criteria** for CITES Appendix II.

Owing to potential confusion in identifying between dried *H. fuscogilva*, *H. nobilis* and *H. whitmaei* in trade, ‘look-alike’ provisions could be considered appropriate for this group.

Scientific assessment in accordance with CITES biological listing criteria

Species distribution

Teatfish species (Figure 1) are non-migratory, relatively sedentary stocks that live in the tropical and subtropical waters of the Indo-Pacific. They occur within country Economic Exclusion Zones in coastal ecosystems from the East African coast to Polynesia and from Okinawa (26 °N) in the north to Lord Howe Islands (31 °S) in the south.³ With regards to FAO Areas, teatfish species distribution is described in Figure 2.

Species productivity

LOW PRODUCTIVITY

Summary of Species Productivity Information:

Scientific studies provide some valuable data about the productivity of sea cucumbers generally, and teatfish species specifically. However, life history information can be difficult to assess in sea cucumbers because they have few hard body parts, are not generally amenable to conventional measuring, weighing or tagging methods and can undergo shrinkage and regrowth in body weight as adults.

Teatfish mature at 3–7 years, and have slow growth rates, with longevity of teatfish unknown. It is thought teatfish could live for several decades, have low rates of natural mortality and low to moderate rates of intrinsic population growth. While they do have high fecundity, fertilisation of broadcast spawned gametes, larval survival and recruitment success are variable. Applying a precautionary approach to consideration of the available scientific information, teatfish species as a whole were determined to have low productivity, noting the best estimate by the Expert Panel was towards the upper end of low productivity scale.

As sea cucumbers are difficult to tag due to having no hard body parts, determining age using traditional fishery methodologies is very difficult. Contributing to this is the high variability in recruitment that sea cucumber stocks can experience (Uthicke *et al.*, 2009). Uthicke (2004) and Uthicke *et al.* (2004, 2009) have noted ‘plasticity’ in echinoderm populations over time generally, which is thought to be a result of a high-risk–high-gain larval strategy that results in occasionally large population increases. This suggests very low reproduction/recruitment rates for echinoderm species once stocks reach low densities.

Calculations of intrinsic growth rates by the Expert Panel demonstrate that sea cucumber stocks have the ability to recover from over-exploitation (Friedman *et al.*, 2008; Flood and George, 2013; Trianni and Tenorio, 2011, Toral-Granda *et al.* 2008, see Table 1). In addition, because of the relatively slow moving nature of these species, successful fertilisation of broadcast gametes can be disproportionately lowered as a result of anthropogenic pressures and various environmental stressors (Uthicke, 2004; Bell *et al.*, 2008). Therefore, in relation to the thresholds listed in Musick (1999: Table 3), and taking a precautionary approach to making a determination of productivity – because much of the information available varies in its integrity – the Expert Panel returned a result towards the upper end of low productivity for teatfish as a whole.

³ Although there are localised disputes in coastal waters in many areas of the range for teatfish species, they are not taken harvested from oceanic areas or the high seas.

Trends and application of the decline criterion

Summary of Species Trend Information:

Teatfish fished in artisanal and small-scale fisheries don't generally benefit from having organized fisheries monitoring of stocks through time to define trends in populations. Using time-series data where available and spatial comparison of one-off underwater surveys, the Expert Panel noted a general negative trend in population measures across their range, and low or depleted abundances when compared to recognized baselines for 'healthy' stocks. The two shallow water species (*Holothuria whitmaei* and *Holothuria nobilis*) that do not receive any surrogate depth protection, compared to the deeper water *Holothuria fuscogilva*, exhibited the greatest declines. Although a small number of 'stand-out' examples of high densities were noted, marked declines in abundance were recorded across various country examples, with many surveys noting low remaining numbers of teatfish in surveys at fished locations. Excessive harvesting at certain localities within countries has resulted in extremely low population densities or no animals at sites surveyed, and this has matched declines in exports. Despite this, no countries have lost species and a range of recoveries were recorded when stocks were rested from fishing.

The harvesting of sea cucumbers for export is the main source of anthropogenic mortality for teatfish species across their ranges. Changing environmental parameters through climate change and increased human activities in coastal zones is also having an effect on sea cucumber habitats, especially coral reefs where *H. whitmaei* and *H. nobilis* prefer to inhabit reef flats, lagoonal systems, mid and outer reef shelves and passes, and the crests of barrier and fringing coral reefs. *H. fuscogilva* stocks have a certain level of buffer from the above impacts due to its preference for deeper water environments, but are still targeted heavily by fishers who use a range of techniques to remove them from deep water.

In their review of the proposal, the Expert Panel looked for:

- i) species extinction at the national scale;
- ii) range restriction at the island or lagoon scale;
- iii) decreases in abundance within islands or lagoons as measured by presence/absence (with related falls in density); and
- iv) the ability for sea cucumber species to recover to a 'healthy' population status (measured through metrics such as presence, density measures) once they have been protected from fishing.

Few examples of standardized data on changes in teatfish species densities within and among countries exist, with a dearth of historical data on early harvests (Friedman *et al.*, 2011). This is because few countries record catches or exports at the species level. Fisheries for sea cucumber species are largely a diffuse activity targeted mainly by artisanal fishers living in remote locations far removed from the presence of centralized fisheries management agencies, and in countries that often have fiscal and governance problems. Despite their high commercial value, the Expert Panel found no obvious extirpation of teatfish species at the national scale, though localised extirpations and severe depletion of stocks have been observed (e.g., Kinch *et al.*, 2008; Hasan and El-Rady, 2012; Friedman *et al.*, 2011; Lane and Limbong, 2013; Ducarme 2016).

The Expert Panel examined species status (Figure 3, Figure 4 and Table 2), where information was available in one or more of the following ways:

STATUS CHECK 1 - CHANGING STATUS ACROSS FISHERY-INDEPENDENT TIME-SERIES SURVEYS: Comparison of data from fishery-independent surveys of teatfish species through time.

STATUS CHECK 2 - SPATIAL COMPARISON OF SINGLE SURVEYS AGAINST BASELINE THRESHOLDS: Spatial comparisons of teatfish densities and size information, which was recorded from fishery independent surveys at fished sites with densities found in largely unfished or sanctuary (i.e. marine reserve) sites.⁴

⁴ Further understanding of what defines the lower limit of a species' density (that which still allows timely recovery from fishing) and the underlying mechanisms that drive these processes is still needed, although some rule of thumbs have been suggested (Bell *et al.* 2011).

STATUS CHECK 3 - CHANGING STATUS OF SEA CUCUMBER COMMODITIES IN THE MARKET: Changes in source and consumer market information through time (e.g. export volume, species complement, etc).

RESULTS OF CHANGING STATUS ACROSS FISHERY-INDEPENDENT TIME-SERIES SURVEYS

Under the CITES criteria for commercially exploited aquatic species (Res. Conf. 9.24 Rev. CoP16), a decline to 15–20 percent of the historical baseline for a low-productivity species might justify consideration for an Appendix I listing. For listing on Appendix II, being “near” this level may justify consideration for a listing, which for a low-productivity species would be 20–30 percent of the historical level (15–20 percent adding a 5–10 percent precautionary measure). The Expert Panel found little reference to quantitative evidence of population decline in the CITES Proposal for teatfish species. The Expert Panel therefore researched and collated a number of abundance indices from different parts of their range, despite these being of varying reliability as indices for these species. Direct time-series data that reflect the status of teatfish stocks were scarce. However survey-resurvey records (of variable replication) do exist for a small range of localities in countries that support or had supported sea cucumber fisheries and these detailed below starting in Pacific and moving westward to the coast of East Africa.

Federated States of Micronesia

In the Federated States of Micronesia, surveys were conducted in 2000 and again in 2016. In Pohnpei, *H. whitmaei* were qualitatively described as “at relatively high densities” in broadscale manta tow surveys in 2000 (Lindsay, 2000; 2001). During a 2016 survey of Pohnpei and Ant Atoll, *H. whitmaei* densities were recorded from 0.2–3.3 ind. ha⁻¹ in broadscale surveys and 34 ind. ha⁻¹ for fine-scale diver swim surveys (Bosselle *et al.*, 2017). Bosselle *et al.* (2017) recorded *H. fuscogilva* densities ranging from 0.1–0.8 ind. ha⁻¹ for broadscale surveys and 10 ind. ha⁻¹ for fine-scale surveys. Of note during this survey, was that no *H. whitmaei* or *H. fuscogilva* were found inside any of the Marine Protected Areas that were surveyed, though this lack of presence is possibly due to the location of the protected areas.

To summarise, the lack of clarity of the early information, and the mixed records of low and moderate densities makes it difficult to reach a conclusion in relation to the CITES Appendix II criteria (CITES Resolution Conf. 9.24. Rev. CoP17).

Republic of Palau

On the main islands of Palau, *H. whitmaei* was previously reported as relatively common (Ilek, 1991). Surveys at four locations (Ngarchelong, Ngatpang, Airai and Koror) in 2007 (Friedman *et al.*, 2009a) recorded *H. whitmaei* in 15–35 percent of broadscale survey transects and 9–50 percent of shallow water reef transects. Recordings of average density across the four locations was 8.6 ind. ha⁻¹ for broadscale survey and 26.2 ind. ha⁻¹ for shallow water reef surveys. Five years later, in 2012 a re-survey of Ngarchelong and Ngatpang was completed (Pakoa *et al.*, 2014a). Broadscale surveys of Ngarchelong (none conducted in Ngatpang) had a higher presence across replicates (33 percent rather than 17 percent of replicates), with a similar average density remained (3.2 ind. ha⁻¹ instead of 3.9 ind. ha⁻¹).

Shallow water reef surveys at Ngarchelong recorded an increase in the presence of *H. whitmaei* between 2007 and 2012, from 9 percent to 40 percent of survey replicates, while the density also increased markedly (from 3.8 ind. ha⁻¹ to over 300 ind. ha⁻¹). In Ngatpang, similar surveys, yielded a decrease in the presence of *H. whitmaei* across survey replicates, from 32 percent to 10.7 percent and a small density increase from 26.3 ind. ha⁻¹ to 32.7 ind. ha⁻¹. The mean size of *H. whitmaei* across both sites was not observed to change between 2007 and 2012 (Pakoa *et al.*, 2012). These results show some large increases in Ngarchelong – an unexplained variability that could be attributed to stock re-building, surveys randomly centering on recruitment hotspots or other ecological conditions.

In 2007 at Ngarchelong, *H. fuscogilva* were recorded in 67 percent of deep dive transects at a density of 5.2 ind. ha⁻¹ (n= 6), but no deep dives were completed in 2012. At Ngatpang, 50 percent of deep-dive replicates recorded *H. fuscogilva* at an overall density of 2 ind. ha⁻¹ (n= 6). Again no repeat deep dives were made in 2012. In other surveys of non-core *H. fuscogilva* habitat, the species was recorded at Ngatpang but not Ngarchelong.

In summary, *H. whitmaei* and *H. fuscogilva* surveys in Palau between 2007 and 2012 noted that there was no indication of *H. whitmaei* meeting the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17). There was also not a sufficient signal to make a determination against the criteria for *H. fuscogilva*.

Cook Islands

A survey in 2007 across the Cook Islands reported *H. whitmaei* densities to be 3.8 ind. ha⁻¹ at Mangaia, 8.2 ind. ha⁻¹ at Palmerston, 6.4 ind. ha⁻¹ at Rarotonga with no *H. whitmaei* observed at Aitutaki (Pinca *et al.*, 2009a). Another survey in 2013, observed five *H. whitmaei* at three of the four islands listed above (Raumea *et al.*, 2013). Unfortunately no density estimates are reported from the 2013 survey.

In summary, the 2007 and 2013 surveys in these remote and isolated islands do not provide sufficient information to make a determination criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

Samoa

Commercial fishing of sea cucumbers in Samoa is limited, and the national regulations have not allowed exports during extended periods. Some sea cucumbers are consumed locally, but teatfish are not one of these. An attempt to compare past trading of sea cucumbers with surveys of presence in underwater surveys between 1994 and 2005 showed that *H. whitmaei* in 2005 was both at low density (< 2 ind. ha⁻¹) and likely not at abundances that would have supported recorded exports from the early-mid-1990s (Vunisea *et al.*, 2008). In other words, *H. whitmaei* were found in lower numbers than the number reported as exported in a single year a decade earlier. However a later survey of the two main islands, conducted in 2012, found healthy densities of *H. whitmaei* at 12.0 ind. ha⁻¹ (Sapatu and Pakoa, 2013). The previous 1994–2005 comparison (Vunisea *et al.*, 2008) noted that the 2005 *H. fuscogilva* abundances far exceeded previous export records (Vunisea *et al.*, 2008).

In summary, this information provides some potential insight into declines of *H. whitmaei* and the resilience of *H. fuscogilva*. These comparisons however do not provide sufficient information to make a determination against the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

Tonga

The sea cucumber fishery in Tonga has been opened and closed using moratoriums on a number of occasions. Underwater surveys conducted four times over a period of 20 years in Tonga (1984–2004) showed that *H. whitmaei*, had an average fall in densities in shallow and deep water surveys of 55 percent (Friedman *et al.*, 2009b). Between 1990 and 1996 (when formal fishing ended), densities of *H. whitmaei* and *H. fuscogilva* were recorded as having declined from 4.6 to 1.3 ind. ha⁻¹ and 8.6 to 2.2 ind. ha⁻¹, respectively (Preston and Lokani, 1990; Lokani *et al.*, 1996). Despite both early and more recent *H. whitmaei* densities being recorded below < 10 ind. ha⁻¹, there was a notable recovery (100 percent+) recorded near the end of a 7-year moratorium (between 1996 and 2004 surveys). On the other hand, comparable assessments of *H. fuscogilva* between 1990 and 2004 recorded an increase in density of 10 percent (Friedman *et al.* 2009b; Friedman *et al.* 2011).

A survey of some shallow water locations in 2010–2011 followed a period of fishing which failed to find any *H. whitmaei* (Pakoa *et al.*, 2013), while deeper water surveys for *H. fuscogilva* across a subset of deep-water locations recorded an average density of 3.9 ind. ha⁻¹ (Pakoa *et al.*, 2013). The most recent study (Moore *et al.*, 2016) again noted *H. whitmaei* at both at Ha'apai and Vavau island groups, although the densities recorded were extremely low (<1 ind. ha⁻¹). Moreover, the average length of *H. whitmaei* was shorter (28 cm) compared to the average length estimated from animals in 2010–2011 (34 cm) (Pakoa *et al.*, 2013). This was despite there still being relatively large numbers of *H. whitmaei* being traded from all three island groups of Tonga as late as 2014 (see Figure 9, Moore *et al.*, 2016). In summary, *H. whitmaei* declined in density from 4.6 ind. ha⁻¹ in 1984 to being only visible in broad-scale surveys in 2016 at densities below 1 ind. ha⁻¹ (no *H. whitmaei* were recorded in shallow reef or deep survey habitats). Such declines of *H. whitmaei*, when reflected against the thresholds for long-term extent of decline and recent rate of decline combined, meet the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

The most recent study (Moore *et al.*, 2016) also noted *H. fuscogilva* at both at Ha'apai and Vavau, although the densities recorded were extremely low (< 1 ind. ha⁻¹). These *H. fuscogilva* had an average length of 26 cm, compared to 32 cm and 37 cm for two islands measures taken in 2010–2011 (Vava'u and Tongatapu by Pakoa

et al. 2013). Of the 12 *H. fuscogilva* measured in 2016 by Moore *et al.* (2016), only two were above the minimum legal harvest length of 320 mm which was in effect in Tonga at the time. Similar to the situation for *H. whitmaei*, large numbers of *H. fuscogilva* were being traded from all island groups as late as 2014 (see Figure 9 in Moore *et al.*, 2016). In summary, between 1984 and 2016 *H. fuscogilva* densities recorded in scuba surveys have declined by 97% (8.6 to 0.25 ind. ha⁻¹); a marked decline that meets the CITES Appendix II criteria when the long-term extent of decline and recent rate of decline are combined.

