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Our Ref.: Your Ref.:

22 January 2010

Dear Mr. Wijnstekers,

It is my pleasure to send you an advance copy of the report of the FAO Expert Advisory Panel for Assessment of Listing Proposals to CITES for Commercially-Exploited Aquatic Species which was convened in Rome, from 7 to 12 December 2009, in accordance with the Terms of Reference for such panel developed by the Twenty-fifth Session of the FAO Committee on Fisheries (COFI), in February 2003. This report has already been submitted informally by FAO to the CITES Secretariat to meet the deadline set for responses to proposals for the CoP15. I would be grateful if you could ensure that it is available for CITES Parties and observers participating in CoP15.

I thank you again for the good cooperation among our Secretariats and I wish you a happy and successful New Year 2010.

Yours sincerely,

Ichiro Nomura
Assistant Director General
Fisheries and Aquaculture Department

Mr W. Wijnstekers
Secretary-General
Convention on International Trade in
Endangered Species of Wild Fauna and Flora, CITES
chemin des Anémones 15
1219 Châtelaine, Switzerland

**FAO Fisheries and Aquaculture Report No. ...** **FIRF/R925 (En)**

**ISSN 2070-6987**

**ADVANCE COPY**

**Report of the**

# THIRD FAO EXPERT ADVISORY PANEL FOR THE ASSESSMENT OF PROPOSALS TO AMEND APPENDICES I AND II OF CITES CONCERNING COMMERCIALLY-EXPLOITED AQUATIC SPECIES

**Rome, 7–12 December 2009**

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2010

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**The third 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 7 to 12 December 2009. 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. CoP13]); 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. Six proposals were evaluated by the Panel: (i) CoP15 Proposal 15. Proposal to include *Sphyrna lewini* (Scalloped hammerhead) on CITES Appendix II; (2) CoP15 Proposal 16. Proposal to include *Carcharhinus longimanus* (Oceanic whitetip shark) on CITES Appendix II; (3) CoP15 Proposal 17. Proposal to include *Lamna nasus* (Porbeagle) on CITES Appendix II; (4) CoP15 Proposal 18. Proposal to include *Squalus acanthias* (Spiny dogfish) on CITES Appendix II; (5) CoP15 Proposal 19. Proposal to include *Thunnus thynnus* (Atlantic bluefin tuna) on CITES Appendix I; CoP15 Proposal 21. Proposal to include all species in the family Coralliidae (Red and Pink corals) on CITES Appendix II. This report includes the assessment of each of the six proposals by the Panel.**

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Barcode

## PREPARATION OF THIS DOCUMENT

**This is the report of the Third FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, held at FAO headquarters from 7 to 12 December 2009. The meeting of the Panel was funded by FAO Regular Programme and by the Governments of Japan and United States of America.**

**Distribution:**

**Participants**
**All FAO Members**
**Directors of Fisheries**
**FAO Fisheries and Aquaculture Department**
**FAO Regional and Subregional Fisheries Officers**
**CITES Secretariat**

FAO.
Report of the third FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species.
Rome, 7–12 December 2009.
FAO Fisheries Report. No. 925. Rome, FAO. 2010. 144 p.

**ABSTRACT**

The third 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 7 to 12 December 2009. 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:

- (assess each proposal from a scientific perspective in accordance with the CITES biological listing criteria (Resolution Conf. 9.24 [Rev. CoP13]);
- 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 six proposals submitted to the CITES fifteenth Conference of the Parties:

1. **CoP15 Proposal 15.** Proposal to include *Sphyrna lewini* (Scalloped hammerhead) in Appendix II in accordance with Article II paragraph 2(a), and to include *Sphyrna mokarran* (Great hammerhead), *Sphyrna zygaena* (Smooth hammerhead), *Carcharhinus plumbeus* (Sandbar shark), and *Carcharhinus obscurus* (Dusky shark) in Appendix II in accordance with Article II paragraph 2(b).
2. **CoP15 Proposal 16.** Proposal to include *Carcharhinus longimanus* (Oceanic whitetip shark) in Appendix II in accordance with Article II paragraph 2(a).
3. **CoP15 Proposal 17**. Proposal to include *Lamna nasus* (Porbeagle) in Appendix II in accordance with Article II paragraphs 2(a) and (b).
4. **CoP15 Proposal 18**. Proposal to include *Squalus acanthias* (Spiny dogfish) in Appendix II in accordance with Article II paragraphs 2(a) and (b).
5. **CoP15 Proposal 19**. Proposal to include *Thunnus thynnus* (Atlantic bluefin tuna) in Appendix I in accordance with Article II paragraph 1.
6. **CoP15 Proposal 21**. Proposal to include all species in the family Coralliidae (Red and Pink corals) in Appendix II of CITES in accordance with Article II paragraphs 2(a) and 2(b).

This report includes the assessment of each of the six proposals by the Panel.

**CONTENTS**

## BACKGROUND AND PURPOSE OF THE EXPERT ADVISORY PANEL

1. The third 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 by the twenty-fifth session of the FAO Committee on Fisheries (COFI), February 2003, 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.

2. The FAO 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 to at the twenty-fifth session of COFI are attached to this report as Appendix D. In accordance with those terms of reference, the Panel was established by the FAO Secretariat, according to its standard rules and procedures and observing the principle of equitable geographical representation, drawing from a roster of recognized experts. The task of the Panel was to:

- 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.

## THE PANEL MEETING

4. The Panel met in Rome, Italy, from 7 to 12 December, 2009, hosted by FAO with funding from the FAO Regular Programme and the Governments of Japan and of the United States of America. The Agenda adopted for the meeting is included as Appendix A.

5. The Panel consisted of a core group made up of eight members, thirteen species and implementation experts covering corals, sharks, and tunas, and a member of the CITES Secretariat (see Appendix B).

6. The meeting was opened by Mr Ichiro Nomura, Assistant Director-General, FAO Fisheries and Aquaculture Department, who welcomed the participants and provided some background information to the convening of the meeting of the Advisory Panel and the importance of its task. Mr. Nomura pointed out that the participants of the Panel were selected based on their individual capacity and not as representatives of any country or organization. He stressed the big responsibility of the Panel to produce reliable, objective and thorough advice and justify the respect and trust that CITES Parties showed for the recommendations of the Panel. Mr. Nomura also highlighted the good working relations with the CITES Secretariat. The text of his statement is reproduced in Appendix C.

7. Mr Arne Bjorge was elected Chair of the Panel and Ms Pamela Mace was elected Vice-Chair.

Ms Ellen Kenchington and Messrs Doug Butterworth, Steven Campana, John Neilson, Howard Powles and Marcelo Vasconcellos were elected rapporteurs.

8. The agenda of the meeting was adopted as tabled.

9. The Third meeting of the Advisory Panel differed from previous meetings in that representatives of the proponents of the six proposals for listing on CITES Appendices were invited to present the proposals in person to the Panel and to answer any questions of clarification by Panel participants. For this purpose, the proponents were represented by the following individuals:

- The European Union by Mr. Gerhard Adams, Mr. Ingo W. Stuermer and Ms. Sarah Fowler (CoP15 Prop.17 - Porbeagle shark; CoP15 Prop.18 - Spiny dogfish);
- The United States of America by Mr. John Carlson (CoP15 Prop.15 for Oceanic whitetip shark; CoP15 Prop.16 - Scalloped hammerhead) and by Ms. Glynnis Roberts (CoP15 Prop. 21 - Coralliidae);
- The Principauté de Monaco by Ambassador Philippe Blanchi and Mr. Justin Cooke (CoP15 Prop.19 - Atlantic bluefin tuna).

10. FAO also invited the International Commission for the Conservation of Atlantic Tunas (ICCAT), represented by Mr. Victor Restrepo from the ICATT Secretariat, to present the results of its most recent assessment on Atlantic bluefin tuna. The representatives of the proponents and ICCAT each joined the Panel for an initial session to present proposals and supplementary information, and for a second session to respond to any questions from Panel members following their initial discussions.

11. Initial discussions were held on interpretation of the CITES listing criteria as they relate to commercially exploited aquatic species (CITES Resolution Conf. 9.24 Rev CoP 14), and in particular on the interpretation of paragraphs A and B of Annex 2a of that document. It was clarified that FAO's interpretation of the listing criteria for commercially-exploited aquatic species is that the two paragraphs are collectively addressed with respect to the application of biological listing criteria by the relevant sections of Annex 5 of Resolution Conf. 9.24 (Rev. CoP 14) (see paragraph 14).

## OUTCOME OF THE MEETING

### Evaluation of the proposals

12. The Panel considered the following six proposals submitted to the fifteenth Conference of the Parties to CITES:

**CoP15 Proposal 15.** Proposal to include *Sphyrna lewini* (Scalloped hammerhead) in Appendix II in accordance with Article II paragraph 2(a), and to include *Sphyrna mokarran* (Great hammerhead), *Sphyrna zygaena* (Smooth hammerhead), *Carcharhinus plumbeus* (Sandbar shark), and *Carcharhinus obscurus* (Dusky shark) in Appendix II in accordance with Article II paragraph 2(b). The proposal includes an annotation stating that "the entry into effect of inclusion of these species in Appendix II of CITES will be delayed by 18 months to enable Parties to resolve the related technical and administrative issues."

**CoP15 Proposal 16.** Proposal to include *Carcharhinus longimanus* (Oceanic whitetip shark) in Appendix II in accordance with Article II paragraph 2(a), including an annotation stating that "the entry into effect of inclusion of *Carcharhinus longimanus* in Appendix II of CITES will be delayed by 18 months to enable Parties to resolve the related technical and administrative issues."

**CoP15 Proposal 17**. Proposal to include *Lamna nasus* (Porbeagle) in Appendix II in accordance with Article II paragraphs 2(a) and (b), including an annotation stating that "the entry into effect of the inclusion of *Lamna nasus* in Appendix II of CITES will be delayed by 18 months to enable Parties to resolve related technical and administrative issues, such as the possible designation of an additional Management Authority and adoption of Customs codes."

**CoP15 Proposal 18**. Proposal to include *Squalus acanthias* (Spiny dogfish) in Appendix II in accordance with Article II paragraphs 2(a) and (b), including an annotation stating that "the entry into effect of the inclusion of *Squalus acanthias* in Appendix II of CITES will be delayed by 18 months to enable Parties to resolve related technical and administrative issues, such as the development of stock assessments and collaborative management agreements for shared stocks and the possible designation of an additional Scientific or Management Authority."

**CoP15 Proposal 19**. Proposal to include *Thunnus thynnus* (Atlantic bluefin tuna) in Appendix I in accordance with Article II paragraph 1, including an annotation stating that "Appendix I listing would be accompanied by a Conference resolution that would mandate the Animals Committee of the Convention to review the status of the East Atlantic and Mediterranean stock and the West Atlantic

stock of *Thunnus thynnus* in light of any intervening actions at ICCAT and, if warranted, ask the Depositary Government (Switzerland) to submit a proposal to a subsequent CoP to downlist the species to Appendix II or remove it from the Appendices. A ruling to this effect by the Animals Committee only requires a simple majority of the Committee members and CoPs have a high rate of acceptance of proposals submitted by the depositary Government at the request of a relevant CITES Committee."

**CoP15 Proposal 21**. Proposal to include all species in the family Coralliidae (Red and Pink corals) in Appendix II of CITES in accordance with Article II paragraphs 2(a) and 2(b).

The assessments prepared by the Panel on each of these Proposals are attached to this report as Appendices E to J.

**General comments and observations**

***Comments from Member Countries received by the FAO Secretariat***

13. In accordance with the terms of reference for the Panel, FAO Members and regional fishery management organizations were notified of the proposals submitted that dealt with commercially-exploited aquatic species and were informed that FAO would be convening the Advisory Panel. They were invited to send any comments or relevant information to the FAO Secretariat, for consideration by the Panel. Two countries and three organizations responded to this request and provided information on management and trade of the proposed species.[1] In addition, two diplomatic representatives from the proponents, one from the European Union (represented by Germany) and the other from Monaco addressed the meeting and shared some interesting political views related to their proposals and the interpretation of the criteria.

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

The Panel applied the CITES Res.Conf. 9.24 (Rev. CoP14) criteria interpreted in accordance with FAO's initial advice to CITES on criteria suitable for commercially-exploited aquatic species[2] and as applied in the 2nd Meeting of the Expert Advisory Panel in March 2007. Document CoP14 Inf. 64[3], prepared by the FAO Secretariat and submitted to the 14th Conference of the Parties to CITES in 2007, also provides an explanation of the interpretation of the Annex 2a criteria for inclusion of species in Appendix II as applied by the Panel.

***General comments by the Panel on the proposals***

16. The Panel welcomed the participation of representatives of the proponents of the six proposals during its meeting. Both the presentations of the proposals, and the opportunity to ask questions of clarification to the representatives of the proponents after initial Panel discussions, greatly improved the information available to the Panel and its ability to make informed assessments of the proposals.

17. The Panel considered that there had been some improvement in presentation of proposals over the set reviewed in 2007. Some proposals used tables to present indices of productivity and decline, and in some cases information was presented in such a way that it could be relatively easily reviewed and assessed. Nonetheless, the Panel's comments in the 2007 report are still relevant for several proposals:

[1] Comments were received from Italy, Monaco, International Commission for the Conservation of Atlantic Tunas (ICCAT), General Fisheries Commission for the Mediterranean (GFCM) and The Federation of European Aquaculture Producers (FEAP) Tuna Commission.

[2] Report of the second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. Windhoek, Namibia, 22–25 October 2001. FAO Fisheries Report No. 667 Rome, FAO. 2002. 87p.

[3] "The interpretation of Annex 2 a (criteria for the inclusion of species in Appendix II in accordance with Article II, paragraph 2(a), of the Convention) and Annex 5 (Annex 5 Definitions, Explanations and Guidelines) of Resolution Conf. 9.24 (Rev CoP13) in relation to commercially exploited aquatic species" available at http://www.cites.org/common/cop/14/inf/E14i-64.pdf

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 clearly and concisely presented. Even where information is difficult to quantify, all efforts should be made to present the information in a form that can be objectively assessed.

18. Most of the proposals relied to some extent on sources that are unpublished or difficult to access. Assessment of proposals would be facilitated if proponents provided copies of all source documents (pdf or other) along with listing proposals. The Panel gratefully acknowledges those proponents who provided copies of source materials during the Panel meeting.

19. For species that have been the subject of proposals at previous Conferences of Parties (CoPs), assessment would be facilitated if information sources which are new since the last proposal and any other relevant changes were identified in the proposal or in a cover note.

20. Assessing proposals against the listing criteria requires an assessment of the importance of international trade in driving exploitation and in affecting species status. In general little information on the relative importance of international trade in driving exploitation was presented in proposals. This is often due in part to the lack of information on this subject, resulting from the lack of species-level tariff codes for many species in trade (see below). However, in some cases available information on the importance of international trade was not used to best effect in the proposals.

21. Accurate recording of international trade in sharks is seriously hampered by the absence of any species-specific reporting mechanism. To address this, the Panel suggested that the CoP encourages the World Customs Organization to establish specific headings within the standardized tariff classification of the Harmonized System to record trade in sharks and their products at the species level.

22. Several proposals suggested that some populations of a species should be listed on Appendix II because of conservation concerns (in accordance with Article II paragraph 2[a]), while other populations of the same species should be listed because of inability to distinguish products from those listed for conservation reasons (in accordance with Article II paragraph 2[b]). While it is almost certainly true that differentiating products from different populations within a species would be difficult and frequently impossible for enforcement officers without specialized equipment or training, the approach of listing different populations of the same species under Article II, some under paragraph 2(a) and others under paragraph 2(b), needs careful consideration. Ultimately the result of adoption of this approach could lead to a situation whereby one (perhaps relatively small) population was listed under paragraph 2(a) and the rest of the species under paragraph 2(b) even though the species as a whole is in a healthy state. This could lead to imposition of administrative burdens and other restrictions on international trade that were excessive in relation to the risks to the species as a whole.

23. In evaluating such proposals, the Panel took note of the wording of CITES Resolution Conf. 9.24 (Rev. CoP 14) indicating that Parties had resolved to adopt measures that are proportionate to the anticipated risks to the species when considering proposals to amend the Appendices. The Panel considered whether effectively listing the biological species as a whole would be proportionate to the risk to the species, in assessing whether some populations should be listed in accordance with Article II paragraph 2 (b).

24. The Panel thus took this approach when assessing whether the species as a whole should be listed when some populations meet the decline criterion for Appendix II and other populations do not. In these cases, an important consideration for the Panel was whether populations representing most of the historical abundance of the species globally meet the criteria for listing in accordance with Article II paragraph 2 (a).

25. In considering proposals to list species in accordance with Article II paragraph 2(b), the Panel noted that there is presently a lack of guidance or standards for assessing such proposals within CITES, concluding that development of such guidance would greatly facilitate future assessment of proposals of this kind. FAO's technical expertise in fish products and fish trade could help support development of such guidance for commercially exploited aquatic species.

***For consideration in reading the reports***

26. As was done in the previous Advisory Panel, in considering trends in abundance reported in the proposals, the 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 Table 1.

**Table 1.** *Criteria used by the Panel to assign a measure of the reliability of information derived from different sources for use as indices of abundance. A score of zero indicates that the information was not considered to be reliable and a score of five indicates that it was considered to be highly reliable. Any information on abundance allocated a non-zero value was considered to be useful. These scores could be adjusted either up or down in any particular case, depending on the length of the time-series and the amount of information that was available on the sources and methods.*

| 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. |

27. The details of references to other publications used in the Panel reports on each proposal can be found in the original proposals, unless otherwise indicated.

**ADOPTION OF THE REPORT**

28. The report, including all Appendices, was adopted by the Advisory Panel on Saturday 12 December 2009.

## APPENDIX A

## Agenda

### Monday, 7 December 2009

1. Arrival and registration
2. Welcome by Ichiro Nomura (Assistant Director-General, FAO Fisheries and Aquaculture Department)
3. Introduction of participants
4. Selection of Panel Chair
5. Panel terms of reference, objectives and work programme for the meeting
6. Overview of the CITES listing criteria (Res.Conf. 9.24 [Rev. CoP 14]).
7. Presentations by proponents of each of the four proposals dealing with shark species, followed by questions from the Panel.
8. Panel discussion on the four proposals

### Tuesday, 8 December 2009

9. Panel discussion on the four proposals
10. Discussion with Proponents of the four shark proposals ( Mr Gerhard Adams, Ms Sarah Fowler and Mr Ingo W. Stuermer, EC – Mr John Carlson, NOAA)

### Wednesday, 9 December 2009

11. Preparation of draft reports on shark proposals
12. Presentation by the FAO consultants of preliminary assessments of the proposals on i) Coralliidae and ii) Thunnus thynnus.

### Thursday, 10 December 2009

13. Presentations by proponents of the proposals on i) Coralliidae and ii) Thunnus thynnus, followed by questions from the panel
14. Presentation by ICCAT Secretariat on the outcomes of the ICCAT Scientific Committee meeting in September 2009 in relation to Thunnus thynnus and the decisions adopted by the Commission in Recife, followed by questions from the Panel
15. Panel discussion on the two proposals

### Friday, 11 December 2009

16. Panel discussion on the two proposals
17. Discussion with Proponents of the Coralliidae and Thunnus thynnus (Ms Roberts, NOAA, USA and Mr Restrepo, ICCAT)
18. Preparation of draft reports on Coralliidae and Thunnus thynnus

### Saturday, 12 December 2009

19. Finalization of reports on all six proposals
20. Clearance and adoption of reports by Panel

## APPENDIX B

### List of participants

**CORE PANEL**


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## SPECIES AND IMPLEMENTATION EXPERTS

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## APPENDIX C

### Welcome speech by Mr Ichiro Nomura, Assistant Director-General, FAO Fisheries and Aquaculture Department

It is my pleasure to welcome you to this third 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 of Wild Fauna and Flora (CITES) Concerning Commercially-Exploited Aquatic Species.

You have been selected, in your individual capacity and not as a representative of any country or organisation, on the basis of your particular expertise to assist FAO to undertake these tasks. For many of you this will be your first experience of the Panel but several of you also participated in one or both former meetings that were able to deliver very satisfactory reports. Those of you who were present at the previous two CITES Conference of Parties know that the Panel reports were welcomed and taken very seriously. The last CITES CoP 14 followed all the recommendations of the Panel even in some controversial cases. This shows the extent to which the advice of the Panel is trusted and respected by Parties. This respect puts a big responsibility on all of us to ensure that the Panel produces reliable, objective and thorough advice. We are very grateful that you have accepted this challenge and have dedicated your time and expertise to assist us. To help the current Panel to keep up with the good work of the previous ones, we prepared preliminary evaluations to serve as working documents for the Panel. We hope that these will allow the Panel to consider each proposal efficiently, to focus quickly on the more difficult or uncertain aspects, if any, in each proposal, and to formulate solid and justified conclusions.

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 and motivate the conflicting opinions to allow CITES Parties to evaluate them and make up their own minds.

I thank you all for giving up your time to help us in this important meeting, 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. David Morgan of the CITES Secretariat for joining us at this meeting and for the cooperation and assistance given by CITES in the work we have been undertaking in relation to CITES and commercially-exploited aquatic species. We have developed a close and positive working relationship with the CITES Secretarial which is valued by both organizations. I must mention though that at present, we do have an important difference of opinion with the CITES Secretariat with regard to the interpretation of the listing criteria. The manner in which this is resolved could have considerable implications for the Convention in the future. However, this issue need not concern the Panel and, as you know, your task is not to evaluate the criteria but to apply them and, in doing this, we have asked you to adhere to the science-based interpretation that is the FAO understanding of what the majority of CITES Parties adopted in 2004. We hope that the CITES Parties will resolve this issue at their Conference next year in a manner that will enable the Convention to fulfil its important mandate in the most effective manner.

The meeting of this Expert Advisory Panel has again been financially supported by the FAO Regular Programme and also by Japan and the United States of America, and I would like to thank these two countries for their generous gesture.

Finally, I sincerely hope that the 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 D

### Terms of Reference for Ad Hoc Expert Advisory Panel for Assessment of Proposals to CITES[4]

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 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 ?? days[5] 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.

[4] Taken from Appendix E of the Report of the twenty-fifth Session of COFI, FAO, Rome, 24-28 February 2003
[5] To be discussed with CITES

## APPENDIX E

## FAO Expert Advisory Panel assessment report:

## Scalloped hammerhead and related species

**CoP 15 Proposal 15**

**SPECIES:**

*Sphyrna lewini* – Scalloped hammerhead shark plus *Sphyrna mokarran* (Great hammerhead shark), *Sphyrna zygaena* (Smooth hammerhead shark), *Carcharhinus plumbeus* (Sandbar shark), *Carcharhinus obscurus* (Dusky shark)

**PROPOSAL:**

Inclusion of *Sphyrna lewini* in Appendix II in accordance with Article II paragraph 2(a); inclusion of *Sphyrna mokarran*, *Sphyrna zygaena*, *Carcharhinus plumbeus*, *Carcharhinus obscurus* in Appendix II in accordance with Article II paragraph 2(b)

**Basis for proposal**:

*Sphyrna lewini*: The proposal indicates that *Sphyraena lewini* qualifies for inclusion in Appendix II because it is over-exploited for its fins, which are highly valued in trade, and has experienced historic declines of at least 15-20% from the baseline. In addition recent rates of decline are projected to drive the species down from the current level to a historical extent of decline consistent with the Appendix I criteria within approximately a 10-year period.

*Sphyrna mokarran*, *Sphyrna zygaena*, *Carcharhinus plumbeus*, *Carcharhinus obscurus:* The specimens of the species in the form in which they are traded resemble specimens of a species included in Appendix II under the provisions of Article II, paragraph 2(a), or in Appendix I, such that enforcement officers who encounter specimens of CITES-listed species, are unlikely to be able to distinguish between them. The proposal indicates (Section 9) that fins from all these species are morphologically similar, thin and falcate, with dorsal fin height longer than the base, and that traders often lump fins from these five species together.

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**ASSESSMENT SUMMARY**

The FAO Expert Panel concluded that the available evidence supports the proposal to include Scalloped hammerhead (*Sphyrna lewini*) in CITES Appendix II in accordance with Article II paragraph 2(a), along with the look-alike species, Great hammerhead shark (*S. mokarran*) and Smooth hammerhead shark (*S. zygaena*), in accordance with Article II paragraph 2(b). However, it considered that there is insufficient evidence to also include Sandbar shark (*Carcharhincus plumbeus*) and Dusky shark (*C. obscurus*) in accordance with Article II paragraph 2(b), due to inadequate evidence relating to “look-alike” considerations.

The Panel concluded that this was a species of low productivity.

When evaluated on a population by population basis, two historically large Scalloped hammerhead populations proposed for listing were considered to meet the Appendix II decline criterion.

In the Northwest Atlantic Ocean, the most robust information is from a population assessment based on multiple data sets that showed an extent of decline of 83% between 1981 and 2005. This meets the Appendix II decline criterion for a low productivity species. In the Southwest Atlantic Ocean, hammerhead sharks were targeted by several fisheries that have subsequently collapsed (overall extent of decline up to 90%). Scalloped hammerhead appear to have been relatively abundant in the past in this area, but are now generally too sparse to support target fisheries.

Information for judging the extent of decline elsewhere is only available for a few areas. In the Pacific Ocean, datasets that provide compelling evidence of substantial declines include beach-protection net data from the Southwest Pacific that indicate a 65-85% decline over a 44 year period spanning 1963-2007, and

sightings data from the eastern Pacific that indicate a 71% decline over a 12 year period spanning 1992-2004. In the western Indian Ocean, beach-protection net data indicate a 64% decline over a 25 year period spanning 1978-2003.

Although the Panel was not able to locate reliable time series of data for other areas, consideration of life history information (philopatry, coastal distribution, vulnerability to fishing at all stages of life, and behaviour) and high demand for fins led the Panel to conclude that levels of decline are likely to be similar elsewhere. Based on these considerations and evidence of substantial declines that meet or nearly meet the Appendix II decline criteria in all areas where adequate time series exist, the Panel considered that, overall, Scalloped hammerhead meets the decline criterion for Appendix II.

Fins for this species are in demand and are of relatively high value in the world market, and there is evidence that international trade has resulted in targeting of this species for its fins. Currrently, it appears that several target fisheries have collapsed and most catches constitute bycatch from fisheries targeting other species.

In the area where the largest decline has been observed, the Northwest Atlantic, increasingly stringent management measures are being implemented for a species complex of which Scalloped hammerhead is a part, which may mitigate risk. In other areas, finning bans may support management but there are no strong management measures in place for this species.

With respect to the proposal to list four other shark species (Great hammerhead shark, Smooth hammerhead shark, Sandbar shark, Dusky shark) in accordance with Article II paragraph 2(b), the Panel concluded that the information available justified the case for Great and Smooth hammerheads, but did not justify the case for Sandbar and Dusky sharks, as products from these two species do not resemble those of the Scalloped hammerhead to the extent that regulation of trade was required to protect the Scalloped hammerhead. Evidence was available that fins of Scalloped and Smooth hammerhead are not separated in the Hong Kong market, so there is clear justification for an Article II paragraph 2(b) listing of the latter. Similarly, fins of these two species and the Great hammerhead closely resemble each other, such that the latter species might be included in a “look-alike” group. However the reasoning provided for including Sandbar and Dusky shark, and for not including other species of sharks, did not appear strong.

Assessing Article II paragraph 2(b) proposals for exploited sharks whose fins are in trade is complicated by a lack of information on the “taxonomy” of fins (as might be provided in an identification guide) and the lack of standards in CITES for making decisions on Article II paragraph 2(b) listings. The former difficulty is being addressed by the US which is preparing an identification guide to fins, and the latter could be addressed by a technical consultation on Article II paragraph 2 (b) listings of commercially exploited aquatic species, perhaps organised by FAO.

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

Scalloped hammerhead is a circumglobal shark species found in coastal warm temperate and tropical seas (Compagno 1984, Fowler et al 2005). Like other hammerhead sharks, this species is primarily found on continental shelves and in deep water adjacent to them, to depths of at least 275 m, but is rarely found in open ocean areas.

A study of global genetic structure based on mitochondrial DNA (Duncan et al 2006) showed strong geographic population subdivisions, corresponding to ocean barriers to migration. The proposal cites an unpublished study which provides further detail on genetic structure (Chapman et al 2009 in review, cited in the proposal). The strong population substructure may account for differences in life history parameters between ocean basins.

***Productivity level***

Most values of life history parameters are consistent with a low productivity level (Table 1). Information is available from the Northwest Atlantic (Piercy et al 2007), western Indian Ocean (Dudley and Simpfendorfer 2006), western Pacific (Chen et al 1990) and eastern Pacific (Tolentino and Mendoza 2001) (Table 1). Values from the western Pacific (Chen et al 1990) indicate a faster growth rate than in other parts of the world and suggest that productivity may be considered medium in this area; however recent studies have cast doubt on this result (J. Carlson pers. comm.).

The detailed life history modelling study of Cortes (2002) provides very different results for *S. lewini* from the Northwest Gulf of Mexico and western Pacific (Table 1), no doubt based on differing observations of life history parameters in these two areas. This study generated a relatively high estimate of population growth rate for *S. lewini* from the western Pacific, the second highest of 41 populations of sharks compared, while estimated population growth rate of *S. lewini* from the Gulf of Mexico was about in the middle of the 41 populations considered. Western Pacific *S. lewini* would correspond to a high or medium productivity level based on this study, while Gulf of Mexico individuals would be rated low productivity (Table 1).

**Population status and trends**

***Decline***

A number of abundance indices are available from different parts of the range (proposal; Table 2), but these are of varying reliability as indices for this species. In some cases indices are for Scalloped hammerhead as a species, in others for a complex of hammerhead sharks (*Sphyrna* spp.), in yet others for a broader shark complex.

*Northwest Atlantic Ocean*

Hayes et al (2009), based on a population assessment of Scalloped hammerhead shark using two forms of surplus production model and incorporating multiple abundance indices (including those listed below), found an extent of decline of 83% from 1980-2005 (Fig. 1). Their study indicates that the population has been increasing since 1995 and that there is a high probability of population recovery under most plausible scenarios, although the time to recovery varies with fishery removals (Table 3). However, they note that surplus production models are often overly optimistic in estimating rebuilding times.