Republic of Fiji

Data on the occurrence and density of sea cucumbers from four village fishing grounds in Fiji surveyed in 2003 and 2009 showed a decline in *H. whitmaei* populations (Friedman *et al.*, 2010). Average densities in fine-scale surveys decreased by 70 percent and were < 10 ind. ha⁻¹, while broad-scale surveys showed – a 50 percent decline in abundance – with both 2003 and 2009 densities at <10 ind. ha⁻¹ (Friedman *et al.*, 2010; Friedman *et al.*, 2011). Jupiter *et al.* (2013) surveyed numerous new sites across the Lau islands in Fiji, reporting *H. whitmaei* densities from shallow water manta surveys. Densities were slightly higher in Lau than surveys by the Fiji Department of Fisheries of Bua Province in the island of Vanua Levu. The density noted on hard benthos deeper SCUBA surveys was 3.1 ind. ha⁻¹ lower than 2003 but higher than 2009 measures (Friedman *et al.*, 2010; Friedman *et al.*, 2011). Pakoa *et al.* (2014b) in 2012 and 2013 surveyed numerous new sites across Fiji, recording *H. whitmaei* in shallow water manta surveys at low density (< 1.5 ind. ha⁻¹) at only two of the eight sites sampled, and one of eight shallow reef snorkel sites (45.8 ind. ha⁻¹). Surveys in 2014 and 2015 of two differing sites from previous studies – at shallow water sites on scuba (Lalavanua *et al.* 2017; Mangubhai *et al.* 2017) recorded densities of *H. whitmaei* of 31 ind. ha⁻¹ at one site, and only in a non-fishing area.

Deepwater surveys of *H. fuscogilva* between 2003 and 2009 recorded declines in density of 84 percent; however these surveys were not comprehensive in scope (Friedman *et al.*, 2010). Pakoa *et al.* (2014b) surveyed new sites across Fiji in 2012 and 2013, however no deeper water surveys were completed. Recording of *H. fuscogilva* were made in shallow-water manta surveys at five of the eight sites (< 0.6 ind. ha⁻¹). Jupiter *et al.* (2013) surveys across sites in the Lau islands reported *H. whitmaei* but only from shallow water manta surveys (< 1 ind. ha⁻¹). No deep dives were conducted for *H. fuscogilva* in later surveys (Pakoa *et al.* 2014b and Lalavanua *et al.* 2017).

In summary, as a result of declines of *H. whitmaei* of 70 percent within early surveys, and the reporting of continued and expanding fishing in recent decades, there was little indication of recovery and therefore concern for the status of black teatfish stocks in Fiji. Despite these surveys not being as extensive in nature as those in Tonga, and with that data not well aligned spatially through time, marked declines were suspected (a combination of the long-term extent and recent rate of decline). Taking the full range of information into account, the Expert Panel determined that the data for *H. whitmaei* met the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17). There was no information for *H. fuscogilva* having met the criteria. Despite the worrying reports in the growth of underwater breathing apparatus operators across Fiji (Pakoa *et al.* 2014b: see appendices in that report), there was a lack of recent deepwater survey information to make a clear determination. In summary, insufficient access to status data limited the Expert Panel's ability to make a determination on whether *H. fuscogilva* met the CITES Appendix II listing criteria (CITES Resolution Conf. 9.24. Rev. CoP17).

Solomon Islands

Surveys were conducted at four locations in the Solomon Islands in 2006 (Pinca *et al.*, 2009b). A larger-scale survey was conducted across the Solomon Islands during 2012 and 2013, which showed varying results for both *H. whitmaei* and *H. fuscogilva* (Pakoa *et al.*, 2014c).

In the 2006 survey, densities of *H. whitmaei* were observed to be 0.0 at Ngella, 3.5–10.4 at Marau, 0 at Rarumana and Chubikopi. In the 2011, densities of *H. whitmaei* were reported to be 0 ind. ha⁻¹ at Rarumana and Chubikopi, 3.5 ind. ha⁻¹ at central Malaita, 11.5 ind. ha⁻¹ at Kia, 1.7 ind. ha⁻¹ at Marau open, 6.9 ind. ha⁻¹ at Ngella MPA, 2.8 ind. ha⁻¹ at Ngella open, 1.6 ind. ha⁻¹ at reef Islands, 1.4 ind. ha⁻¹ at Russell Island open, 15.6 ind. ha⁻¹ at Tapazaka, 3.2 ind. ha⁻¹ at Taro, 4.6 ind. ha⁻¹ at Tatamba and 0.3 ind. ha⁻¹ at Santa Cruz. Of the sites surveyed, four are directly comparable over time. From 2006 to 2011, surveys showed an increase in abundances of *H. whitmaei* at Ngella, similar densities at Marau, and no *H. whitmaei* observed at Raraumana or Chubikopi in either survey.

In the 2006 survey, densities of *H. fuscogilva* were observed to be 0.0 ind. ha⁻¹ at Ngella, 6.9–17.4 ind. ha⁻¹ for Marau, 0.0 ind. ha⁻¹ at Rarumana, 2.1 ind. ha⁻¹ at Chubikopi. In the 2011, densities of *H. fuscogilva* were reported to be 8.3 ind. ha⁻¹ at Chubikopi, 7.2 ind. ha⁻¹ at Kia, 26.0 ind. ha⁻¹ at Marau MPA, 8.6 ind. ha⁻¹ at Marau open, 6.9 ind. ha⁻¹ at Ngella MPA, 5.6 ind. ha⁻¹ at Ngella open, 11.9 ind. ha⁻¹ at Rarumana, 3.2 ind. ha⁻¹ at Reef Islands, 11.5 ind. ha⁻¹ at Russell Island open, 6.9 ind. ha⁻¹ at Santa Cruz, 5.2 ind. ha⁻¹ at Tapazaka, 22.4 ind. ha⁻¹ at Taro, 23.1 ind. ha⁻¹ at Tatamba, 8.3 ind. ha⁻¹ at Ugi, 2.5 ind. ha⁻¹ at west Guadalcanal open. Of the sites surveyed, four are directly comparable over time. Between 2006 and 2011 there was an increase in average abundance estimates of *H. fuscogilva* at Chubikopi, Ngella and Rarumana while similar densities were observed at Marau.

A small time-series dataset on *H. fuscogilva* is also available for surveys conducted at one location in the late-1990s and early-2000s, across areas both closed and open to fishing. These showed an abundance of *H. fuscogilva* that nearly doubling at two closed sites and decreasing by up to 90 percent at four sites in the fished areas (Lincoln-Smith *et al.*, 2001). The trend suggested that the closed areas increased abundance at some sites and prevented declines at others. The densities of *H. fuscogilva* in closed areas was estimated at 16 ind. ha⁻¹.

In summary, this information provides some insight into measuring population trends and potential recovery (and increases) of *H. whitmaei* and *H. fuscogilva*. With this information and noting that densities reported in 2011 are above the baseline ‘rule-of-thumb’ thresholds (see Pacific Islands Region section), *H. whitmaei* and *H. fuscogilva* in Solomon Islands do not meet the listing criteria for CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

Australia

In the Great Barrier Reef region (GBR), catches of *H. whitmaei* rose rapidly during the early-1990s (Uthicke, 2004; Eriksson and Byrne, 2015). Surveys of over 60 reefs conducted in 1998–1999 along the entire Great Barrier Reef conducted allowed a comparison between reefs fished and reefs protected from fishing (Green Reefs or No-Take Zones) (Uthicke, 2004). This comparison showed that fishing reduced the densities of *H. whitmaei* on the fished reefs by about 75 percent from densities of 5–21 ind. ha⁻¹ (Uthicke and Benzie 2003; Uthicke, 2004). GIS-based model calculations indicate that an initial virgin biomass of about 5 500 tonnes was reduced by 2 500 to 3 000 tonnes. Uthicke (2004) state that stocks of *H. whitmaei* were reduced to approximately 20 percent of virgin abundance in fishing grounds. In mid-2019, after a long period of zero-quota allocations (i.e. no *H. whitmaei* catch since 1999; see Eriksson and Byrne, 2015) the fishery will receive quota allocations again in 2019. This re-opening of black teatfish fishing follows an extensive 2015 survey of previously fished locations and closed areas (Knuckey and Koopman, 2016 [report embargoed until mid-2019]). The range of average *H. whitmaei* densities observed spanned 12–27 ind. ha⁻¹ which are similar or above the ‘rule-of-thumb’ threshold (10 ind. ha⁻¹) for this species in a suitable habitat (Pakoa *et al.* 2014). The average densities on both closed and open reefs of > 12 ind. ha⁻¹ were not statistically different between previously fished and ‘closed’ reefs. Like Uthicke and Benzie (2003), the 2016 survey found no difference in weights of individuals between historical zoning (Knuckey and Koopman, 2016 [report embargoed until mid-2019]). This recovery in densities mirrors a separate *H. whitmaei* population recovery reported in the Torres Strait after a seven-year closure, when black teatfish populations returned to near natural (unfished) densities (Skewes *et al.*, 2010).

H. fuscogilva became a key target species with the decline of *H. whitmaei*, with catches higher prior to 2004–2005, but lower and stable exploitation during 2004–2011 (Eriksson and Byrne, 2015).

Further north in the Coral Sea, a decline in catch and catch rates of *H. whitmaei*, starting from a far lower peak than recorded in the GBR marine park, resulted in annual catch limits being reduced. Since 2003–2004, the annual sea cucumber catch has fluctuated between 0.0 and 9.2 tonnes. Annual catches since 2007–2008 have generally been less than 3 tonnes, with 2.8 tonnes recorded in 2016–2017. Average animal weights from commercial catch data are used to estimate biomass, and surplus production models relative to 1997 levels are used to estimate maximum sustainable yield (MSY). Today *H. whitmaei* is classified as not overfished and not subject to overfishing (ABARES 2017, ABARES 2018). In addition, the Coral Sea fishery for *H. fuscogilva* is maintained through a TAC using ITQs and assessed as sustainable.

A summary for understanding the status of teatfish for Australia's Pacific coast is that earlier indications of marked historical rates of decline for *H. whitmaei* prior to 1999 have been reversed through a cessation of fishing for over 17 years. Some stocks were also protected in no-take reserves (green zones). This has resulted

in a recovery on the GBR to a level where fishing can recommence. Australia's CSIRO evaluated harvest strategies for their sea cucumber fisheries (Skewes *et al.*, 2014), finding that despite some information gaps, in general the current management arrangements, "result in a low risk to most fishery species". For the GBR and Coral Sea area, *H. whitmaei* stocks have now been assessed to be fished within sustainable limits and are not subject to overfishing (ABARES 2017; 2018): they therefore do not meet the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17). Similarly, a reported sustainable take of *H. fuscogilva* (assessments in 2015, 2017), maintained through a TAC using ITQs is assessed as not meeting the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

In Western Australia, *H. whitmaei* catches along the coastline and inshore islands is sporadic (Gaughan and Santoro, 2018: see section on sea cucumbers), with the annual catch levels remaining within acceptable range as defined by the WA Fishery Department. Densities of *H. whitmaei* within protected reef areas (e.g. Ningaloo Marine Park) have been recorded at densities ranging from 19–27 ind. ha⁻¹ (Shiell, 2004; Shiell and Knott, 2012). *H. whitmaei* populations on more isolated coral reefs off the NW Australian coast are more difficult to manage and are dependent on self-replenishment, making them vulnerable to over-exploitation. At Ashmore Reef, Ceccarelli *et al.* (2011) noted low numbers of *H. whitmaei* (< 1 ha⁻¹), with a 75 percent fall in abundance between 1998 and 2006. In the case of *H. fuscogilva*, the 1998 density of 1.4 ind. ha⁻¹ fell to 0.2 ind. ha⁻¹ by 2006, which is a 86 percent decline (Ceccarelli *et al.* 2011). The remote reefs of Ashmore, Cartier (Smith *et al.*, 2001, 2002) and Mermaid (Rees *et al.*, 2003) have traditionally been over-harvested by passing fishing boats originating from a range of countries. In the Timor Box MoU area, surveys at Ashmore, Browse, Cartier, Hibernia, Scott and Seringapatam Reefs returned densities for *H. whitmaei* of 0.23 ind. ha⁻¹ (Skewes *et al.*, 1999). For *H. fuscogilva*, extremely low densities have been recorded at 0.03 ind. ha⁻¹ (Skewes *et al.*, 1999). Due to these low densities, it was recommended that the fishery for these two species be closed. An assessment of the density of *H. fuscogilva* at the Cocos Keeling Island (a remote territory of Australia in the Indian Ocean) returned a low density of 0.3 ind. ha⁻¹ (Bellchambers, 2011; Bellchambers and Evans, 2013).

In summary, Australia's Indian Ocean coastline reflects two differing situations in relation to the CITES criteria. In the case of the mainland coast, including inshore islands and protected areas like Ningaloo, abundances are at least equal to, or greater than those described on reefs closed to fishing on the Great Barrier Reef (Uthicke and Benzie, 2000; Byrne *et al.*, 2004). As a result, because of these higher densities, *H. whitmaei* and *H. fuscogilva* do not meet the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17). However, declines and low densities recorded for *H. whitmaei* and *H. fuscogilva* on remote offshore reefs would likely trigger the thresholds for marked long-term extent and recent rate declines.

Republic of Indonesia

Surveys were conducted in the Bunaken Marine Park, north Sulawesi in the Indonesia Islands from 1993–2010 (Lane and Limbong, 2013). For *H. whitmaei*, numbers fluctuated between 1993 and 2010, but it has not been observed in the last five survey periods from 2007–2010. *H. fuscogilva* was observed in most yearly surveys, with numbers increasing up to 2009. For the years that *H. fuscogilva* was observed, densities ranged from 2.5–5.3 ind. ha⁻¹. In 2010, *H. fuscogilva* was not observed. Low count rates or total absence indicate that stocks of teatfish species are generally low.

In summary, and noting that this information is from only one small locality, the Expert Panel determined that indications from the information for *H. whitmaei* suggest that the species has been extirpated from this locality and thus likely meets the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17). The study provides evidence of both decreases and increases of *H. fuscogilva*. Based on limited spatial coverage of available *H. fuscogilva* density estimate data, the Expert Panel considered the available information insufficient to make a determination against the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

Republic of Maldives

Joseph (1992) visited a total of 17 islands in seven atolls in 1991 to assess the sea cucumber fishery. At that time the fishery was very new, having commenced in 1985, with teatfish collected and exported from late 1986. At that time only Kadholhudhoo had fishing with fishers using SCUBA and declines in catches were noted. By 1988, three mechanized boats carried fishers from all the northern atolls except Haa Dhaalu. At this time 17 divers worked in two groups, generally working in the same area and fishing for sea cucumber 15–20 days/month for 9 months of the year. Joseph (1992) notes that the Ministry of Fisheries and Agriculture

recorded exports of teatfish species of 67 tonnes, 54 tonnes and 99 tonnes for 1988, 1989 and 1990 respectively, which dropped again after 1990. Joseph (1992) named these exports as *H. nobilis*, however this was possibly a mix of *H. nobilis* and *H. fuscogilva* teatfish species.

The ecology of *H. fuscogilva* was assessed at North Male and Laamu Atolls in the Republic of Maldives in 1994–1995 (Reichenbach, 1999), with a relative abundance of *H. fuscogilva* ranging from 70–95 percent of all sea cucumbers observed on lagoon floor habitat in the two atolls studied. In one island gap area the median density for *H. fuscogilva* was 29 ind. ha⁻¹ with a maximum of 43 ind. ha⁻¹, and the catch per unit effort of Laamu Atoll was considered higher than that recorded in New Caledonia by Conand (1981), while the CPUE at North Male Atoll was lower. A later survey in north Male Atoll, likely from the early 2000s, did not observe *H. fuscogilva*, but found abundances of *H. nobilis* to be 0.4 percent relative to the total number of individuals encountered at all sites from eight islands, using 40-minute searches along a transect parallel to the reef crest (Muthiga, 2008).

Extensive surveys (45-min searches within 13 sites at each of 9 islands, including 11 dives deeper than 10 m) at Baa atoll in 2014 found 0 ind. ha⁻¹ for both *H. fuscogilva* and *H. nobilis* (Ducame, 2015), despite *H. fuscogilva* being found on the same atoll in 2009 (Andréfouët, 2012). There were no previous records of *H. nobilis* from Baa atoll. Other surveys in 2015 (multiple transects at each of 3 sites at 12 island reefs) at Ari Atoll in 2015 found 0 ind. ha⁻¹ for both *H. fuscogilva* and *H. nobilis*. These surveys were in shallower water (< 10m depth), despite both species being found at other atolls in this survey (Ducame, 2016).

In summary, this finding of low current teatfish species densities provides potential insight into declines of *H. nobilis* and *H. fuscogilva* for atoll systems in the Maldives, but does not provide sufficient information to make a determination against the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17).

Egypt

The sea cucumber fishery in Egypt has been described by Lawrence *et al.* (2004), where it began in 1998 in the southern part of the country using trawling vessels. It expanded dramatically and the Red Sea Governorate initiated a ban in 2001 but illegal fishing was reported to have continued. The ban was lifted in 2002 and preliminary observations showed a rapid decline of resources, which resulted in a new ban in 2003.

Two sites, Wadi Quny and Eel Garden in the Gulf of Aqaba were surveyed on four occasions over 11 years (Hasan and El-Rady, 2012). Lawrence *et al.* (2004) surveyed 116 sites between 2002 and 2003 and documented both teatfish densities across sites, but also the growth in fishing effort over time and the decline in sea cucumber catches. At sites surveyed in 1995 (predating active fishing for sea cucumbers) both *H. nobilis* and *H. fuscogilva* were recorded with densities of 16.7 ind. ha⁻¹ for *H. nobilis* at one site and 6.7 ind. ha⁻¹ at the other (Hasan and El-Rady, 2012). Additional surveys were conducted in 2002, 2003 and 2006 while the fishery was active. By 2002, densities of *H. nobilis* had decreased to 0.7 ind. ha⁻¹ for *H. nobilis* at one site and 1.3 ind. ha⁻¹ at the other. *H. fuscogilva* was reported absent from further surveys and *H. nobilis* was absent in the 2003 and 2006 surveys. Lawrence *et al.* (2004) recorded both species in their surveys in 2002–2003, although these were limited to sites that had benefited from some form of protection. Ahmed and Lawrence (2007) updated the situation a few years later. Following the initial study, they revisited some sites to determine whether there was any evidence of stock recovery following the 2003 fishery ban. Four sites were assessed using the belt transect method applied in the original study. The sites were selected based on their accessibility, initial levels of stocks and levels of exploitation. A further six sites were visually assessed to determine the presence or absence of commercial species. It appeared that four years after the ban on the fishery, there was some evidence of the return of selected commercial species to some of the sites, but no evidence of stock recovery.

Due to the report of species' loss from the above studies, the Expert Panel contacted a range of diving organizations in Egypt during the Expert Panel's sitting period to ascertain if *H. nobilis* and *H. fuscogilva* were being observed during tourists' recreational diving activities. In response both the Oonas Dive Club, Na'ama Bay, Sharm El Sheikh, Egypt (Tel: +20 (0) 69 3600 581, E-mail: info@oonasdiveclub.com, contact Amy Oxtoby, Dive Centre Manager) and Elite Diving, Web www.elite-diving.com (Tel: +201224308780, E-mail: alun@elite-diving.com, contact Alun Evans, Dive Centre Manager) responded with notification that both *H. nobilis* and *H. fuscogilva* were commonly seen on their dives, supplying images of the species for verification of this information. In the case of *H. nobilis*, the shallow water species, a photo was supplied taken 25 January 2019 (in response to the FAO request for a species verification).

Hasan and El-Rady (2012) suggested that trade regulations through CITES might help to manage the sea cucumber fishery in Egypt. The Egypt fishery has been closed in the past due to overfishing. In summary, the information provided from these surveys offers evidence of marked declines in both *H. nobilis* and *H. fuscogilva* that likely meets the criteria for listing under CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17), however the common sightings reported by dive operators should also be factored into any consideration of stock status.

RESULTS OF SPATIAL COMPARISON OF SINGLE SURVEYS AGAINST RULE-OF-THUMB THRESHOLDS

Much of the information examined by the Expert Panel involved single surveys that included teatfish species. To support the response to the proposal, a number of specific examples are detailed below.

Pacific Islands Region

From shallow reef and lagoon reef survey records collected across Pacific Island countries (Pinca *et al.*, 2010), teatfish density records were collected both in locations subject to low fishing pressure, or protected areas that allowed the Secretariat of the Pacific Community to define a ‘rule of thumb’ baseline threshold for ‘healthy’ *H. whitmaei* stocks (Pakoa *et al.*, 2014). This ‘rule of thumb’ threshold (10 ind. ha⁻¹ for broadscale surveys, scaled down from 12.5 ind. ha⁻¹, reported in Kinch *et al.* 2008 and Pinca *et al.*, 2010), closely reflected other studies in Eastern Australia (Uthicke *et al.*, 2004a), and Western Australia (Shiell and Knott, 2010). Shiell and Knott (2010) reported minimum natural population density estimates of between 11.4 and 17.1 ind. ha⁻¹, a threshold calculated by including only habitats occupied by *H. whitmaei*. A similar ‘rule of thumb’ for *H. fuscogilva*, taken from deep-dive surveys resulted in a baseline threshold of 10–20 ind. ha⁻¹ (; Pakoa *et al.*, 2014).⁵

High densities of teatfish greater than 100 ind. ha⁻¹ are not unprecedented, but are seldom reported for adult specimens. For *H. whitmaei*, healthy densities have also been reported on reefs of Papua New Guinea (Lokani 1990), New Caledonia (Conand, 1989), the Great Barrier Reef (Byrne *et al.*, 2004) and the north-west of Western Australia (Shiells and Knott, 2011); higher density aggregations of *H. fuscogilva* have been observed in Papua New Guinea (Skewes *et al.*, 2002a).

Comparing the density of teatfish species at a wide range of reefs open to fishing showed that most fished reefs held less than 25 percent of baseline rule-of-thumb threshold for *H. whitmaei*. Even when areas had been ‘closed’ for a reasonable closure period (e.g. 10 years), reports of population recovery were variable (Uthicke *et al.*, 2004a; Friedman *et al.*, 2004; Friedman *et al.*, 2011; Skewes *et al.*, 2010; Knuckey and Koopman, 2016 [report embargoed until mid 2019]). A description of densities for teatfish species from snapshot or one-off (irregular) surveys are given below, to reflect survey densities against the ‘rule of thumb’ thresholds described above.

Papua New Guinea

In the Milne Bay Province of Papua New Guinea, *H. whitmaei* density was reported to be of 0.2 ind. ha⁻¹ (Skewes *et al.*, 2002a). Densities observed during the survey are far lower than comparable fished reefs in Torres Strait (Long *et al.*, 1996; Skewes *et al.*, 2002b) and similar to fished areas such as the Timor MOU Box in Western Australia (Skewes *et al.*, 1999). The Expert Panel noted that densities for both teatfish species were below both of the respective thresholds and there were recommendations that the *H. whitmaei* fishery be closed as a result of the low numbers observed. However, given the constant volumes of exports for both teatfish species, this would imply that stocks are relatively stable and that both species are still widespread around PNG, despite being at well below threshold densities.

Sri Lanka

Surveys were conducted in eastern and northwestern Sri Lanka with densities of *H. nobilis* and *H. fuscogilva* being < 1 ind. ha⁻¹ (Dissanayake and Stefansson, 2010).

⁵ The habitat for this species is harder to locate from the surface, and may require some in-survey searching, hence the wider range of the baseline threshold.

Mayotte (overseas department and region of France)

To improve ecological understanding of the targeted species, the reefs of Mayotte, in the Western Indian Ocean, were surveyed by Eriksson *et al.* (2012). It should be noted that Mayotte reefs were closed to fishing, and the national fishery ministry had decided not to allow fishing of sea cucumbers. The mean density of 10–20 ind. ha⁻¹ for *H. nobilis* in surveyed areas in Mayotte are similar to ‘natural’ densities from the Pacific Islands region (Eriksson *et al.*, 2012).

Seychelles

Due to the large marine area of the Seychelles, surveys were carried out during 2003–2004 at the Mahe and the Amirantes Plateaux (Aumeeruddy *et al.*, 2005). Sea cucumbers have been harvested in the areas by industrial-scale fishers. Densities of *H. nobilis* were recorded at 2.0 ind. ha⁻¹ whilst *H. fuscogilva* was reported to be 0.6 ind. ha⁻¹ (Aumeeruddy and Conand, 2008). *H. nobilis* was considered under-exploited whilst *H. fuscogilva* was considered to be fully exploited. A later survey reported *H. nobilis* counts from 154 m² plot, noting higher densities in closed areas than areas open to fishing (Cariglia *et al.*, 2013)

Zanzibar

Stock assessments of commercial sea cucumbers were conducted by visual census using line transects and ‘manta-tow’ transects at Mkokotoni, Uroa and Fumba. *H. fuscogilva* densities of 0.1 ind. ha⁻¹ were recorded (Muthiga, 2014). This survey method and results are problematic for density estimates, as it is commonly acknowledged that *H. fuscogilva* inhabit deeper water environments.

Underwater surveys were also performed in 2009 (Eriksson *et al.* 2010) on reefs near villages of Mkokotoni, Fumba, and Uroa, and within the marine reserve of Chumbe Coral Park. The surveys found no *H. nobilis* in the fished areas and only a low density (1.2 ind. ha⁻¹) in the marine reserve site.

RESULTS OF THE CHANGING STATUS OF SEA CUCUMBER COMMODITIES IN THE MARKET

Trends in the documented flows of trade are not necessarily evidence of concomitant trends in in-water species abundance – but they are indicative of likely trends, and provide additional evidence when dealing with data-poor situations. Acquiring accurate signals from an approach along multiple lines is significantly hampered by: records not classifying trade to species level; inconsistencies between data reported by exporting countries and importing countries; inconsistencies between national export statistics and that reported to FAO; the high degree of re-exporting; the combination of frozen and dried weights in some statistics; and the general level of undocumented trade. Although world tropical fisheries for holothurians appear to be increasing (Conand, 2018) there is a general understanding that major producing regions have seen exports decline markedly (see Figure 5; Govan, 2017).

CITES recognizes these complications and does not include analysis of declines in trade as part of the decline criteria (see listing criterion 2aA in Resolution 9.24 when read in conjunction with the footnote for aquatic species in Annex 5, which describes whether the species is in international trade and whether there is a decline). However, in this case the ‘decline’ refers to: “a reduction in the abundance, or area of distribution, or area of habitat of a species” (i.e. not trade). In the context of CITES criteria, this examination of trade is therefore useful as supporting information, but not as a direct measure of ‘decline’. Looking for trade trend information for the teatfish species as supporting information for whether a species meets the listing criteria for CITES Appendix II (CITES Resolution Conf. 9.24. Rev. CoP17) is further complicated by the nature of the fishery in many regions where periodic closures and openings of sea cucumber fisheries result in boom-and-bust fluctuations in the trading of sea cucumber species, the which does not always accurately reflect stock status (see Eriksson *et al.*, 2017: Figure 3; Pakoa *et al.*, 2013: Figure 4).

Most producing regions have seen shifts in exports from higher-value species (such as the teatfish species) to more mixed and then lower-valued species. Anderson *et al.* (2011) found that species trade shifts from high-value species to low-value species occurred in 22 out of the 29 fisheries they examined.

In the Philippines, sea cucumber exports have involved increasing effort for declining export volumes, which are in turn made up of greater numbers of lower-value species (Akamine, 2001; Gamboa *et al.*, 2004). There are also local, anecdotal examples of sea cucumbers and teatfish species (e.g. Fabinyi, 2018; Jontila *et al.*, 2018) no longer being harvested in areas where they once were.

In Papua New Guinea, the nationally available aggregated data suggest that, between 1994 and 2005, exports of black teatfish declined and white teatfish increased (Govan *et al.*, 2019: Table 4). Data from one of the major beche-de-mer producing provinces in Papua New Guinea, Milne Bay (recent national data are not yet available), show that the proportion of *H. whitmaei* and *H. fuscogilva* in exports remained relatively similar after a moratorium of 7 years, to pre-moratorium levels.

In the Solomon Islands the data may be subject to misidentification errors, but in general the data shows a reduction in catches for *H. whitmaei* and *H. fuscogilva* (see Govan *et al.*, 2019: Figure 7). The data available for Vanuatu do not allow for time-series comparisons, while for Fiji the variations in the export of *H. whitmaei* and *H. fuscogilva* appear – generally speaking – to follow the variations of beche-de-mer exports, suggesting that identification by species is less than reliable, and that there is low confidence in the integrity of the data by volume (see Govan *et al.*, 2019: Figure 1).

In Australia the capture of sea cucumbers was dominated by *H. whitmaei* during the 1990s. Following declines in catches despite increasing effort, the fishery for *H. whitmaei* was closed in 1999 (Eriksson and Byrne 2015).

Indonesia was the largest importer of tropical dried beche-de-mer into Hong Kong SAR in to 2012–2016 period (To *et al.* 2018). There is a paucity of information on Indonesian sea cucumber trade, although there are local cases of sea cucumbers no longer being harvested in areas where they used to be harvested, including teatfish species (Massin 1999; Schwerdtner Máñez and Ferse 2010). Export data of sea cucumbers show fluctuating exports in the 2012–2017 period (UN Comtrade data).

In Kenya, fisheries department data and reported Kenyan imports into Hong Kong SAR show a variable and declining trend of production (Muthiga *et al.*, 2007). In Madagascar, exports peaked between 1991 and 1994 and subsequently declined until 2004 with the exception of a sharp uptick in 2002 (Rasolofonirina, 2007). In the Seychelles, the numbers of sea cucumbers harvested increased significantly overall between 2001–2006; the numbers of *H. nobilis* harvested increased from 7 794 tonnes to 8 753 tonnes while the numbers of *H. fuscogilva* increased from 17 202 tonnes to 31 899 tonnes (Aumeeruddy and Conand 2008: Table 2). By 2014, production of sea cucumbers had decreased overall in most countries of the Western Indian Ocean except the Seychelles (Muthiga and Conand, 2014: Table 17). In Sri Lanka, exports appeared to peak in the late 1990s and then decreased significantly in the early 2000s (Kumara *et al.*, 2005).

While imports into Hong Kong SAR have been declining since 2013 (To *et al.*, 2018), this may mask alternative trade routes that are less well documented.

There is no published information on the status of teatfish species in the Chinese market over time.

Comments on technical aspects relating to management, trade and likely effectiveness of implementation of a CITES listing

Management comment

Summary of fishery management issues:

Teatfish species are predominantly exploited in small-scale and artisanal fisheries through most of their range, with little international or regional coordination in management. Harvests at national and smaller scales have proved difficult to manage, with booms in fishing typically followed by fishery closures or moratoriums on fishing once stocks are depleted. Sea cucumber fisheries and postharvest processing of their products commonly suffers from weak management and/or enforcement, and high pressures from largely foreign buyers have proved difficult to counter.

Many of the sea cucumber fisheries in the Indo-Pacific suffer from fishing pressure and poor management (Kinch *et al.*, 2008; Conand, 2008; Choo, 2008). Persistent pressure from buyers (predominantly from Asia) to supply sea cucumber products creates unsustainable fisheries especially in countries that have poor development indices and other governance issues (e.g. high levels of corruption, and unlawful activity along the value chain). Generally, sea cucumbers are not important as a food source in producing countries but the income from harvesting and selling sea cucumbers can contribute strongly to poverty reduction and (indirectly) to food security.

In most countries where teatfish species occur, 10–40 species of sea cucumber are also harvested (Purcell *et al.*, 2013). A noticeable aspect of the sea cucumber fishery and beche-de-mer trade is that high-value species (of which *H. fuscogilva*, *H. nobilis* and *H. whitmaei* are included) are initially targeted. When these are over-exploited a movement down the value chain occurs, with lower value sea cucumbers species harvested; at the same time, medium-value species move up the value chain as high-value species become less prominent in trade (Eriksson and Byrne, 2015; Purcell *et al.*, 2013). High-value species, such as the teatfish species will continue to be collected opportunistically even after densities have reduced significantly (Branch *et al.*, 2013).

The optimum size for an MPA to preserve a population of holothurians at sustainable levels will vary among species. For example, recovery of *H. whitmaei* on the Great Barrier Reef was observed only in closed MPAs that were 28 km long, while smaller areas of approximately 11 km long showed no difference in stocks compared with fished areas (Uthicke and Benzie, 2000).

Currently adopted management regimes/measures related to governance, population monitoring and compliance

International management

There are no known international protections for these species.

Regional management:

There are few, if any, management measures at the regional scale. In the past the Secretariat of the Pacific Community (SPC) and the IUCN have put forward ideas for a regional approach to sea cucumber trade, but few tangible outcomes have eventuated (Friedman, 2008). Fishery management happens predominantly at the national level, and regulatory measures are, for the most part, decided and implemented by national government fishery ministries. Nevertheless, some co-management arrangements exist in some range states.