Jiao et al (2009) conducted an assessment of the hammerhead shark complex (Scalloped, smooth, great), concluding that recent depletion level (extent of decline) would be 91-93% for 1980-2005, based on ratio of current number to $N_{MSY}$ and the fact that $N_{MSY}$ is half of unexploited biomass.

Myers et al (2007) summarised abundance trends for Scalloped hammerhead and other shark species from a number of survey and commercial CPUE databases. A 31-year survey in North Carolina coastal waters (UNC) showed an instantaneous rate of decline of 0.127 for Scalloped hammerhead, equivalent to a 98% extent of decline over the series (Fig. 2). A SEAMAP survey in coastal waters of the southeast United States showed an instantaneous rate of increase for Scalloped hammerhead of 0.094 over 17 years; the authors note that this was one of only 2 out of 31 shark abundance trends which showed an increase, and hypothesised that since the individuals taken were mostly juveniles, the increase could reflect release of competition and/or predation due to decline in abundance of large sharks. Commercial logbook and observer time series for all hammerheads pooled (noting that Scalloped hammerhead was the most abundant of the three species in the group) showed extents of decline of 91% and 79% respectively over 14-15 yr series, based on instantaneous rate of decline estimates. Myers et al (2007) indicate an instantaneous rate of decline from a meta-analysis of trends from several surveys of approximately 0.05 (Fig. 3).

Baum et al (2003), apparently based on the same logbook data set as Myers et al (2007) indicated a decline from 1986 to 2000 of 89% in commercial CPUE of pooled hammerhead species (Fig. 4), and noted that this species group had declined in all fishing areas examined (Fig. 5). Burgess et al (2005) provided arguments that the declines in abundance indices observed by Baum et al (2003) were probably greater than population declines, while Baum et al (2005) in responding to this critique provided arguments that their estimates of population decline were robust.

Two survey indices from Ingram et al (2005) are included (Table 2) since they were included in the proposal, however these are considered of low reliability for Scalloped hammerheads since they are based on all coastal sharks, of which Scalloped hammerhead made up only 6-7%. Inspection of survey CPUEs for this complex showed no trend for the Atlantic coast of the USA for 1995-2005 and for the Gulf of Mexico coast 1995-2003, contrary to the interpretation in the proposal.

Catches of Scalloped hammerheads have declined substantially over the period 1981-2005, from maximum annual catches of over 40 000 individuals in some years in the early 1980s to 2 600-6 000 in the last three years of the series (Fig. 6) (Hayes et al 2009). Recreational catches made up almost all the total harvest in the early years of the series, while these have declined to less than 1 000 per year recently; commercial catches increased beginning in the early 1990s. Harvest levels have been affected by increasingly stringent management measures (NMFS 2006) and should not be considered a reliable measure of abundance.

*Southwest Atlantic*

Information from southern Brazil fisheries targeting hammerhead sharaks (Kotas pers. comm.), shows strong declines from 2000 to 2008 in two of three available series : surface longline CPUE and bottom gillnet CPUE declined by 80% or more (Fig. 7). Surface gillnet CPUE varied without trend (Fig. 7). Catch and CPUE information from the same fishery (Kotas et al 2008) indicates that these fluctuated by about a factor of 5 between 1995 and 2005, with a decline in the last years of the series (Fig 8). Catch would not be a strong abundance index. The targeted hammerhead fishery was abandoned after 2008 because the species had become rare (Kotas pers. comm.)

Vooren et al (2005) provide information from this area for an earlier period, 1993 to 2001. Annual landings of hammerheads (*S. lewini* and *S. zygaena* combined) in the main fishing ports in southern Brazil (Rio Grande and Itajai) increased from 30 tonnes in 1992 to 700 tonnes in 1994 and oscillated from 100 to 300 tonnes between 1995 and 2002 (Figure 9). Vooren et al. (2005) noted that landings may not represent the actual catches of hammerheads in the region because of shark finning practices. CPUE of the oceanic gillnet fisheries varied between 100 and 300 kg per trip without a clear trend from 1992 to 2002 (Figure 9). CPUE of longline fisheries increased from 1993 to 2000 and then declined to 2002 (Figure 10). Effort data used to calculate CPUE were not corrected for changes in the size of gillnets or in number of hooks in the longline fisheries (C. Vooren pers. comm.). The CPUE of recreational fisheries targeted to neonate hammerheads in shallow coastal waters also do not show a clear trend from 1999 and 2004, but possibly indicate a decline after 2001 (Figure 11). Based on the above results the authors concluded that hammerheads were not threatened in southern Brazil but that effective conservation measures were needed to maintain the population at its current level of abundance.

*Mediterranean Sea*

The proposal indicates that Ferretti et al (2008) show a 99% decline in Scalloped hammerhead. However Ferretti et al (2008) indicate that *Sphyrna zygaena* is the only species of hammerhead covered by their indices, and that other species occurred only sporadically. Accordingly this was not considered an appropriate index for Scalloped hammerhead.

*Western Indian Ocean*

In an analysis of CPUE in large-mesh gillnets used to protect beaches from sharks, Dudley and Simpfendorfer (2006) indicated a steady decline in abundance between 1978 and 2003; level at the end is 35% of that at the beginning of the series, ie an extent of decline of 65% (Fig. 12).

The proposal (p. 10) cites FAO landings data for Scalloped hammerhead in Oman as varying between 2 800 and 8 300 t/yr, with peaks in the mid 1980s and late 1990s, and a 2000 value of 4 000 t.

*Western Pacific Ocean*

De Jong and Simpfendorfer (2009) reported a decline of over 85% in Scalloped hammerhead standardised CPUE over 44 years in a beach protection net program in eastern Australia (northern Queensland). The Panel was advised that a range of 65-85% was consistent with the most recent analyses of this information (Simpfendorfer personal communication to the Panel).

Gribble et al (2005) presented catch and CPUE for all species combined in the Queensland shark fishery, in which *S. lewini* is one of the most important species (2nd in abundance and 18% of the total shark catch on 4 observed trips). Both catch and CPUE (all fisheries combined, kg/day) increased steadily from the late 1980's to the early 2000's (Fig. 13). This index cannot be considered to be of high reliability for *S. lewini* as there are no data on species composition over time, and this could well have changed.

*Eastern Pacific Ocean*

Myers et al (n.d.) found a 71% decline in a diver visual sightings index for Scalloped hammerhead in a protected area in the Cocos Islands, from 1992 to 2002.

***Small population size***

The only population estimate available is that of Hayes et al (2009) for the Northwest Atlantic, 24 500 individuals (a misprint on their figure suggests ca 2 000 individuals).

No worldwide population estimate is available.

***Restricted distribution***

No estimate of distribution area is available but given that this species is circumglobal in tropical and warm temperate waters it can be concluded that it does not have a restricted distribution.

***Other indices***

Myers et al (2007) presented information on change in length of Scalloped hammerhead in the Northwest Atlantic, which indicates that there has been a slight decline over the period sampled (Fig. 14).

Dudley and Simpfendorfer (2006) found no trend in length of females, and a significant increasing trend for males, for the Southwest Indian Ocean over the period observed (1978-2003) (Fig. 15).

**Assessment relative to quantitative criteria**

***Decline***

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 14), a decline to 15-20% of the historical baseline for a low productivity species might justify consideration for Appendix I. For listing on Appendix II, being "near" this level might justify consideration, "near" for a low productivity species being 20-30% of the historical abundance level (15-20% + 5-10%).

The Panel concluded that this is a low productivity species.

No overall population decline index is available for comparison with the guidelines. Indices in the individual areas are considered below. Most relevant indices available show declines consistent with the criterion threshold for listing a low productivity species on Appendix II.

In the Northwest Atlantic, the most robust index of abundance available (Hayes et al 2009) indicates a historical extent of decline of some 83% from 1980 to 2005. This assessment indicates that numbers have been increasing in the period 1995-2005, and that the increase would be expected to continue under most plausible catch scenarios. The results of this assessment are consistent with an assessment of three hammerhead species pooled (Jiao 2009) which indicated a historical extent of decline of of 91-93% in the period 1980-2005. These assessments incorporate other abundance index series available for the Northwest Atlantic (Table 2), some of which show conflicting trends. The 83% or 91-93% extents of decline would be consistent with the decline criterion for an Appendix II listing.

For the Southwest Atlantic two of three CPUE time series available for fisheries in southern Brazil historical extents of decline of the order of 80% or more for the period 2000-2008. These are the most recent data available in this area, following earlier time series which show inconsistent trends. This fishery closed subsequent to 2008 because low abundance of the hammerhead sharks targeted no longer justified fishing.

For the western Indian Ocean, the 64% historical extent of decline 1978-2003 of Dudley and Simpfendorfer (2006) would not be consistent with Appendix II decline guidelines, but does indicate a substantial, sustained decline.

In the Pacific Ocean, the historical extent of decline of 71% 1992-2002 (Cocos Islands, eastern Pacific) is consistent with Appendix II listing, while the extent of decline of 65 - 85% over 44 years (northern Queensland, western Pacific) is consistent with or at least very close to the decline criterion for Appendix II listing.

***Small population***

No global population estimate is available for this species, although an estimate for the Northwest Atlantic is available.

The CITES guideline is considered generally inappropriate for populations of commercially-exploited marine species, except for a few species such as some sessile or semi-sessile species, some species with extremely low productivity, and some small endemics (FAO 2001).

***Restricted distribution***

No guidelines for restricted area of distribution are provided in the CITES Criteria, which indicate that thresholds should be taxon-specific (Conf Res 9.24 Rev CoP 14). FAO (2001) recommended that historical extent of decline in area of distribution would be a better measure of extinction risk than absolute value of distributional area, but that if no other suitable information is available and absolute area of distribution has to be used for an exploited fish population, analyses should be on a case-by-case basis as no numeric guideline is universally applicable.

No estimate of global distribution area is available but given the circumglobal distribution of the species, it would not appear to be characterised by a restricted distribution.

***Were trends due to natural fluctuations?***

There is no indication in the materials consulted that natural fluctuations caused any of the observed abundance trends.

**Risk and mitigating factors**

Fins from this species are in high demand and are easily preserved and transported, and the species co-exists with other high-value pelagic species and is readily taken as bycatch.

Risk in the Northwest Atlantic may be mitigated by the existence of a US NMFS Fishery Management Plan for Highly Migratory Species, including Scalloped hammerhead shark, which is managed as one of 11 species in a “large coastal shark” (LCS) complex (NMFS 2006, NMFS 2008). Reduced harvest quotas for the LCS complex and other stricter regulations were introduced with the 2006 version of the management plan (NMFS 2006) and its followup amendments (NMFS 2008). Managememt measures for the LCS complex are supported by periodic assessments (e.g. NOAA 2006), although since these are at the level of the species complex they may not track status of individual species well.

Risks may be mitigated by existence of shark-finning bans in 21 countries and the European Union, and in 9 regional fisheries management organisations, although provisions of these bans and thresholds (for example, ratio of fins to carcass weights in landings) are variable (Camhi et al 2009 Table 5.7) and compliance is likely to be variable.

**Trade considerations**

***Trade in Scalloped hammerhead parts and derivatives***

Scalloped hammerhead is exploited in many parts of its range, both in directed shark fisheries or as bycatch in fisheries for pelagic and demersal species. Recreational fisheries are or have been important in some parts of the range, for example the USA (Hayes et al 2009), Australia (Gribble et al 2005) and Brazil (Vooren et al, 2005) but would not contribute significantly to trade.

Although meat, oil and hides are used, they are apparently not widely traded, with the possible exception of meat products in some areas (proposal). Meat is not as palatable as for some other species (for example

porbeagle) but is consumed and may be processed (salted and/or dried) for transport. Limited trade in meat is documented in east Africa, west Africa and South America (sources cited in proposal, Section 6.3.1).

Fins are widely traded and demand is high. Trade statistics are not available, since this species (as most other shark species) does not have its own customs code under systems currently in international use (Harmonized Tariff Schedule). Recent work on quantities of fins of different shark species transiting the Hong Kong fin market has helped clarify amounts of Scalloped hammerhead fins in trade.

The Hong Kong fin market has represented a substantial proportion of the global trade in shark fins: 65-80% in 1980-90, 50-65% from 1991-1995, 44-59% from 1996-2000, 30-50% following 2000 (Clarke 2008). The decline in Hong Kong's share of world trade is attributed to increasing trade through mainland China, where statistics are difficult to obtain (Clarke et al 2007). Despite the estimated decline over time in share of the world trade transiting Hong Kong, total imports to Hong Kong increased during the 1990s (Figure 14), suggesting that total world trade in shark fins was increasing during this period.

Hammerhead fins are highly valued in the international fin trade, with high recent prices for the various species ($88 to $135/kg, Clarke Ph. D. thesis 2003 cited in proposal) providing evidence of high demand. Shark fins are a traditional luxury or celebration commodity in China, and a recent trend of rising incomes in mainland China is considered a key driver of increasing demand for shark fins (Clarke et al 2007).

Fins of Scalloped hammerhead and Smooth hammerhead (*S. zygaena*) together made up 4.4% of fins traded in the Hong Kong market (Clarke et al 2006 Table 5) between November 2002 and February 2004.

Overall, it seems clear that Scalloped hammerhead fins are an important product in the international fin trade, although a relatively minor component of the overall trade. Hammerhead sharks are a target species in some areas, while in others they are taken as bycatch in fisheries targeting tuna-like or other shark species. Ease of processing and storage of dried fins facilitates trade, and the products command relatively prices in trade.

***Basis for Article II paragraph (2b) ("look-alike") Appendix II listing of Great hammerhead shark, Smooth hammerhead shark, Sandbar shark, Dusky shark***

As indicated in the CITES listing criteria (Resolution Conf. 9.24 Rev. CoP 14), listing of the four shark species named above could be justified if the parts and derivatives of these species in trade resemble those of the listed Appendix II species (Scalloped hammerhead in this case) to the extent that enforcement officers would be unable to distinguish them.

The proposal provides little detail on the basis for the proposed listing of these four species. It notes (section 9) that fins from the five species are morphologically similar (thin, falcate, dorsal fin height higher than base) and are often lumped together and sorted separately from those of other species in markets. No comparative information is provided on pectoral or caudal fins, which are also in trade (Clarke et al 2006).

Hong Kong traders are generally able to identify fins in trade to species or to small species groups, as indicated by a comparison of categories of shark fins used by traders in the Hong Kong market with species identifications based on DNA testing (Clarke et al 2006). The degree of correspondence between the trader categories and the DNA identification ranged from 62% ("bai qing", corresponding to Sandbar shark) and 95% ("chun chi", corresponding to a mix of Scalloped and smooth hammerhead) (Clarke et al 2006 Table 3). When there was lack of correspondence, a variety of species was miscategorised by traders. Scalloped and Smooth hammerhead were not separated by traders but pooled in a single category, with a high rate of correspondence between the market category and the identification to this species pair (95%).

This study (Clarke et al 2006) did not indicate that the five species covered by this proposal were lumped together in the market. While Scalloped and smooth hammerheads were lumped into a single category, each of the other three species proposed for listing under Article II paragraph 2(b) had its own category in the market, with a relatively high rate of correspondence between the trader category and the species: correspondence for Great hammerhead ("gu pian") was 86%, for Sandbar shark ("bai qing") 74%, for Dusky shark ("hai hu") 85% (Clarke et al 2006 Table 3).

This study indicates that it is possible to identify shark fins in trade to species, with the important exception of Scalloped and Smooth hammerhead which are not currently separated. However, expert knowledge and experience are doubtless required to attain the level of identification demonstrated in the Hong Kong market.

Accordingly, this study supports the argument that enforcement officers with general knowledge (possibly even with some additional identification materials) would have difficulty identifying fins in trade to species. Available DNA technology could provide a backup to identification but current technology is generally considered not to provide useful techniques for routine separation of species at customs posts.

Clearly, Scalloped and Smooth hammerhead fins cannot be distinguished, or are not distinguished, even with expert knowledge. Fins of all three hammerhead species are quite similar, to the extent that separating them would be dificult for non-experts. However the proposal and other information available do not provide adequate information to support the argument that Sandbar and Dusky sharks should be considered for listing in accordance with Article II paragraph 2(b), if Scalloped hammerhead is listed in accordance with Article II paragraph 2(a).

**Implementation issues**

***Introduction from the sea***

Based on current knowledge of distribution, Scalloped hammerhead is primarily a species of continental shelf and coastal waters, and is uncommon in oceanic waters (Compagno 1984; Fowler et al 2005). Most of the fisheries which exploit this species operate within continental shelf waters rather than in the open ocean. As such, most harvests would be from waters within state Extended Economic Zones, for which the Introduction from the Sea provisions of CITES would not apply. The same would be true for the two other hammerhead species proposed under Article II paragraph 2(b).

***Basis for findings: legally-obtained, non-detrimental***

Non-detriment findings (NDFs) are the responsibility of the exporting country and must show that exports are not detrimental to survival of the species, that is, that they are consistent with sustainable harvesting. Development of an NDF requires appropriate scientific capacity, biological information on the species, and an approach to demonstrating that exports are based on sustainable harvests. Quality of NDFs is assured by review in the Scientific Committees of CITES (Animals and Plants Committees) and in individual parties. FAO (2004, paras 28–29) provides some guidance on NDFs in a fisheries context.

For the Northwest Atlantic, NDFs could be based on the recent assessments of this species (Hayes et al 2009, Jiao et al 2009). The US Fisheries Management Plan (NMFS 2006) treats Scalloped hammerhead as one of 11 species in a large coastal shark complex, and as such does not include a quota for this species alone, but harvest levels consistent with stock rebuilding have been determined (Hayes et al 2009) and NDFs could be issued for harvests consistent with such levels.

For other parts of the distribution, no species-specific assessments are available which could provide a basis for NDFs.

There appear to be no restrictions on harvest of this species in any part of the range, so there would be no difficulty in providing a finding that specimens were legally obtained but, under these circumstances, such a finding would be meaningless in relation to assuring sustainable use.

***Identification of products in trade***

Fins are the principal product in trade. Although fin traders are generally able to identify fins to species consistently, accuracy is not 100%, and two species of hammerheads (Scalloped and smooth) are not differentiated even by expert traders in the market (Clarke et al 2006). The proposal indicates that fins of the five species covered by this proposal are morphologically similar to the extent that Article II paragraph 2(b) listing is justified for four species, but provides little background information.

Accurate recording of international trade in sharks is seriously hampered by the absence of any species-specific reporting mechanism. To address this, the Conference of the Parties should encourage the World Customs Organization to establish specific headings within the standardized tariff classification of the Harmonized System to record trade in sharks and their products at the species level.

***"Look-alike" issues***

Although non-experts would probably have difficulty separating shark fins in trade, there is little widely-available information on identifying shark fins to species and on separating these at the present time. Further, CITES does not have clear standards for making decisions on whether to list species under Article II paragraph 2(b). Development of identification materials for shark fins, and development of standards for making decisions on "look-alike" listings would help support assessment of future listing proposals.

**Likely effectiveness of a CITES Appendix II listing**

An Appendix II listing for hammerhead shark might improve monitoring of catches at the species level (through documentation of trade flows) and assessment of sustainabililty of harvests (through provision of non-detriment findings). Few national markets for hammerhead shark products exist, so most of the products in trade would move internationally and would thus come under the Appendix II regulatory provisions. However it is also possible that enhanced regulation of trade would encourage more sustainable use of this species and thus reduce pressure on stocks.

For the four species proposed for listing under Article II paragraph 2(b) the same comments are relevant.

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**Tables and Figures**

Table 1. Information for assessing productivity of Scalloped hammerhead

| Parameter | Information | Productivity | Source |
|---|---|---|---|
| **Intrinsic rate of increase** | a. NW Atlantic – 0.082 ($\lambda$ = 1.086) | a. Low | a. Cortes 2002 |
| | b. W. Pacific – 0.472 ($\lambda$ = 1.600) | b. High | b. Cortes 2002 |
| | c. W. Indian Ocean r = 0.103 | c. Low | c. Dudley and Simpfendorfer 2006 |
| | d. $R_{2M}$ = 0.028 | d. Low | d. Smith et al 1998 |
| **Natural mortality** | M = 0.129 | Low | Smith et al 1998 |
| **Age at maturity** | a. W. Indian Ocean – 11 yr | a. Low | a. Dudley and Simpfendorfer 2006 |
| | b. Females – 15 yr | b. Low | b. Smith et al 1998 |
| **Maximum age** | a. NW Atlantic – 30.5 yr | a. Low | a. Piercy et al 2007 |
| | b. W. Indian Ocean – 30 yr | b. Low | b. Dudley and Simpfendorfer 2006 |
| | c. 35 yr | c. Low | c. Smith et al 1998 |
| **von Bertalanffy K** | a. NW Atlantic - Male 0.13 Female 0.09 | a. Low | a. Piercy et al 2007 |
| | b. W. Indian Ocean – 0.057 | b. Low | b. de Bruyn 2000 cited in Dudley and Simpfendorfer 2006 |
| | c. W. Pacific – Male 0.222 Female 0.249 | c. Medium | c. Chen et al 1990 cited in proposal |
| | d. E. Pacific – Male 0.131 Female 0.156 | d. Low | d. Tolentino and Mendoza 2001 |
| **Generation time** | a. NW Atlantic – 16.7 yr | a. Low | a. Cortes 2002 |
| | b. W. Indian Ocean – 18.3 yr | b. Low | b. Dudley and Simpfendorfer 2006 |
| | c. W. Pacific – 5.7 yr | c. Medium (H) | c. Cortes 2002 |

Table 2. Decline indices for Scalloped hammerhead

| Criterion | Index | Trend | Basis | Coverage | Reliability | Source |
|---|---|---|---|---|---|---|
| Northwest Atlantic | Abundance estimate from population assessment | EOD 83% | Surplus production model, multiple indices, 1980-2005 | Atlantic coast USA | Assessment based on multiple surveys (5) | Hayes et al 2009[6] |
| | Abundance estimate from population assessment | EOD 91% to 93% | Surplus production model for mixed hammerhead species, probabilistic, multiple indices, 1980-2005 | Atlantic coast USA | Assessment based on multiple surveys, for mixed species (5-) | Jiao et al 2009 |
| | Catches, recreational and commercial | EOD ca 90% | Inspection of figure, 1981-2005 | USA Atlantic coast | Catches, uncorrected for effort (2) | Hayes et al 2009 |
| | CPUE, UNC research survey | EOD 98% | Instantaneous decline - 0.127 over 31 yr (1973-2003) | North Carolina coastal | Designed survey (5) | Myers et al 2007 Table S5[7] |
| | CPUE, SEAMAP survey | Increase | Instantaneous increase 0.094 over 17 yr (1989-2005) | Southeast USA coast | Designed survey (5) | Myers et al 2007 Table S5 |
| | CPUE, commercial logbook (all hammerheads) | EOD 91% | Instantaneous decline - 0.158 over 15 yr (1986-2000) | Northwest Atlantic | Pooled species, commercial data (3) | Myers et al 2007 Table S5 |

Table 2 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| | CPUE, commercial observers (all hammerheads) | EOD 79% | Instantaneous decline 0.110 over 14 yr (1992-2005) | Northwest Atlantic | Pooled species, commercial observer data (3) | Myers et al 2007 Table S5 |
| | CPUE, commercial logbooks (all hammerheads, mainly Scalloped) | EOD 89% | Calculated by authors, 1986-2000 | Northwest Atlantic | Pooled species, commercial logbooks (3) | Baum et al 2003 |
| | CPUE, longline survey | No trend | Inspection of figure, 1995-2005 | Atlantic coast USA | pooled coastal sharks, Scalloped hammerhead is 6% of total (1-2) | Ingram et al 2005 Fig. 39 |
| | CPUE, longline survey | No trend | Inspection of figure, 1995-2003 | Gulf of Mexico, USA | Pooled coastal sharks, Scalloped hammerhead is 7% of total (1-2) | Ingram et al 2005 Fig. 42 |
| Southwest Atlantic | CPUE, surface gillnet | Decline 80% or more | Inspection of figure, 2000-2008 | Southern Brazil | Unstandardised CPUE, Scalloped hammerhead (3) | Kotas, J.E. personal communication to the Panel |
| | CPUE, bottom gillnet | Decline 80% or more | Inspection of figure, 2000-2008 | Southern Brazil | Unstandardised CPUE, Scalloped hammerhead (3) | Kotas, J.E. personal communication to the Panel |
| | CPUE, surface longline | No trend | Inspection of figure, 2000-2008 | Southern Brazil | Unstandardised CPUE, Scalloped hammerhead (3) | Kotas, J.E. personal communication to the Panel |
| | CPUE (*S. lewini* and *S. zygaena*) gillnet fisheries | No trend | Inspection of figure, 1992 - 2002 | Southern Brazil | Pooled species, uncorrected effort data (1-2) | Vooren et al 2005 |

Table 2 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| | CPUE (*S. lewini* and *S. zygaena*) longline fisheries | Increase from 1993 to 2000, decline from 2000-2002 | Inspection of figure, 1992 - 2002 | Southern Brazil | Pooled species, uncorrected effort data (1-2) | Vooren et al (2005) |
| | CPUE (*S. lewini* and *S. zygaena*) recreational fisheries | No trend, possible decline from 2001 | Inspection of figure, 1999 - 2004 | Southern Brazil | Pooled species, commercial data (2) | Vooren et al (2005) |
| Western Indian Ocean | CPUE, shark protection nets | EOD 65% | Inspection of figure, 1978-2003 | South Africa | Good species identification, designed for sharks (5) | Dudley and Simpfendorfer 2006 Fig.2 |
| Western Pacific Ocean | CPUE, all fisheries, all sharks | Increasing trend | Inspection of figure, 1978-2003 | Queensland, Australia | All shark species combined, all fisheries combined (1-2) | Gribble et al 2005 Fig 2. |
| | CPUE, shark protection nets | Decline 65-85% | Provided by authors | Queensland, Australia | Hammerhead sharks, standardised CPUE (5) | De Jong and Simpfendorfer 2009 |
| Eastern Pacific Ocean | Diver sightings index | Decline 71% | Provided by authors | Cocos Islands, Costa Rica | Visual sightings (5) | Myers et al n.d. |

Table 3. Probability (%) that the stock of Scalloped hammerheads will rebuild (i.e., attain a final population size greater than NMSY) in 10, 20, and 30 years under several constant-catch scenarios (relative to the catch in 2005) using the BASE scenario with the Fox surplus-production model. Source: Hayes et al 2009.

| | | Percent of 2005 catch (number) | | | |
|---|---|---|---|---|---|
| Time frame | No catch | 50 (2,068) | 69 (2,853) | 100 (4,135) | 150 (6,203) |
| 10 years | 95 | 85 | 70 | 58 | 20 |
| 20 years | 99 | 96 | 92 | 86 | 50 |
| 30 years | 99 | 98 | 96 | 91 | 63 |

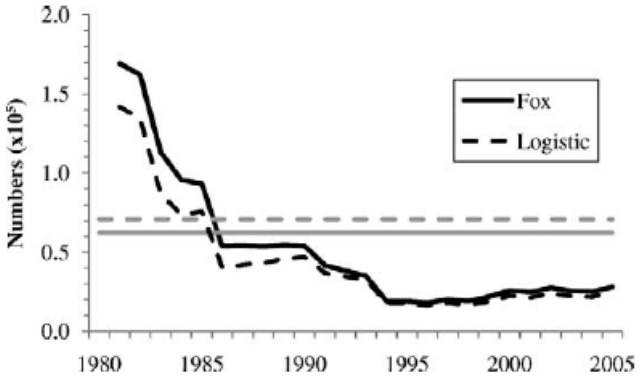


Figure 1. Scalloped hammerhead population estimates from two models, 1981-2005. Grey lines are MSY levels for the two models. Source: Hayes et al 2009.

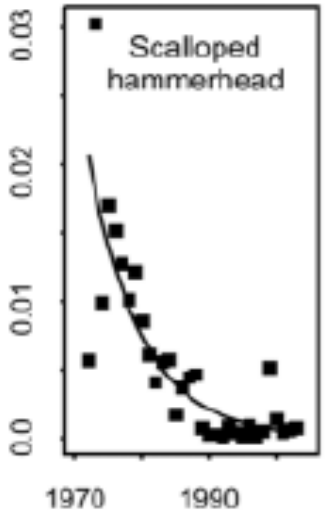


Figure 2. Abundance trend, Scalloped hammerhead, UNC survey. Source: Myers et al 2007, Fig. 1.

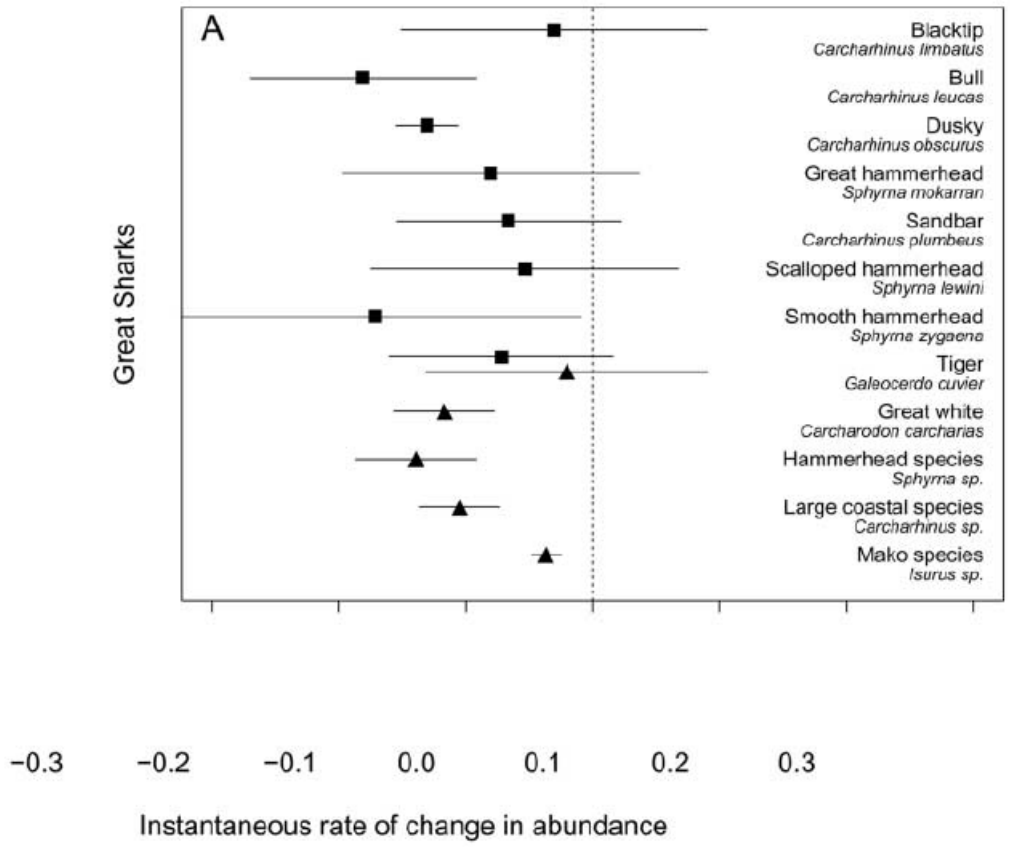


Figure 3. Instantaneous rate of change in abundance, meta-analysis of multiple research surveys. Mean time span of surveys 28 yrs. Source: Myers et al 2007 Fig. 2

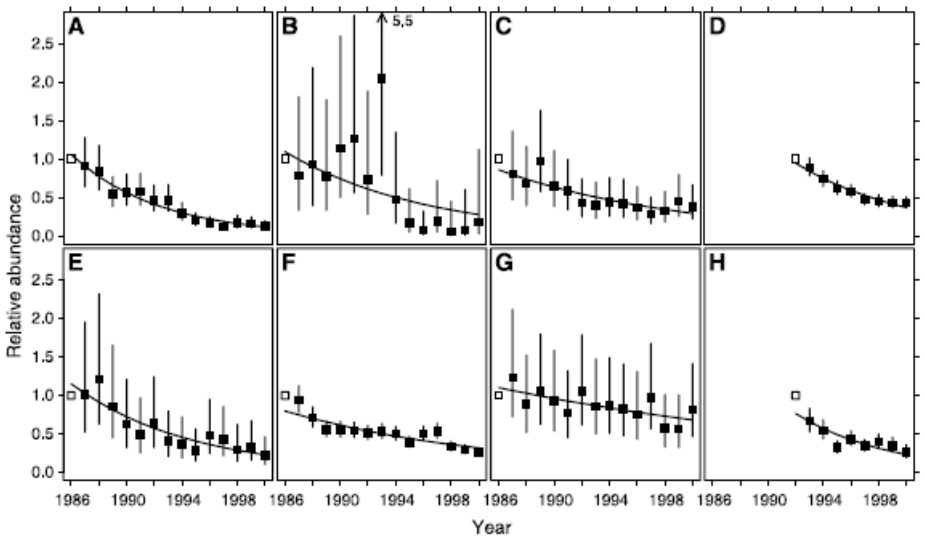


Figure 4. Changes in abundance indices. A = hammerhead sharks pooled. Source: Baum et al 2003 Fig. 2

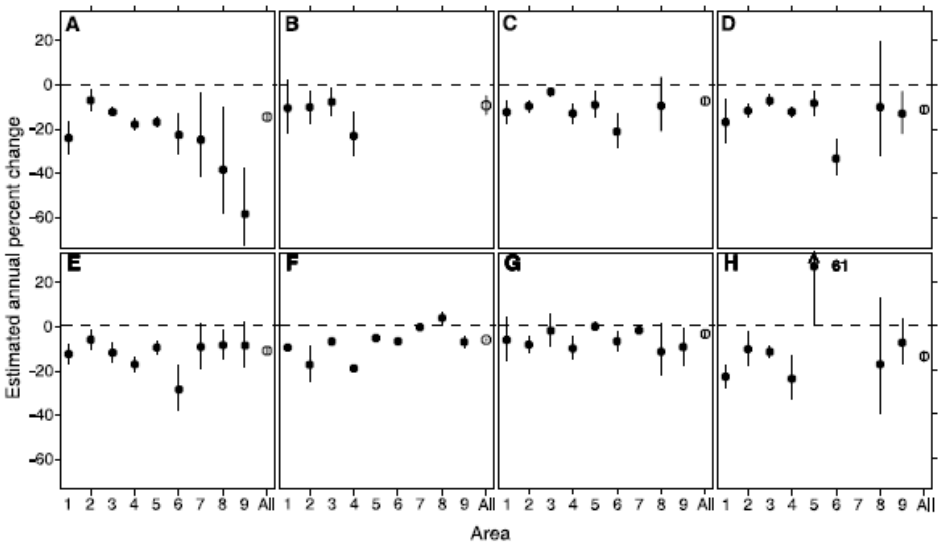


Figure 5. Annual rate of change in abundance, 1986-2000, in 10 subareas of the Northwest Atlantic. A = hammerhead sharks pooled. Source: Baum et al 2003 Fig. 3

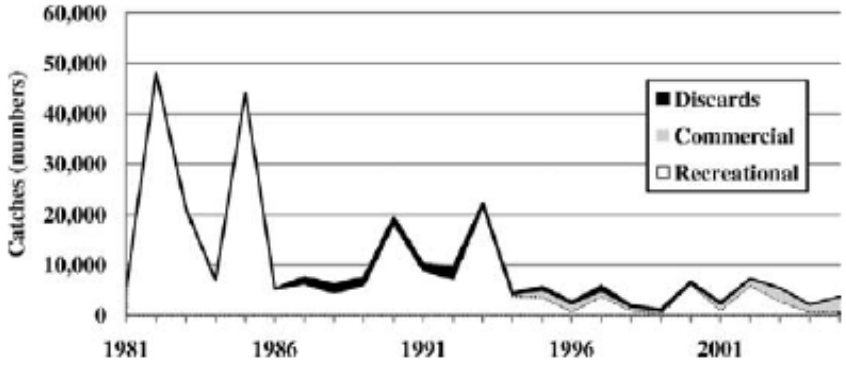


Figure 6. US catches of Scalloped hammerhead. Source: Hayes et al 2009.

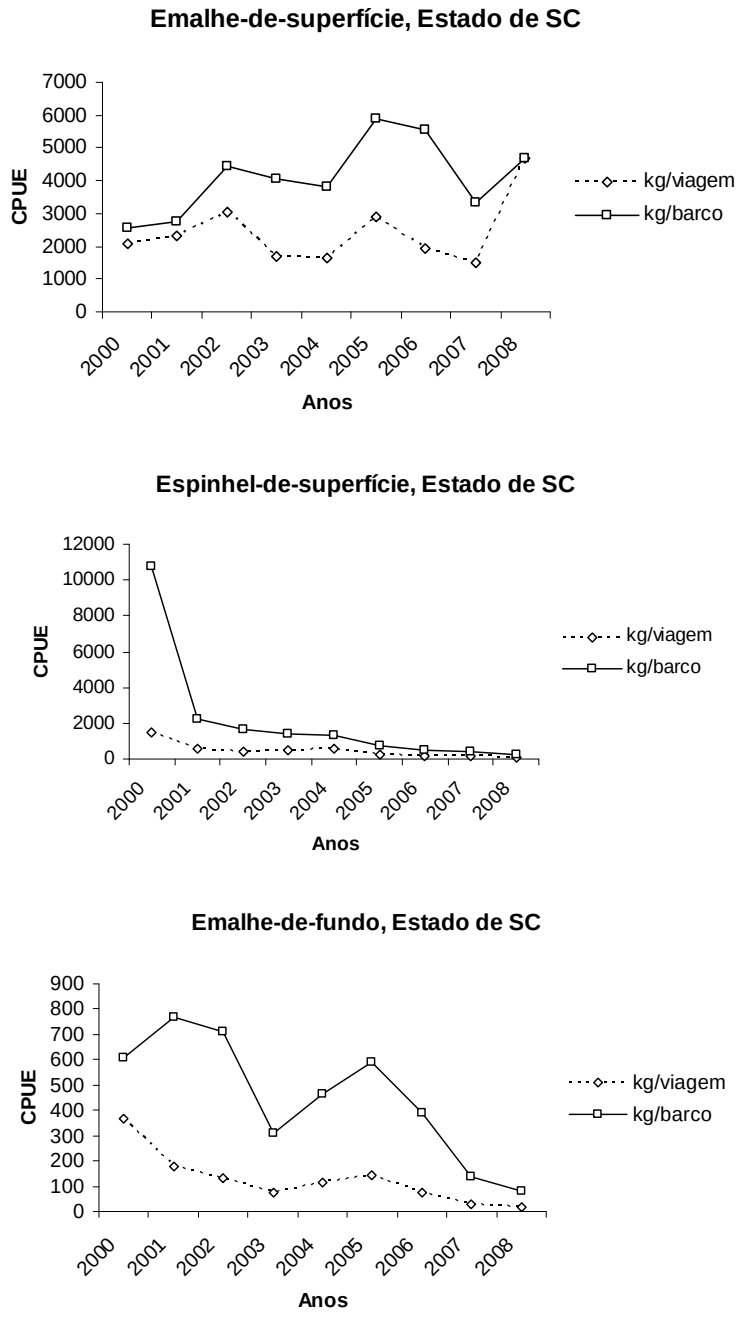


Figure 7. CPUE, Scalloped hammerhead, southern Brazil. Dashed lines: kg/trip; solid lines: kg/vessel. Top: surface gillnet; middle: surface longline; bottom: bottom gillnet. Source: Kotas pers. comm.

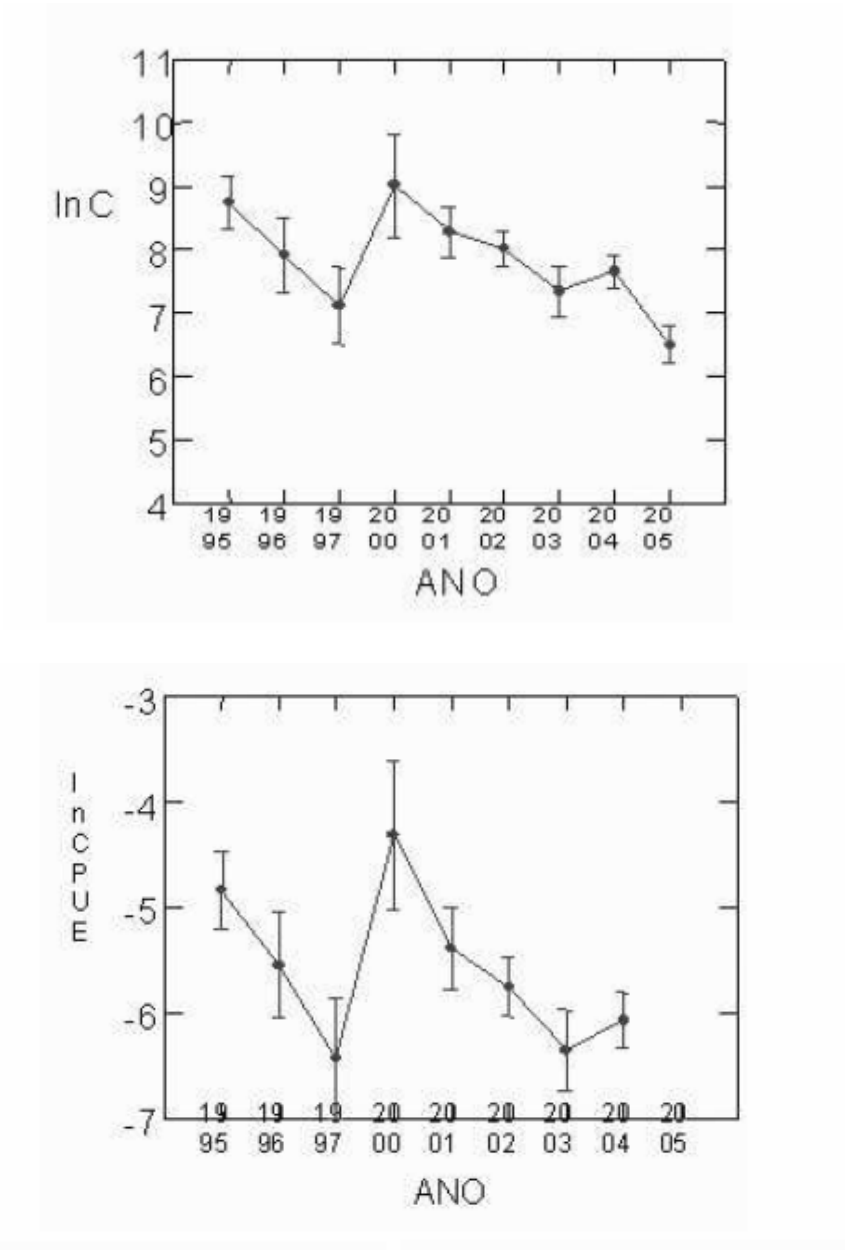


Figure 8. Catch (kg) (top) and CPUE (kg/m2 of net) (bottom) of pooled Scalloped and smooth hammerheads, surface gillnets, southern Brazil. Source: Kotas et al 2008.

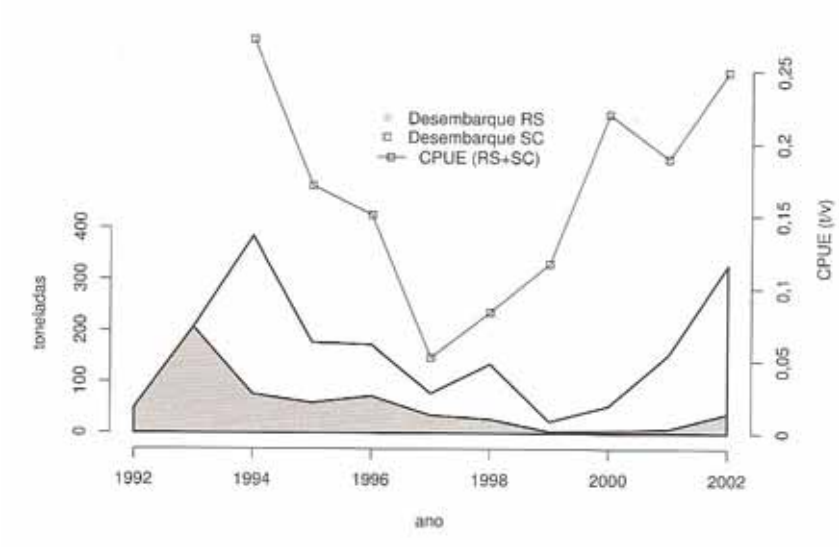


Figure 9. Landings and cpue of oceanic gillnet fisheries in southern Brazil (Vooren et al 2005).

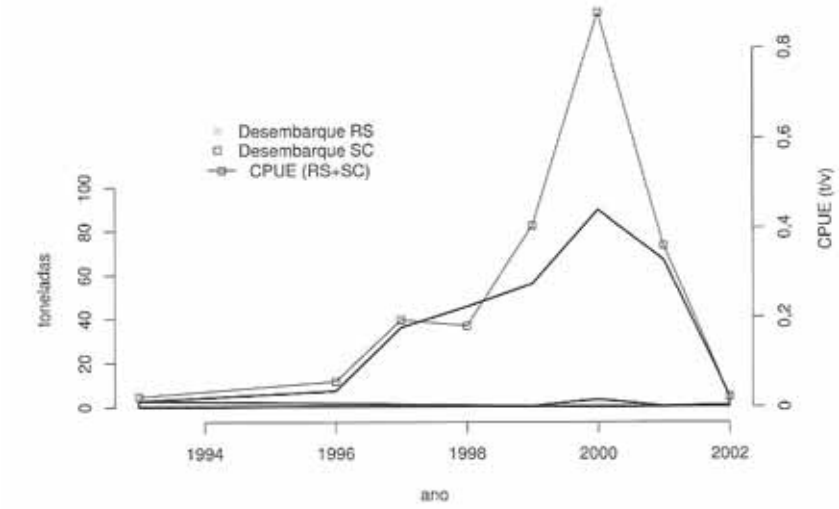


Figure 10. Landings and cpue of longline fisheries in southern Brazil (Vooren et al, 2005)

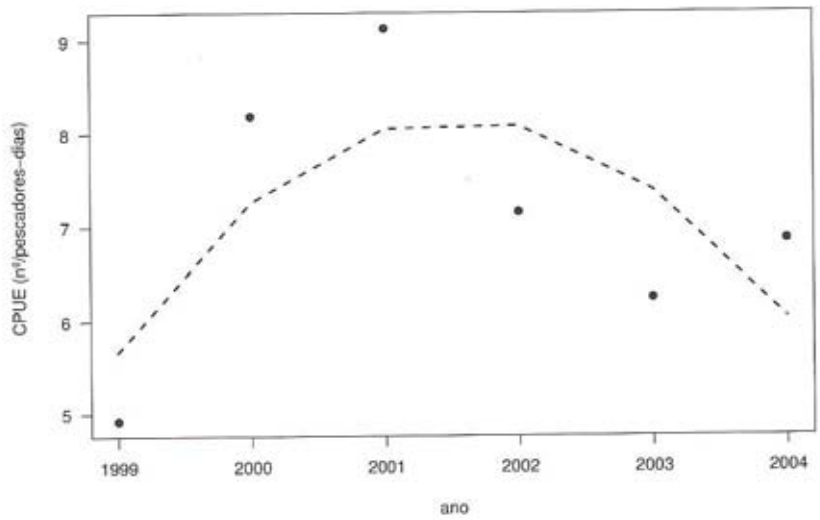


Figure 11. Catch per unit of effort (numbers/fisher/day) of the recreational fishery targeted to neonate hammerheads in southern Brazil (Vooren et al, 2005).

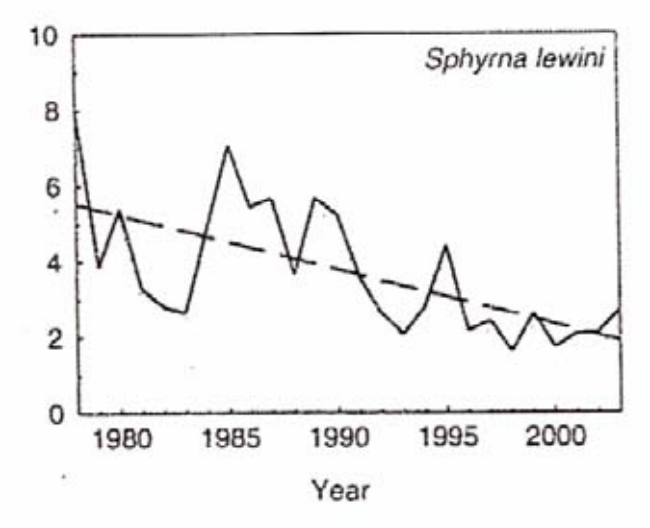


Figure 12. Annual CPUE of Scalloped hammerhead in the KwaZulu-Natal beach protection program, 1978-2003. Units are number/km net/yr. Source: Dudley and Simpfendorfer (2006).

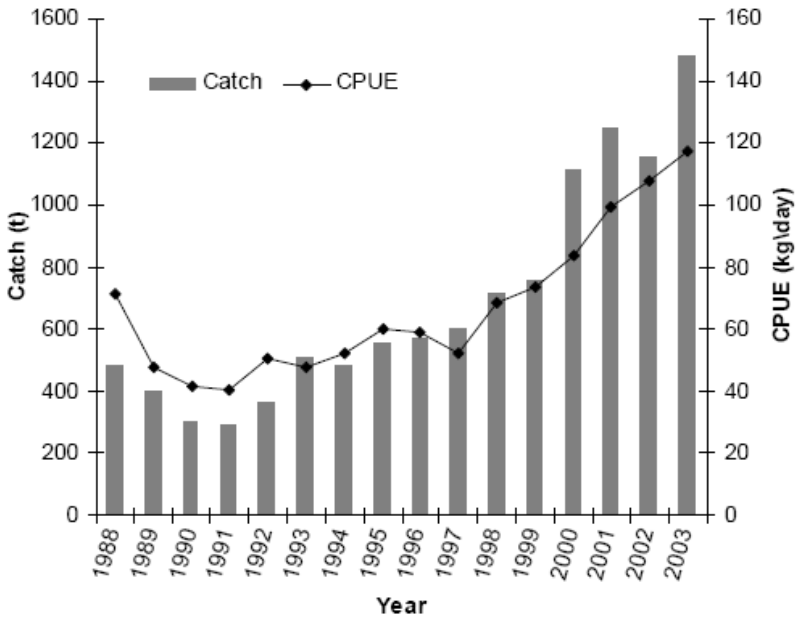


Figure 13. Annual catch and catch per unit, all fisheries combined, all shark species combined, Australian east coast. *S. lewini* made up 18% of the total catch on 4 observed trips. Source: Gribble et al 2005.

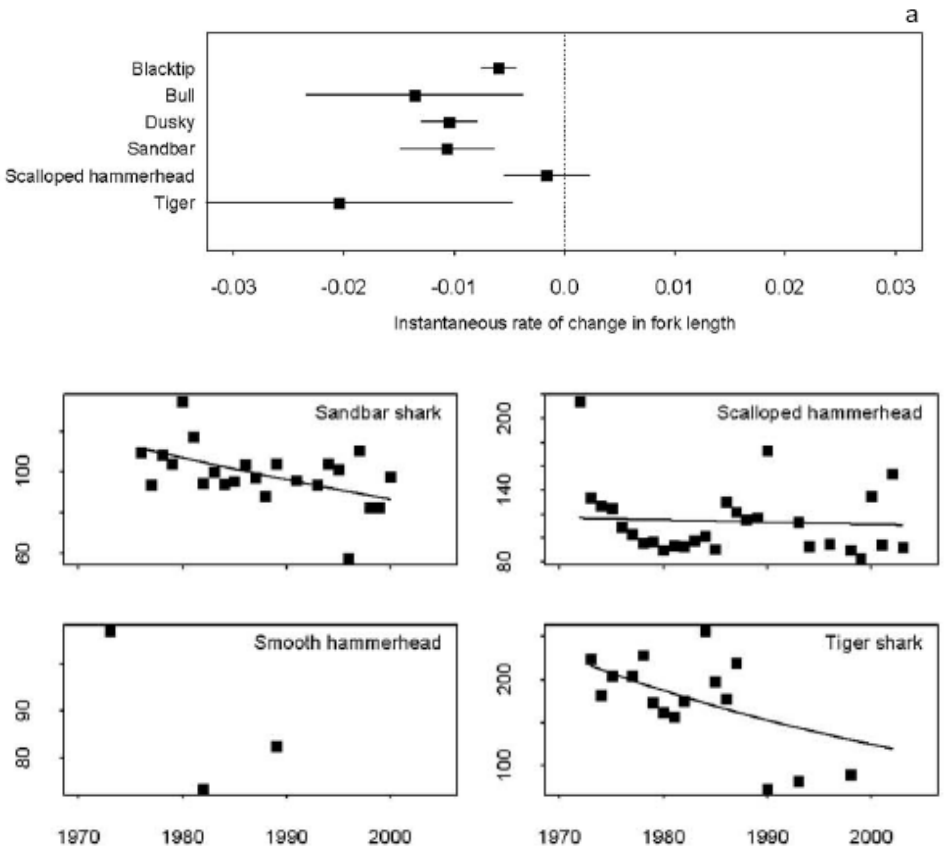


Figure 14. Changes in fork length, Scalloped hammerhead, North Carolina shark survey. In lower figure, y-axis is fork length. Source: Myers et al 2007, supplementary material, Fig. S3.

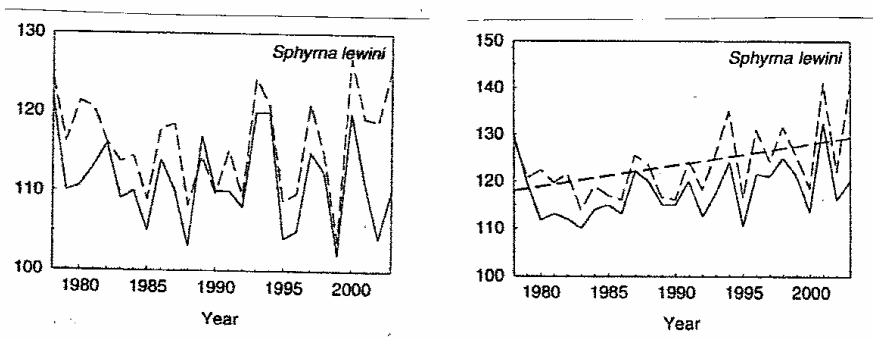


Figure 15. Annual median (solid line) and mean (dashed line) sizes (precaudal length) of Scalloped hammerhead caught in the KwaZulu-Natal beach protection program, 1978-2003. Left panel: females; right panel: males. Straight line fit to male data indicates a significant regression.

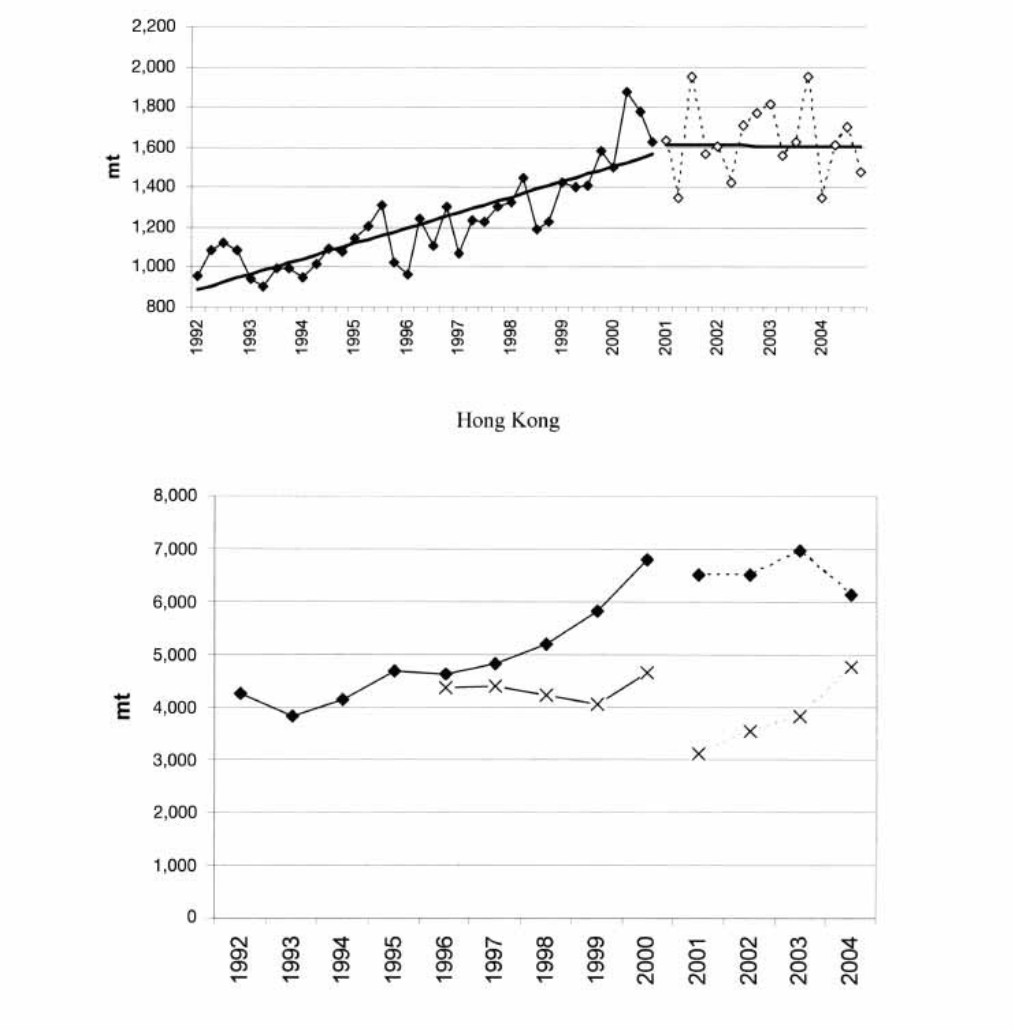


Figure 16. Imports of shark fins to Hong Kong and mainland China. Upper figure: quarterly imports to Hong Kong (a change in statistical reporting means values before and after 2001 are not strictly comparable). Lower figure: annual imports to Hong Kong (solid symbols) and mainland China (x's). Source: Clarke et al 2007.

## APPENDIX F

### FAO Expert Advisory Panel assessment report: Oceanic whitetip shark

**CoP15 Proposal 16**

**SPECIES**: *Carcharhinus longimanus* – Oceanic whitetip shark

**PROPOSAL**: Inclusion of *Carcharhinus longimanus* in Appendix II in accordance with Article II paragraph 2(a) of the Convention and satisfying Criterion A in Annex 2a of Resolution Conf. 9.24 (Rev. CoP14).

**Basis for proposal**: 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.

The proposal indicates that this low-productivity species has undergone declines of 60-70% in the Northwest and Central Atlantic Ocean, and up to a 10-fold decline in abundance in the Central Pacific Ocean, that the species is overexploited for its fins which are large and highly valued in trade, and that the species is likely to become threatened with extinction unless international trade is regulated and monitored.

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**ASSESSMENT SUMMARY**

The FAO Expert Panel concluded that, on balance, the available evidence supports the proposal to include the Oceanic whitetip shark, *Carcharhinus longimanus,* in CITES Appendix II.

The Panel concluded that this was a species of low productivity.

There is a paucity of quantitative data with which to determine global trends in this widely-distributed tropical Oceanic shark. All the available indices are based on fishery catch per unit effort (CPUE). Two regional studies provide long time series (45-50 years) that show historical extents of decline conforming to the Appendix II decline criterion, and a short (10 yr) recent time series in one area also shows a historical extent of decline consistent with the Appendix II decline criterion. Information from other areas is very limited and difficult to interpret.