The Melanesian Spearhead Group, which is made up of the independent states of Papua New Guinea, Solomon Islands, Vanuatu and Fiji, as well as the indigenous Kanak population of the French territory of New Caledonia (the Indonesia Province of Papua has observer status) signed a Memorandum of Agreement as well as a Roadmap for Inshore Fisheries Management and Sustainable Development in 2015 (MSG Secretariat 2015a; 2015b). These initiatives were put in place to assist collaboration in the management, maintenance and restoration of sea cucumber stocks, with the goal of maximising long-term economic value and ecological sustainability within the states' respective sea cucumber fisheries and beche-de-mer trade. In 2017, Pacific MSG member countries agreed to on a minimum size limit for harvesting live sea cucumbers and selling dried beche-de-mer (Govan, 2017), agreeing to improve the coordination and sharing of harvesting, operator and market information between MSG members to increase prices and facilitate control.

National measures:

Apart from regulations on minimum legal size limits for teatfish species, the other management measures in nearly all of the range countries apply to sea cucumbers as a whole. There are a range of inter-governmental, non-governmental and governmental organizations with remits in the Indian and Pacific Oceans that promote and support the research and governance of sea cucumbers by range states. These organizations include WIOMSA, ACIAR, SPC, WorldFish, Wildlife Conservation Society and FAO. For example, SPC led a regional assessment of sea cucumber populations across 17 Pacific Island countries and trained numerous national fishery officers to perform underwater population surveys. However, few range states carry out population monitoring of stocks on a regular basis to provide evidence of trends in stock abundance for particular species.

Regulatory measures most common in sea cucumber fisheries in the Indo-Pacific are minimum legal size limits, gear restrictions (bans on the use of scuba), requirements for exporters to submit logbooks, and no-take reserves (FAO, 2012; 2013; Purcell *et al.*, 2013). The effectiveness of these measures is variable and sometimes limited. In some countries, total allowable catch quotas are used specifically for teatfish species. However, catch quotas do not work well in sea cucumber fisheries for reasons relating to the artisanal nature of most fisheries, shortcomings in catch reporting and monitoring by national fisheries agencies, and the intractable problem of communicating closures to remote village fishers when quotas are reached (Purcell, 2010). Owing to these problems, the quotas for teatfish species are often exceeded in small island states such as Tonga and Papua New Guinea. In Seychelles and Australia, the quota regulations operate more effectively,

mainly because there are fewer fishers than in most other tropical sea cucumber fishers and catch reporting is unusually better organized.

In Papua New Guinea, total allowable catches were previously determined for individual species including teatfish species, though these have not implemented per se beyond a total allowable catch which is determined for each province (Government of Papua New Guinea, 2018).

On the Great Barrier Reef, *H. whitmaei* were harvested by only a few fishing companies and stocks had shown a decline by 75 percent on fished reefs compared to unfished (sanctuary) zones (Uthicke 2004, Uthicke *et al.* 2004). A specific ban was placed on *H. whitmaei*, which has been active for over 16 years.

Local measures:

Management of sea cucumber stocks at the local level is usually done through co-management arrangements with NGOs or other partners. There are other examples of communities managing their sea cucumber stocks either by their own governance arrangements or in partnerships, but these have failed due to intense economic pressure. For example, at Ontong Java Atoll in the Solomon Islands, when the Area Council was strong, the sea cucumber fishery proved to be a sustainable and a reliable income source. The collapse of the Area Council's authority in 1996 resulted in a lack of compliance with the former closed-season restrictions, which in turn led to sea cucumbers being harvested in greater quantities, leading to an eventual collapse of wild stocks (Bayliss-Smith *et al.*, 2010; Christensen, 2011). Cohen and Steenbergen (2015) note that for Indonesia decisions to open the sea cucumber fishery and the quantities harvested were dictated by social and economic factors, influenced by community needs or agreements with middlemen, without further reference to results from monitoring – and this in spite of data being provided to the church council on stock densities by an NGO in order to inform harvesting regimes. In a different approach, Rasmussen (2015) describes an attempt by the Mbuke Islanders in the Manus Province of Papua New Guinea, to form a community-based business enterprise in the mid-to-late-2000s. The business focused on benefiting from the post-capture component of the in-country market chain (on buying and processing beche-de-mer) in order to have some influence on management and increase economic returns, but the enterprise failed due to overfishing of sea cucumber stocks and the poor quality of the beche-de-mer produced.

Trade comment

Summary of trade issues:

International trade of sea cucumbers, including teatfish species, has been well documented for several centuries, and in recent decades' production and trade of teatfish species has expanded spatially. Being of high value, teatfish species are preferentially targeted by fishers and exporters. Teatfish species sold to markets, primarily in East Asia, can realize prices over US \$200/kg, with prices that vary greatly depending on the size and processing quality of sea cucumbers. Overall, these values are increasing as supply declines struggle to supply growing markets. Trade value chains and fishery to market traceability remain largely opaque at a species level, due to the specialized nature of this trade that is handled by a small number of well-connected agents. Trade is currently proceeding through hubs in Hong Kong SAR, Vietnam and China, where product can be both transited for further re-export or sold directly, with IUU trade still too common across market chains.

Export trade of sea cucumbers, has been well-documented since the early 18th century, when sea cucumber trade between Southeast Asia and China began and then expanded rapidly during the 18th and 19th centuries (MacKnight 1976; Warren, 1981; Sutherland, 2000; Akamine, 2001; Dai, 2002; Tagliacozzo, 2004). Sea cucumbers are mostly traded as whole dried animals, called beche-de-mer, trepang, gamat and balat. Sea cucumbers that are consumed in China, Asia and around the world, are associated with traditional Chinese medicine and are seen as a health food or wealth-status food item. In China, teatfish species are consumed primarily in southern provinces and SARs. Sea cucumbers are also incorporated into different products such as soap. The commercial value of a species is generally determined by its size, flavour and the thickness of the body wall. Species of high commercial value such as *H. whitmaei*, *H. nobilis* and *H. fuscogilva* tend to be traded preferentially (Purcell *et al.*, 2009; Purcell *et al.*, 2017a).

In the dried form, most of the tropical species can be distinguished from each other with some training/knowledge. Teatfish species are easily differentiated from other species of sea cucumbers, and can be distinguishable from one another (Purcell *et al.*, 2012a). However, it is expected that compliance and customs capacity could find it a challenge to distinguish specific teatfish species if not well informed or trained. Noting that in the guidance contained in CITES Resolution Conf. 9.24 (Rev.CoP17) on the ‘look-alike’ criterion in Annex 2b, the CITES Parties clarify that this criterion applies “when enforcement officers who encounter specimens of CITES-listed species are unlikely to be able to distinguish them”. Moreover, noting that such enforcement officers will usually not have received species-specific identification training, there may be ‘look-alike’ issues between the teatfish species proposed.

Sea cucumber fisheries have followed patterns of rapid spatial expansion at multiple scales, involving processes described as ‘serial exploitation’ (Anderson *et al.*, 2011), ‘roving bandits’ (Eriksson *et al.*, 2012) and ‘contagious exploitation’ (Eriksson *et al.*, 2015), involving a high level of IUU. Between 1996 and 2011, the number of countries serving the Chinese sea cucumber market expanded from 35 to 83 (Eriksson *et al.*, 2015). From 2012 to 2016, dried and frozen beche-de-mer was reportedly supplied to Hong Kong SAR by 119 and 48 countries/territories respectively (To *et al.*, 2018).

In recent years, there has been a new wave of illegal fishing involving vessels from the Republic of Vietnam. In the 2015–2017 period, Vietnamese Blue Boats were apprehended in: Queensland, Australia; New Caledonia; Solomon Islands and the Federated States of Micronesia. In Papua New Guinea, Vietnamese Blue Boats have been caught in the East Sepik, New Ireland and Milne Bay Provinces. In Milne Bay Province, the *FV Hoang Dung* was apprehended with 18, 200-litre drums of *H. whitmaei* and *H. fuscogilva*. Another three Vietnamese fishing vessels were apprehended shortly after with 77 drums of *H. whitmaei* and *H. fuscogilva*. After diplomatic pressure from the Australian Government, the Pacific Islands Forum Secretariat and the Forum Fisheries Agency, the Vietnamese Blue Boat incursions have ceased for the time being.

Currently the vast majority of harvested teatfish species are exported. Some insignificant quantities are consumed locally in producing countries, such as Tonga and Fiji (Purcell *et al.*, 2016). Most of the value of the product is captured by downstream actors (importers, wholesalers, retailers) in the value chain, and the proportion of value captured by downstream actors is greater for higher-value species including the teatfish species (Purcell *et al.*, 2017a). Much trade goes through a relatively small number of exporters. Product from various source countries is sold separately in bins and bags in Asian dried seafood markets and retail shops, sometimes with labels stating their source country, although mislabeling is likely widespread (Fabinyi *et al.*, 2017).

Hong Kong SAR has, for a long time, been the largest trade hub for sea cucumbers. Imports of dried sea cucumbers into Hong Kong SAR have been declining since 2013 (To *et al.* 2018). Countries such as China, Malaysia, Singapore, United Arab Emirates, Viet Nam and Yemen also play roles as tropical sea cucumber trade hubs and (in some cases) markets (Toral-Granda *et al.*, 2008). Since 2004, Hong Kong SAR re-exports to Vietnam have been greater than re-exports to China (To and Shea, 2012; Eriksson and Clarke, 2015). Viet Nam is also reportedly a major destination of direct exports, e.g. from Indonesia (UN Comtrade data), although it is likely that much of the product traded in Viet Nam is bound for mainland China (Eriksson and Clarke, 2015; To *et al.*, 2018), which is also likely to be an increasing destination for direct trade. A clear understanding of trade volumes is significantly hampered by the lack of transparency in trade between exporting and importing countries, Hong Kong SAR, Vietnam and mainland China. Much of this opaque trade operates clandestinely to avoid tariffs and is commonly referred to as ‘grey trading’ (Fabinyi *et al.*, 2017). The problem is compounded by the fact that commodity codes for trade data do not distinguish sea cucumbers by species. The main trade organization dealing with teatfish species in China (the Guangzhou Dried Seafood and Nut Industry Association) was consulted by the Expert Panel during the preparation of this report and the Expert Panel was advised that they did not publish data on trade by species. Similarly, only a small proportion of source countries collect export data for species separately, such as Fiji and Papua New Guinea.

As noted above, in retail markets in Hong Kong SAR, teatfish species are among the highest priced species of tropical sea cucumbers, averaging more than USD 200 kg⁻¹ (Fabinyi *et al.*, 2017; Purcell *et al.*, 2018). Prices of all tropical sea cucumbers are still well below the most highly-priced specimens of spiky sea cucumber *Apostichopus japonicus*. Prices of *H. whitmaei* and *H. fuscogilva* increased by 2.7–2.9 percent per annum between 2011 and 2016, above the average annual consumer price index in China. This suggests that despite the influence of a government anti-corruption campaign in China and a broader economic slowdown, market

demand for these species is expanding. In contrast to shark fin consumption in China, where additional factors may be dampening trade and consumption (such as environmentalist campaigns) (Eriksson and Clarke, 2015), increasing demand for sea cucumbers, including teatfish will strengthen incentives for capture and trade.

Likely effectiveness of a CITES Appendix II listing for conservation: summary comment in relation to technical aspects of biology, ecology, management and trade.

Summary of likely effectiveness of CITES listing:

Implementation of a CITES listing would require significant investments in the capacities of fisheries, conservation and trade agencies in both producing countries and in transit and market countries. Positive attributes of teatfish species for population assessment include their conspicuous and slow-moving nature and ease of identification in the wild, which all make fishery-independent population assessments technically undemanding although there are resources and capacity considerations. If additional support was provided to countries through technical assistance from regional agencies and increased partnerships across producing countries and between exporting and importing countries, then it is possible that CITES listing of teatfish species could have some benefit for conservation, and it could also provide a mechanism for comprehensive and standardized trade and quota reporting. The effects of a CITES listing on the nascent emergence of sea cucumber aquaculture could also be a consideration. Given that controls on illegal exports have proved to be of limited effectiveness in many source countries, illegal and unreported trade would be expected to continue unless there was significant investment in product traceability and increasing of surveillance across the market chain. As has been the case for other newly listed species (e.g., sharks, and seahorses), the Expert Panel expects that listing of teatfish species on Appendix II will prompt some countries to simply cease legal exports of these species specifically or all sea cucumber species, which would likely be of limited value in increasing governance in these high value, low volume fisheries.

Before any CITES Management Authority may issue a permit to allow exports of a species listed in Appendix II, its Scientific Authority must have advised that the proposed export will not be detrimental to the survival of a species: in other words, it must have made a positive non-detriment finding (NDF) and the Management Authority must ensure the trade is legal (i.e. a legal acquisition finding, LAF). The science-based process of getting a positive NDF focusses on assessing the risk of a harvest against past known or future projected population responses to ensure it effectively mitigates long-term stock declines. The Expert Panel noted that Lovatelli *et al.* (2004), Purcell (2010), Pakoa *et al.* (2014), Friedman *et al.* (2008) have published information on assessing the management and status of sea cucumbers stocks for many years, from investing in the collection of stock and fishery data to monitoring the status of trends in sea cucumber resources and their exploitation. This type of information would assist in prosecuting management decision-making and the preparation of an NDF.

Potential implementation challenges

Implementation issues resulting from a CITES Appendix II listing of teatfish species can be fishery-specific or country-specific. For example, fisheries targeting teatfish species also target other sea cucumbers species as well as a diverse range of other marine resources including pearl shell, trochus, green snail, lobster, fish, and octopi. Subsequently, they need to be considered as diverse and multi-stakeholder in nature, and a part of much wider fishing and marine-based activities. In addition, producing States come from a wide range of development where policy objectives, capacity, experience and resource bases vary among the environment, wildlife and fishery agencies responsible for sea cucumber management. In completing in-country status assessments, many parties exporting sea cucumbers species as beche-de-mer do not have extensive past datasets at the species level on the condition of the resource or its trade, with which to develop NDFs. In addition, the implementation of surveys, however simple, still requires both funding, labour and equipment. As mentioned, protocols for this work are already published, and do not require sophisticated levels of training or apparatus. However such assessments still require training and resources, and these requirements need to be commensurate with the nature and value of the stocks being assessed. To deliver these functions, many states will need support for management requirements at many levels, from independent in-water surveys, to

developing a clearer picture of fishing pressures, the activity of post processors and exporters, and upgrading the skill set of fishery and customs agents. In many cases these authorities may already struggle with their current responsibilities, and will find the extra fishery, trade traceability and administrative requirements of a CITES listing (e.g. of ensuring CITES permits, certificates and CITES reporting) an extra burden and responsibility.

In their live form, sea cucumbers are relatively easy to identify at the species level with a little training, and species guides are easily available. In dried form most of the tropical species can be distinguished one from another with limited training and teatfish species can normally be distinguished one from the other and from other sea cucumber species (Purcell *et al.*, 2012a). Analysis of the coloration of teatfish species has been conducted by Uthicke *et al.* (2004). Their findings demonstrated that *H. fuscogilva* comprises a range of colour morphs ranging from white to greyish-brown to beige bodies, often with mottled brown-black dorsal markings. The greyish-brown variants could appear similar to *H. whitmaei*. *H. whitmaei* is entirely dark grey to black in the adult form, though juvenile *H. whitmaei* can have white or beige markings. *H. nobilis* are mainly dark grey to black, and usually also have large white blotches on their ventral-lateral surface. However, due to potential variation in coloration among individuals of *H. whitmaei* and *H. nobilis* these species can be regarded as a 'lookalike' species. The CITES definition for 'look-alike' species considers the likelihood that responsible officers along the supply chain might confuse them if they have not had sufficient training. In this case all teatfish species may be considered 'look-alike' species, as they all possess lateral teats along their body sides and can be difficult to distinguish from one another by the untrained eye (Figure 1).

Furthermore, the taxonomy of sea cucumbers is a rapidly evolving field, both in the past two decades and likely in the next. Notably, sea cucumber species originally identified from type specimens from the Indian Ocean have been split into separate species from those in the Pacific Ocean. Previously, both the Indian Ocean and Pacific Ocean black teatfish were referred to as *H. nobilis*, but genetic studies resulted in the Pacific species being assigned the name *H. whitmaei* (Uthicke *et al.*, 2004b). The *H. fuscogilva* taxa itself may also comprise a group of subspecies and species where *Holothuria* sp. "pentard" or 'flower teatfish' may be further described (Aumeeruddy and Conand, 2008; Conand, 2008; Purcell *et al.*, 2017b). The Expert Panel is aware that genetic studies have been undertaken recently to assess the full teatfish species complex further, and this is likely to result in additional changes to the understanding of species and subspecies.