In the Northwest Atlantic, the longest time series (1950s to 1990s) shows a substantial extent of decline consistent with the Appendix II decline criterion. This series is based on different approaches in the early and late parts of the time series (research vessels and commercial vessels with observer coverage respectively), but areas sampled and gear used were generally consistent and efforts were made to standardise the data sets. Trends in longline CPUE for large pelagic teleost species show larger declines than were seen over similar periods from more detailed stock assessments, raising questions about the reliability of long-term CPUE trend information; however no stock assessments of Oceanic whitetip are available. Indices from the Northwest Atlantic covering more recent periods (1992-2005) showed continuing declines.

In the Central Pacific, the longest time series (1950s to 1999-2002) shows a substantial extent of decline consistent with the Appendix II decline criterion. As with the Northwest Atlantic, approaches in early and late periods were different (research vessels and observed commercial longliners respectively) and areas covered were also somewhat different, but gear was similar and efforts were made to standardise the data sets. Interpretation of this series is complicated by the same issue as for the Northwest Atlantic, a discrepancy between population trends over long periods in CPUE series and in more detailed assessments for teleost species, but again no detailed assessment of Oceanic whitetip is available for comparison. A set of shorter time series (1960s to early 1990s) shows declines in four subareas of the Central Pacific, but not to levels consistent with the Appendix II decline criterion, when information uncorrected for depths of sets is considered. When corrected data is considered, trends are conflicting. However this document indicates that further standardisation is required. More recent series (1995-2005) show a continuing large decline.

In the eastern Pacific, the only available index shows a very large historical extent of decline, consistent with the Appendix II decline criterion, over a short time period (1994-2006). This is based on information from a purse seine fishery which takes relatively low numbers of this species, and occurred after a lengthy period

during which this species would have been harvested in longline fisheries, suggesting that such a rapid decline during this recent period may not reflect population changes reliably.

Fins for this species are in demand and of high value in the world market, and there is evidence that international trade is driving exploitation. This species is generally not targeted, but is taken as bycatch in fisheries targeting other species. The Panel noted that a large proportion of individuals captured as bycatch could be released alive.

Demand in the international shark fin trade and bycatch in high-seas tuna fisheries constitute important risk factors for the species. Each of the five Tuna Regional Fisheries Management Organizations has a management measure requiring vessels to have fins onboard that total no more than 5% of the weight of sharks onboard, up to the first point of landing. A number of countries have adopted finning bans but no species-specific international or domestic management measures are in place. Sustainable management requires that, where they had not done so, range States develop and implement National Plans of Action for sharks.

With respect to the likely effectiveness of a CITES Appendix II listing, the Panel concluded that the resulting regulatory measures could aid management of this species by improving catch monitoring and encouraging assessments of sustainability of harvests. Most harvests would be from international waters, falling under the Introduction from the Sea provisions of the Convention. These would require catch documentation to the species level for specimens entering the jurisdiction of a State from international waters, along with a non-detriment finding indicating that the harvest was sustainable.

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

Oceanic whitetip shark is a circumglobal, oceanic shark of tropical and subtropical waters, usually found between latitudes 35° N and 30° S and at temperatures warmer than 20°C (Compagno 1984; Fowler et al. 2005). It is normally found offshore in oceanic waters, or near oceanic islands. The species primarily occurs in surface waters at less than 100 m depth, based on unpublished pop-up satellite tag observations off Hawaii (Musyl, unpublished, cited in Burgess et al. 2005) and on observations of decreasing catch rate between 80 and 280 m (Nakano et al. 1997 cited in Bonfil et al. 2008).

No studies have been done of population structure of this species. Kohler et al. (1998, p. 49) summarise results of tagging 542 individuals between 1962 and 1993 in the Atlantic Ocean. Six individuals were recaptured, with a maximum distance travelled of 2 270 km (1 226 nm) and a maximum movement of 32 km/day (17.5 nm/day). Studies of population structuring have been identified as a priority in the Pacific because of different CPUE trends between eastern and western Pacific (IATTC 2007a).

#### *Productivity level*

Life history characteristics of Oceanic whitetip are associated with low or medium productivity (Table 1). Information on life history characteristics associated with productivity level is available from the Southwest Atlantic (Lessa et al. 1999) and the western Pacific (Seki et al. 1998). This information has been used to derive rate of increase and generation time estimates (Smith et al. 1998; Cortes 2002; Cortes 2008). Growth rate (as indexed by von Bertalanffy K) and intrinsic rate of population increase are consistent with low productivity, while age at maturity and generation time indicate medium productivity (or low to medium).

**Population status and trends**

***Decline***

Abundance indices from several parts of the range are available (Table 2).

*Northwest Atlantic*

Baum and Myers (2004) compared longline CPUE from research surveys in 1954-1957 ("the 1950s") to those from observed commercial longline sets in 1995-1999 ("the 1990s") in the Gulf of Mexico (Fig. 1). A severe decline in Oceanic whitetip CPUE was observed, equivalent to a 99.3% extent of decline; 3 individuals were taken in 275 sets in the 1990s compared to 397 individuals in 170 sets in the 1950s. The authors made efforts to ensure comparability of methods between the two periods and outlined sources of uncertainty in making the comparison.

Baum et al. (2003) found an extent of decline of 70% in CPUE based on logbook records in the Northwest Atlantic pelagic longline fishery between 1992 and 2000 (Fig. 2), and indicated that declining CPUE trends had been observed in almost all subareas of the fishery area (Fig. 3). The exception was a substantial increase in CPUE in Subarea 5, the US mid-Atlantic (Cape Hatteras to Cape Cod).

The methods and results of Baum et al. (2003) and Baum and Myers (2004) were critiqued by Burgess et al. (2005), who agreed that abundance of large pelagic sharks has declined but presented arguments that the population declines were probably less severe than indicated by these indices. Of particular relevance to Oceanic whitetip, Burgess et al. (2005) noted that change from steel to monofilament leaders between the 1950s and 1990s could have reduced catchability of all large sharks, while increasing average depths of sets during the same period could have reduced catchability of the surface-living Oceanic whitetip. Reductions in catchability due to a shift from steel to monofilament leaders are cited in Burgess et al. (2005). Baum et al. (2005) in responding to the critique indicated that their model had in part addressed the change in depth of sets, but agreed that change in catchability with change in leader material needed further study. They noted that subtle changes in methods of setting gear could have large effects on catch rates, and that for some species of large sharks catch rates on monofilament were higher than on steel leaders. Nonetheless, Baum et al. (2005) concluded that their estimated decline rates were robust.

Ingram et al. (in preparation), in a study of the effect of different leader materials on CPUE of oceanic sharks, determined that with equivalent methods but a wire leader, catch rates of Baum and Myers (2004) for the recent period would have been 0.55 rather than 0.02 (as estimated by Baum and Myers 2004 using nylon leaders). Comparing the recent 0.55 value with the Baum et al. (2003) value of 4.62 for the 1950s gives an extent of decline of 88%.

Cortes et al. (2007) found less severe declines over a shorter time period (1992-2003/2005) than those above. Declines of 57% in logbook CPUE from the commercial longline fishery, and of 9% in observer CPUE from the same fleet, were provided. Observer CPUE is considered more reliable than logbook CPUE.

*Central Pacific*

Ward and Myers (2005) compared longline CPUE from research surveys in 1951-1958 ("the 1950s") (880 sets) to those from commercial longline fisheries with observers aboard in 1999-2002 ("the 1990s") (505 sets) (Fig. 4). They estimated a 10-fold decrease in CPUE, to 0.099 over the time period (http://www.esapubs.org/archive/ecol/E086/043/appendix-A.htm). The authors made efforts to ensure comparability of methods between the two periods and have outlined sources of uncertainty in making the comparison. Distribution of sampling in the two periods was different although areas overlapped.

Polacheck (2006) has provided evidence that declines in longline CPUE of large pelagic fishes over long periods may overestimate population declines. This has been shown to occur for large pelagic species other than sharks, for which detailed stock assessments are available to compare with CPUE trends.

Matsunaga and Nakano (1999) provided information on longline CPUE changes between 1967-70 ("the 1960s") and 1992-95 ("the 1990s") in four contiguous subareas of the Central Pacific. For the later period, they provided information which had been corrected for a difference in depths sampled compared to the earlier period, as well as uncorrected information (Table 3). The uncorrected data show declines in all four

subareas, ranging from 5% to 53%, while the corrected data show declines in two subareas and increases in two subareas. They noted that further standardisation of data sets is required to clarify the extent of change.

Walsh et al. (2009), comparing observer data on commercial longline sets in 1995-2000 and 2004-2006, showed a 76% extent of decline in nominal CPUE in deep sets (median depth of deepest hook 248 m) and a 53% decline in shallow sets (median depth of deepest hook 60 m) (deep and shallow sets also differed in gear configuration and bait). More weight should be given to the information from shallow sets given the shallow-living habits of this species. The authors noted that area differences may have affected the estimated trends.

*Eastern Pacific*

Background information for design of a shark research program for the IATTC (IATTC 2007b) indicates that purse seine CPUE on floating objects of Oceanic whitetip has experienced an extent of decline greater than 95% in the eastern Pacific between 1994 and 2006 (Fig. 5). This is based on an unstandardised index using observer data from 100% of sets during the short period of time that fish aggregating devices have been used (details in Roman-Verdesoto and Orozco-Zoller 2005). However the purse seine catches have been relatively small compared to those of the longline fishery which has operated in this area over the last 50 years.

*Western Pacific*

Longline CPUE of Oceanic whitetip has reportedly not declined since the early 1990s in the western Pacific (IATTC 2007a). This observation, without additional information, is contained in a proposal for studies of shark status by the IATTC.

*Southwest Atlantic*

Unstandardised CPUE observations are available from several papers on this species which may provide a basis for comparing abundance levels in different periods. Domingo (2004) recorded catch rates of 0.006 (1998-2003) while Domingo et al. (2007) found catch rates ranging between 0.022 to 0.491 individuals per hooks in 2003-2006. The more recent catch rates are higher but these are probably affected by differences in methodology, season and fishing areas between studies. In the equatorial SW Atlantic Oceanic whitetips were reported as the second most abundant shark outnumbered only by blue shark in research surveys between 1992-97 (Lessa et al. 1999). However, data from observers on the Uruguayan surface longline fleet in the south and equatorial Atlantic does not confirm this; highest CPUE recorded did not exceed 0.491 samples/1000 hooks for the 2003-2006 period with only 63 Oceanic whitetips caught on 2,279,169 hooks (Domingo et al. 2007). Hazin et al. (2007) noted that total catch of the Oceanic whitetip has shown a continuous decline over the past 6 years (2000-2005) from about 640t to 80t. It was noted that the Spanish longline fleet increased its effort in the South Atlantic in the early to mid 1990s and that expansion of fishing activities by southern coastal countries, such as Brazil and Uruguay, also contributed to increased effort at this time (SCRS 2009).

*Southeast Atlantic*

Castro and Mejuto (1995) recorded a catch rate in this area of 0.26 per 1000 hooks in the mid-1990s, and Domingo (2004) and Domingo et al. (2007) recorded catch rates of 0.09 (2003) and 0.08 (2003-06), respectively. The more recent values are lower but could have been affected by differences in methodology and study areas.

*Other areas*

Observations on confiscated fin caches from high-seas longline fleets in 2004 from both the South Atlantic and Southwest Indian Ocean noted very few Oceanic whitetip fins (J. Stevens, personal communication, 12 December). Information from the eastern Atlantic, Southwest Pacific and Indian Ocean is very limited with some observations suggesting no declines, but the basis for most of these was not available. For the Oceanic blue shark, for which much more information is available, it has proved difficult to build a consistent picture of stock status as abundance trend information is sometimes conflicting.

***Small population size***

No estimates of population abundance are available.

***Restricted distribution***

No estimate of distribution area is available but this species is circumglobal in oceanic waters so can be considered to have a very large distribution.

***Other indices***

Baum and Myers (2004) observed a 35% decline in average weight of individuals taken (from 86.4 kg to 56.1 kg) , comparing longline catches in the 1950s with those in the 1990s. Ward and Myers (2005) observed a 50% decline in average weight of individuals taken, from approximately 40 kg in the 1950s to approximately 20 kg in the 1990s (Fig. 6). They noted that the decline in biomass, considering the concurrent declines in abundance (80%) and average weight (50%), would have been substantial.

**Assessment relative to quantitative criteria**

***Decline***

Oceanic whitetip should be considered a low productivity species, based on the available life history information (Table 1).

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 14), a decline to 15-20% of the historical baseline for a low productivity species might justify consideration for Appendix I. For listing on Appendix II, being "near" this level might justify consideration, "near" for a low productivity species being 20-30% of the historical abundance level (15-20% + 5-10%). For a medium productivity species, the Appendix I level would be 10-15% of the baseline, the Appendix II ("near") level 15-25%. FAO (2001) advised that in examining historical extent of decline, the longest time horizon possible should be examined.

No overall population decline index is available for comparison with the guidelines. Indices in the individual areas are considered below.

In the Northwest Atlantic (Gulf of Mexico), Baum and Myers (2004) estimated an extent of decline of over 99% in approximately 40 years. Correcting this with recent information on leader materials gives an extent of decline of 88%. Recent rates of decline for the Northwest Atlantic are provided by Baum et al. (2003) (70% 1992-2000), and Cortes et al. (2007) (57% 1992-2005 for logbook data, 9% 1992-2003 for observer data, with more weight to the latter). The historical extent of decline would be consistent with an Appendix II listing, if it portrays population abundance accurately. The long time series of Baum and Myers (2004) should be interpreted in light of the evidence of Polacheck (2006) that long-term CPUE series may overestimate population declines of large pelagic fishes.

In the Central Pacific the longest time horizon is provided by Ward and Myers (2005), who indicated a historical extent of decline of 90% over a period of approximately 40 yr. Again this should be interpreted in the context of the evidence of Polacheck (2006) that long CPUE series may overestimate abundance declines in large pelagic species. Matsunaga and Nakano (1999) indicate consistent declines in four subareas, but not to Appendix II levels, from the last 1960s to the early 1990s (approximately 34 yr), using uncorrected data, and a mixed pattern of declines and increases using corrected data. This paper indicates that further standardisation would be required to fully interpret the data. A recent rate of decline of 76% (deep sets) or 53% (shallow sets, more appropriate information for this species) over an approximately 10-year period (1995-2000 vs 2004-2006) is provided by Walsh et al. (2009). The Ward and Myers and Walsh et al. indices would be consistent with an Appendix II listing for a low or medium productivity species. The Matsunaga and Nakano (1999) information do not show a decline to Appendix II levels but are for a shorter time period than Ward and Myers.

In the eastern Pacific the longest time series available is 13 yr (1994-2006) (IATTC 2007b) and indicates a substantial decline of over 95%. The information appears to be robust but is surprising considering the long history of longline exploitation prior to the beginning of this time series, and the relatively low removals by this fishery. This decline would be consistent with an Appendix II decline level.

In the south Atlantic, observations of relative CPUEs suggest a decline in the Southeast Atlantic and there is conflicting information in the Southwest Atlantic. These unstandardised observations do not appear adequate to support a decision based on the decline criterion.

In the western Pacific, IATTC (2007a) indicates no decline but for an unknown time period and without explanation of the basis. Information available is not highly reliable but would not be consistent with an Appendix II listing.

Information presented at the meeting indicated that Oceanic whitetip have recently been a rather uncommon species off South Africa.

***Small population***

As no population estimate is available, it is not possible to assess Oceanic whitetip against this criterion. However, the species is widely distributed and probably occurs in relatively large numbers worldwide.

***Restricted distribution***

As a species occurring circumglobally in tropical and subtropical waters, Oceanic whitetip cannot be characterised as a species with a restricted distribution.

**Were trends due to natural fluctuations?**

There is no indication in the sources available that declines were due to natural fluctuations.

**Risk and mitigating factors**

Fins from this species are in high demand and are easily preserved and transported. The species is one of the most common bycatch species in tuna fisheries in offshore tropical waters, although they are seldom explicitly targeted (Bonfil et al. 2008). Individuals taken as bycatch could be released alive if products were of low value.

Reduction in abundance of large mature individuals is a potential risk factor for large shark species. Both in the Northwest Atlantic (Baum and Myers 2004) and in the Central Pacific (Ward and Myers 2005), declines in mean weight were observed concurrent with declines in abundance indices. These data have not been analysed to show changes in proportion of mature individuals but may indicate that large mature individuals have decreased in abundance over the periods observed.

Risk has been mitigated by the introduction of finning bans in 21 countries and the European Union, as well by nine Regional Fisheries Management Organisations (Camhi et al. 2009 Table 5.7). Each of the five Tuna Regional Fisheries Management Organizations has a management measure requiring vessels to have onboard fins that total no more than 5% of the weight of sharks onboard, up to the first point of landing. These bans may reduce mortality or at least improve monitoring of shark catches. However compliance with these management measures is likely to be variable.

The finning ban in the US Hawaii-based longline fishery introduced in 2001 has acted to reduce mortality on Oceanic whitetip and other large shark species (Walsh et al. 2009). In 1995-2000, prior to the ban, a large proportion of Oceanic whitetip were finned (72.3% in deep sets and 52.7% from shallow sets), as was the case with other large sharks (Walsh et al. 2009 Table 3). In 2004-2006, following the ban, almost all sharks were released, although some were dead on release. Minimum mortality estimates declined substantially with the finning ban, from 81.9% to 25.6% in deep sets and from 61.3% to 9.1% in shallow sets (Walsh et al. 2009 Table 3).

**Trade considerations**

Oceanic whitetip is exploited in many parts of its range, primarily as bycatch in oceanic longline fisheries targeting large pelagic species (tunas, swordfishes and others). In most areas Oceanic whitetip makes up a relatively small proportion of longline catches, and catch rates are relatively low, but total global catch may be substantial. Clarke et al. (2006a) (Fig. 7) estimated total annual catches of Oceanic whitetip, based on trade data from the Hong Kong fin market, at 200 000 to 1 200 000 individuals or 22 000-42 000 t.

Meat and skins may be used, and may be traded on a small scale, but the principal product in trade is fins. Oceanic whitetip meat from longline bycatch has been marketed in Europe, North America and Asia (Rose 1996; Vanuccini 1999). Skins may be used for leather products in the USA and Mexico (Rose 1996).

Market preferences for fins of shark species are variable, but Oceanic whitetip are a preferred species in many fin markets and make up part of the "first choice" category in the Hong Kong fin market (Vanuccini 1999). Oceanic whitetip fins reportedly command high prices in the Hong Kong market (US $45-$85/kg, proposal).

Trade statistics for Oceanic whitetip fins are not available, since this species (as most other shark species) does not have its own customs code under systems currently in international use (Harmonized Tariff Schedule). Recent work on quantities of fins of different shark species transiting the Hong Kong fin market has provided information on the relative importance of Oceanic whitetip fins in trade.

The Hong Kong market has represented a substantial proportion of the global trade in shark fins: 65-80% in 1980-90, 50-65% from 1991-1995, 44-59% from 1996-2000, 30-50% following 2000 (Clarke 2008). The decline in Hong Kong's share of world trade is attributed to increasing trade through mainland China, where statistics are difficult to obtain (Clarke et al. 2007). Despite the estimated decline over time in share of the world trade transiting Hong Kong, total imports to Hong Kong increased during the 1990s (Figure 8), suggesting that total world trade in shark fins was increasing during this period. Shark fins are a traditional luxury or celebration commodity in China, and a recent trend of rising incomes in mainland China is considered a key driver of increasing demand for shark fins (Clarke et al. 2007).

Fins of Oceanic whitetip made up 1.8% of fins traded in the Hong Kong market (Clarke et al. 2006b Table 5) between November 2002 and February 2004.

In summary, it seems clear that Oceanic whitetip fins are an important product in the international fin trade, although a relatively small component of the overall trade. This species appears not to be targeted in fisheries for trade, but is taken as bycatch in fisheries targeting other species. Ease of processing and storage of dried fins facilitates trade, and the products command relatively high prices in trade.

**Implementation issues**

***Introduction from the sea***

Given that Oceanic whitetip is a species of the open ocean, rather than of continental shelves, and therefore primarily occurs in the marine environment not under the jurisdiction of any State, introduction from the sea (i.e. transport of captured specimens from international waters to areas under national jurisdiction) would be expected to occur often. Under CITES such transport of specimens listed on Appendix II would require a certificate from the state to whose jurisdiction the specimens were brought, including a non-detriment finding.

***Basis for findings: legally-obtained, non-detrimental***

Export permits for Appendix II species must be accompanied by a certificate attesting that the specimens were legally obtained. There appears to be no current and specific national or RFMO regulations on harvest of Oceanic whitetip, other than the blanket ban on finning of harvested sharks in a number of countries and RFMOs and the requirement under the FAO Compliance Agreement[8] and the UN Fish Stocks Agreement[9] for States to require vessels entitled to fly their flags to have an authorization to fish in areas beyond national jurisdiction. To this end, a small number of States have made it a requirement in national legislation for vessels entitled to fly their flags to have an authorization to fish on the high seas or in areas beyond national jurisdiction. Other than the potential of some control in these few states, there would appear to be little

[8] The Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas

[9] Agreement for the Implementation of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

impediment to jurisdictions certifying that specimens were legally obtained, should an Appendix II listing come into effect.

Export permits for products from Appendix II species must also be accompanied by non-detriment findings (NDFs) showing that exports are not detrimental to survival of the species, that is, that they are consistent with sustainable harvesting. Development of an NDF requires appropriate scientific capacity, biological information on the species, and a framework for demonstrating that exports are based on sustainable harvests. Quality of NDFs is assured by review in the Scientific Committees of CITES (Animals and Plants Committees) and within individual parties. FAO (2004, paras 28–29) provides some guidance on NDFs in a fisheries context.

There appears to be little current basis for developing NDFs for Oceanic whitetip, as no assessments of population status and allowable harvests are available for any parts of the range.

***Identification of products in trade***

The proposal indicates that fins from Oceanic whitetip are one of the most distinctive products in the Asian shark fin trade, possessing characteristic morphological and colour characters which facilitate identification. Traders in the Hong Kong fin market classify Oceanic whitetip fins to a single product category ("Liu Qui") with a high degree of accuracy (100% on a sample of 23 fins) (Clarke et al. 2006b).

***Shark species codes***

Accurate recording of international trade in sharks is seriously hampered by the absence of any species-specific reporting mechanism. To address this, the Panel suggested that the Conference of the Parties encourage the World Customs Organization to establish specific headings within the standardized tariff classification of the Harmonized System to record trade in sharks and their products at the species level.

***"Look-alike" issues***

CITES allows for Appendix II listing of species whose parts and derivatives resemble those of other Appendix I or II species to the extent that enforcement officers who encounter such products are unlikely to be able to distinguish between them (Article II paragraph 2 (b)).

From the information available, fins of Oceanic whitetip are relatively distinctive, and could possibly be distinguished from those of other species by enforcement officers using identification manuals.

**Likely effectiveness of a CITES Appendix II listing**

A CITES Appendix II listing could have significant impacts on monitoring and assessment of species status. Since most harvest is expected to be from international waters, the catch documents required under the Introduction from the Sea provisions would provide species –level information on catches which were brought from international waters to national jurisdiction. The requirement for non-detriment findings to accompany such transfer of specimens or products could contribute to developing better assessments of species status.

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## TABLES AND FIGURES

Table 1. Information for assessing productivity of Oceanic whitetip

| Parameter | Information | Productivity | Source |
|---|---|---|---|
| **Intrinsic rate of increase** | General – $r_{2M}$ = 0.067 | Low | Smith et al. 1998 |
| | General – 0.067 (from $\lambda$ = 1.069) | Low | Cortes 2008 |
| | Western/Central Pacific – 0.11 (from $\lambda$ = 1.117) | Low | Cortes 2002 |
| **Natural mortality** | | | |
| **Age at maturity** | Southwest Atlantic – 6-7 yr (both sexes) | Medium | Lessa et al. 1999 |
| | West Pacific – 4-5 yr (both sexes) | Medium | Seki et al. 1998 |
| **Maximum age** | | | |
| **von Bertalanffy K** | Southwest Atlantic – 0.075 back-calculated lengths (0.099 observed lengths) | Low | Lessa et al. 1999 |
| | West Pacific – 0.103 | Low | Seki et al. 1998 |
| **Generation time** | General – 10 yr | Low/Medium | Cortes et al. 2008 cited in proposal |
| | General – 11.1 yr | Low | Cortes 2008 |
| | Western/Central Pacific – 7 yr | Medium | Cortes 2002 |

Table 2. Decline indices for Oceanic whitetip

| Criterion | Index | Trend | Basis | Coverage | Reliability | Source |
|---|---|---|---|---|---|---|
| North-west Atlantic | CPUE longline | EOD 99% | Calculated by authors, 1950s to 1990s | Gulf of Mexico | Research surveys (1950s), observers (1990s) (4-5) | Baum and Myers 2004 |
| | CPUE longline | EOD 88% | Calculated by authors, 1950s to 1990s | Gulf of Mexico | Research surveys (1950s), observers (1990s) (4-5) | Baum and Myers 2004 corrected by Ingram et al. in prep |
| | CPUE, commer. longline | EOD 70% | Calculated by authors, 1992-2000 | Northwest Atlantic | Commercial logbook data (3) | Baum et al. 2003 |
| | CPUE longline | EOD 57% | 1986-2005 CPUE logbooks | Northwest Atlantic | Commercial logbook data (3) | Cortes et al. 2007 |
| | CPUE longline | EOD 9% | 1992-2005 CPUE observed sets | Northwest Atlantic | Observer program data (4) | Cortes et al. 2007 |
| SW Atlantic | CPUE longline | Increase from late 1990s to early 2000s | Comparison of observations from different sources | Various parts of the Southwest Atlantic | Comparison of unstandardised CPUEs from different sources (3-) | Domingo et al. 2007 |

Table 2 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| SE Atlantic | CPUE longline | Decrease from mid 1990s to 2006 | Comparison of observations from different sources | Southeast Atlantic | Comparison of unstandardised CPUEs from different sources (3-) | Domingo et al. 2007 |
| Western Pacific | CPUE, longline | "No decline" | Unknown | Western Pacific Ocean | Basis unknown | IATTC 2006 |
| Central Pacific | CPUE longline | EOD 90% | Calculated by authors, 1950s to 1990s | Central Pacific Ocean | Research surveys (1950s), observers (1990s) (4-5) | Ward and Myers 2005 |
| | CPUE longline | EOD 76% in deep sets, 53% in shallow sets | Calculated by authors, 1995-2000 vs 2004-2006 | Central Pacific Ocean | Observer data from commercial fleet (4) Information from shallow sets should be given higher weight | Walsh et al. 2009 |
| | CPUE longline | EOD 53%, 5%, 27%, 52% in 4 subareas | Late 1960s to mid 1990s | Central Pacific, uncorrected for depth changes | Unstandardised CPUE (3) | Matsunaga and Nakano 1999 (see Table 3 of present report) |
| | CPUE longline | EOD 32%, 31% in 2 subareas; increases of 38%, 4% in 2 subareas | Late 1960s to mid 1990s | Central Pacific, corrected for depth changes | Unstandardised CPUE (3) | Matsunaga and Nakano 1999 (see Table 3 of present report) |
| Eastern Pacific | CPUE, observed purse seine sets on floating objects | EOD 95% | Inspection of figure, 1994-2006 | Eastern Pacific Ocean | Standardised, observer data (4) | IATTC 2007a, b |

Table 3. Catch rate observations and decline calculations in Central Pacific. 0-10E, 0-10W etc are different subareas of the Central Pacific. "Uncorrected" are 1990 observations uncorrected for depth changes between periods; "corrected" are 1990s observations corrected for depth differences. In "Decline" row, positive numbers are declines, negative numbers are increases. Source: Matsunaga and Nakano 1999.

| ***Years*** | ***Uncorrected*** | | | | ***Corrected*** | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-10E | 0-10W | 10-20E | 10-20W | 0-10E | 0-10W | 10-20E | 10-20W |
| 1960s | 1,6 | 1,73 | 0,51 | 0,77 | 1,6 | 1,73 | 0,51 | 0,77 |
| 1990s | 0,76 | 1,65 | 0,37 | 0,37 | 1,09 | 2,38 | 0,53 | 0,53 |
| Decline | 53 | 5 | 27 | 52 | 32 | -38 | -4 | 31 |

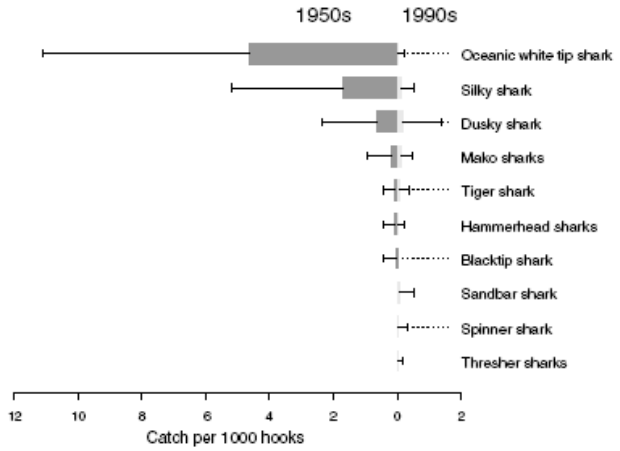


Figure 1. Mean catch rates (+/- SD) in 1950s (longline research survey) and 1990s (commercial observer from longline fleet) from Gulf of Mexico. Source : Baum and Myers 2004.