In the import countries and retail markets of Hong Kong SAR and China, the lack of transparent species specific reporting systems for sea cucumbers in trade between Hong Kong SAR, Viet Nam and mainland China – in addition to the level of inspections of seafood shipments and markets – makes it difficult to follow the movement of teatfish commodities (Figure 6) between source countries and markets and thus promote legal trade. This has been a common problem for other species listed on CITES Appendix II that share similar trade routes through Hong Kong SAR and China, such as humphead wrasse (CITES CoP18 Doc. 67; Wu & Sadovy de Mitcheson, 2016), certain shark commodities (Cardeñosa *et al.*, 2017; Shea & To, 2017; Sadovy de Mitcheson *et al.*, 2018) and seahorses (CITES CoP18 Doc. 72).

Complicating the traceability question, is the fact that whole dried or frozen sea cucumber is not the only commodity exported. In some cases, sea cucumber parts and post-processed products such as creams, compounds and medicines are also exported (Figure 6). The make-up of these products can be very difficult to identify and trace back to the species level. This is also the case for products of other CITES species (shark and ray meat, cartilage, skin and oils and seahorses), as such products can be made from parts of CITES-listed species, often comprising many species in a single shipment. Procedures and processes for the analysis of such compounded products at the species level is yet to be developed in a practical form for rapid analysis at ports and airports.

As mentioned, CITES Authorities are responsible for the scientific and administrative aspects of implementing and reporting on the delivery of CITES provisions in a given country (e.g. creation of NDFs, issuing permits, certificates and reporting). If a state's ability to make NDFs for sea cucumber is limited in the absence of information on wild stocks, as evidenced by difficulties encountered in making NDFs for other recently Appendix II listed marine taxa (Kinch *et al.* 2010, 2011; Friedman *et al.* 2018), the following outcomes are likely:

- i) previous legal trade is ceased through government decree;
- ii) trade continues without proper CITES documentation (also known as 'illegal trade'); and/or

iii) trade continues with inadequate NDFs.

In regards to point i), the Expert Panel expects that the listing of teatfish species on Appendix II might prompt some countries to simply ban the export of teatfish species specifically, or all sea cucumber species. Such a response could arise from perceived hardship in costs and effort of making NDFs, misunderstanding of CITES, or other local political or socio-economic reasons. The Expert Panel noted this approach can result in negative social impacts when the listing of a species in Appendix II leads to an automatic ban on fishing and trade (for example in the Philippines, following Section 102 of Republic Act 10654 and Section 4 of FAO 233 of legislation). In similar cases, previous listings have resulted in unintended consequences including a reduction in incomes (see Acebes *et al.*, 2018, for mobulid rays), and in some cases the continuing collection of listed species (see Christie, Oracion & Eisma-Osorio, 2011, for seahorses). Consequently, there is a risk that an Appendix II listing could economically disadvantage village-based fishers in some localities.

Given that controls on illegal exports are limited in many source countries, a proportion of trade would be expected to continue illegally and might be increased. Evidence from Fiji, where exports of one sea cucumber species (*Holothuria scabra*) were banned (Purcell *et al.*, 2017a), suggests that black-market trade might diminish the market share of benefits received by local fishers who are offered less for products by traders dealing in illegal shipments.

Potential benefits

If a CITES Appendix II listing for teatfish stimulated more research and assessment of these and related sea cucumber stocks, this could result in the improved management of sea cucumber fisheries generally, with countries systematically monitoring populations and exports at the species level, in order to continue legal trade.

Positive attributes of teatfish species include their easily identified shape and slow-moving nature and ease of identification in the wild, which all make fishery-independent population assessments less technically demanding, albeit requiring extra resources to conduct. Since *H. whitmaei* and *H. nobilis* occur in shallow waters and all teatfish can be surveyed from small vessels using unsophisticated survey gears, population surveys for making NDFs are not prohibitive, even for low-income countries. Government officers in many source countries often have the required training and qualifications to undertake such assessments (Purcell *et al.*, 2014b). Data to inform NDFs should therefore be technically feasible, although range states often report a lack of funds to cover costs of field assessments (Purcell *et al.*, 2014), or the capacity to analyse and store survey data. To improve this situation, education and awareness would need to be provided to fishers, industry stakeholders and government officials, while data collation, analysis and sharing mechanisms might need improvement. A sea cucumber guide, originally in English (Purcell *et al.*, 2012a), is now freely available in Chinese (Purcell *et al.*, 2017c). Other guidebooks, posters and identification cards have been produced for the benefit of government agencies, fishers and traders in the Indian Ocean, Southeast Asia and Pacific Ocean (e.g. CITES AC25 Doc. 20 Annex - p. 1; Purcell *et al.*, 2008, 12b; Purcell, 2014c).

If through technical assistance to national fisheries authorities and regional agencies, data on the status of teatfish stocks were to be collected, collated and shared on a national or regional basis, all producer states would be able to benefit from having a clearer understanding of how stocks respond to fishing pressures, and potentially the setting up 'rules of thumb' harvest controls that could be adopted by neighbouring countries (Friedman *et al.*, 2011).

A secondary negative impact of uncontrolled and uncoordinated sea cucumber fisheries is the potential negative health impacts to collectors while diving. When training is absent and there are pressures to make catches accidents have been noted. Pakoa *et al.* (2014b), Jupiter *et al.* (2013) and Tabunakawai-Vakalalabure *et al.* (2017) have reported from Fiji that there are regular instances of local divers who have lost their lives or suffered from permanent disabilities as a direct result of diving too deep or for too long while harvesting sea cucumbers. Jupiter *et al.* (2013) reported that families were receiving little to no compensation from local operators for these diving-related injuries and deaths (see a video shot in Indonesia on this issue: <https://www.youtube.com/watch?v=nHEglgSWrv0>).

If training was made available for fishers and post-harvest capacity development requirements, with basic levels of training in fishing and effective post-processing of sea cucumbers, the fishery would yield a higher value product. In addition, responsible officers (fisheries and customs departments) would not have difficulty identifying teatfish species from other sea cucumbers, and between the three species of teatfish, in both live and dried forms.

As a potential related point, the beginnings of sea cucumber aquaculture, which has already seen experimentation in teatfish rearing and ranching (Battaglione *et al.* 2002; Battaglione and Bell, 2004; Friedman and Tekanene, 2005; Purcell *et al.* 2012b) may also reap rewards. A potential shift of focus for a small number of species from wild capture to aquaculture and ranching could be helped (or potentially hindered) by a CITES listing. The extra governance requirements for trade in wild-caught CITES species could spur such investment in the future, although the burden of following CITES provisions for shipments in trade might also deter investment, or facilitate the laundering of wild-caught specimens as aquacultured specimens.

If the CITES listing proposal is adopted by CITES Parties and effectively implemented by the countries concerned, then future export trades will be recorded in the CITES trade database. This will require additional support, capacity and resources in some countries to implement the required measures. Better export records would help authorities monitor and support sustainable, legal and traceable trade of teatfish species between producers and consumers. Increasing the reliability and volume of export and import recordings should help to inform priorities for the management and control of sea cucumber fisheries generally, help eliminate IUU products from entering trade chains, and thus increase control of teatfish species across the market from exporting countries to retail markets.

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Tables and figures

Table 1. Information for assessing productivity of teatfish.

| Parameter | Status | Information | Area | Source |
|------------------------------|--------------|--|----------------|--|
| planktonic phase | medium - low | 14–21 days Kiribati hatchery run of <i>H. fuscogilva</i> | Indo - Pacific | Friedman and Tekanene, 2005 |
| Tmax longevity | low | No direct measurements completed to date. <i>H. whitmaei</i> and <i>H. fuscogilva</i> reportedly live for around 10–15 years Growth rates and negative growth found in <i>H. whitmaei</i> show that longevity appears to be at least several decades. Other sea cucumber species: <i>S. chloronotus</i> with a life span of about five years, whilst <i>T. ananas</i> , <i>A. echinites</i> , <i>A. mauritiana</i> have life spans in excess of 12 years. Longevity of <i>Bohadschia argus</i> appears to be at least several decades. | Pacific | Plagányi <i>et al.</i> , 2015 Uthicke <i>et al.</i> , 2004 Shelley, 1981; Conand, 1990; Purcell <i>et al.</i> , 2016. |
| tmat time to maturity | low | medium–low productivity for <i>H. whitmaei</i> (3–5 years). <i>H. nobilis</i> considered to be similar to <i>H. whitmaei</i> . Low productivity for <i>H. fuscogilva</i> (5–7 years). | Indo - Pacific | Uthicke and Benzie, 2002; Conand, 1989, 1990, 1993; Purcell <i>et al.</i> , 2012a |
| fecundity | high | Fecundity 13–78 mill eggs per female per year for <i>H. whitmaei</i> and 2–14 mill eggs per female per year for <i>H. fuscogilva</i> | Indo - Pacific | Conand 1993; Battaglione <i>et al.</i> , 2002 |
| growth Von Bertalanfy k | low | Roughly 0.096 based upon published growth from 1000 to 1098 in year and max wt 3500 | | Indicative calculation using data by Uthicke and Benzie, 2004 |
| natural mortality | low | No direct measurements completed to date. Using K of .06 and taking M at first maturity using $M=K*(W/W_{oo})^{.5}$. Suggests $M=0.1$ at first maturity. Results from <i>H. whitmaei</i> genetic fingerprinting by suggest “presumably with low mortality”. Other sea cucumber species: <i>Actinopyga mauritiana</i> : 16–60 percent y^{-1} natural mortality | | Charnov <i>et al.</i> , 2013 Uthicke <i>et al.</i> , 2004 Kinch <i>et al.</i> , 2008; Shelley, 1981; Conand, 1990 |
| intrinsic growth rate of pop | medium-low | Rough calculations from Tonga data suggests intrinsic growth rate of about 0.16 i.e. increase by 3 fold over 7 years from low levels for both species NB This calculation assumes a self-sustaining population rather than recruitment coming from elsewhere. <i>H. fuscogilva</i> : Maximum length about 57 cm, commonly to about 42 cm; mean live weight about 2.4 kg. <i>H. nobilis/whitmaei</i> : Maximum length about 55 cm, commonly to about 37 cm; mean live weight about 1.7 kg. | | Rough Expert Panel calculations from data available in Friedman <i>et al.</i> , 2008; 2011; Uthicke and Benzie, 2002 Purcell <i>et al.</i> , 2012a Purcell <i>et al.</i> , 2012a |
| generation time | | Undetermined. Rough Expert Panel calculations suggest that this is more than 5 years | | |

Table 2ab. Evidence of sea cucumber status reviewed by the Expert Panel for a) *Holothuria whitmaei* & *Holothuria fuscogilva*, b) *Holothuria nobilis* & *Holothuria fuscogilva*.

Table 2a) *Holothuria whitmaei* (*Hw*) and *Holothuria fuscogilva* (*Hf*) information reviewed by Expert Panel.

| Evidence | References | Relative to CITES Criteria na = not appropriate. | Score | Comments (Methods: basic/ median/robust; Spatial scale: limited/median/broad ; Temporal scale: short/median/long) |
|--|---|---|-------|--|
| Time-series data of % decline | | | | |
| Federated States of Micronesia (2000–2016) | Lindsay, 2000; 2001; Bosserelle <i>et al.</i> , 2017 | insufficient information | 3 | Methods: median; Spatial: median; Temporal: short. Although data was insufficient for determining if the CITES criteria were met, <i>H. whitmaei</i> was at a density below the baseline threshold. Alternatively, <i>H. fuscogilva</i> was at baseline density |
| Palau (2007–2012) | Ilek, 1991; Friedman <i>et al.</i> , 2009a; Pakoa <i>et al.</i> , 2012 ; 2014a | <i>Hw</i> : does not meet <i>Hf</i> : insufficient information | 3 | Methods: median [too few deep dives]; Spatial: median-broad; Temporal: median-long. There was insufficient sampling to compare <i>H. fuscogilva</i> densities to a baseline threshold (6 dives only) |
| Cook Islands (2007–2013) | Pinca <i>et al.</i> , 2009a; Raumea <i>et al.</i> , 2013 | insufficient information | 2 | Methods: basic-median; Spatial: limited; Temporal: short. Limited methods replication and temporal view. Although data was insufficient for determining if the CITES criteria were met, <i>H. whitmaei</i> were recorded a density below the baseline threshold. No <i>H. fuscogilva</i> sampling reported |
| Samoa (1994–2012) | Vunisea <i>et al.</i> , 2008; Sapatu and Pakoa, 2013 | insufficient information | 2 | Methods: basic; Spatial: limited; Temporal: short. Although data was insufficient for determining if the CITES criteria, both <i>H. whitmaei</i> and <i>H. fuscogilva</i> were at baseline densities |
| Tonga (1984–2016) | Preston and Lokani, 1990; Lokani <i>et al.</i> , 1996; Friedman <i>et al.</i> , 2009b, 2011; Pakoa <i>et al.</i> , 2013; Moore <i>et al.</i> , 2016 | <i>Hw</i> : meets <i>Hf</i> : meets | 4 | Methods: median-robust; Spatial: median-broad; Temporal: median-long. Some issues with study comparability |
| Fiji (2003–2015) | Friedman <i>et al.</i> , 2010, 2011; Jupiter <i>et al.</i> , 2013; Pakoa <i>et al.</i> , 2014b; Lalavanua <i>et al.</i> , 2017 | <i>Hw</i> : meets <i>Hf</i> : insufficient information | 3–4 | Methods: median- robust; Spatial: median-broad; Temporal: median-long. Shortage of deep dive surveys and sites not well aligned through time. Between 2003 and 2009 a 50–70% density decline in <i>H. whitmaei</i> was recorded, with both datasets reflecting low densities (<10 ind. ha ⁻¹) |
| Solomon Islands (2006–2013) | Lincoln-Smith <i>et al.</i> , 2001; Pinca <i>et al.</i> , 2009b; Pakoa <i>et al.</i> , 2014c | <i>Hw</i> : does not meet <i>Hf</i> : does not meet | 3–4 | Methods: median-robust; Spatial: median-broad; Temporal: median-long. Shortage of deep dive surveys and sites not well aligned through time |
| Australia – continental shelf reefs East (1998–2017) | Uthicke, 2004; Eriksson and Byrne, 2015; Uthicke and Benzie 2003; Eriksson and Byrne, 2015; Skewes <i>et al.</i> , 2014; Knuckey and Koopman, 2016; ABARES 2017; 2018 | <i>Hw</i> : does not meet <i>Hf</i> : does not meet | 4 | Pacific Ocean and Coral Sea Methods: robust; Spatial: broad; Temporal: median-long |

Table 2a) *Holothuria whitmaei* (Hw) and *Holothuria fuscogilva* (Hf) information reviewed by Expert Panel (continued).

| Evidence | References | Relative to CITES Criteria na = not appropriate. | Score | Comments (Methods: basic/ median/robust; Spatial scale: limited/median/broad ; Temporal scale: short/median/long) |
|--|--|---|--------------|---|
| Australia – continental shelf reefs West (2002–2003 Ningaloo; to 2017 fishery assessments) | Gaughan and Santoro, 2018; Shiell, 2004; Shiell and Knott, 2012; Skewes <i>et al.</i> , 1999 | <i>Hw</i> : does not meet <i>Hf</i> : does not meet | 4 | Methods: robust; Spatial: median; Temporal: short. <i>H. whitmaei</i> still present in Ningaloo marine park monitoring surveys in 2015 (Kim Friedman, pers. observation). Western Australia not as extensively surveyed as East coast |
| Australia – remote reefs (1989–2006) | Ceccarelli <i>et al.</i> , 2011; Smith <i>et al.</i> , 2001, 2002; Rees <i>et al.</i> , 2003; Bellchambers, 2011 | <i>Hw</i> : Meets <i>Hf</i> : likely Meets | 4 | Methods: robust; Spatial: median; Temporal: median–long |
| Indonesia (1993-2010) | Lane and Limbong, 2013 | <i>Hw</i> : Meets <i>Hf</i> : insufficient information | 2 | Methods: limited; Spatial: limited; Temporal: median |
| One-off abundance surveys | | | | |
| Pacific Island Region | Pinca <i>et al.</i> , 2010; Friedman <i>et al.</i> , 2011; Pakoa <i>et al.</i> , 2014; Uthicke <i>et al.</i> , 2004a; Lokani, 1990; Conand, 1989; Byrne <i>et al.</i> , 2004; Skewes <i>et al.</i> , 2002a; Friedman <i>et al.</i> , 2004; Skewes <i>et al.</i> , 2010; Knuckey and Koopman, 2016. | na | na | |
| Papua New Guinea | Skewes <i>et al.</i> , 2002a; Long <i>et al.</i> , 1996; Skewes <i>et al.</i> , 2002b | <i>Hw</i> : below baseline <i>Hf</i> : below baseline | 4 | Methods: median-robust; Spatial: median |
| Trade data | | | | |
| Change in export volumes | Eriksson and Clarke, 2015; Eriksson <i>et al.</i> , 2017; Govan, 2017; Conand, 2018; To and Shea, 2012; To <i>et al.</i> , 2018; Govan <i>et al.</i> , 2019; UN Comtrade, Hong Kong Census and Statistics Department | na | na | Major producers have seen export volumes decline significantly, however: records rarely classify trade to species level; inconsistencies between data reported by exporting countries and importing countries, and between data reported by national statistics offices and that reported to the FAO; the high degree of re-exporting; high level of undocumented trade; and the combining of frozen and dried weights in some statistics |
| Recent price trend | Purcell, 2014; Purcell <i>et al.</i> , 2018; Dumestre, 2017; Fabinyi <i>et al.</i> , 2017 | na | na | Reliable data on the market price of <i>H. whitmaei</i> and <i>H. fuscogilva</i> increased by 2.7–2.9% p.a. between 2011 and 2016, above the average annual consumer price index rate in China |

Table 2b) *Holothuria nobilis* (Hn) and *Holothuria fuscogilva* (Hf) information reviewed by Expert Panel.

| Evidence | References | Meets CITES Criteria na = not appropriate | Score | Comments (Methods: basic/ median/robust; Spatial scale: limited/median/broad ; Temporal scale: short/median/long) |
|----------------------------------|---|--|-------|---|
| Time-series data | | | | |
| Maldives (1991–2014) | Reichenbach, 1999; Muthiga, 2008; Ducame, 2015; 2016; Andréfouët, 2012 | insufficient information | 3 | Methods: basic-median; Spatial: median; Temporal: long. Although data was insufficient for determining if the CITES criteria were met, both <i>H. nobilis</i> and <i>H. fuscogilva</i> were at densities below the baseline threshold and surveys of Baa Atoll in 2014 and Ari Atoll in 2015 did not find teatfish species |
| Egypt (1995–2006); (2019) | Lawrence <i>et al.</i> , 2004; Hasan and El-Rady, 2012; Ahmed and Lawrence, 2007; Dive club reports | <i>Hn</i> : likely Meets <i>Hf</i> : likely Meets | 2–3 | Methods: basic; Spatial: limited; Temporal: long. Localized assessments of limited spatial or temporal scope. Between 1995 – 2006 <i>H. nobilis</i> and <i>H. fuscogilva</i> were lost from Wady Quny and Eel Garden survey sites |
| One-off abundance surveys | | | | |
| Sri Lanka | Dissanayake and Stefansson, 2010 | <i>Hn</i> : below baseline <i>Hf</i> : below baseline | 2–3 | Methods: basic; Spatial: limited |
| Mayotte | Eriksson <i>et al.</i> , 2012 | <i>Hn</i> : does not meet <i>Hf</i> : does not meet | 3 | Methods: median-robust; Spatial: not determined. |
| Seychelles | Aumeeruddy <i>et al.</i> , 2005; Aumeeruddy and Conand, 2008; Cariglia <i>et al.</i> , 2013 | <i>Hn</i> : below baseline <i>Hf</i> : below baseline | 3 | Methods: basic-median; Spatial: limited. Mix of methods |
| Zanzibar | Muthiga, 2014; Eriksson <i>et al.</i> , 2010 | <i>Hn</i> : below baseline <i>Hf</i> : below baseline | 3 | Methods: median; Spatial: limited |
| Trade data | | | | |
| Change in export volumes | Kumara <i>et al.</i> , 2005; Muthiga <i>et al.</i> , 2007; Rasolofonirina, 2007; Conand and Muthiga, 2007; Muthiga and Conand, 2014; Eriksson and Clarke, 2015; Conand, 2018; To and Shea, 2012; To <i>et al.</i> , 2018; UN Comtrade; Hong Kong Census and Statistics Department | na | na | Limited data on exports; by 2014 production of sea cucumbers had decreased in most countries of the Western Indian Ocean except the Seychelles, however: records rarely classify trade to species level; inconsistencies between data reported by exporting countries and importing countries, and between data reported by national statistics offices and that reported to the FAO; the high degree of re-exporting; high level of undocumented trade; and combining of frozen and dried weights in some statistics |

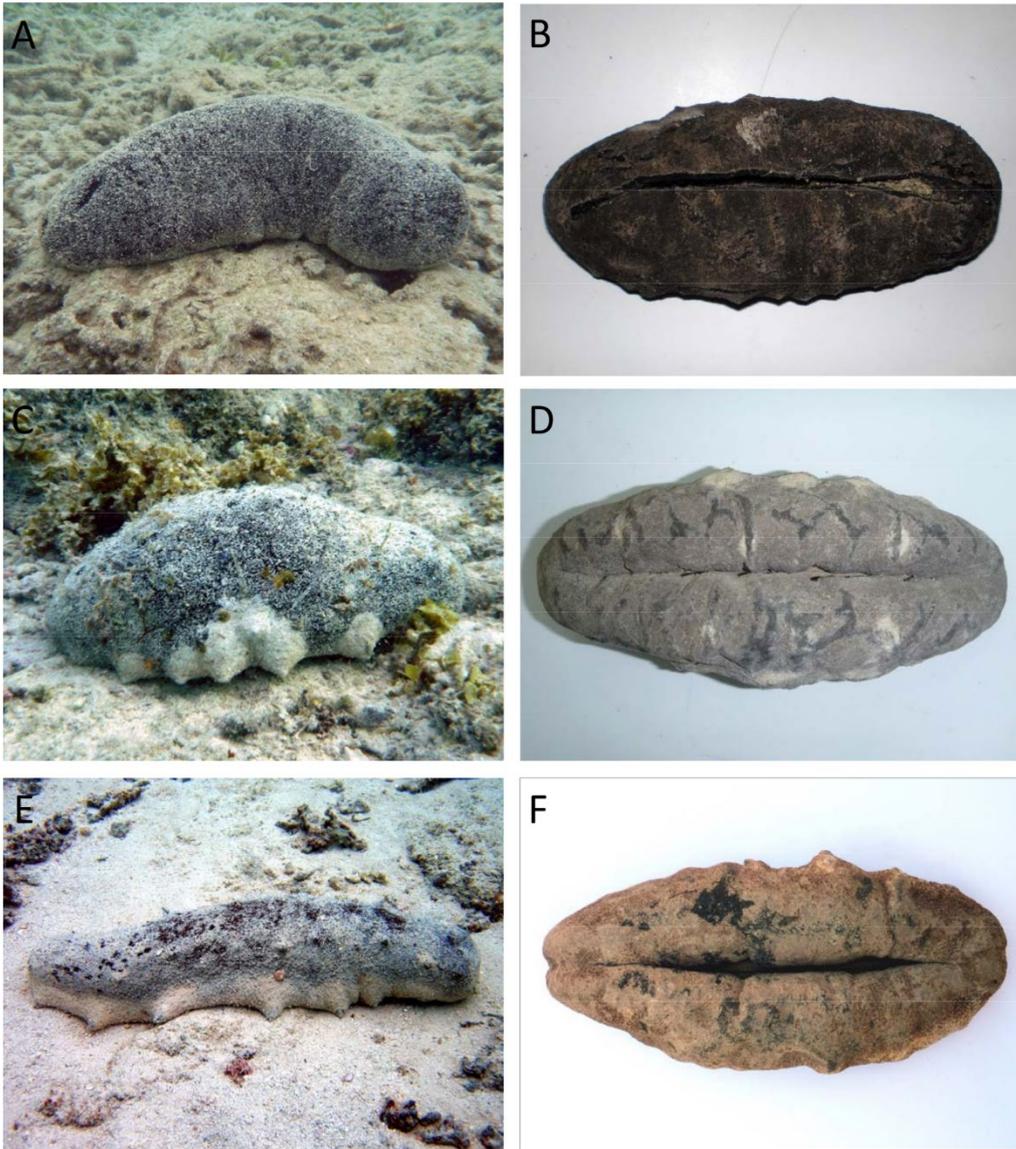
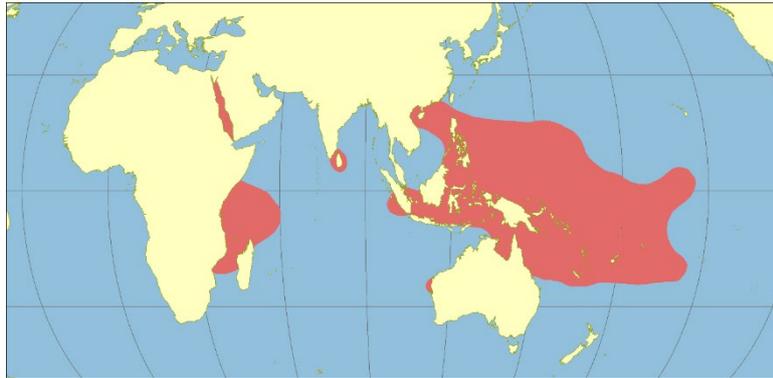
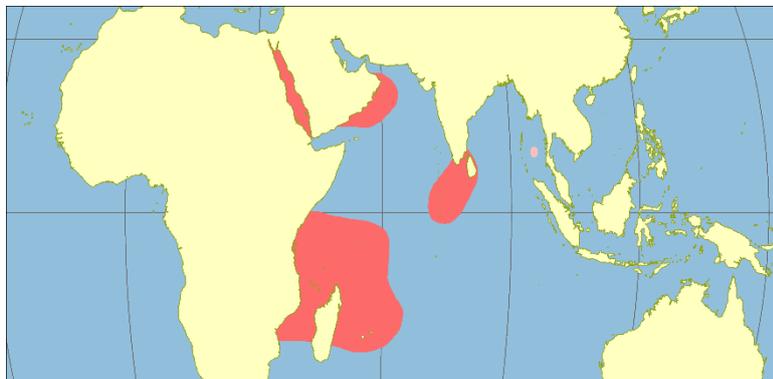


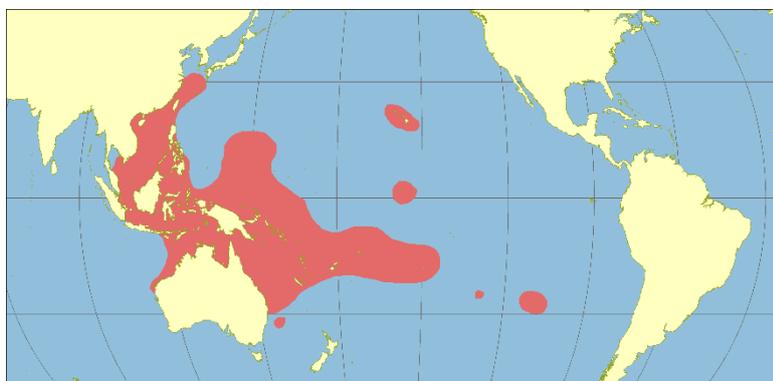
Figure 1. Teatfish species within the proposal. (A) *Holothuria whitmaei* alive underwater, (B) *Holothuria whitmaei* dried, (C) *Holothuria nobilis* alive underwater, (D) *Holothuria nobilis* dried, (E) *Holothuria fuscogilva* alive underwater, (F) *Holothuria fuscogilva* dried. Photos: S.W. Purcell, rights reserved.

Holothuria fuscogilva

From Madagascar and the Red Sea in the west, across to Easter Island in the east and from southern China to south to Lord Howe Island. Occurs throughout much of the western central Pacific as far east as French Polynesia.

Holothuria nobilis

Known from localities in the western Indian Ocean, from East Africa to possibly India and Maldives. Recent sighting in Thailand - Mu Ko Surin National Park potentially extends the distribution further east (Dr Sumaitt Putchakarn, Curator of Echinodermata at Burapha University, Thailand, per comm. 2019). It can also be found in the Red and Arabian Seas. This species does not appear to occur as far east as the Java Sea (e.g. western Indonesia) and south China Sea (e.g. Malaysia, Viet Nam, Philippines).

Holothuria whitmaei

From Western Australia east to Hawaii and French Polynesia and southern China south to Lord Howe Island, 31°S (Australia). Records of *H. nobilis* from Pitcairn Islands and Easter Island are most probably *H. whitmaei*.

Figure 2. Global Distribution of Teatfish (Purcell *et al.* 2012a; Expert Panel input).

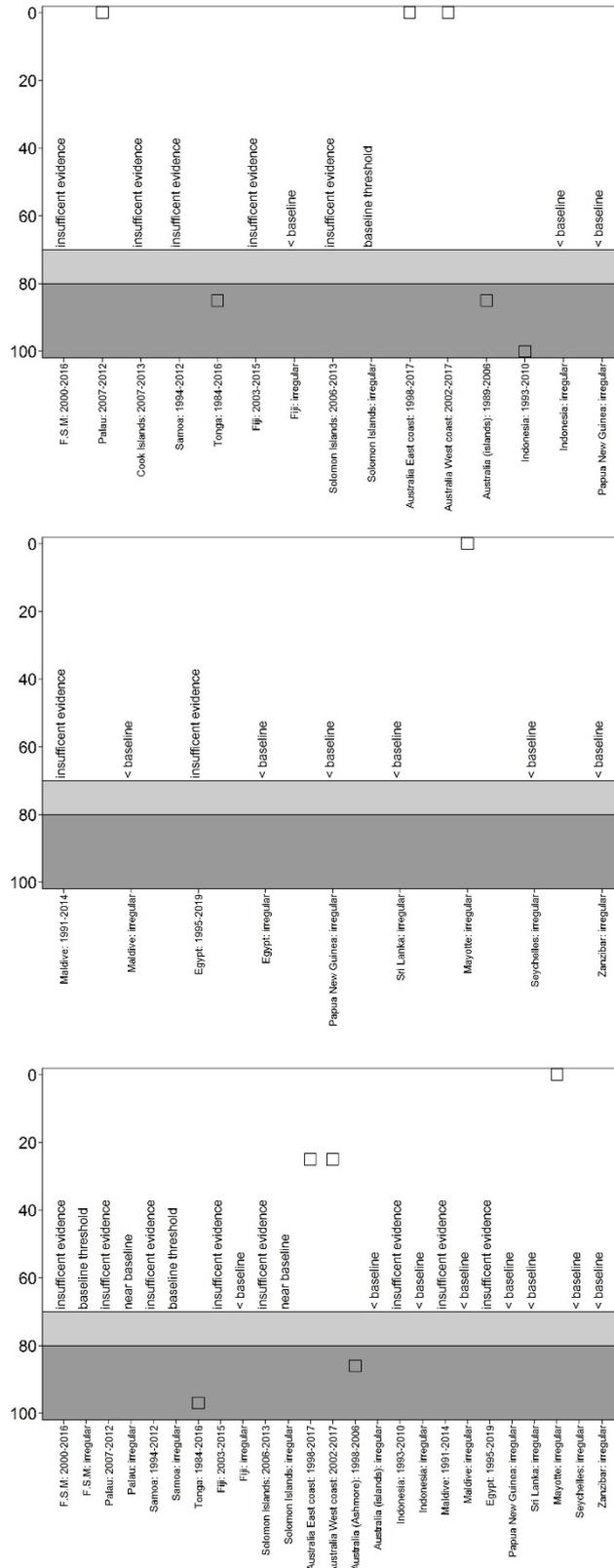


Figure 3. Estimated percent declines from available survey information for *H. whitmaei* (top), *H. nobilis* (middle), and *H. fuscogilva* (bottom). The dark band is a marked decline for a species of low productivity (80 percent of baseline), with 5–10 percent subtracted as a precautionary buffer (light band). The graphs include unfilled squares from time-series surveys where possible and descriptions of snap-shot or one-off (irregular) surveys (see Table 2). Irregular surveys offer insights into stock status when compared to ‘rule of thumb’ biomass thresholds (Pakoa *et al.*, 2014). Irregular surveys are not definitive evidence of stock status, as some surveyed locations have ‘naturally’ lower densities due to environmental considerations (see Figure 4).