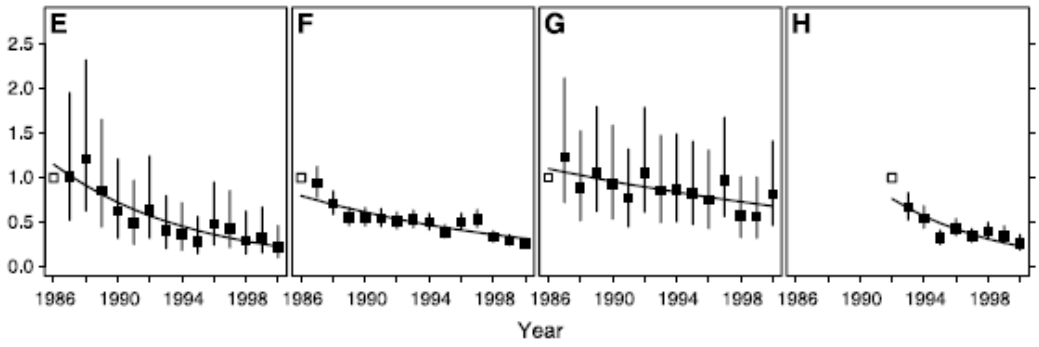


Figure 2. Relative abundance index (CPUE) of oceanic sharks in the NW Atlantic from logbook records in the pelagic long line fishery. H = Oceanic whitetip. Source: Baum et al. 2003

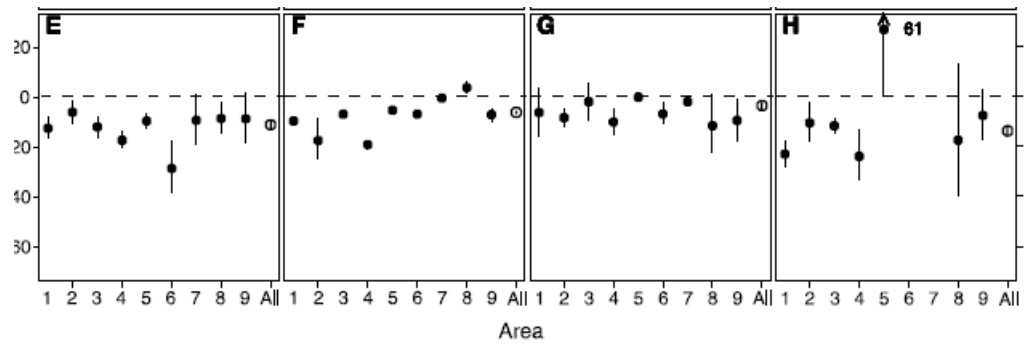


Figure 3. Rate of change in abundance over time in subareas of the NW Atlantic. H = Oceanic whitetip. Source: Baum et al. 2003.

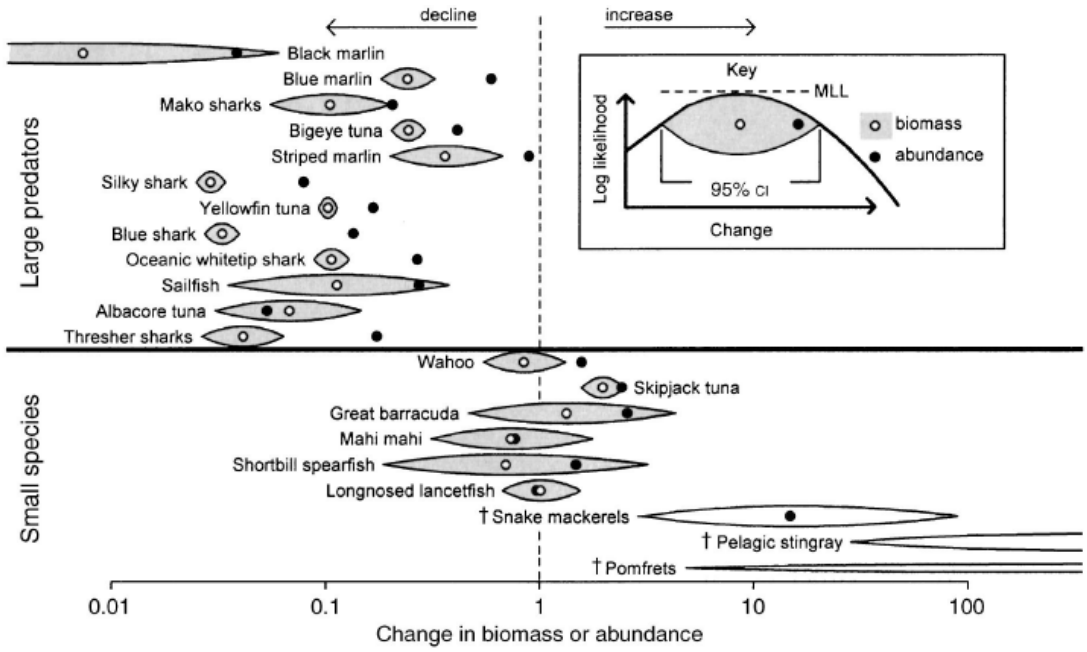


Figure 4. Change in biomass and abundance between 1950s and 1990s, Central Pacific Ocean. Source: Ward and Myers 2005.

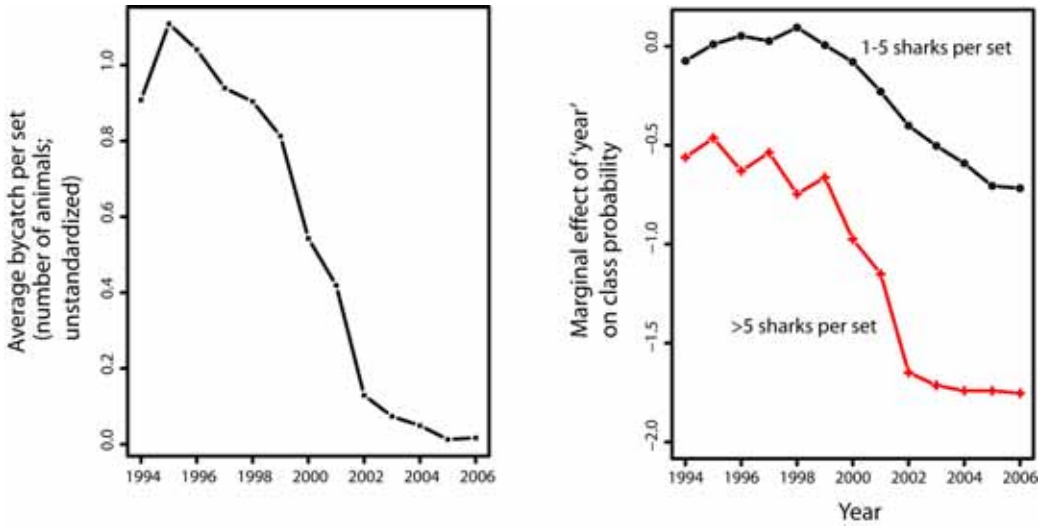


Figure 5. CPUE of Oceanic whitetip sharks, purse seine research surveys, eastern Pacific Ocean (left panel). Source: IATTC 2008.

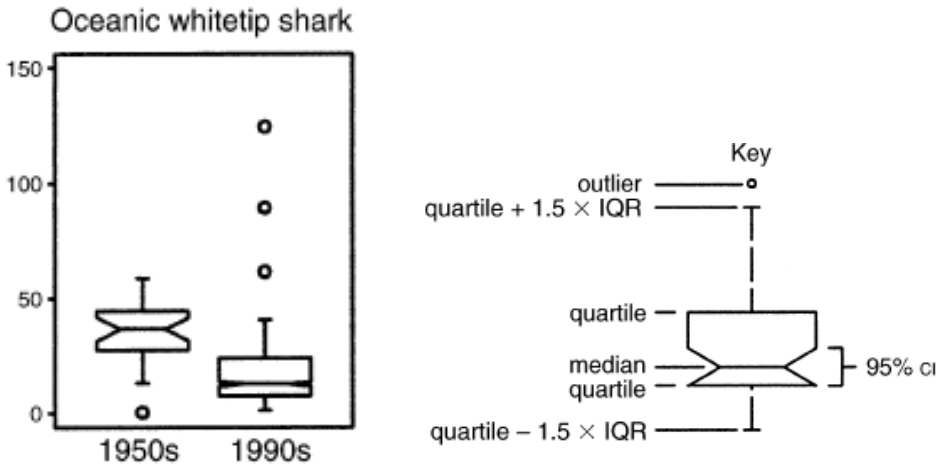


Figure 6. Change in mean body mass (kg), longline-caught individuals, Central Pacific Ocean. Source: Ward and Myers (2005)

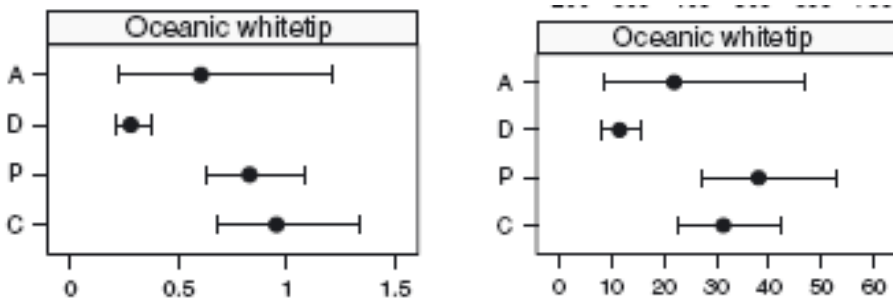


Figure 7. Estimated annual catches of Oceanic whitetip based on trade data from Hong Kong fin market. Left panel – thousands of individuals. Right panel – tonnes. Estimates based on dorsal fins (D), pectoral fins (P), caudal fins (C) and a mixture distribution (A). Source: Clarke et al. 2006a.

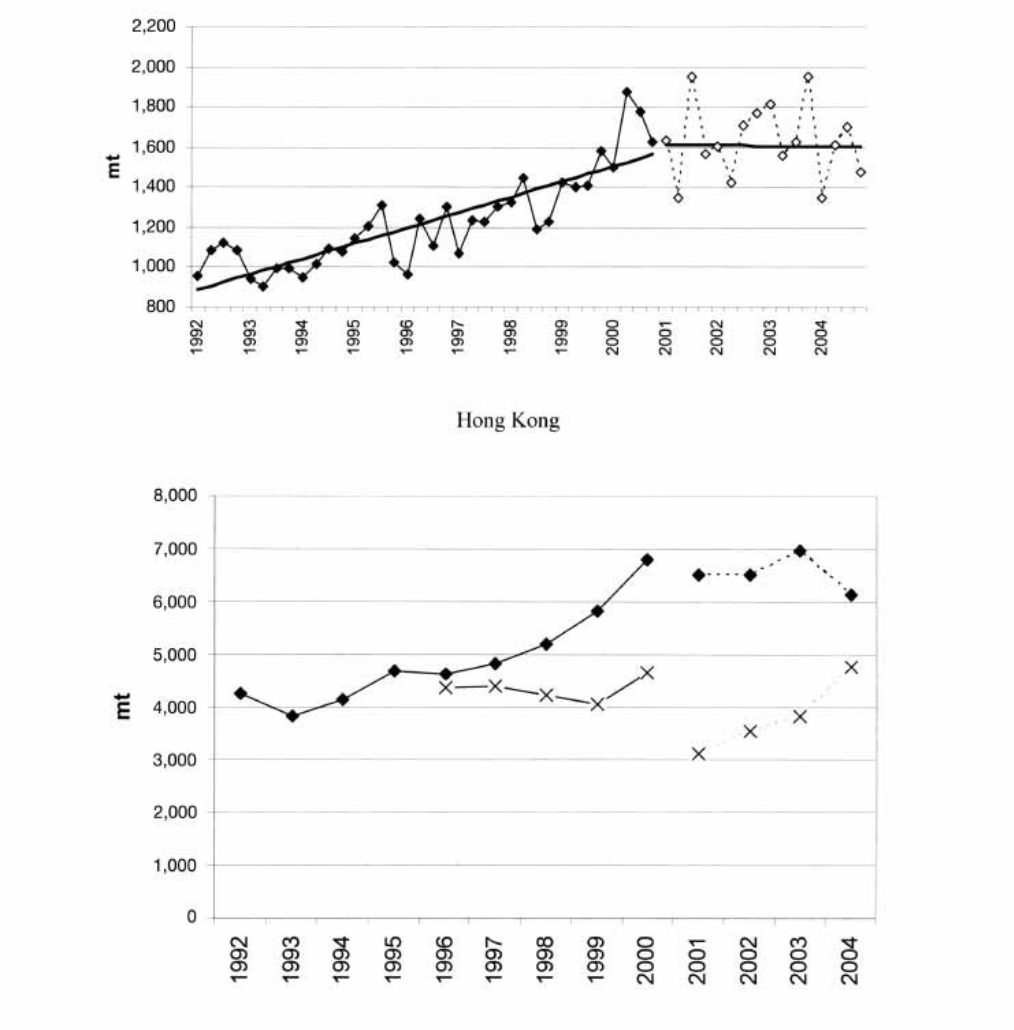


Figure 8. Imports of shark fins to Hong Kong and mainland China. Upper figure: quarterly imports to Hong Kong (a change in statistical reporting means values before and after 2001 are not strictly comparable). Lower figure: annual imports to Hong Kong (solid symbols) and mainland China (x's). Source: Clarke et al. 2007.

## APPENDIX G

## FAO Expert Advisory Panel: Porbeagle shark

**CoP15 Proposal 17**

**SPECIES**: *Lamna nasus* – Porbeagle shark

**PROPOSAL**: Inclusion of *Lamna nasus* (Bonnaterre, 1788) in Appendix II in accordance with Article II 2(a) and (b).

**Basis for proposal**: The proposal states that the regulation of trade in the species is necessary to avoid it becoming eligible for inclusion in Appendix I in the near future (consistent with Annex 2a A), and that regulation of trade in the species is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences (consistent with Annex 2a B). According to the proposal the North and Southwest Atlantic and Mediterranean stocks meet the decline criteria for a low productivity species while other southern hemisphere stocks are likely to experience similar decreases unless international trade regulations are put in place. In addition stocks that do not qualify for listing under criteria specified by Article II 2(a) are proposed to be listed under Article II 2(b) to avoid implementation problems resulting from the split listing of the species.

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**ASSESSMENT SUMMARY**

The FAO Expert Panel concluded that the available evidence supports the proposal to include Porbeagle shark, *Lamna nasus,* in CITES Appendix II.

When evaluated on a population by population basis, the historically large Porbeagle populations in the North Atlantic (Northeast and Northwest) and Mediterranean were considered to meet the Appendix II decline criterion.

Porbeagles in the Northeast Atlantic Ocean were considered to meet the Appendix II decline criterion, with no evidence that the decline has ceased. Past management has been inadequate. The decline in population abundance of the Northwest Atlantic meets the Appendix II decline criterion, although the population is currently recovering. Although no stock assessment has been performed, the tuna trap catch data for Porbeagle in the Mediterranean indicate that this population also meets the Appendix II decline criterion. New assessments for the Southwest Atlantic indicated substantial declines, but results were too uncertain to determine whether Porbeagle in this region meet the decline criterion for Appendix II.

The status of other southern hemisphere populations (excluding the Southwest Atlantic) was considered to be above Appendix II decline thresholds. The proposal refers to additional stocks that qualify under Article II paragraph 2(b), which the Panel was not able to identify.

The Panel took note of the wording of CITES Resolution Conf. 9.24 (Rev. CoP 14) indicating that Parties had resolved to adopt measures that are proportionate to the anticipated risks to the species when considering proposals to amend the Appendices. In this case, the Panel considered that populations representing most of the historical abundance of the species globally met the decline criteria for Appendix II. Therefore, listing the smaller, less exploited southern hemisphere populations as well would be consistent with the proportionate risks to the species as a whole.

Although adequate management measures are in place in some regions, there are others where appropriate management is urgently needed. Risk to the Northwest Atlantic population is mitigated by population rebuilding and the implementation of both Canadian and United States management plans designed to rebuild stocks. In other populations, sustainable management requires that, where they have not done so, range States develop and implement National Plans of Action for sharks.

In the event of a CITES listing, Porbeagle caught in EU waters would likely be traded within the EU, and thus not be subject to CITES trade limitations. In the Northwest Atlantic, most Porbeagle are harvested within the EEZs under rigorous management, which should form the basis for non-detriment findings. A CITES listing would also result in better monitoring of catches entering international trade from all stocks. Introduction from the Sea would only be an important issue for high seas longline fleets, which sometimes take Porbeagle shark as bycatch. .

In its 2007 deliberations, the Panel concluded that the species did not meet the biological decline criterion for inclusion in CITES Appendix II. The additional information available to the current Panel included a stock assessment for the Northeast Atlantic and additional information for the Mediterranean and Southwest Atlantic stocks. On the basis of this additional information, the species as a whole now warrants listing under Appendix II.

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

Porbeagle, *Lamna nasus* (Bonnaterre, 1788), is distributed throughout the North Atlantic Ocean and in a broad circumglobal band in the southern hemisphere. Porbeagle generally occurs in the Northwest and Northeast Atlantic Ocean. Tagging studies indicate that populations in the Northwest and Northeast Atlantic are distinct (COSEWIC, 2004), although occasional movements between the two areas have been observed (ICES, 2006b). The Northwest Atlantic population migrates seasonally between southern Newfoundland/the southern Gulf of St. Lawrence, and Massachusetts (COSEWIC, 2004). A single stock is considered to exist in the Northeast Atlantic (ICES, 2006a). Evidence from Japanese catches in high seas longline fishing fleets could indicate the potential for a third stock of Porbeagle off Iceland (Matsumoto, 2005; FAO, 2007). Stock boundaries in the southern hemisphere are unclear. Apparently a stock in the Southwest Atlantic could include waters of the Southeast Pacific and a stock in the Southeast Atlantic could include waters of the Southwest Indian Ocean, but not enough data is available to confirm these hypotheses (SCRS, 2009)

#### *Productivity level*

Biological information indicates that the species falls into the category of “low” productivity (Campana et al., 2001; Natanson et al., 2002; FAO 2007) (Table 1). Age determination has been validated up to at least 26 years but ages may be underestimated in older fish (Campana et al., 2002; Francis et al., 2007). Fecundity in Porbeagle is very low at an average of 3.9 pups per female with females giving birth annually (Campana et al., 2001). There is no relationship between fecundity and age (Jensen et al., 2002). Age at maturity in the Northwest Atlantic was estimated at 8 years for males and 13 years for females (Jensen et al. 2002). The intrinsic rate of increase of the population was estimated between 0.026 and 0.07. Porbeagle off New Zealand may be less productive than stocks in the North Atlantic Ocean. A recent study of New Zealand Porbeagle estimated age at maturity at 8–11 years for males and 15–18 years for females, while longevity may be around 65 years (Francis et al., 2007).

### Population status and trends

#### *Small population size*

Available estimates for the Northwest Atlantic population are 11-14 thousand mature females, 33–38 thousand mature individuals, and 196–207 thousand total individuals (SCRS 2009). For the Northeast Atlantic population size was estimated between 127 and 204 thousand individuals (SCRS, 2009). No information on population size is available from other areas where the species occurs.

#### *Restricted distribution*

The extent of occurrence in Canada is estimated at 1.2 million $km^2$, while the area of occupancy in Canada from recent catch locations is estimated at 830 000 $km^2$; range is not known to have changed since the fishery began in 1961 (COSEWIC, 2004; FAO 2007). Area of occupancy and extent of occurrence for the

Northwest Atlantic would be greater than these values. There is no evidence that local depletion exists in this area for Porbeagle because tagging data suggest this species is highly migratory. Area of occurrence in Norwegian waters is estimated at 395 000 $km^2$ (A. Bjorne pers. comm.). The area of occurrence in the Northeast Atlantic would be considerably larger than that. No information on distribution area is available from other areas where the species occurs, but it is a widely distributed species in the Northeast Atlantic and southern hemisphere (FAO, 2007).

***Decline***

Because this species occurs in several widely separated areas, and in distinct populations, no single abundance index can be applied to the species as a whole. Assessment of decline in abundance of the species can only be calculated using abundance indices from as many parts of the species' distribution as possible. Trend information for each stock is summarized in Table 2.

*Northeast Atlantic*

Available catch and CPUE time series data were used by ICCAT's Standing Committee on Research and Statistics (SCRS, 2009) to assess the status of the Northeast Atlantic stock of Porbeagle. Two assessment models were used by SCRS (2009): a surplus production and an age structured production model. Both models used catch data from 1926 and CPUE data from Spanish (1981 – 2007) and French (1972 – 2008) longline fleets. Results from satisfactory runs of the surplus production model (runs based on the longest time series and based on realistic values for the unexploited population size) estimated that the current population size is between 15% and 39% of the unexploited population size (Fig. 1). Results from the age structured production model estimated that the current stock biomass is 6% in biomass and 7% in numbers of the unexploited population size (Figure 2). Current fishing mortality is estimated between 2.3 and 3.5 of the fishing mortality that would maximize yield in the long run. SCRS (2009) concluded that all the models that used biologically plausible assumptions about unfished biomass inferred that the population is currently depleted. However, the results of both assessment models are considered highly uncertain, given that the majority of the fishery removals occurred before data were available to estimate abundance trends (SCRS 2009).

Forward projections of the stock based on the surplus production model indicated that the current TAC of 436 t is likely to cause the population to remain fairly stable at a low biomass level. Rebuilding of the stock could take several decades under lower fishing mortality rates. In the absence of better information to assess the status of the stock, the management recommendation of ICES is to prohibit the target fishing for Porbeagle, to limit the bycatch and to prohibit landings (SCRS, 2009).

Catch per unit of effort data from the French longliners decreased by one third between the early 1970s and early 1980s and since then has oscillated without a trend. The Spanish CPUE has also oscillated without a trend since the mid-1980s (Fig. 3; SCRS, 2009). As noted above, both CPUE time series were used in the stock assessment models for the Northeast Atlantic stock.

Updated catch data were used in the proposal to demonstrate a decline in the Northeast Atlantic stock, as done in the previous proposal submission (FAO, 2007). In the Northeast Atlantic the species has been fished by many European countries, mainly by Norway, Denmark, France, Faroes and Spain. Total landings in the Northeast Atlantic declined from an average of 2 953 tonnes in 1933-37 to 388 tonnes in 2004-08 (Fig. 4). Landings of the Norwegian and Danish fleets are currently about 1% of their historical peaks in the 1930s and 1950s, respectively (Table 2). French longliners started targeting Porbeagle in the 1970s. Catches peaked in 1979 at 1 092 tonnes and are currently about 291 tonnes per year. The species is also caught opportunistically as bycatch in Spanish longliners targeting swordfish and sharks in the Atlantic. Reported catches have oscillated without a trend since the early 1970s, being always below 70 t/yr. As stated by FAO (2007), landings data do not provide an accurate index of abundance because changes in landings may be influenced by market conditions and management measures rather than abundance of the species.

*Mediterranean*

The proposal compiled different sources of information suggesting the disappearance of Porbeagles in the Mediterranean. It is not known if the Porbeagles in the Mediterranean are part of a separate stock from the Northeast Atlantic. Declines of more than 99% in catches of lamnid sharks (including Porbeagle) in tuna traps in the Ligurian Sea were estimated between 1950 and 2006 (Figure 5; Ferretti et al., 2008). Ferretti et al

(2008) also estimated declines of more than 98% in the cpue of longline fisheries in the Ionian Sea between 1978 and 1999. The authors noted however that the cpue in the beginning of the time series was already very low (in the order 0.2 sharks/1000 hooks).

Reported landings to FAO have been below 4 tonnes per year since 1970; the highest landings on record (11 tonnes) were reported by Algeria in 2007. Neither the Panel nor an Algerian fisheries representative could confirm the reliability of the catch data reported by Algeria.

*Northwest Atlantic*

Landings in the Northwest Atlantic fishery were high in the early 1960s, declined to low levels during the 1970s and 1980s, increased during the early 1990s and declined to low values in the early 2000s (Figure 6; Gibson and Campana, 2005). Recent catches are 4% of the historical maximum levels (Table 2) due to strict quota regulations.

Two assessment models were used by SCRS (2009) to estimate the status of Porbeagle shark in the Northwest Atlantic: a surplus production model and an age structured model. Results from the surplus production model applied to data through 2009 estimated that current stock biomass is about 32% of the stock biomass in 1961 (Fig. 7). According to the age structured model the current population size is about 22% to 27% of its size in 1961 (Fig. 8). The number of mature females in the population is estimated at 12% to 16% of the estimated number in 1961. Both models indicate that population size has stabilized and is undergoing a slow recovery in recent years. The current population size is about 95% to 103% of its size in 2001, and a recovery to $B_{MSY}$ levels is likely to occur in about 20 years with no fishing.

*Southern Hemisphere*

Catch per unit of effort data of Porbeagle caught as bycatch in the Uruguayan pelagic longline fleet shows a declining trend from 1982 to 2008 (Figure 9). Changes in the Uruguayan CPUE time series occurred too quickly to be explicable solely on the basis of abundance changes, but alternate abundance indices were not available (SCRS 2009). Therefore the Uruguayan CPUE time series was used by SCRS (2009) to assess the status of the Porbeagle stock in the Southwest Atlantic using a surplus production model. Because of suspected high levels of unreported catches from all tuna longline fleets operating in the area, the model included estimates of potential total catches based on pelagic longline fishing effort and the ratios of Porbeagle to other species in the pelagic longline catch. Results indicated that the current stock biomass is about 18 – 39% of the unexploited stock size, depending on the assumption made about unreported catches (Fig. 10). The Uruguayan CPUE data was also used by SCRS (2009) to assess the stock using a catch free age structured production model. The model estimated that the current spawning stock biomass is 18% of the unexploited level and 54% of the biomass in 1982 (Figure 11). SCRS (2009) concluded that despite the convergence of the methods in showing potential declines in Porbeagle abundance in the Southwest Atlantic, data are too limited to provide a robust indication on the status of the stock.

Other data available from the southern hemisphere are from bycatch fisheries, including in Japanese longline fisheries for southern bluefin tuna, and in the New Zealand and Argentina longline and trawl fisheries. Porbeagle is one of the main pelagic shark species, following blue shark, caught by the southern bluefin tuna fishery of Japan (Matsunaga, 2009). Standardized CPUE data from this fleet showed no trend from 1992 to 2007 (Fig. 12). Reported landings in New Zealand reached a peak of 300 tonnes in 1998-99 and declined by 75% since then to a low of 55 tonnes in 2005-06 (Fig. 13). Unstandardized catch per unit of effort of New Zealand tuna longline fishery derived from observer data collected between 1992 and 2005 suggests a declining trend in stock abundance during the period (Figure 14). However it is noted in the proposal that declines may not necessarily reflect changes in abundance because of low observer coverage and changes in fishing operations. Reference is also made to the decline of 40% in Porbeagle landings from longline fisheries operating off New Zealand between 1997 and 2003 (FAO, 2007). Porbeagle bycatch in the demersal fisheries on the southern Patagonian shelf has been estimated at 20-70 t over the period 2003-2006 (Waessle, 2007). No updated information is presented in this regard.

***Other indices***

Average length of individuals taken in Northwest Atlantic fisheries declined from over 200 cm in 1960-1980, to 140-150 cm in 1999-2000 (Campana et al 2001; Fig. 15).

**Assessment relative to quantitative criteria**

***Small population***

The estimate of total population size for the Northwest Atlantic is 11-14 thousand mature females, and 196–207 thousand total individuals. For the Northeast Atlantic total population size is 127 – 204 thousand individuals. The total population size in the North Atlantic would be therefore at least 323 thousand individuals. Total population size worldwide would be well above this. These estimates are well above the general guideline (5000) for small population size provided in the CITES definitions (CITES Conf. Res. 9.24 Rev CoP14). The species is therefore not characterized by a small population size.

***Restricted distribution***

No guidelines for restricted area of distribution are provided in the CITES Criteria, which indicate that thresholds should be taxon-specific (Conf Res 9.24 Rev CoP 14). FAO (2001) recommended that historical extent of decline in area of distribution would be a better measure of extinction risk than absolute value of distributional area, but that if no other suitable information is available and absolute area of distribution has to be used for an exploited fish population, analyses should be on a case-by-case basis as no numeric guideline is universally applicable.

Estimated distribution area for the species would be substantially greater than estimates for Canada where extent of occurrence is 1.2 m $km^2$ and area of occupancy 830 000 $km^2$. For the Northeast Atlantic the area of occurrence would be at least 395 000 km2. . Therefore, as concluded by FAO (2007), the species is not characterized by a “restricted” distribution.

***Decline***

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 14), a decline to 15-20% of the historical baseline for a low productivity species might justify consideration for Appendix I. For listing on Appendix II, being “near” this level might justify consideration, which for a low productivity species would be 20-30% of the historical level (15-20% + 5-10%).

No overall population decline index is available for comparison with the guidelines. Information from different areas is summarized below.

For the Northwest Atlantic population, the current mature female population estimated with an age structured model is 12–16% of the historical baseline prior to major fisheries (1961), while the total population is 22–27% of that historical baseline. Results from a surplus production model applied to the same time series of data estimated that current stock biomass is about 32% of the stock biomass in 1961, which is only slightly above the decline threshold of 30% for an Appendix II listing. These results indicate the population in the Northwest Atlantic meets the criterion for Appendix II, as concluded in the previous Panel report (FAO, 2007). The population is under a conservative harvesting regime in Canada and USA which is expected to allow the recovery of the stock. Recovery to target levels will however take decades due to the low productivity of the species. As noted by SCRS (2009), there is probably unreported catch in the high seas within the stock area and increased effort in these areas could compromise stock recovery efforts.

For the Northeast Atlantic, assessment against the decline criterion is more difficult due to the lack of long term indices of abundance. The only CPUE data available are from longline fisheries from 1972 to 2008, well after the historical peak in landings in the 1930s. Stock assessment results based on the available catch and CPUE data indicate that current population size is about 15-39% of the unexploited population size, according to one modeling approach, and 6% in biomass and 7% in numbers of the unexploited population size according to another modeling approach. Despite the uncertainties of the results, these levels of decline put the Northeast Atlantic stock generally within the decline threshold for an Appendix II listing.

In the Mediterranean, a decline of more than 99% in catches in tuna traps was estimated between 1950 and 2006. Although catches are not generally an appropriate measure of abundance trends, catch data from the fixed tuna traps were considered a relatively reliable source of information about abundance trends. Considering in addition the estimated decline of more than 98% in longline CPUE between 1978 and 1999

and other anecdotal information about the disappearance of the species, the Panel concluded that the decline in Porbeagle abundance in the Mediterranean meets the criterion for an Appendix II listing.