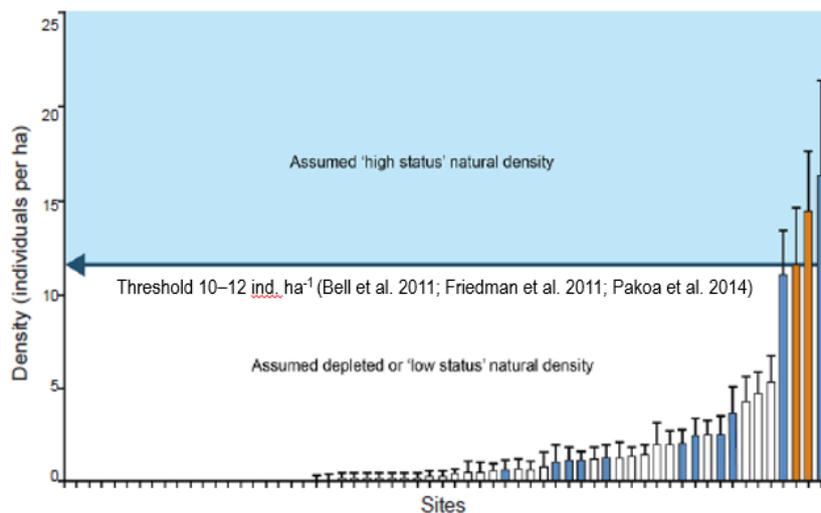


Figure 4. Mean density (individuals per ha, +SE) of the high-value black teatfish sea cucumber (*Holothuria whitmaei*) at a range of sites in the tropical Pacific where fishing has occurred (blue bars – solid dark), where fishing has been halted for a decade or more (blue bars), and where fishing has not been recorded in recent history (orange bars – light solid bars) (Source: adapted from SPC PROCFish Project and, for a single site, S. Purcell, the WorldFish Center, graph from Bell *et al.*, 2011: Chapter 9).

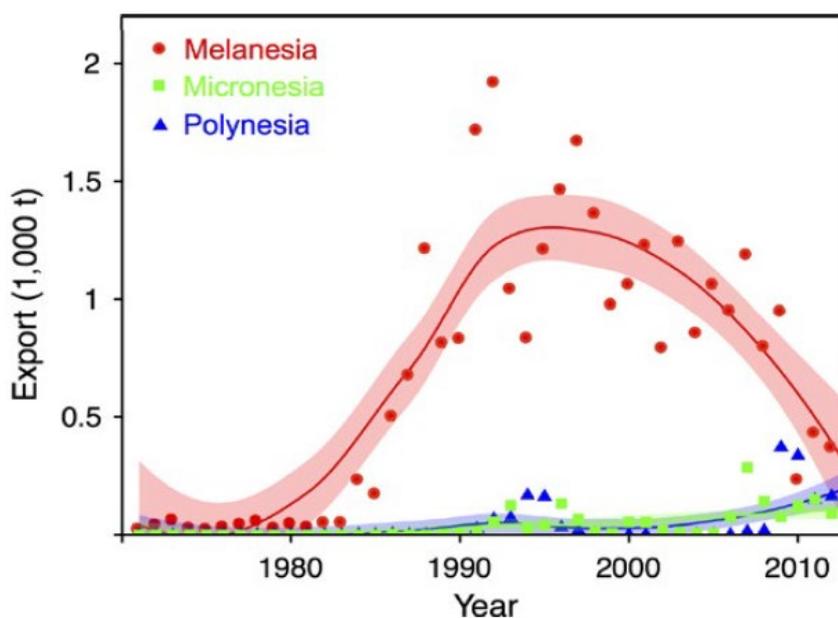


Figure 5. Melanesia, Micronesia, Polynesia total exports of dried sea cucumbers (fitted loess curves with 75 percent window of the data). Source: Eriksson *et al.*, 2017, Figure 2).



Figure 6. Products, compounds, medicines etc. made from sea cucumbers (undetermined species). Photos courtesy of Dr Sumaitt Puchakarn (left) and Claude Massin (right).

APPENDIX A

Terms of reference for an ‘Ad Hoc Expert Advisory Panel for Assessment of Proposals to CITES’⁶

1. FAO will establish an Ad Hoc Expert Advisory Panel for the Assessment of Proposals to Amend CITES Appendices I and II.
2. The Panel shall be established by the FAO Secretariat in advance of each Conference of the Parties, according to its standard rules and procedures and observing, as appropriate, the principle of equitable geographical representation, drawing from a roster of recognized experts, to be established, consisting of scientific and technical specialists in commercially-exploited aquatic species.
3. The Panel members shall participate in the Panel in their personal capacity as experts, and not as representatives of governments or organizations.
4. The Panel will consist of a core group of no more than 10 experts, supplemented for each proposal by up to 10 specialists on the species being considered and aspects of fisheries management relevant to that species.
5. For each proposal the Panel shall:
 - assess each proposal from a scientific perspective in accordance with the CITES biological listing criteria, taking account of the recommendations on the criteria made to CITES by FAO;
 - comment, as appropriate, on technical aspects of the proposal in relation to biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness for conservation.
6. In preparing its report, the Panel will consider the information contained in the proposal and any additional information received by the specified deadline from FAO Members and relevant regional fisheries management organizations (RFMOs). In addition, it may ask for comments on any proposed amendment, or any aspect of a proposed amendment, from an expert who is not a member of the Panel if it so decides.
7. The Advisory Panel shall make a report based on its assessment and review, providing information and advice as appropriate on each listing proposal. The Panel shall finalize the advisory report no later than ?? days⁷ before the start of the CITES Conference of the Parties where the proposed amendment will be addressed. The advisory report shall be distributed as soon as it is finalized to all Members of FAO, and to the CITES Secretariat with a request that they distribute it to all CITES Parties.
8. The general sequence of events will be as follows:
 - Proposals received by CITES
 - Proposals forwarded by CITES Secretariat to FAO
 - FAO forwards proposals to FAO Members and RFMOs and notifies them of deadline for receipt of comments
 - Member and RFMO comments and input received by FAO
 - Panel meets and prepares advisory report on each proposal
 - Panel report reviewed by FAO Secretariat and forwarded to FAO Members, RFMOs and CITES Secretariat.

⁶ Taken from Appendix E of the Report of the twenty-fifth Session of COFI, FAO, Rome, 24-28 February 2003.

⁷ To be discussed with CITES.

APPENDIX B

Agenda for the Expert Advisory Panel for Assessment of Proposals to CITES⁸

FAO Headquarters, Rome, Italy, 21 to 25 January 2019
Viale delle Terme di Caracalla, 00153 Rome, Italy

| | |
|------------------|--|
| Mon 21 January | Introductions, the CITES Listing Amendment Process |
| 9.00–10.30 | Welcome by Mr Manuel Barange, Deputy Director Fisheries and Aquaculture Department; Introduction of participants, Observers and FAO staff; Selection of Panel Chair and Proposal leads; Overview and orientation by Mr. Kim Friedman: CITES, listing amendment criteria; FAO Expert Panel terms of reference: meeting objectives and work programme |
| 11.00–12.45 | Presentation on options for further standardizing the discussion and outputs from the Expert Panel with the aim of making the process more predictable and systematic as well as efficient Presentation by proponents of CITES CoP18 proposals 42, 43, 44. |
| 14.15–15.45 | Break out into working groups |
| 16.15–18.30 | Continue Break out working groups Plenary discussions to sum up progress, and discuss forward planning |
| Tues 22 January | Sharks and Sea Cucumbers: On-going review |
| 9.00–10.30 | Plenary discussion on sharks and sea cucumber progress, plus lessons on reporting. Break out into working groups |
| 11.00–12.30 | Break out working groups |
| 14.00–15.30 | Break out working groups |
| 16.00–17.30 | Continue Break out working groups Plenary discussions to sum up progress, and discuss forward planning |
| Wed 23 January | Sharks and Sea Cucumbers: On-going review |
| 9.00–10.30 | Plenary discussion on sharks and sea cucumber progress, plus lessons on reporting. Break out into working groups |
| 11.00–12.30 | Break out into working groups |
| 14.00–15.30 | On-going break out working groups Drafting in working groups alternating with plenary discussion as determined during the meeting |
| 16.00–17.30 | On-going break out working groups Drafting in working groups alternating with plenary discussion as determined during the meeting |
| Thurs 24 January | Sharks and Sea Cucumbers: On-going review |
| 9.00–10.30 | Presentation by proponents of CITES CoP18 proposal 45. Plenary discussion on progress of species deliberations by Panel Drafting in working groups alternating with plenary discussion as determined during the meeting |
| 11.00–12.30 | On-going break out working groups |
| 14.00–15.30 | On-going break out working groups |
| 16.00–17.30 | Plenary discussion as determined during the meeting Clearance and draft adoption of single report by working groups |
| Fri 25 January | Review and Clearance of the Report |
| 9.00–10.30 | Plenary discussion on progress of species deliberations by Panel Drafting in working groups alternating with plenary discussion of single reports as determined during the meeting |
| 11.00–12.30 | Clearance and draft adoption of single reports by working groups |
| 14.00–15.30 | Clearance and draft adoption of single reports by working groups |
| 14.00–19.30 | Clearance and adoption of the full report by Panel Meeting closure |

⁸ Some logistical detail removed.

APPENDIX C

List of Panel Members, Proponents, Observers, Invitees and FAO Staff Participants

| PANEL MEMBER PARTICIPANTS | |
|-------------------------------------|--|
| AUSTRALIA AUSTRALIE AUSTRALIA | Steven Purcell Associate-Professor Southern Cross University Australia Michael Fabinyi Associate Professor University of Technology Sydney Sydney Australia |
| CHINA CHINE CHINA | Jie Zhang Associate Professor Key Laboratory of Animal Ecology and Conservation Biology Institute of Zoology, Chinese Academy of Sciences Beijing China |
| IRELAND IRLANDE IRLANDA | Maurice Clarke Team Leader Fisheries Ecosystems Advisory Services Marine Institute Galway Ireland |
| INDONESIA INDONÉSIE INDONESIA | Dharmadi Dharmadi Senior Researcher Ministry of Marine Affairs and Fisheries Jakarta Indonesia |
| JAPAN JAPON JAPÓN | Mikihiko Kai Senior Researcher of Tuna Fisheries Resources Group National Research Institute of Far Seas Fisheries Shizuoka Japan Akamine Jun Professor Hitotsubashi University Tokyo Japan |
| MEXICO MEXIQUE MEXICO | Javier Tovar Avila Senior Researcher National Fisheries and Aquaculture Institute Bahía de Banderas, Nayarit Mexico |

| PANEL MEMBER PARTICIPANTS (continued) | |
|--|--|
| NEW ZEALAND NOUVELLE ZÉLANDE NUEVA ZELANDA | Alastair Macfarlane International Fisheries Management International Policy and Trade Ministry for Primary Industries Wellington New Zealand |
| NIGERIA NIGÉRIA NIGERIA | Cheke Abiodun Oritsejemin Deputy Director Federal Department of Fisheries Federal Department of Fisheries Abuja Nigeria |
| PAPUA NEW GUINEA PAPOUASIE NOUVELLE GUINÉE PAPÚA NUEVA GUINEA | Jeffrey Paul Kinch Community and Coastal Fisheries Social Scientist Secretariat of the Pacific Community Noumea New Caledonia |
| SOUTH AFRICA AFRIQUE DU SUD SUDÁFRICA | Doug S. Butterworth Emeritus Professor Department of Mathematics and Applied Mathematics University of Cape Town Cape Town South Africa Paul DeBruyn Senior fisheries officer (science manager) Indian Ocean Tuna Commission Victoria Seychelles |
| THAILAND THAÏLANDE TAILANDIA | Somboon Siriraksophon Project Director Project Coordinating Unit of the SEAFDEC/UNEP/GEF/Fisheries Refugia Samutprakarn Thailand |
| UNITED KINGDOM GRANDE BRETAGNE REINO UNIDO | John Pope NRC (Europe) Ltd Norfolk United Kingdom |
| UNITED STATES OF AMERICA ÉTATS-UNIS D'AMÉRIQUE ESTADOS UNIDOS DE AMERICA | Elizabeth A. Babcock Associate Professor Department of Marine Biology and Ecology University of Miami Miami, Florida USA Shelley Clarke Technical Coordinator-Sharks and Bycatch Common Oceans (ABNJ) Tuna Project Rome Italy |

| PANEL MEMBER INVITEES | |
|-------------------------------------|--|
| AUSTRALIA AUSTRALIE AUSTRALIA | Colin Simpfendorfer Co-Chair IUCN Shark Specialist Group Co-Chair College of Science and Engineering James Cook University Queensland Australia |
| CANADA CANADA CANADÁ | IUCN Shark Specialist Goup incumbent, requested not to be listed |
| CHINA CHINE CHINA | Zhihua Zhou Director of the National Natural Protection Area Ministry of Natural Resources Beijing China |
| GERMANY ALLEMAGNE ALEMANIA | Heike Zidowitz Regional Vice-Chair of the Northeast Atlantic Regional Group of the IUCN Shark Specialist Group International WWF Center for Marine Conservation Hamburg Germany |
| KENYA KENYA KENIA | Elizabeth Mueni Mulwa Assistant Director of Fisheries (Research and Environment) Kenya Fisheries Services State Department for Fisheries Aquaculture and the Blue Economy Mombasa Kenya |
| MOROCCO MAROC MARRUECOS | Lahsen Ababouch Senior advisor UNCTAD International Expert, SIPPO Fish and Seafood International Trade Rome Italy Taoufik El Ktiri Directeur des Affaires Générales et Juridiques Ministère de l'Agriculture et de la Pêche Maritime Département de la Pêche Maritime Rabat Morocco |
| MALAYSIA MALAYSIE MALASIA | Ahmad Bin Ali Senior Research Officer Marine Fishery Resources Development and Management Department Southeast Asian Fisheries Development Center Terengganu Malaysia |

| PANEL MEMBER INVITEES (continued) | |
|--|--|
| NEW ZEALAND NOUVELLE ZÉLANDE NUEVA ZELANDA | William Emerson Project Coordinator – ABNJ Deep Seas Project Fischcode Programme (FIDF) Fisheries and Aquaculture Department Food and Agricultural Organization (FAO) Rome Italy |
| PORTUGAL PORTUGAL PORTUGAL | Rui Coelho Portuguese Institute for the Ocean and Atmosphere, I.P. Division of Modelling and Management of Fishery Resources Olhão Portugal |
| SENEGAL SÉNÉGAL SENEGAL | Birane Samb Canary Current Large Marine Ecosystem Project (CCLME) Dakar Senegal |
| SOUTH AFRICA AFRIQUE DU SUD SUDÁFRICA | Kevern Cochrane Department of Ichthyology and Fisheries Science Rhodes University Grahamstown South Africa |
| URUGUAY URUGUAY URUGUAY | Ramiro Sánchez Senior Scientific Advisor to the CTMFM-Argentine Delegation Emeritus Researcher INIDEP (Instituto Nacional de Investigación y Desarrollo Pesquero, Argentina) Buenos Aires Argentina Andrés Domingo Balestra (Species Expert) Deputy Director DINARA Dirección Nacional de Recursos Acuáticos Ministerio de Ganadería Agricultura y Pesca Montevideo Uruguay |
| UNITED KINGDOM GRANDE BRETAGNE REINO UNIDO | Mark Dickey-Collas Chair of the Advisory Committee International Council for the Exploration of the Sea (ICES) Copenhagen Denmark |
| UNITED STATES OF AMERICA ÉTATS-UNIS D'AMÉRIQUE ESTADOS UNIDOS DE AMERICA | Enric Cortez Senior Research Scientist NOAA / NMFS / SEFSC Panama City, Florida USA |

| PANEL OBSERVERS | |
|--|---|
| CITES SECRETARIAT | <p>Daniel Kachelriess Marine Species Officer CITES Secretariat Geneva Switzerland</p> <p>Karen Gaynor Scientific Support Officer CITES Secretariat Geneva Switzerland</p> |
| AUSTRALIA AUSTRALIE AUSTRALIA | <p>Matias Braccini Senior Research Scientist (Shark and Ray Sustainability) Department of Primary Industries and Regional Development Perth Australia</p> |
| GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN COMMISSION GENERALE DES PECHES POUR LA MEDITERRANEE COMISIÓN GENERAL DE PESCA DEL MEDITERRÁNEO | <p>Miguel Bernal Fishery Resources Officer General Fisheries Commission for the Mediterranean (GFCM) Fisheries and Aquaculture Department Rome Italy</p> |

| PROPONENT REPRESENTATIVES | |
|---|--|
| SENEGAL SENEGAL SENEGAL | Mamadou Diallo Advisor to the CITES Management Authority for Senegal Dakar Senegal Sarah Fowler Advisor to the CITES Management Authority for Senegal Plymouth United Kingdom |
| MEXICO MEXIQUE MEXICO | Hesiquio Benítez Director General de Cooperación Internacional e Implementación CONABIO Autoridad Científica CITES de México México |
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APPENDIX D

Welcome speech by Mr Manuel Barange, Director, FAO Fisheries and Aquaculture Policy and Resources Division

It is my pleasure to welcome you to this 6th meeting of the FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of the Convention on International Trade in Endangered Species (CITES).