For the southern hemisphere, information was patchy and the time series were short (1982 to 2008). Stock assessment based on CPUE data from the Uruguayan fleet and on reconstructed catches in the Southwest Atlantic estimated current stock biomass at about 18% and 39% of the unexploited stock size. This level of decline would be generally within the decline criterion for an Appendix II listing. However, the results were considered highly uncertain because of data limitations. The Panel concluded that other stocks in the southern hemisphere are probably not lightly fished but may be above the Appendix II decline criteria threshold.

In summary the Panel concluded that the available evidence indicates that the stocks of Porbeagle in the north Atlantic (Northwest and Northeast stocks) and Mediterranean Sea meet the decline criteria for inclusion in CITES Appendix II. The status of stocks in the southern hemisphere is more uncertain but overall the Panel considered that these stocks are likely to be above the decline threshold for an Appendix II listing.

The Panel took notice of the wording of Resolution Conf. 9.24 (Rev. CoP 14) indicating that Parties had resolved to adopt measures that are proportionate to the anticipated risks to the species when considering proposals to amend the Appendices. In this case, the Panel considered that populations representing a large proportion of historical abundance of the species globally (North Atlantic) met the decline criteria for Appendix II. Therefore, listing the smaller, less exploited southern hemisphere populations as well would be consistent with the proportionate risks to the species as a whole.

The proposal refers to additional stocks that qualify for inclusion on Appendix II in accordance with Article II paragraph 2(b) which the Panel was not able to identify.

**Were trends due to natural fluctuations?**

There is no evidence that observed trends were due to natural fluctuations.

**Risk factors and mitigating factors**

Different risk factors for the species were noted in FAO (2007). Life history characteristics, such as low fecundity, slow growth and late maturation, make the species particularly vulnerable to mortality from human activities including fishing. Such vulnerability factors are addressed in the decline criterion threshold for a low productivity species. The high value of products from the species (meat, fins) in domestic and international markets constitutes another risk to the conservation of the species. In addition the species is taken with longline fishing gear both in directed fisheries and as bycatch for other high-value species such as tuna and swordfish. Therefore even with appropriate management measures and controls some level of fishing mortality is likely to be maintained because of bycatch.

Unreported catch represents a significant potential risk factor as this will constrain developing accurate information on stock status. Even in the area where stock information is considered best, the Northwest Atlantic, unreported catch is apparently being taken (Campana and Gibson 2008) and it is estimated that worldwide real catches are substantially above reported catches (SCRS 2009).

The existence of rebuilding plans in the United States and Canada represents an important mitigating factor for the Northwest Atlantic population. Catch quotas have been reduced to levels that will support the population recovery, but recovery will take decades because of the low productivity of the species (SCRS, 2009). Catches in the high seas areas of the North Atlantic may undermine these efforts if they are not strictly regulated.

Recent regulations adopted under the European Common Fisheries Policy, including restrictive quotas for the directed fishery, maximum landing size and the banning of shark finning, can mitigate to some extent the risk to the Northeast Atlantic population. The recently established European Community Action Plan for the Conservation and Management of Sharks may lead to the adoption of several measures to rebuild depleted stocks of sharks, including Porbeagle. The entering into force of EU Regulation 1005/2008 establishing

catch certification requirements for imports into the EU is expected to mitigate IUU fisheries to a certain extent.

In the southern hemisphere, mitigating factors include Argentinean regulations prohibiting finning (Consejo Federal Pesquero, Res. 13/2009) and requiring all live captures of sharks greater than 1.6 metres to be released by Argentinean longline and trawl fisheries (Consejo Federal Pesquero, Res. 13/2003). Moreover, Argentina has a 100 percent observer coverage requirement for longline fisheries which provides accurate catch estimates for Porbeagle (FAO, 2007). New Zealand has included Porbeagle under a quota management system since 2004.

In addition, measures adopted by Regional Fishery Management Organizations are likely to have some effect on the conservation of sharks. For instance, since 2007 ICCAT requires Parties to reduce the mortality of Porbeagle sharks in directed fisheries where a peer-reviewed stock assessment is not available (proposal). The proposal also refers to the recent moratorium on directed shark fishing in the area of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) until data become available to assess fishing impacts on sharks. Finally, the FAO International Plan of Action for the Conservation and Management of Sharks urges shark fishing nations to implement conservation and management plans which will lead to sustainable utilization of sharks. Strengthening the implementation of the IPOA-Sharks by countries and RFMOs could be expected to benefit the conservation of Porbeagle throughout its range.

**Trade considerations**

Porbeagle shark products, particularly the meat and fins, are highly valued in markets and accordingly are in demand (proposal; Rose, 1996; Fowler *et al.*, 2004; FAO, 2007). However, as noted in the proposal, the lack of species-specific landings and trade data make it impossible to assess the volume of catches supplying domestic and international trade.

The high value of Porbeagle meat in European countries is well documented (proposal; Vannucinni, 1999; FAO, 2007). Based on catch data reported to FAO, EU Member States took 60% and 75% of the global reported Porbeagle catches in 2006 and 2007, respectively. Trade in Porbeagle meat between France, Spain and Italy has been documented but this is within the EU so is not considered “international” (FAO, 2007). Exports of Porbeagle meat from Canada to the USA and EU, from Japan to the EU, and from the EU to the USA have been documented in earlier studies (Vannuccini, 1999), but the quantification of these transactions could not be done because of the lack of any customs code for Porbeagle in the Customs Hamonized System (proposal).

Besides the meat, fins of Porbeagle are also highly valued. According to the proposal Porbeagle is among the preferred species for fins in Indonesia. The species is among the main species frequently used in the global fin market (Shivji et al., 2002; cited in the proposal). In this regard, FAO (2007) noted that “Porbeagle fins are found in markets in China, Hong Kong, Special Administrative Region, and internationally (proposal; Shivji et al., 2002), but are apparently not one of the common species in the Hong Kong dried fin market, possibly because fins in that market primarily come from areas other than those where Porbeagle is most abundant (Northwest and Northeast Atlantic) (Table 2 in Clarke et al., 2006)”. Other products probably in trade cited in the proposal are hides, liver oil and cartilage, but the actual traded volumes are unknown.

In the absence of any new information, the conclusions of FAO (2007) with respect to trade in Porbeagle products remain valid and relevant. “Trade in Porbeagle parts (primarily meat and fins) was determined by the panel to be a factor affecting Porbeagle catch. However, Porbeagle caught in EU waters would likely be traded within the EU, and thus not be subject to CITES trade limitations. In the Northwest Atlantic, most Porbeagles harvested to supply trade are managed under existing Canadian and United States management plans supporting population growth” (FAO, 2007).

**Implementation issues**

***Introduction from the sea***

As stated in the proposal and also in FAO (2007), most Porbeagles are harvested within the Exclusive Economic Zones (EEZs) and as such introduction from the sea would only be a significant issue for those individual taken by high seas longline fleets. Porbeagle is known to be taken as bycatch in Japanese, Korean and Taiwan Province of China longline fisheries operating in the high seas. Estimates of Japanese bycatch ranging from 15 to 280 t annually between 2000 and 2002 are reported in the proposal. The landing of these specimens would need to be accompanied by Introduction from Sea and Non-detriment findings certificates. Exactly how these certification processes would be carried out is still a matter of debate within CITES. Some level of involvement of Regional Fisheries Management Organization is expected in areas where such organizations have been established with mandate over shark fisheries.

***Non-detriment findings***

Non-detriment findings (NDFs) are the responsibility of the exporting country and must show that exports are not detrimental to survival of the species, that is, that they are consistent with sustainable harvesting. Development of an NDF requires appropriate scientific capacity, biological information on the species, and an approach to demonstrating that exports are based on sustainable harvests.

For the Northwest Atlantic population, the basis for non-detriment findings should follow the current rebuilding plans and TACs established by Canada and USA based on results from a stock assessment. For the Northeast Atlantic, scientific advice is available on which NDFs could be based. In addition, the recently adopted European Community Action Plan for the Conservation and Management of Sharks may eventually provide the management reference points needed to evaluate non detriment findings. For Porbeagle introduced from the sea, existing RFMOs could be used to provide the basis for NDFs (FAO, 2007). Resources and tools are available to inform other CITES Parties on the necessary information and steps to be taken in the making of NDFs (Rosser and Haywood, 2002; Anonymous, 2008).

***Findings that specimens were legally obtained***

Porbeagle harvests from the Northwest Atlantic population are regulated under the Canadian and USA management plans. Exports of products based on legal harvesting under these management plans would qualify as legally obtained for CITES. In the Northeast Atlantic, recently established EU regulations for Porbeagle catches, including specific TAC, maximum landing size and no finning measures, provides the basis to judge if takes were legally obtained. TACs for the species have also been established by New Zealand, Norway and Faroe Islands, and a maximum landing size is in place in Argentina. Regulations controlling shark finning is also in place in many countries and regional fisheries management organizations. Exports from these countries and areas that are in agreement with the established regulations would qualify as legally binding under CITES.

***Identification of products in trade***

FAO (2007) noted that “it would probably be difficult for a non-expert to distinguish meat of Porbeagle from that of other similar lamnoid sharks in trade such as shortfin mako. Dorsal fins from large shark species may also be difficult to distinguish, although Porbeagle dorsal fins have a characteristic white rear edge (proposal). Accordingly, a basis for unequivocal identification of Porbeagle products in trade does not appear to exist. DNA techniques are not considered practical as initial screening tools although they may be useful for secondary inspections or enforcement (CITES, 2006)”. According to the proposal, such techniques for Porbeagle are already available and could be used for distinguishing between southern and northern hemisphere stocks.

***“Look-alike” issues***

In relation to “look-alike” issues, FAO (2007) noted that “listing for “look-alike” reasons (i.e., listing on Appendix II under Article II paragraph 2 (b) of the Convention) is justified when enforcement officers who encounter specimens of CITES-listed species are unable to distinguish between them and unlisted species. Trade in Porbeagle products is predominantly meat and fins. If the trade in products was undermining the conservation effectiveness of a Porbeagle listing, and tools such as identification guides and DNA tests were

not feasible, there would be potential justification for proposals to list other species of sharks on the basis that their products resemble those of Porbeagle in trade, were Porbeagle shark to be listed on Appendix II".

The proposal cites Resolution Conf. 9.24 (Rev. CoP 14) Annex 2b (listing in accordance with Article II paragraph 2 (b)) to justify the listing in Appendix II of "stocks that do not qualify under Annex 2a". Considering that the stocks proposed to be listed under Article II paragraph 2 (a) ("Annex 2a") comprise all known stocks of Porbeagle shark (Northwest and Northeast Atlantic, Mediterranean, Southwest Atlantic and other southern hemisphere stocks), the Panel considered that there were no other stocks to be evaluated against Annex 2b criteria for listing in accordance with Article II paragaraph 2(b).

**Likely effectiveness of a CITES Appendix II listing**

The impact of a CITES Appendix II listing on species status depends on several factors including the extent to which international trade (as opposed to exploitation for national utilization) is driving exploitation; the relative importance of directed harvest for trade and of other sources of mortality including incidental catch; and the actual effects of the listing.

Although Porbeagle products are traded internationally, the actual proportion of the catches that are in international trade remains unknown due to the lack of specific customs codes for the species. However, as noted by FAO (2007), much of the harvest in the EU is apparently for internal markets, and thus would not be subject to CITES provisions. Therefore the listing would have little impact on the status of the Northeast Atlantic stock. For other stocks, restrictions on trade resulting from an Appendix II listing might result in a diversion of product from international to national markets, since the meat and fins are of high quality.

The existence of rebuilding plans in the United States and Canada was recognized as an important mitigating measure for the Northwest Atlantic population. The listing in Appendix II would probably strengthen the efforts to keep harvesting for trade commensurate with the rebuilding plan for this stock.

Under an Appendix II listing, landings of Porbeagle caught in high seas fisheries would require certificates of introduction from the sea accompanied by non detriment findings. Although high seas catches are believed to be minor compared to the levels of takes within EEZs, improving the control of high sea catches is expected to strengthen current management measures in place for the Northwest and Northeast stocks.

The Panel also noted that a CITES listing is expected to result in better monitoring of catches entering international trade from all stocks. The improved catch monitoring could have a beneficial effect on the management of the species in all parts of its range.

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## TABLES AND FIGURES

Table 1. Information for assessing productivity level of Porbeagle. Unless otherwise indicated, information is from the proposal. “Productivity” is relative to guidelines in FAO 2001.

| **Parameter** | **Information** | **Productivity** | **Source** |
|---|---|---|---|
| Intrinsic rate of increase | 0.05-0.07 (North Atlantic)<br>0.026 (Southwestern Pacific) | Low (less than 0.14) | Proposal; Campana et al. 2001 |
| Natural mortality | 0.10 (immature), 0.15 (mature males), 0.20 (mature females) (Northwest Atlantic) | Low (less than 0.2) | Proposal; Campana et al. 2001 |
| Age at maturity | Female: 50% mature at 13 yr (N. Atlantic), 15-19 yr (S. Pacific<br>Male: 50% mature at 8 yr (N. Atlantic), 8-10 yr (S. Pacific) | Low (greater than 8 yr) | Proposal; Campana et al 2001; Francis et al 2007 |
| Maximum age | > 29 – 45 years (Northwest Atlantic)<br>60 years (Southern hemisphere) | Low (greater than 25 yr) | Proposal; Francis et al., 2007, SCRS, 2009. |
| K | 0.07, Northwest Atlantic | Low (less than 0.15) | Natanson et al 2002 |

Table 2. Decline indices for Porbeagle. Reliability indices refer to FAO (2001).

| Area | Index | Trend | Basis | Coverage | Reliability | Source |
|---|---|---|---|---|---|---|
| NE Atlantic | Landings | Landings declined to 13% of historical peak of 2 953 tonnes in 1933-37. | Average landings 1933-37 vs. 2004-08 | Northeast Atlantic | Catch data (2) | Proposal; SCRS, 2009. |
| | Landings | Danish landings declined from average of 1380 tonnes in 1950-54 to 6 tonnes in 2004-08 (< 1%) | Average landings 1950-54 vs. 2004-08 | Danish fleet | Catch data (2) | Proposal; SCRS (2009) |
| | Landings | Norwegian landings decline from 2 953 t/yr in mid-1930s to less than 20 t/yr in 2004-08 (<1% of peak) | Average landings 1933-37 vs 2004-08 | Norwegian fleet | Catch data (2) | Proposal |
| | Cpue | No trend since mi-1980s | Inspection | Spanish longline fleet | Catch per unit of effort (standardized?) (4) | Proposal, SCRS (2009) |
| | Cpue | Decline by 1/3 from early 1970s and 2004-08 | Inspection | French longline fleet | Catch per unit of effort (standardized) (4) | Proposal, SCRS (2009) |
| | Stock biomass | Decline to 15% to 39% of unexploited biomass | Surplus production model | Northeast Atlantic, 1926 – 2008. | Population model based on catch data and catch per unit of effort (standardized) (4) | Proposal, SCRS (2009) |
| | Stock biomass and numbers | Decline to 6% in biomass and 7% in numbers of unexploited biomass | Age structured production model | Northeast Atlantic, 1926 – 2008. | Population model based on catch data and catch per unit of effort (standardized) (4) | Proposal, SCRS (2009) |

Table 2 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| Mediterranean | Compiled observations, landings | "Virtually disappeared" | Landings recorded in FAOFishstat, observations in research surveys. | Mediterranean | Catch data (2), observations (1) | Proposal |
| | Catches lamnid sharks in tuna traps | Decline of 99% between 1950 and 2006. | GLM of catches over time | Ligurian Sea | Catch data (2) | Proposal, Ferretti et al. (2008) |
| | Cpue lamnid sharks in pelagic longlines | Decline of 98% between 1978 and 1999 | GLM of cpue over time | Ionian Sea | Catch per unit of effort standardized (4) | Proposal, Ferretti et al. (2008) |
| Northwest Atlantic | Landings | Recent catches are 4% of historical highs | Average catch 2004-2008 vs. average catch 1961-1965 | Northwest Atlantic fishery | Catch data (2) | Proposal; numbers from Gibson and Campana 2005 |
| | Stock biomass | Current stock is 32% of the size in 1961 | Surplus production model | Northwest Atlantic | Catch per unit of effort standardized (4) | Proposal, SCRS (2009) |
| | Total numbers | Current population size is 22% to 27% of its size in 1961 | Age structured model | Northwest Atlantic | Catch per unit of effort standardized (4) | Proposal, SCRS (2009) |
| | Numbers of mature females | Current numbers is 12-16% of numbers in 1961 | Age structured model | Northwest Atlantic | Catch per unit of effort standardized (4) | Proposal, SCRS (2009) |

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Table 2 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| Southern hemisphere | Stock biomass | Current stock biomass about 18 – 39% of the unexploited stock size | Surplus production model | Southwest Atlantic | Catch per unit of effort of Uruguayan fleet (3) | Proposal, SCRS (2009) |
| | Spawning stock biomass | Current SSB is 18% of unexploited SSB | Catch free, age structured production model | Southwest Atlantic | Catch per unit of effort of Uruguayan fleet (3) | Proposal, SCRS (2009) |
| | Longline cpue | Declining trend since 1982 | Inspection | Uruguay, Southwest Atlantic | Catch per unit of effort of Uruguayan fleet (3) | Proposal, SCRS (2009) |
| | Landings | Decline of 75% between 1998 and 2006. | Inspection | New Zealand | Landings (2) | Proposal, Ministry of Fisheries New Zealand |
| | Longline cpue | Decline to ca. 30% between 1992 and 2005 | Inspection | New Zealand | Unstandardized cpue (3) | Proposal, Ministry of Fisheries New Zealand |
| | Longline cpue | No trend between 1992 and 2007 | Inspection | Japan, southern bluefin area. | Standardized cpue (4) | Matsunaga (2009) |

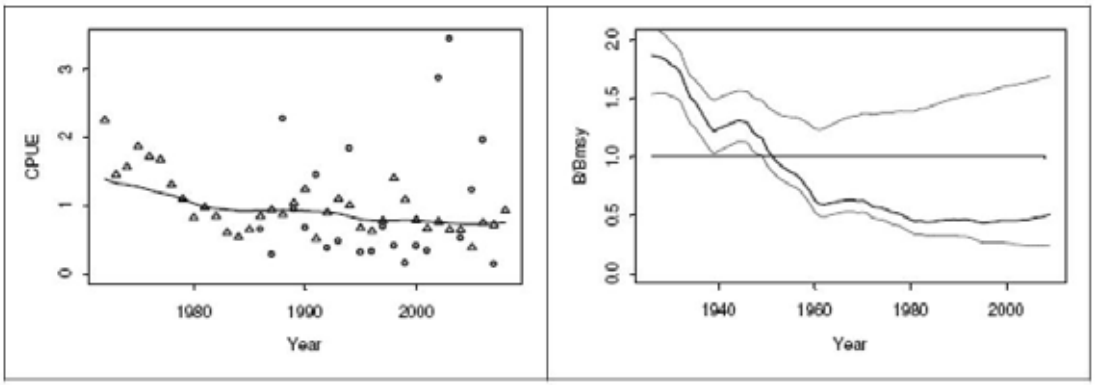


Figure 1. Results of a Bayesian Surplus Production model of the Northeast Atlantic Porbeagle stock. Left: French and Spanish catch per unit effort and fitted biomass trend. Right: biomass (B) relative to biomass at MSY ($B_{msy}$) (Source: SCRS 2009).

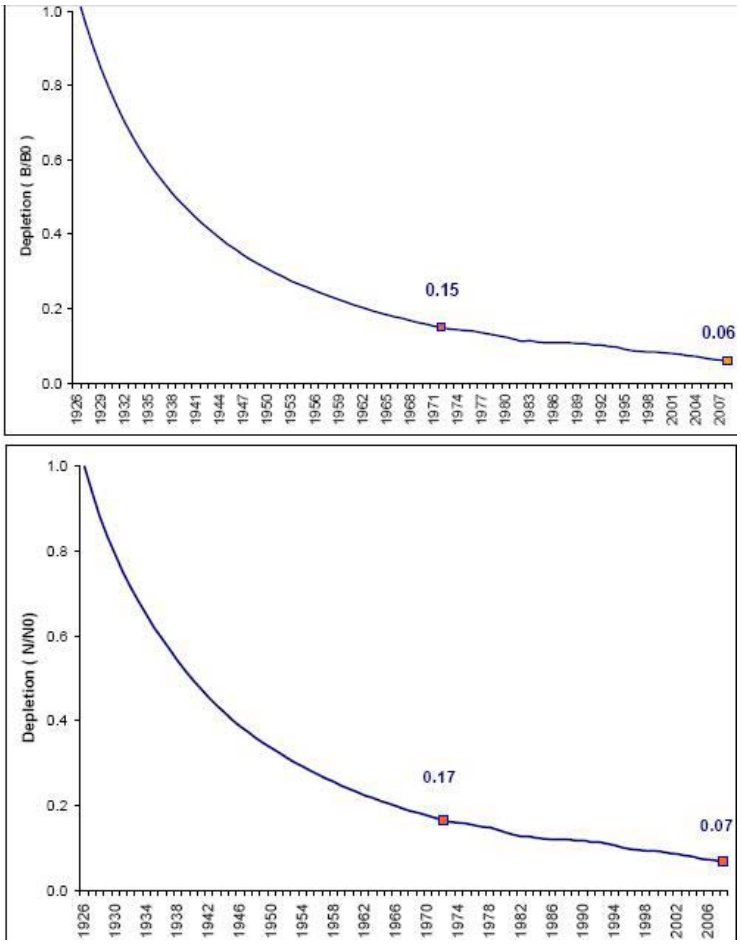


Figure 2. Depletion in total biomass (upper panel) and numbers (lower panel) for the age-structed production model assuming virgin conditions in 1926 for Northeast Atlantic Porbeagle shark. The dots indicated on the line correspond to depletion at the beginning of the modern period (1972) and current depletion (2008) (source SCRS, 2009).

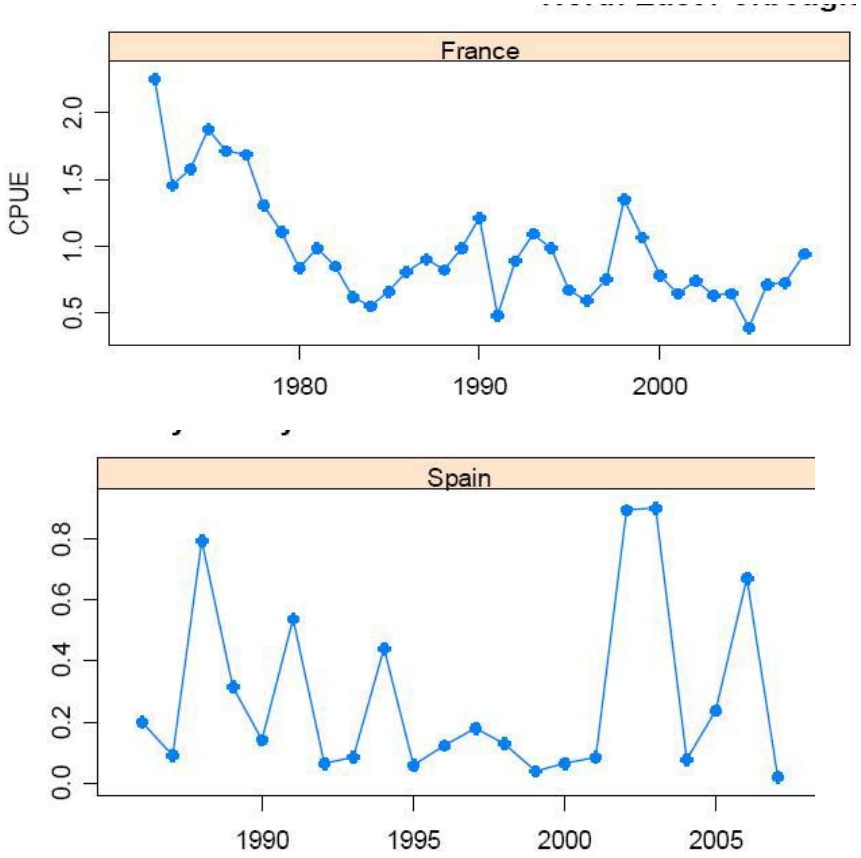


Figure 3. French and Spanish Porbeagle cpue from longline fisheries in the Northeast Atlantic (SCRS, 2009).

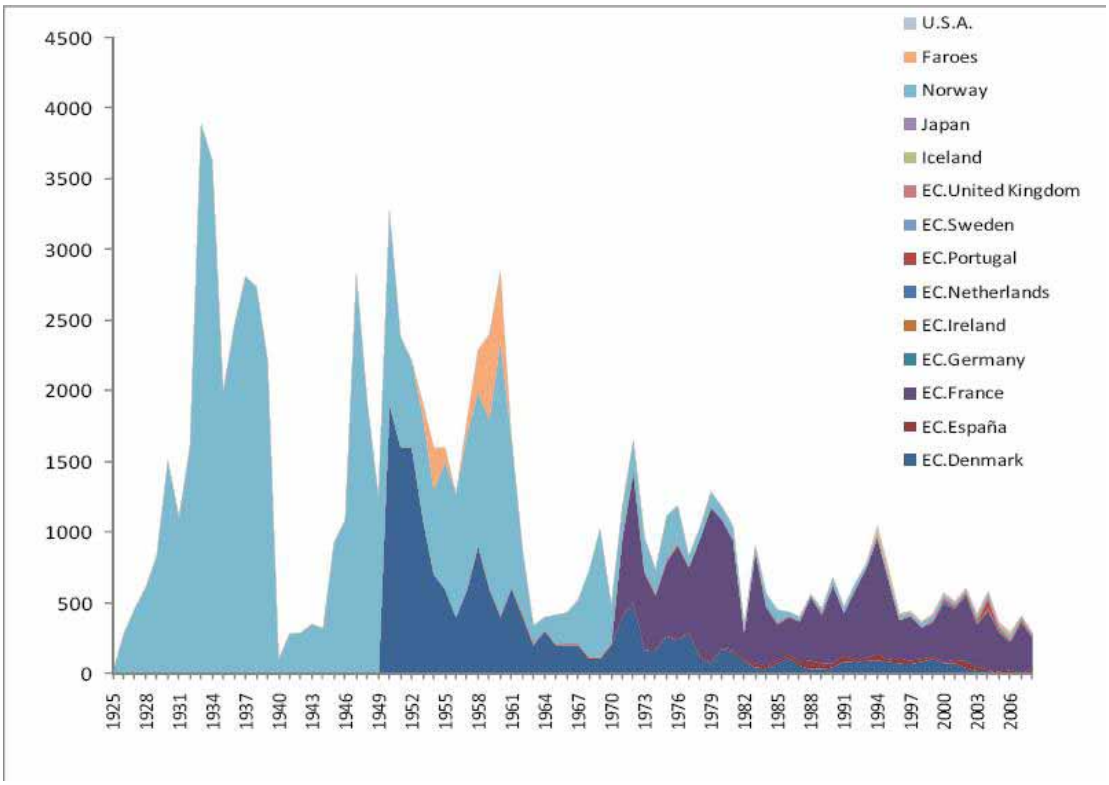


Figure 4. Catch of Porbeagle sharks from the northeastern Atlantic by country used in the assessment undertaken by SRCS (2009).

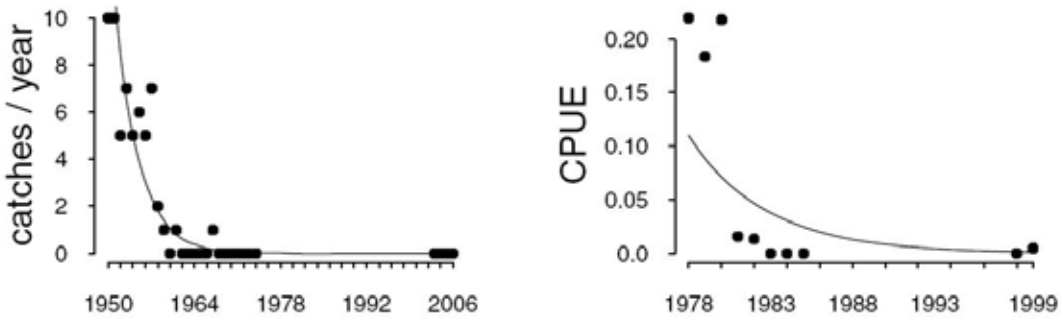


Figure 5. Trends in lamnid shark standardized annual catches in tuna traps in the Ligurian Sea (left) and in catch per unit effort (CPUE, sharks landed per 1000 hooks) for the Ionian sea (Ferreti et al., 2008).

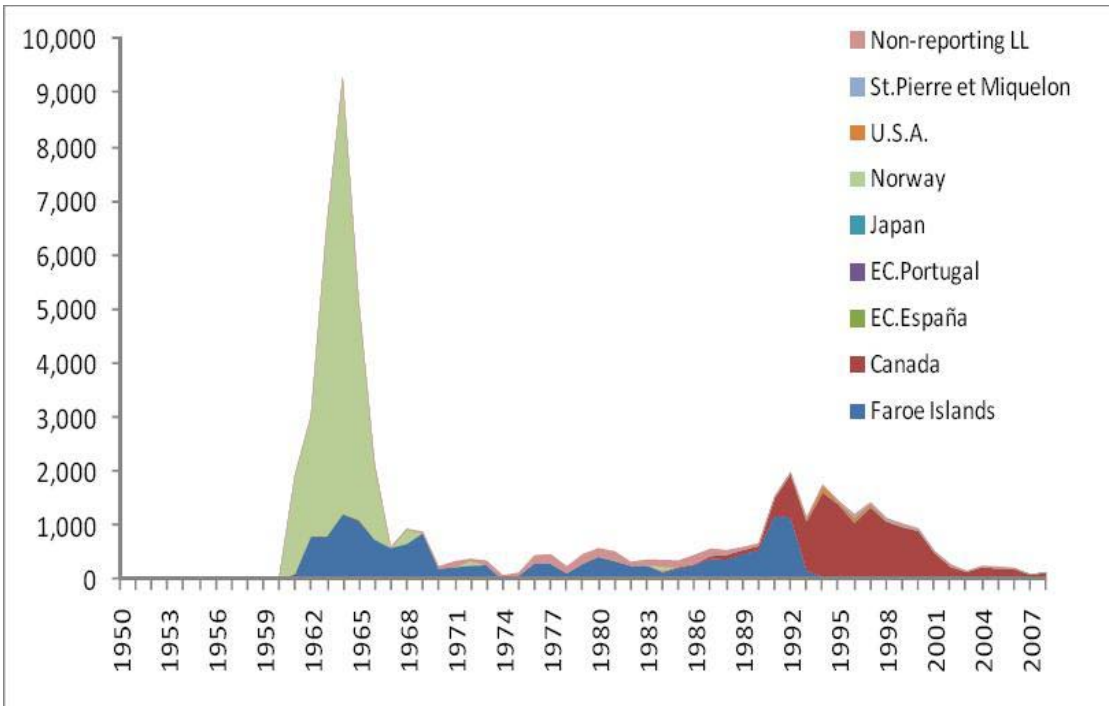


Figure 6. Catch of Porbeagle sharks from the northwestern Atlantic by country used in the assessment undertaken by SRCS (2009).

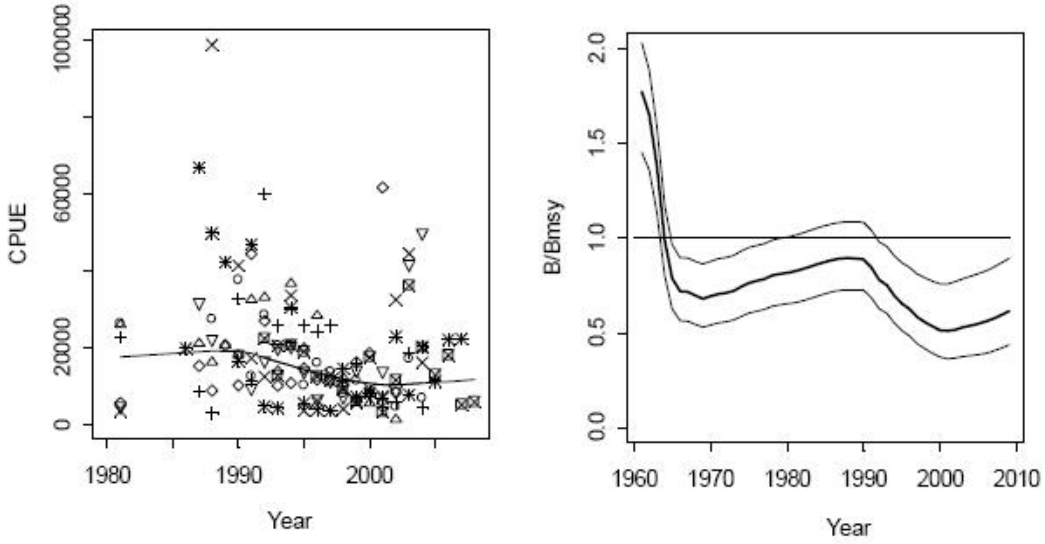


Figure 7. Results of a Bayesian Surplus Production model of the Northwest Atlantic Porbeagle stock. Left: Canadian, U.S. and Spanish catch per unit effort and fitted biomass trend. Right: biomass (B) relative to biomass at MSY (Bmsy) (Source: SCRS 2009).

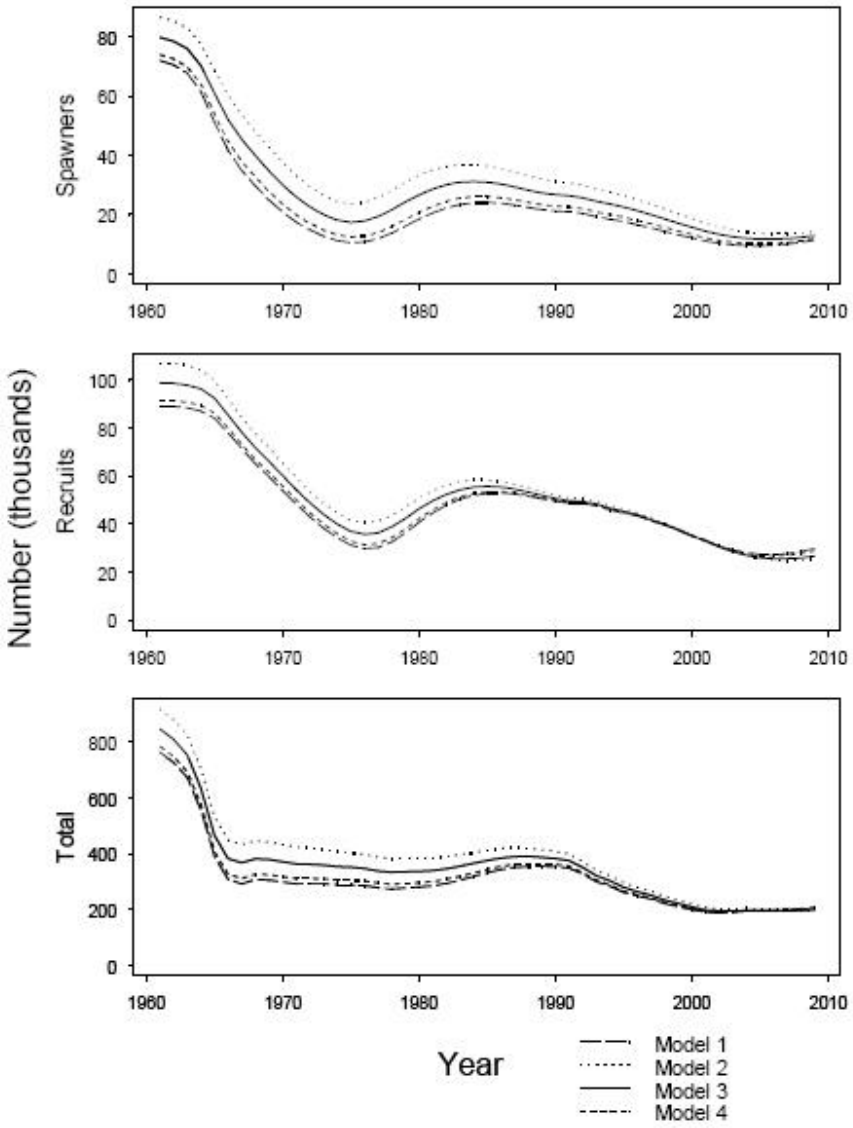


Figure 8. Estimated numbers of mature females (top), age-1 recruits (centre) and total number of *Lamna nasus* in Canadian waters, 1961–2008 (Source: Campana and Gibson 2008

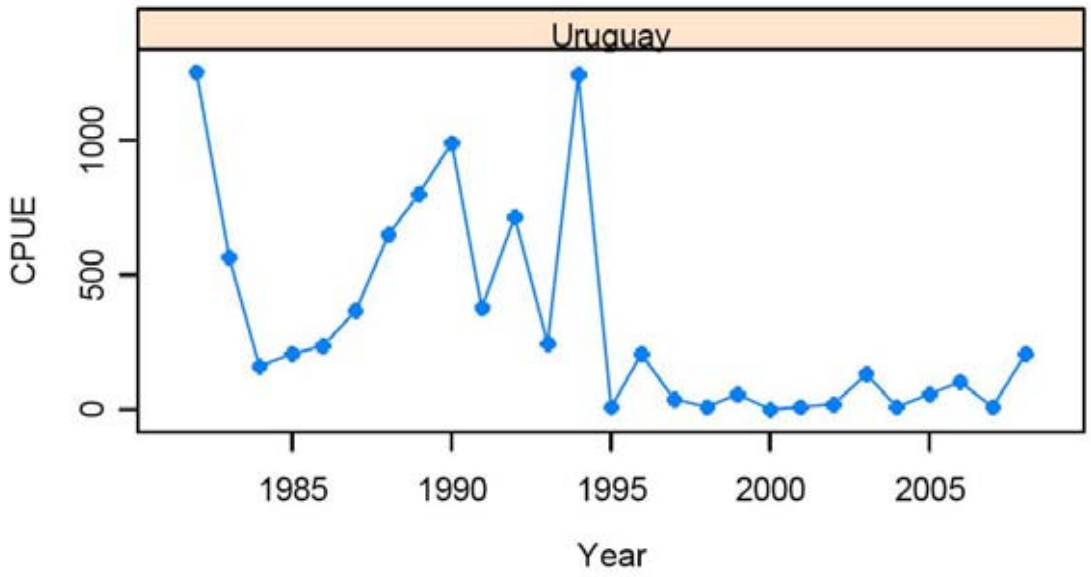


Figure 9. Uruguay Porbeagle cpue from longline fisheries in the Southwest Atlantic (SCRS, 2009).

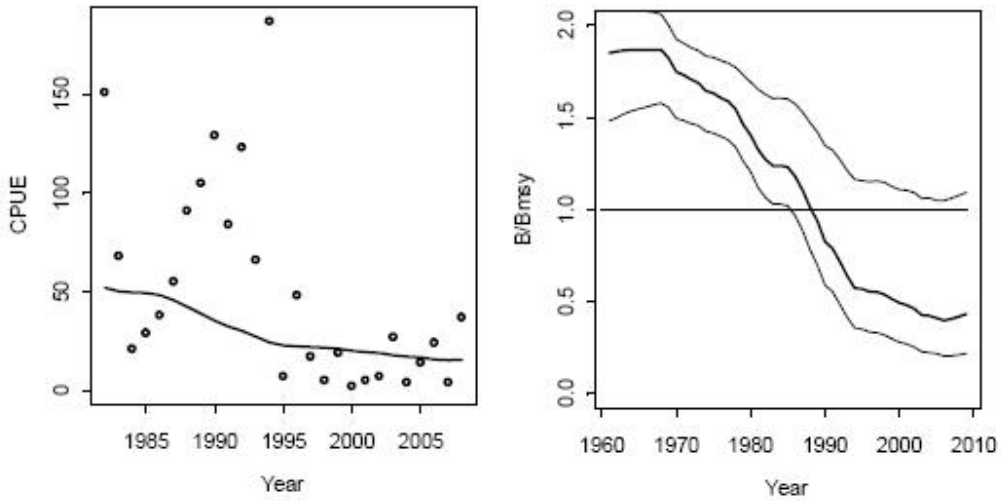


Figure 10. Results of a Bayesian Surplus Production model of the Southwest Atlantic Porbeagle stock, assuming that catches are proportional to effort. Left:Uruguayan catch per unit effort and fitted biomass trend. Right: biomass (B) relative to biomass at MSY (Bmsy) (Source: SCRS 2009).

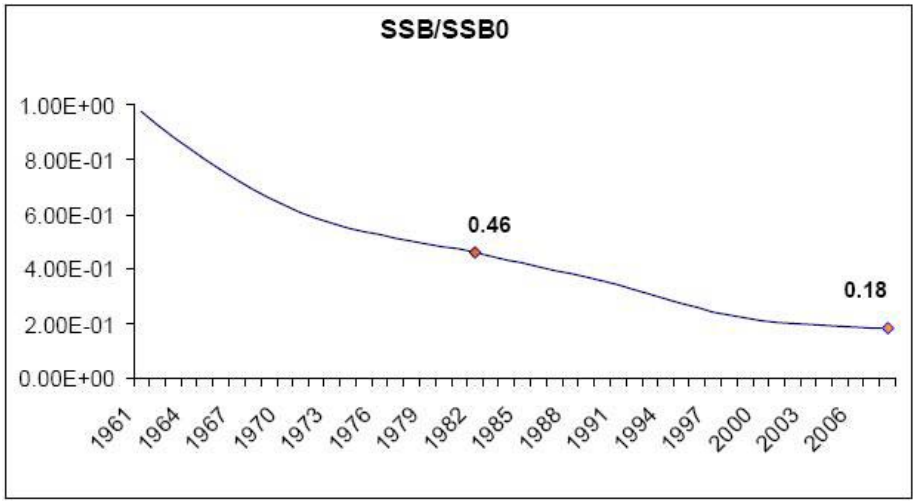


Figure 11. Relative spawning stock biomass (SSB) trend for the catch-free age structured production model assuming virgin conditions in 1961 for Southwest Atlantic Porbeagle shark. Dots indicate the depletion at the beginning of the modern period (1982) and current depletion (2008) (SCRS, 2009).

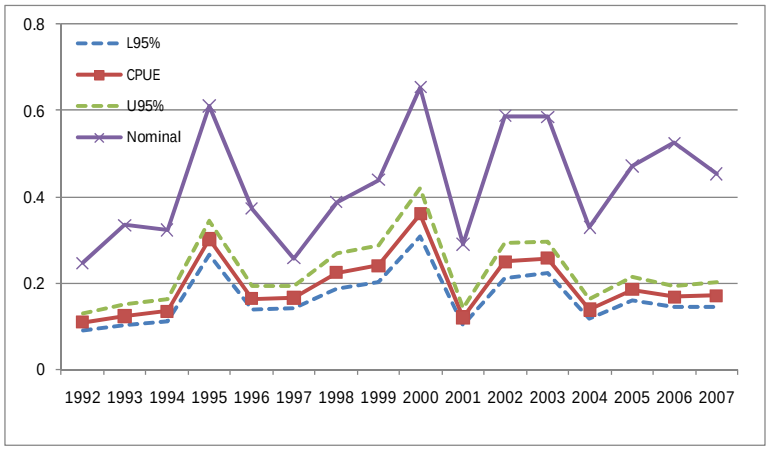


Figure 12. Trend of standardized CPUE and 95% CI and nominal (unstandardised) CPUE for Porbeagle using Japanese observer data (source: Matsunaga, 2009).

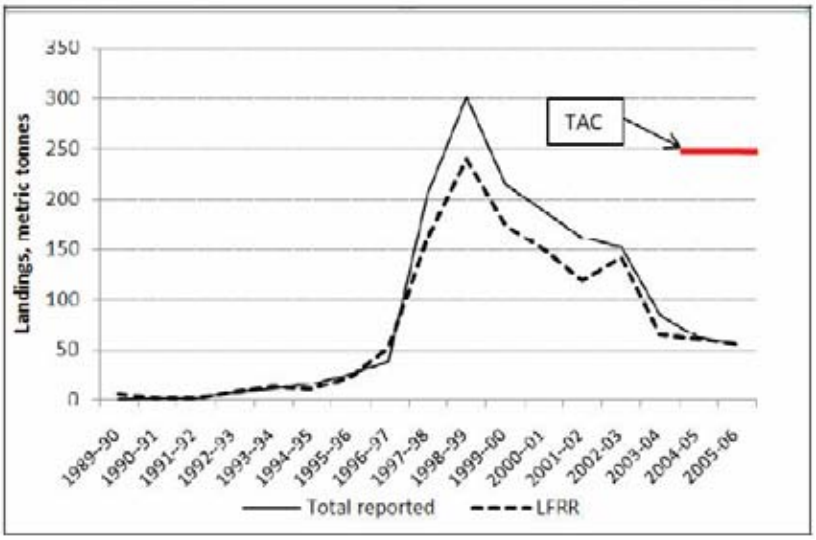


Figure 13. New Zealand commercial landings of Porbeagle sharks reported by fishers and processors, 1989/90 to 2004/05. (Source: proposal).

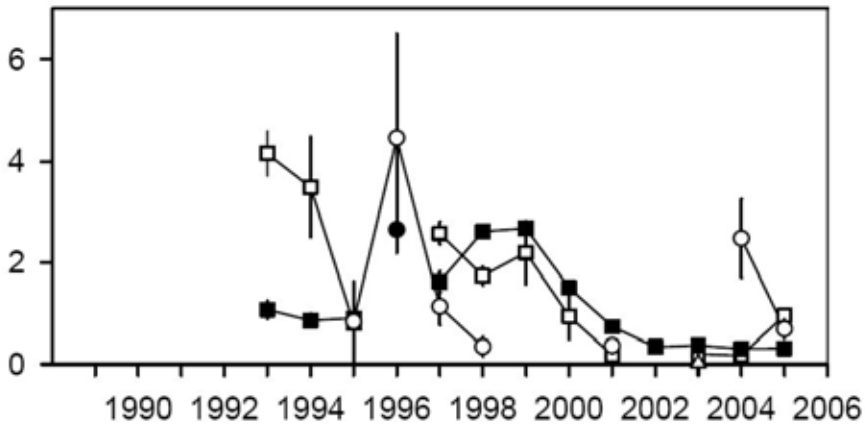


Figure 14. Unstandardised CPUE indices (number of *Lamna nasus* per 1000 hooks) for various New Zealand tuna longline fishery based on observer reports (source proposal).

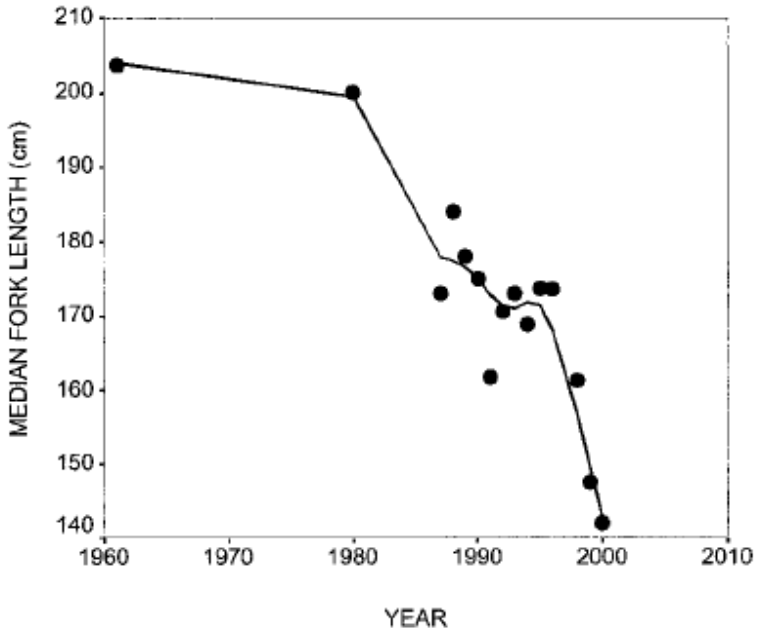


Figure 15. Change in median fork length of Porbeagle in commercial catch in September-November on mating grounds off southern Newfoundland. A LOESS smoothing line is fitted to the data (source: Campana et al. 2001).

## APPENDIX H

### FAO Expert Advisory Panel assessment report: Spiny (Picked) dogfish

**Cop15 Proposal 18**

**SPECIES**: *Squalus acanthias* Linnaeus, 1758 – FAO English name: Picked dogfish; other names also in use: Spiny dogfish, Spurdog, Piked dogfish)[10]

**PROPOSAL**: Inclusion of *Squalus acanthias* Linnaeus, 1758 in Appendix II in accordance with Article II 2(a) and (b)

**Basis for proposal**: The following is quoted from the Proposal

*Annex 2a A: 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.*

With the possible exception of the Northeast Pacific (Alaska to California) coastal stock, all northern hemisphere stocks qualify under this criterion. Their marked decline in population size (to <10–30% of historic baseline) and/or rapid recent rates of decline meet CITES and FAO guidelines for the application of decline to commercially exploited aquatic species.

*Annex 2a B: It is known, or can be inferred or projected, that regulation of trade in the species is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences. Squalus acanthias* fisheries are largely unmanaged and/or poorly monitored in several other parts of its range, where international trade demand for its high value meat is likely to increase as a result of the closure of EU fisheries. Based on the past fisheries' development it can be projected that stocks not meeting the criterion A may experience similar decreases within the next decade, unless trade regulation through CITES provides an incentive to introduce sustainable management or to improve existing monitoring and management measures in order to provide a basis for non-detriment findings and legal findings.

*Annex 2b A: The specimens of the species in the form in which they are traded resemble specimens of a species included in Appendix II under the provisions of Article II, paragraph 2 (a), or in Appendix I, such that enforcement officers who encounter specimens of CITES-listed species, are unlikely to be able to distinguish between them*. Complex patterns of export, processing and re-export of meat make it difficult to distinguish readily products from different stocks, as only DNA analysis is available for identification of processed products. A split listing is not recommended as it "could facilitate IUU fishing for Spiny dogfish" stocks listed in Appendix II, "with catches laundered as taken from nonlisted stocks. Such an outcome would be clearly undesirable and had the potential to undermine the effectiveness of conservation and management efforts for Spiny dogfish globally" (FAO 2007). Stocks that do not qualify under Annex 2a (see Table 9) are proposed for listing under Annex 2b A.

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**ASSESSMENT SUMMARY**

The FAO Expert Panel concluded that the available evidence does not support the proposal to include Spiny dogfish, *Squalus acanthias,* in CITES Appendix II.

[10] To maintain consistency with the 2007 Panel report (FAO 2007) of this species it was decided to continue using the common name Spiny dogfish. FAO has developed a global list of English, French and Spanish names for exploited aquatic species (ASFIS list of species) and encourages the use of these FAO names to reduce ambiguity and uncertainty of fishery information.

The Panel agreed that this was a species of low productivity. When evaluated on a population by population basis, most of the Spiny dogfish populations did not meet the decline criteria.

A historically-fished population of Spiny dogfish in the Mediterranean and the large population in the Northeast Atlantic Ocean are considered to meet the extent of decline criterion. Directed fishing in the EU was prohibited in 2007 and bycatch quotas have subsequently been reduced. In the Northwest Pacific, the decline may meet the Appendix II decline criterion.

The historical extent of decline in population abundance does not meet the Appendix II decline criterion for the following regions defined in the proposal: Northwest Atlantic (USA and Canada), Northeast Pacific (Alaska, Hecate Strait, Puget Sound, Georgia Strait) and the Black Sea. The Panel noted that certain stocks covered in the proposal had been inappropriately subdivided into additional units.

In the southern hemisphere, surveys in the Southwest Pacific indicate stable abundance, while those in the Southwest Atlantic show modest declines. No information on abundance trends is available for other populations in the southern hemisphere, such as those around Australia, South Africa and Chile.

Absolute abundance estimates are often difficult to evaluate in the context of CITES criteria, but in the case of Spiny dogfish, the global population estimate is in the order of one billion individuals, which mitigates risk of extinction.

International trade of *Squalus acanthias* is the key driver of exploitation in most areas, except the Northeast Atlantic where most of the catch is traded internally within EU markets. There has been a serious fisheries management failure for the Northeast Atlantic Spiny dogfish population, which has led to the closure of the directed fishery. Catches from the Northeast Atlantic stock, both internally traded in the EU and imported, need to be further curtailed. In the event of a CITES listing, Spiny dogfish caught in EU waters would likely be traded within the EU, and thus not be subject to CITES trade limitations. The Panel noted that the EU has adopted a Shark Action Plan and looks forward to its implementation.

In other areas, Spiny dogfish populations will benefit from improved management. Federal and state U.S. fishery management plans have been implemented for the Northwest Atlantic stock, but could benefit from better coordination internally and with Canada. All other areas in which *Squalus acanthias* is harvested need to be closely monitored to ensure that catches remain sustainable. Sustainable management requires that, where they have not done so, range States develop and implement National Plans of Action for sharks.

If *Squalus acanthias* is listed on Appendix II key implementation issues will include difficulties in differentiating *Squalus acanthias* products from other sharks in trade.

The proposal states that some populations of Spiny dogfish should be listed on Appendix II because of conservation concerns (in accordance with Article II paragraph 2(a)), while others should be listed because of inability to distinguish products from those listed for conservation reasons (in accordance with Article II paragraph 2(b)). While it is almost certainly true that differentiating products from different Spiny dogfish populations would be impossible by enforcement officers without specialized equipment or training, the approach of listing different populations of the same species under Article II, paragraphs 2 (a) and 2 (b) needs careful consideration. Ultimately the result of adoption of this approach could lead to a situation whereby one (perhaps relatively small) population was listed under paragraph 2 (a) and the rest of the species under paragraph 2 (b) even though the species as a whole is in a healthy state.

The Panel took note of the wording of CITES Resolution Conf. 9.24 (Rev. CoP 14) indicating that Parties had resolved to adopt measures that are proportionate to the anticipated risks to the species when considering proposals to amend the Appendices. In this case, the Panel considered that listing some stocks (New Zealand, Argentina, and Alaska) in accordance with Article II paragraph 2 (b) would be inconsistent with the proportionate risks to the species as a whole, since populations representing most of the historical abundance of the species globally were considered not to meet the criteria for listing in accordance with Article II paragraph 2 (a).

In the 2007 deliberations of the Panel, the Panel concluded that the species did not meet the biological decline criteria for listing in CITES Appendix II. The additional information available to the current Panel included evidence of improved management actions in the Northeast Atlantic, updated stock assessments for the Northwest Atlantic, which indicated an improved prognosis due primarily to reduced fishing mortality and recovering recruitment, and additional information for the Northwest Pacific and Southwest Atlantic stocks. For the Northwest Pacific, in light of all the available information, it remains unclear whether the decline criterion is met. The additional information reinforces the previous conclusion of the Panel that the species as a whole does not warrant listing under Appendix II.

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

The proposal is to list the species *Squalus acanthias* Linnaeus, 1758, on Appendix II. This species is widely distributed on continental shelves in temperate and boreal waters of the northern and southern hemispheres, and is most common at depths 10-200 m. It is the most common of all shark species.

Although little work is available on structuring and relationships of populations within the species, populations within the distribution of the species have been identified, separated by deep ocean waters, tropical areas and polar areas. A few long-distance migrations, including across ocean basins, have been documented, but most tag recaptures show relatively short movements (McFarlane and King 2003) and most individuals are assumed to remain within the identified populations.

Individuals in the Northeast Atlantic from the Barents Sea to northwestern Africa are considered to be a single population for fishery management purposes, based on recent tagging studies (ICES WGEF 2006). Earlier studies had suggested at least two separate populations within this area. The relationship of individuals in the Mediterranean and Black Sea to this population and to each other is not known.

Individuals in the Northwest Atlantic have in the past been considered a single population for fisheries management purposes, based on tagging results (NMFS 2006), but a recent study indicates that Spiny dogfish in this area should be considered a metapopulation with components in Canadian and US waters which mix to some extent (10-20%) (Campana et al 2007). The species is most common between Nova Scotia and Cape Hatteras but is found from Labrador to Florida.

For the north Pacific there does not appear to be an agreed picture of population structure, although the picture of western and eastern populations would be consistent with available tagging observations and with the north Atlantic situation. Of 71,000 individuals tagged over a 20-year period in British Columbia, most were recaptured near their release site, but 30 of 2940 recaptures were from near Japan (McFarlane and King 2003).

Spiny dogfish occur off eastern South America, South Africa, Australia and New Zealand, but there appears to be little information on movements or population structure in these areas. Separate populations in these areas would be an assumption consistent with information from the north Atlantic and north Pacific.

#### *Productivity level*

Information available (Table 1) indicates that Spiny dogfish fit into the “low” productivity category. Intrinsic rate of increase for the Northeast Pacific was estimated as 0.017 at the MSY level, the lowest among 26 species of sharks for which estimates were made (Smith et al. 1998); an estimate of 0.034 for the Northwest Atlantic (Smith et al. 1998) is also available. Aging of older individuals is imprecise but the natural lifespan is known to be well beyond the threshold for low productivity (25 years),; 50 years is assumed in assessments in the Northwest Atlantic (NMFS 2006). Natural mortality in the Northeast Atlantic assessment is assumed to be 0.1 for most ages (higher for young and old individuals) (ICES WGEF 2006), and is estimated at 0.1 from the assumed lifespan for the Northwest Atlantic assessment (NMFS 2006). Ages at 50% maturity and von

Bertalanffy K are available from published studies of age, growth and maturation (Campana et al. 2009). Fecundity increases with length of females and varies from 1-20 pups per litter; a range of 2-14 is used in Northeast Atlantic assessments (ICES WGEF 2006). Females give birth on average every two years.

Life history parameters differ considerably for the Northeast Pacific population and for north Atlantic populations (Table 1), with the Northeast Pacific population showing much lower productivity. A recent study found that age at maturity in the Northeast Pacific had decreased from the 1940s to the 2000s, as a result either of environmental factors or of reduced population sizes due to fishing (Taylor and Gallucci 2009).

**Population status and trends**

***Small population size***

FAO (2007) estimated global abundance of recruited Spiny dogfish at more than 1 billion recruited individuals (i.e. excluding small juveniles). Revised estimates of recruited biomass based on new information up to 2009 differ somewhat between regions, but give a similar total (Table 2). The abundance of mature females could presumably be as low as 5-10% of this number; i.e. 50 million to 100 million mature females, which still represents an extremely large number on a global basis.

***Restricted distribution***

Quantitative estimates of the distribution area are not available, but the species occurs over very wide areas on continental shelves in many parts of the world's temperate oceans.

***Decline***

Abundance indices are available from many parts of the range (Table 3).

*Northeast Atlantic*

The most recent full assessment of Spiny dogfish in the Northeast Atlantic was in 2006 (ICES WGEF 2006), and its results were available to the FAO Panel meeting in 2007 (FAO 2007). Indices have not been updated subsequently, although updated landings and a summary of recent management measures is available (ICES WGEF 2008).

The 2006 assessment (ICES WGEF 2006) was based on a model which fit the data relatively well, and whose results were consistent with those from earlier analyses of this population by ICES using a variety of approaches. The "base case" of the model runs indicates that current total biomass level is 5% of that in 1905 (unexploited) and 7% of that in 1955 (lightly exploited) (Fig. 1) (ICES WGEF 2006). The only survey CPUE series considered valid, from a Scottish trawl survey (used in the population model), shows that recent values have been around 40% of those in the late 1980's (ICES WGEF 2006 Table 2.4, Fig 2.8).

Landings increased during the 1920s and early 1930s, dropped to low levels between 1940-1945, increased to very high levels during the 1950s and 1960s and subsequently declined. Recent landings have been well below 10% of values in the early 1950s, following imposition of a bycatch-only TAC in 2007 (Fig. 2) (ICES WGEF 2008).