As you all know, CITES offers a mechanism for regulating international trade, with the purpose of ensuring that such trade does not put the survival of threatened or near threatened species. You may also know that since 1994, CITES Parties have increasingly chosen to list marine species taken by commercial and artisanal fisheries in their appendices.

Recognizing FAO's global role in supporting the sustainable management and conservation of fisheries resources, FAO and CITES - under an MOU signed in 2006 - have continued to work together to refine mechanisms to support the CITES decision process, and assist fisheries managers in their implementation of CITES provisions, where appropriate.

In May this year, the 18th CITES Conference of Parties, with representatives from over 180 States will meet in Colombo, Sri Lanka, to consider a further suite of commercially exploited marine species that have been proposed for listing under CITES Appendix II, including both sharks and sea cucumbers. The importance of this CITES CoP should not be underestimated, as the decisions made in Colombo have the potential to impact the operation of fisheries, their management, and thus the livelihood and food security of dependent communities.

The Parties of CITES, who are rarely represented by Fisheries Ministries, benefit from having access to information supplied by fisheries experts. The FAO Expert Advisory Panel, now in its sixth sitting provides this technical information to them. The Panel consists of a broad range of experts on commercial fisheries species, their management and conservation, and their local and international trade, and is convened to negotiate a common understanding on the status of species proposed for CITES listing, supported by the best available information we have to hand.

You have been selected for the FAO Expert Advisory Panel because of your particular expertise, but you are here in your individual capacity and not as a representative of any country or organization. This is crucial. Only scientific evidence matters in your decisions. For many of you this will be your first experience in the Panel, but several of you also participated in one or more of the former meetings that were able to deliver reports that comprehensively described the current understanding of the status of species under consideration, plus the likely effectiveness for conservation of a CITES listing.

Those of you who were present at the previous CITES CoPs, know that FAO Expert Panel reports are welcomed and taken very seriously, but are not always followed. In the last few CoPs we have seen a shift in uptake of the Panels advice, where CITES Parties have been listing species despite advice showing a given species 'did not meet' the CITES listing criteria, while at early CoPs Parties even rejected including a species in Appendices that were deemed to the Panel to have "met" the CITES criteria. We live in a complex world and scientific evidence is not the only evidence considered, but this should not change in any way the role of the Panel, which is to ensure that its reports provide the best scientific and technical advice based on the information available.

The Panel process in 2019 will respond in two ways. Firstly - by facilitating both remote and in person participation in the Panels deliberations, to ensure we include a broad range of views in the discussion, while cutting down on carbon emissions, - and Secondly- by broadening the way we communicate the Panel's role and findings, so that we "reach" the full range of end users with the knowledge products we are preparing.

We are very grateful that you have accepted the challenge of participating and have dedicated your time and expertise to assist in the FAO Panels' work. And in delivery of this work, please remember, our task is not to evaluate the merits of CITES criteria – as that is the sovereign decision of CITES Parties. Our role is to use the expertise of the Panel to apply the CITES criteria against the best available information, and in doing so,

adhere to the science based interpretation that is the 'FAO understanding' of what the majority of CITES Parties adopted in 2004.

It may not always be possible for the Panel to reach agreement on the evaluation of all proposals and there may be differing views in some instances. I do urge you to do all that you can to achieve consensus and to express your agreed conclusions clearly and unambiguously. Where consensus is not possible, the Panel report should equally clearly describe differing opinions, to support CITES Parties in coming to their own conclusions.

I thank you all again, for giving up your time to help in this important task, especially as I know you are all very busy and some of you have had to rearrange your schedules to be able to attend. I also thank Mr. Daniel Kachelriess and Ms Karen Gaynor of the CITES Secretariat for joining us at this meeting and for the cooperation and assistance of the Secretariat in the work we have been jointly undertaking in relation to the management and conservation of commercially-exploited aquatic species.

Before I close, let me share with you my thoughts on how you can measure the success of this meeting? Firstly, it is not by making recommendations on whether to list or not list a species or species group. That is a job for the Parties. The measure of success by which you can judge the success of the Expert Panel should be – Firstly - the level of engagement by participants in the process of determining whether the criteria for listing a species is supported, or not supported, while – Secondly - and most importantly, for the Expert Panel to work in such a way that all participants are able to stand side by side at the end of this process, to defend the Panels final report.

Before I go, let me just make some further acknowledgements. This meeting of this Expert Advisory Panel benefits greatly from financial support provided by the FAO Regular Programme, but also from extra budgetary support by Japan and the European Union. I would especially like to thank them for their generous gesture, which carries no strings. Finally, I sincerely hope that your hard work on the Panel leaves you some time to relax in Rome and to enjoy some of the many attractions that the Eternal City has to offer. I wish you a fruitful and enjoyable meeting.

APPENDIX E

Criteria used by the FAO Expert Advisory Panel to assign a measure of the reliability of information derived from different sources for use as indices of abundance

| Reliability index of population abundance information | Source of data or information |
|---|---|
| 5 | Statistically designed, fishery-independent survey of abundance |
| 4 | Consistent and/or standardized catch-per-unit effort data from the fishery |
| 3 | Unstandardized catch-per-unit effort data from the fishery; scientifically-designed, structured interviews; well-specified and consistent anecdotal information on major changes from representative samples of stakeholders. |
| 2 | Catch or trade data without information on effort |
| 1 | Confirmed visual observations; anecdotal impressions |
| 0 | Information that does not meet any of the above, or equivalent, criteria; flawed analysis or interpretation of trends |

Notes: A score of 0 indicates that the information was not considered reliable, while a score of 5 indicates that it was considered highly reliable. Any information on abundance allocated a non-zero value was considered useful. These scores could be adjusted up or down in any particular case, depending on the length of the time series and the amount of information available on the sources and methods.

Sources: FAO (2004, 2007, 2010).

APPENDIX F

Email correspondence from Mr Alastair Macfarlane, the Chair of the Expert Advisory Panel to FAO

Dear FAO,

I was honoured to be selected by the Experts convened at FAO HQ, to chair the FAO Expert Advisory Panel for the assessment of proposals to amend CITES appendices.

I am writing to highlight some concerns I had when leading the Panel that you might want to consider prior to CITES CoP19, in order for the CITES proposal review process to adequately fulfil its function on behalf of FAO Members and CITES Parties;

- a. CITES Proposals are typically not a clear reflection of the best available data – required by the Expert Panel to assess species status against the CITES criteria for listing amendments;
- b. Experts invited on the Panel - who volunteer their time - are therefore faced with high workloads and stress in re-collating and assessing information – over a short period of time – to do the task required of Proponents;
- c. The release of Proposals by the CITES Secretariat less than 150 days from voting at the CoP rushes the process of ensuring the best complement of experts is available to attend the FAO Panel meeting. Global Experts invited to the FAO Expert Panel need to have Government clearances – which makes the inclusion of very specialized experience or knowledge difficult to arrange at a late hour;
- d. Invited experts are required to complete so much writing (and re-writing) of the proposal arguments, that they are not able to dedicate sufficient time to point 2 of the Expert Panel TORs (“comment, as appropriate, on technical aspects of the proposal in relation to biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness for conservation”). This is a shame as we have much to learn from them if they were tasked less with the re-writing of the listing argument text and could dedicate their time across the full requirement of the Expert Panel’s workload;
- e. The period of five days is very short to fulfil the Expert Panel Terms of Reference, given the challenges that the Panel are faced with due to the issues identified. It would be adequate if those issues could be addressed;
- f. The Experts were also well aware that their work will likely be challenged if their decision on listing does not agree with species conservation advocates, in what has proved to promote ugly and personalized criticism in the public sphere; and
- g. Global experts in fisheries are in short supply, and I fear that requesting such assistance time and time again, without any improvement in the process by CITES proponents and Parties who have an opportunity to adapt the process, will result in fewer being available for this difficult task in the future.

The situation outlined above could be ameliorated if FAO and CITES arranged for earlier expert intervention in the writing of proposals before they were lodged, and the time period for scientific and technical reflection was adjusted to enable an orderly and proper, in-depth, scientific and technical review.

As Chair, I would like to say that the level of professionalism of invited Experts, FAO staff and CITES Secretariat Observers was excellent. The meeting succeeded in delivering a consensus report after dealing with data and arguments across a broad range of issues.

Yours sincerely,
Alastair Macfarlane
Chair,
Expert Panel

APPENDIX G

FAO and CITES additional comments in relation to the Expert Panel report

1. FAO and CITES work closely together under the 2006 MOU. Under the endorsement of the Committee on Fisheries (COFI), FAO plays an active role in the evaluation of proposals to amend CITES Appendices for commercially exploited aquatic species. The Organization holds Expert Panels to evaluate listing proposals submitted to Conferences of the Parties to CITES (<http://www.fao.org/fishery/cites-fisheries/ExpertAdvisoryPanel/en>), and to address some of the technical difficulties of countries in fulfilling the requirements of a CITES listing.
2. FAO and CITES also have an active role in supporting the capacity development in Members on issues related to commercially exploited-aquatic species listed on CITES Appendices (or under consideration by the CITES Parties), with sharks and sea cucumbers of specific relevance for the upcoming CITES CoP18.
3. In regards to sharks, the FAO IPOA-Sharks applies to chondrichthyans and underscores the responsibilities of fishing and coastal states to sustain shark populations, ensuring full utilisation of retained species and improving data collection and monitoring. The progress of, and challenges faced by, FAO Members in the implementation of the IPOA-Sharks (FAO, 1999) were reviewed in 2012 (Fischer et al., 2012), noting successful creation of NPOAs (36 countries,), plus a number of challenges in implementation. A growing record of instruments (binding and non-binding Conservation and Management Measures, Plans of Action, and national legislation) are being put in place for the conservation and management of sharks and these are tracked and reported annually by FAO on the “Database of measures on conservation and management of sharks”⁹.
4. CITES Parties wishing to export sharks, or shark commodities for species listed on Appendix II of the Convention, are required to complete CITES provisions for trade that include the making of an NDF. Equally all catches landed from the high seas would under the provisions of CITES Resolution Conf. 14.6 require either IFS or Export Permits depending on whether these are one-state or two-state transactions. This generally applies not only to landings for commercial purposes but also to the taking of samples for scientific purposes.
5. With regard to further collaboration between FAO Members and CITES Parties, FAO and CITES have worked together on:
 - i. Active work programmes on addressing legal and implementation issues associated with the application of CITES provisions, in particular under the framework of two multi-year projects generously funded by the European Union and other studies generously funded by the United States and Japan. This includes assisting countries in designing and implementing legislative frameworks that facilitate the delivery of standard and novel CITES provisions. In May 2019 FAO, with cooperation from the CITES Secretariat, will run and Expert Workshop on Implementing CITES through Fisheries Legislation from FAO HQ in Rome, Italy. FAO and CITES are also providing advice to CITES Parties on how to resolve challenges with regard to the movement of scientific samples for CITES listed species (SC70 Doc. 36 <https://cites.org/sites/default/files/eng/com/sc/70/E-SC70-36.pdf>).
 - ii. In 2019, FAO and CITES are working actively to support countries in the monitoring of catches, bycatch (discard best practice), which involves both RFMOs and fisheries authorities, concentrating on developing countries and countries whose economies are in transition. This work also incorporates training and tool development in shark species and shark commodity identification (e.g. FishFinder¹⁰; iSharkFin, <http://www.fao.org/ipoa-sharks/tools/software/isharkfin/en/>).
 - iii. FAO and CITES have active studies of the market and chain of custody for CITES-listed shark products (fin and non-fin commodities), including a project working with the UNEP World

⁹ <http://www.fao.org/ipoa-sharks/database-of-measures/en/>.

¹⁰ <http://www.fao.org/fishery/fishfinder/en>.

Conservation Monitoring Centre on describing the reporting process and data on trade for CITES Appendix II species.

- iv. FAO ran an Expert Consultation on Impacts of CITES Listing of Sharks and Rays Species in South and Southeast Asia. This study, which was run with input from the CITES Secretariat, found a measurable, albeit small, mostly positive influence of CITES in five of eight Southeast Asian countries, while noting predominantly negative influences across two, and ongoing challenges for all in maintaining legal trade of these CITES-listed species (Friedman et al., 2017).
- v. FAO and CITES are collaborating on communication, both among FAO, CITES and IUCN as part of the FAO-IUCN SDG 14.4 ad hoc Technical Working Group that is built on a mutual understanding of the complementarity between the FAO – IUCN – CITES approaches for defining fishery status and categorizing threatened species, but also in education and awareness-raising in the wider community.
- vi. FAO and CITES also work together in improving synergies across the multilateral environmental processes and have submitted a joint information document in 2018 to the CITES Sharks MoU highlighting some of the opportunities for synergies¹¹. FAO has also accepted a CITES invitation to contribute to the organization of, and participate in World Wildlife Day 2019 themed: Life Below Water.

¹¹ https://www.cms.int/sharks/sites/default/files/document/cms_sharks-mos3_inf.22_CITES%20FAO%20cooperation_0.pdf.

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The sixth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species was held at FAO headquarters from 21 to 25 January 2019. The Panel was convened in response to the agreement by the twenty-fifth session of the FAO Committee on Fisheries (COFI) on the terms of reference for an expert advisory panel for assessment of proposals to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and to the endorsement of the twenty-sixth session of COFI to convene the Panel for relevant proposals to future CITES Conference of the Parties. The objectives of the Panel were to: i. assess each proposal from a scientific perspective in accordance with the CITES biological listing criteria (Resolution Conf. 9.24 [Rev. CoP17]; ii. comment, as appropriate, on technical aspects of the proposal in relation to biology, ecology, trade and management issues, as well as, to the extent possible, the likely effectiveness for conservation. The Panel considered the following four proposals submitted to the eighteenth Conference of the Parties to CITES: CoP18 Prop. 42 to include mako shark, *Isurus oxyrinchus* in Appendix II in accordance with Article II paragraph 2(a) and *Isurus paucus* in Appendix II in accordance with Article II paragraph 2(b). The FAO Expert Panel assessment of proposal 42 concluded that the available data do not provide evidence that the species meets the CITES Appendix II listing criteria. CoP18 Prop. 43 to include blackchin guitarfish *Glaucostegus cemiculus* and the sharpnose guitarfish, *Glaucostegus granulatus* in Appendix II in accordance with Article II paragraph 2(a) and inclusion of all other giant guitarfish, *Glaucostegus* spp. in accordance with Article II paragraph 2(b). The FAO Expert Panel assessment of proposal 43 concluded that there was insufficient evidence to make a determination against the CITES criteria. CoP18 Prop. 44 to include white-spotted wedgetfish, *Rhynchobatus australiae* and *Rhynchobatus djiddensis* in Appendix II in accordance with Article II paragraph 2(a). The FAO Expert Panel assessment of proposal 44 concluded that there was insufficient evidence to make a determination against the CITES criteria. CoP18 Prop. 45 to include the subgenus *Holothuria (Microthele)*: *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei* in Appendix II in accordance with Article II paragraph 2(a). The FAO Expert Panel assessment of proposal 45 concluded that the available data for *Holothuria fuscogilva* does not meet, there was insufficient evidence to make a determination for *Holothuria nobilis* and *Holothuria whitmaei* does meet the CITES Appendix II listing criteria.

ISBN 978-92-5-131315-2 ISSN 2070-6987



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CA3576EN/02.19