*Mediterranean and Black Sea*

Results of a virtual population analysis of Spiny dogfish abundance in the Black Sea indicate that population biomass increased by about a factor of 3 between 1972 and 1982, and subsequently declined to 1992 by about the same extent (FAO 1997; proposal Figs 18-19). Landings in the Mediterranean and Black Sea (Fig. 3) show an increase from the 1950s to 1980, a period of high landings from 1980 to the mid-1990s, followed by a steep decline to levels similar to those of the 1950s.

*Northwest Atlantic*

The most recent full assessment of Northwest Atlantic dogfish, based on the assumption of a single population shared by Canada and the USA, was in 2006 (NMFS 2006). These results were available to the FAO Panel in 2007. That assessment indicated that total biomass increased by a factor of 3 from the late 1960s to the early 1990s and then declined to about 60% of maximum values (Fig 4). The biomass of mature females declined to about 20% of the observed maximum between the late 1980s and the early 2000s. Although the time series for females is not as long as that for total biomass, an increase in female biomass was observed during the 1980s which may correspond to the end of the increase observed in total biomass.

An assessment update in 2008 (ASMFC 2008) indicated that female spawning biomass has been increasing from low levels since 2004 and is currently above target and limit reference levels (Fig. 5). The 2007 value of approximately 180,000 tonnes is similar to values in the early 1980s at the beginning of the time series, prior to the mid-1980s increase.

The 2008 assessment update projected a decline in abundance of the Northwest Atlantic population beginning in 2011 at the current fishing mortality rate of about 0.117., to a minimum level in 2017, as a result of low recruitment to this population (Fig.6) (ASMFC 2008). However, this minimum biomass level for $F_{rebuild}$(0.11), which is close to the status quo F (0.117), is only marginally below the target female spawning biomass of 167,800 tonnes, and well above the rebuilding threshold (which is half of the target).. A new survey conducted in the spring of 2009 shows that recruitment has been recovering since 2003 following a long period (1997 – 2003) of apparent recruitment failure (Fig. 7). The 2007-09 estimates shows much larger numbers of juveniles less than 50 cm than have been observed in over a decade (Figure 6a) (MAFMC 2009). The 2009 estimate of recruitment is one of the highest on record. The 2009 mean stochastic estimate of the female spawning biomass was slightly below the target of 167,800 tonnes. The swept area biomass estimate of Spiny dogfish in the 2009 spring bottom trawl survey was 557,900 tonnes.

New projections (MAFMC 2009) predict that female spawning stock biomass in 2017 may be slightly lower than the estimates from the 2008 projections. However, the overall prognosis has improved substantially since the 2007 Panel report due to reductions in realized fishing mortality and evidence of recovering recruitment.

An assessment of Spiny dogfish in Canada was conducted in 2007 (DFO 2007), which concluded that populations in Canada and the USA were partially distinct and could be considered to be part of a metapopulation. Trawl survey abundance indices from eastern Canada were superficially contradictory: the Scotian Shelf summer survey showed an increasing trend from 1970 to 2007 (Fig. 8), while an eastern Scotian Shelf survey in spring (Fig. 9) and a George's Bank survey in February (Fig. 10) showed major declines and almost complete disappearance of Spiny dogfish. The summer survey is not considered to track mature females well, while the winter and spring surveys may track these better (DFO 2007).

Landings in the Northwest Atlantic show two peaks, in the early 1970s and the mid/late 1990s, both with maximum landings of over 25,000 t/yr (Fig. 11) (DFO 2007). Recent landings are below 20% of these historical values, coincident with reduced TACs in the USA. Fisheries in the USA have targeted mature females which are preferred in markets, and which can be targeted (NMFS 2006).

A joint US/Canada assessment meeting considering past, current and projected trends will be held in January 2010. The results of this assessment may be available for consideration by Parties at CoP15.

*Northeast Pacific*

New information on population status in this area cited in the proposal (King and McFarlane in press; Palsson in press) was not available for the Panel. The information presented in the FAO 2007 Panel report is therefore recapitulated here, supplemented by Wallace et al (2009).

In the Gulf of Alaska, trawl survey biomass (Figure 12) and longline survey catches (Wright and Hulbert, 2000) have been increasing in recent years. On Canada's continental shelf, trawl survey CPUE (Figure 13) and longline survey CPUE (Figure 14) have varied without trend since the mid 1980s and early 1990s respectively, although

both surveys show declines in the most recent period. Trawl survey numbers and biomass in waters in the area on both sides of the Canada-USA border have fluctuated without trend since 1980 (Figure 15). The population in Puget Sound is considered to be at a low level of abundance (Proposal Section 4.4.4).

Reported landings of Spiny dogfish in the Northeast Pacific have generally been below 10,000 t/yr since the late 1800s, with a large increase to 25,000-50,000 t/yr from the mid-1940s to mid-1950s (Fig. 16) (Taylor and Gallucci 2009).

*Northwest Pacific*

Taniuchi (1990) provided information on Japanese catches of Spiny dogfish from 1951 to 1967, which declined from over 50,000 t in the 1950s to less than 10,000 in the late 1960s.

Information on catches in the Sea of Japan and off the east coast of Japan was provided by Fisheries Agency, Government of Japan (2003). Catches off the east coast of Japan (Pacific North Area) declined from over 700 t in 1974-79 to around 200 t in the late 1990s and early 2000s. In the Sea of Japan catches were 7,500 to 11,250 t in the late 1920s, accounting for 17-25% of Japan's overall catches.

In areas representative of traditional dogfish fishing, most CPUE indices declined. Off eastern Japan for the period 1972-2002 there was a long-term decline of about 90% and 81% for Danish seine in Shiriyazaki and Erimo, respectively (Figs 17, 18)(Fishery Agency 2003, 2004), although a change in the target fishery in the late 1980s complicated the interpretation of the extent of the decline (Fishery Agency 2005). Trawl CPUE in the Sea of Japan decreased by 74% from the early 1970s to the early 2000s (Fishery Agency, 2004) (Fig. 18) .

In Iwate, an area considered to be less representative of the fishery (since it is well south of the main fishing area), for the period 1972-2002, an early period of high catch rates followed by a long period of stability was observed for bull trawl, while CPUE fluctuated without trend for otter trawl and for Danish seine (Fishery Agency 2004) (Fig. 17)

The proposal includes a series of CPUE graphs for the period 1970-2006 (Fishery Agency of Japan 2008 cited in the proposal), two of which show substantial declines to about 10% of values at the beginning of the series (Proposal Figure 23 a, d). Two other CPUE series are essentially without trend at low levels since 1970 (Proposal Figure 23 a, c) while a fifth series shows high values in the 1970s followed by no trend at a low level (Proposal Figure 23 b). Interpretation of these figures was difficult as the captions are in Japanese, but they appear to be consistent with the information summarised above.

*Southern hemisphere*

In New Zealand reported catches have increased since the early 1990s to about 2003 but this increase may be due to better reporting as well as to increased harvest (New Zealand Ministry of Fisheries 2009). Reported catches have declined since 2003 and have been well below the TAC (an average of 6,700 tonnes compared to a TAC of 12,660 tonnes). Trawl surveys indicate no overall trend in abundance between the early 1990s and the present, although an increase in abundance in the mid 1990s was observed (Table 7 in New Zealand Ministry of Fisheries 2009).

Trawl surveys in the EEZ of Argentina indicate that there is no clear sign of decline in Spiny dogfish abundance over the last 30 years when the total distributional range (35°S-55°S) is considered (FAO 2009). However declines of Spiny dogfish in some coastal areas, but not in others, over the last ten years have been reported (Massa et al., 2007). In the Bonaerense region (Figure 19a) recent survey biomass has been about 20 percent of a single high value in 1994; this is a relatively small part of the distribution. In the central region (Figure 19b), recent biomass estimates are about 50 percent of those in the late 1990s. In the southern region comprising the largest part of the population there has been no trend in survey biomass estimates since the early 1990s (Figure 19c).

No information on abundance trends is available from other areas where Spiny dogfish are found in the southern hemisphere (Australia, South Africa and the Chilean coast of South America).

**Assessment relative to quantitative criteria**

***Small population***

The global population of Spiny dogfish may be as high as 1 billion individuals (FAO 2007 and revised numbers in Table 2). Even if mature females represent as little as 5-10% of this number; i.e. 50 million to 100 million individuals, this still represents a very large number on a global basis. Thus, although there may be concerns about abundance at the level of local populations or subpopulations, the species is not characterized by a small population size at the global level.

***Restricted distribution***

The species is widely distributed on continental shelves of northern and southern hemispheres, so cannot be characterized as having a restricted distribution.

***Decline***

For most populations, the information base has not changed substantially since the report of the FAO 2007 Panel (FAO 2007). Accordingly, the conclusions of the Panel are recapitulated here for those populations. The exception is the Northwest Atlantic, for which the most recent US assessment suggests a recent increase in abundance (ASMFC 2008), and for which more information on abundance trends in Canada has recently been published (DFO 2007). This report addresses the new information in assessing decline in the Northwest Atlantic.

For an Appendix II listing, assessment of whether the species is near Appendix I levels or likely to become so in the foreseeable future is required. For a low productivity species, a decline to less than 15-20% of the historical baseline would lead to consideration for Appendix I. To be near the Appendix I threshold, values 5-10% above this (ie 20-30% of the historical baseline) either now or in the foreseeable future may justify consideration for Appendix II.

*Northeast Atlantic*

In the Northeast Atlantic, the most recent peer-reviewed stock assessment indicates that recent total biomass has been ca 5-7% of historic values, within the 15-20% value which might qualify a species for Appendix II.

*Mediterranean and Black Sea*

The limited information available for the Mediterranean and Black Sea made it difficult to assess abundance trends against the decline criteria. If weight is given to the longer time series of reported landings, it is likely that the stock in the Mediterranean is currently within the decline threshold for a low productivity species. The available data for the Black Sea is somewhat contradictory.

*Northwest Atlantic*

Based on US assessments, decline can be assessed for different population components (mature females or total) and relative to different historical baselines (values in the late 1980s, following a population increase, or at earlier periods, representing the longest historical time series available). Using the mature females component would recognize the importance of this group to subsequent recruitment and would be a more cautious approach. Choice of historical baseline depends to some extent on the reason for the observed increase in abundance during the 1980s. If this was an increase toward a “normal” abundance level following exploitation in the 1970s, it would be appropriate to use the higher late 1980s level as best representing the historical population abundance. If this was an increase to “anomalous” levels as elasmobranchs replaced depleted groundfish stocks, the earlier, lower baseline population levels would be more appropriate.

Using mature females and the recent baseline (the most “cautious” scenario), current abundance is at 65% of historic. Relative to the earlier baseline, current mature female abundance is similar to the historic. No recent rate of decline is observed as abundance has been increasing in recent years. For total individuals, recent abundance is around 67% of the recent baseline (late 1980s), and twice the earlier baseline (late 1960s). None of these values is within the decline threshold for an Appendix II listing.

Since mature females are uncommon in the Canadian summer survey region, only total individuals are tracked by the survey with the longest time series, although two other surveys are considered to represent mature individuals better than the summer survey (DFO 2007). Canadian indices show apparently contradictory trends. The summer Scotian Shelf index, considered to represent immature individuals, has increased 4-fold from 1970 to 2007. The spring index on the eastern Scotian Shelf and the February George's Bank index, which may represent mature individuals better, have shown severe declines of 99.3% and 98% respectively, from 1986-2007. Neither the eastern Scotian shelf survey nor the Georges Bank area include the area of greatest abundance of Spiny dogfish in Atlantic Canada (DFO 2007), which may reduce the robustness of these indices as measures of population abundance. Trends in the latter indices would be consistent with the Appendix II guideline.

*Northeast Pacific*

There appear to be no indications of decline to or near levels consistent with the Appendix II guideline other than for Puget Sound, a small enclosed part of the distribution area. Details of abundance trends in Puget Sound were not available to the Panel. Indices from the Gulf of Alaska are increasing, while for Canadian waters and US waters near the Canadian southern border indices have been fluctuating without overall trend.

*Northwest Pacific*

Information quoted in the proposal (declines in CPUE of 80-90% in one fishery, 90% in another) would suggest that this population has declined to levels consistent with Appendix I, as would the observation that recent catches are less than 2% of those in the early 1950s. Decline in the Sea of Japan trawl CPUE to 26% of that in the early 1970s would also put this population "near" the Appendix I threshold. .

Since CPUE is most useful as an index of abundance when it is calculated for areas most representative of the fishery, the Panel concluded that the Shiriyazaki and Erimo CPUE indices were likely to be useful indicators of relative dogfish abundance in the area of the Japanese dogfish fishery. These indices suggest declines of 74-90%, although the extent of the decline may have been artificially exaggerated by the change in target fishery in the 1980s. As a result, the Panel could not assess if the Appendix II decline criteria had been met.

*Southern hemisphere*

Abundance indices appear to be stable or increasing in New Zealand. Off Argentina, in the period 1992-2006, a decline to 20% of a single historical value was observed in one relatively small area, a decline to 50% of historical in another, and no trend in a third area; overall this pattern does not show declines to levels at or near the Appendix II guideline.

*Summary*

In summary, the Panel concluded that the Spiny dogfish in both the Northeast Atlantic Ocean and the Mediterranean were considered to meet the extent of decline criterion for inclusion in Appendix II. In the Northwest Pacific, the decline may meet the Appendix II decline criterion. The historical extent of decline in population abundance does not meet the Appendix II decline criterion for the following regions defined in the proposal: Northwest Atlantic (USA and Canada), Northeast Pacific (Hecate Strait, Puget Sound, Georgia Strait) and the Black Sea. The Panel noted that certain stocks covered in the proposal had been inappropriately subdivided into additional units. In the southern hemisphere, surveys in the Southwest Pacific indicate stable abundance, while those in the Southwest Atlantic show modest declines. No information on abundance trends is available for other populations in the southern hemisphere, such as those around Australia, South Africa and Chile.

**Were trends due to natural fluctuations?**

In the Northwest Atlantic population, observed trends could have been influenced by natural fluctuations as well as by exploitation. Observed increases in Spiny dogfish abundance from the 1960s to the 1980s are hypothesized by some to have resulted from replacement of depleted groundfish populations by elasmobranchs (eg Hall 1999;

Sinclair and Murawski 1997), which would suggest that the population levels in the 1980s were anomalously high. This would mean that subsequent declines were greater than from a "typical" level of abundance. However this increase may also have been in response to a decline in dogfish harvests which were at maximum levels in the early 1970s and subsequently dropped to about 20% of the maximum levels (Fig 2). Arguing against the "replacement" hypothesis is the lack of recovery of teleost groundfish as Spiny dogfish have declined since the mid 1990s. Link et al (2002) found no evidence that elasmobranch predation was removing enough groundfish biomass to account for low levels of groundfish biomass.

Taylor and Gallucci (2009) documented changes in life history parameters of the Northeast Pacific population between the 1940s and 2000s (mainly a decrease in age at maturity) and considered whether these changes might be due to environmental factors (extrinsic) or density-dependent population responses to reduced abundance as a result of fishing (intrinsic). While unable to clearly determine the principal reasons for the changes, they concluded that intrinsic factors were somewhat more likely to have been the cause.

Overall, there is no clear indication that observed changes in abundance were due to causes other than fishing. The observed changes are consistent with patterns of fishing in the areas for which information is available.

**Risk factors and mitigating factors**

Life history parameters of Spiny dogfish are such as to make them particularly vulnerable to the impacts of mortality from human activities (Table 1). Intrinsic rate of increase is low, even compared to other sharks (Smith et al. 1998). Rate of reproduction is low and contributes to the low rate of increase; females give birth every two years and number of pups produced is typically 2-14 (ICES 2006), although this may range from 1-20. Recent pup production in the Northwest Atlantic has averaged 4-9 (NMFS 2006; Campana et al. 2009).

Loss of large reproductive females and changes in sex ratio under exploitation may represent an additional risk factor for some populations of this species, particularly given the potential impact on recruitment. In the Northwest Atlantic, the ratio of mature males to females in survey catches increased 3-fold from 1993-2006 (Fig. 20), and the mean length and weight of females taken in surveys declined substantially over the past two decades (Fig. 21) (NMFS 2006), consistent with targeting of large females in the fishery. In addition, the average size of pups has declined consistent with the reduction in average size of females (NMFS 2006). The changes in size of females and in sex ratio might negatively affect reproductive potential of the population. A stock-recruitment relationship for this population indicates that recruitment success is influenced by maternal size, with the odds of poor recruitment 4.5 times greater when maternal size is less than 87cm; average maternal size in 2006 was less than 85 cm (NMFS 2006). A skewed sex ratio such as observed here has been shown to have negative impacts on other elasmobranch populations although no information on Spiny dogfish is available (NMFS 2006). Recruitment was very poor in 1997-2003, with recruit biomass near zero, compared with values of 1000-10000 t in many previous years (NMFS 2006), and individuals less than 60 cm in length have become very rare in survey catches since 1997 (NMFS 2006). As a result of these developments, the population is projected to decline from 2009 to 2017, with the extent of the decline dependent on level of harvest (ASMFC 2008). However trawl survey indices suggest that recruitment has improved since 2003 and the number of recruits in the most recent survey was among the highest on record (Fig. 7).

Similar analysis of size and sex trends is not available in the ICES assessment (ICES WGEF 2006) but inspection of size and sex frequency histograms from surveys over the past two decades indicates that most females have been less than 80cm in length in the North Sea (ICES WGEF 2006), while very few females have been greater than 80cm off the Scottish west coast and in the Celtic Seas (ICES WGEF 2006). In surveys in the Irish Sea there is a large proportion of individuals greater than 80cm (ICES WGEF 2006), although some concern is expressed about whether this information is biased by availability.

In Hecate Strait (Canada's Pacific continental shelf) proportion of large mature individuals in trawl survey catches declined substantially during the 1980s and 1990s (Fig. 21) (Wallace et al. 2009). Fishing may have

contributed to this change but is not considered the primary cause, which remains unknown (Wallace et al. 2009).

Strengthened fishery management measures have been put in place in the Northeast Atlantic and Northwest Atlantic in the last several years which should act to mitigate risk to Spiny dogfish populations in these areas. In the Northeast Atlantic, small bycatch-only TACs were put in place in 2007 covering most of the fishery area, and Norway and Sweden have introduced additional restrictions on Spiny dogfish fisheries in their waters (ICES WGEF 2008). In the Northwest Atlantic, TACs have been reduced in recent years in US waters and Canadian harvests have been consistent with TACs, resulting in reduced catches (Fig. 11).

Fishery management measures in other areas are essentially as in the 2007 Panel report (FAO 2007). While measures are essentially non-restrictive on catches, in some areas catches are below TACs (Northeast Pacific, New Zealand).

**Trade considerations**

Spiny dogfish meat is highly valued in markets. Products in trade include fillets, steaks, portions, backs, and belly flaps (smoked) (Vannuccini 1999). Fins may also be in trade although their value is lower than from larger species, and derivatives (cartilage) may also be traded.

There is no species level customs code for Spiny dogfish in international trade, although "dogfish" are differentiated from other sharks under Harmonized System codes and in available information from States. Much of the international trade is probably Spiny dogfish (at least between North America and Europe), but other species are traded under the "dogfish" classification. Dogfish products are well known to marketers and consumers under a variety of names such as "rock salmon" and "saumonette".

Spiny dogfish meat has high value in markets and substantial amounts have been traded internationally over the past decade. The European Union is a significant importer (proposal Tables 5, 6), and consumed 65% of world production in 2001 (Fowler et al 2004). EU countries took 77% of exports from the USA over the period 1999-2007 (proposal Table 7), confirming that the EU is indeed a major importer. Other countries taking US exports included Thailand, China, Mexico, Japan and Australia (proposal Table 7).

A number of countries have supplied Spiny dogfish meat to the EU in the past decade (proposal Table 5). As landings in the EU have declined, landings in the USA increased substantially in the 1990s, then declined, while Canadian landings increased in the late 1990s and early 2000s (Fig. 9). The pattern in imports from these countries has followed that in landings (proposal Table 5). With the decline in landings in countries which formerly supplied the EU, imports from "new" areas such as Morocco and New Zealand are increasing (proposal Table 5).

With the strict limits on catches of Spiny dogfish in EU waters, demand in the immediate future will have to be met primarily from imports. Imports to the EU have already declined substantially (proposal Table 6) and may decline further in future as a result of stricter limits on the fishery in the USA.

Although it appears that trade flows may be limited by stricter fishery management in future, there is no doubt that Spiny dogfish meat has been and is widely traded, and that there will be continued demand in importing markets as supplies decrease.

**Implementation issues**

Much of the material in this section is based on the 2007 FAO Panel report (FAO 2007), whose conclusions generally continue to apply. Material has been updated where appropriate.

***Introduction from the Sea***

Spiny dogfish are associated with continental shelf habitats, most of which are within States' EEZs. Catch of Spiny dogfish from waters outside EEZs is possible but it is likely to be a rare event.

The greatest potential for catches of Spiny dogfish to be taken from waters not under the jurisdiction of any State is in the Mediterranean Sea where few bordering countries have established EEZs.

***Basis for findings: legally-obtained, non-detrimental***

Scientific capacity, stock information, and management measures are in place with respect to populations in the Northeast Atlantic and Northwest Atlantic. In the Northeast Atlantic, TACs have been reduced to a very low level, for bycatch only, in the EU, and it is doubtful that there will be any exports requiring an NDF in the near future, given demand within the EU. In the Northwest Atlantic, where Canada and the USA have in the past conducted separate assessments and implemented separate management measures, a joint assessment of Spiny dogfish is planned for early 2010, which should help to build a common picture of stock status. Should Canadian and US assessments be relied on as the basis for NDFs, domestic catch restrictions would need to be revised in line with scientific advice and take into account straddling stock and discard issues.

For other populations of Spiny dogfish there are apparently no biological assessments of population status which could serve as a basis for non-detriment findings. Information may exist which could serve as a basis for such assessments, particularly in areas where exploitation rates appear to be relatively low such as the Northeast Pacific and southern hemisphere.

***Identification of products in trade***

It is difficult to determine from available information the extent to which Spiny dogfish products might be distinguishable from other shark or fish products in trade, but this would probably be difficult. Identification guides and DNA testing could be used, and work is under way to develop DNA identification techniques (references in proposal, page 12). DNA techniques are not considered practical as initial screening tools, although they may be useful for secondary inspections or enforcement (CITES, 2006). The high value of Spiny dogfish meat should ensure that it is correctly labelled and differentiated in the marketplace (FAO 2007). Further, international markets appear to be reasonably narrow and focused in the EU. These factors, combined with the stricter domestic measures of the EU, which require the grant of an import permit for Appendix II specimens, would help facilitate identification of meat products were the species to be listed on Appendix II (FAO 2007).

***"Look-alike" issues***

Listing for "look-alike" reasons (i.e., listing on Appendix II under Article II paragraph 2(b) of the Convention) is justified when enforcement officers who encounter specimens of CITES-listed species are unable to distinguish between them. Trade in Spiny dogfish product is predominantly as meat as belly flaps and backs, though the fins, cartilage and hides may also be traded.

The proposal states that some populations of Spiny dogfish should be listed on Appendix II because of conservation concerns (in accordance with Article II 2(a)), while others should be listed because of inability to distinguish products from those listed for conservation reasons (in accordance with Article II 2(b)). While it is almost certainly true that differentiating products from different Spiny dogfish populations would be impossible by enforcement officers without specialized equipment or training, the approach of listing different populations of the same species under Article II, paragraphs 2a and 2b needs careful consideration. Ultimately the result of adoption of this approach could lead to a situation whereby one (perhaps relatively small) population was listed under 2a and the rest of the species under 2b even though the species as a whole is in a healthy state.

If the trade in by-products was undermining the conservation effectiveness of a Spiny dogfish listing, and tools such as identification guides and DNA tests were not feasible, there would be potential justification for listing other species of shark on the basis that their products resemble those of Spiny dogfish in trade.

**Likely effectiveness of a CITES Appendix II listing for species status**

In evaluating the likely effectiveness of an Appendix II listing for the conservation of Spiny dogfish FAO (2007) concluded that the listing would be an inefficient management measure because it could impose unnecessary regulations on a number of populations that are under low fishing pressure. On the other hand, for the population that is of primary conservation concern (Northeast Atlantic), the requirement for non-detriment findings for trade in Appendix II species may assist in securing a closer alignment between scientific advice and management measures for the stocks. As noted by FAO (2007), management benefits of an Appendix II listing would be lower for the Northeast Atlantic population because most of the catch is traded internally within EU markets.

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## TABLES AND FIGURES

Table 1. Information for assessing productivity of Spiny dogfish

| Parameter | Information | Productivity | Source |
|---|---|---|---|
| **Intrinsic rate of increase** | a. NW Atlantic – $r_{2M}$ = 0.034<br>b. NE Pacific - $r_{2M}$ = 0.017 | a. Low<br>b. Low | a. Smith et al 1998<br>b. Smith et al 1998 |
| **Natural mortality** | a. NE Atlantic – 0.1<br>b. NW Atlantic – 0.1<br>c. NE Pacific – 0.065 | a. Low<br>b. Low<br>c. Low | a. ICES WGEF 2006<br>b. NMFS 2006<br>c. Smith et al 1998 |
| **Age at maturity** | a. NE Atlantic females – 11 yr<br>b. NW Atlantic females – 12 yr; males – 6.5 yr<br>c. NW Atlantic females – 16 yr; males – 10 yr<br>d. NE Pacific females – 43 yr (1940s); 32 yr (2000s)<br>e. SW Pacific females – 10 yr; males – 6 yr | Females<br>a. Low<br>b. Low<br>c. Low<br>d. Low<br>e. Low | a. ICES 2006a<br>b. Nammack et al 1985<br>c. DFO 2007<br>d. Taylor and Gallucci 2009<br>e. NZ Ministry of Fisheries 2006 |
| **Maximum age** | NW Atlantic – 50 yr (assumed) | Low | NMFS 2006 |
| **von Bertalanffy K** | a. NE Atlantic - 0.09 (female), 0.17 (male)<br>b. NW Atlantic – 0.1057 (female), 0.1481 (male)<br>c. NW Atlantic – 0.042 (female), 0.099 (male) | Females<br>a. Low<br>b. Low<br>c. Low | a. ICES WGEF 2006<br>b. Nammack et al 1985<br>c. Campana et al 2007 |
| **Generation time** | NW Atlantic – 19.9 yr | Low | Cortes 2002 |

Table 2. Approximate global population estimate of recruited Spiny dogfish.

| Area | Population assessment (million) | FAO landings (tonnes) | Source/method | Estimated population (million) |
|---|---|---|---|---|
| Northeast Atlantic | 50 | 2 455 | Population assessment: 100 000 tonnes, individual average weight 2 kg. | 50 |
| Northwest Atlantic – USA (new survey data and analyses) | 280 | 2 881 | 558,000 tonnes biomass, average weight 2 kg (new survey data and analyses) | 280 |
| Northwest Atlantic - Canada | 200 | 2 328 | Trawl survey numbers | 200 |
| Mediterranean (new information) | 0.35 | 101 | Population assessment: 6,700 tonnes biomass, individual average weight 2 kg. | 0.5 |
| Black Sea (new information) | 50 | included in Mediterranean | Population assessment: 100,000 tonnes biomass, individual average weight 2 kg. | 50 |
| Northeast Pacific (new information) | | 4 710 | Whole BC coast: 450,000 tonnes[11] and 130,000 million individuals assuming average weight 3.5 kg; similar for Alaska. | 260 |
| Northwest Pacific (new information) | 50 | - | Assumed the same as in the Northeast Atlantic. | 50 |
| Southwest Pacific | 50 for New Zealand | 3 967 | Note 1 | 100 |
| Southwest Atlantic | 50 for Argentina shelf | 43 | 100,000 tonnes survey biomass, individual average weight 2 kg | 50 |
| Approximate global population | | 1 6605 | | 1 040 |

Note 1. New Zealand trawl survey biomass 100,000 tonnes; individual average weight 2 kg; therefore NZ numbers about 50 million. Since the NZ stock component represents a small part of the distribution area in Southwest Pacific, the total population size was estimated at twice the NZ estimate.

[11] J. King, Pers. Comm. (DFO, Canada)

Table 3. Decline indices for Spiny dogfish

| Area | Index | Trend | Basis | Coverage | Reliability | Source |
|---|---|---|---|---|---|---|
| Northeast Atlantic | Model estimate of biomass | Recent total biomass is ca 5% that in 1905 | Analytical assessment | Northeast Atlantic stock, 1905-2005 | Population model with multiple inputs (5) | ICES WGEF 2006 |
| | Model estimate of biomass | Recent total biomass is ca. 7% of that in 1955 | Analytical assessment | Northeast Atlantic stock, 1905-2005 | Population model with multiple inputs (5) | ICES WGEF 2006 |
| | CPUE | Recent values ca 40% of historic | Mean values of "year effect" 1985-1989 are 39% of 2001-2005 | Scottish trawlers 1985-2005 | Standardized CPUE (4) | ICES WGEF 2006 Table 2.4, Fig 2.8 |
| Mediterranean and Black Sea | Landings | Recent values ca. 30% of historical. | Decline by 70% between 1980-95 to 2000-07 | Mediterranean and Black Sea | Reported landings FAO (2) | Proposal, FAO |
| | Model estimate of biomass | Increased 1972 (80 000t) to 1982 (220 000t), declined to 1992 (80 000t) | Virtual population analysis | Black Sea, 1972–1992 | Population model, no details (1) | Proposal, FAO (1997) |
| Northwest Atlantic | Swept area biomass, females | Recent values ca 65% of those in late 1980s/early 1990s | Smoothed values 2006-7 ca 160Kt, 1987-91 ca 250Kt | Northwest Atlantic (US) 1980-2007 | Survey CPUE (5) | NMFS 2006; ASMFC 2008; Figs 4, 5 this report |
| | Swept area biomass, females | Recent values similar to those in early 1980s | Smoothed values 2006-7 ca 160Kt, 1980-84 ca 150Kt | Northwest Atlantic (US) 1980-2007 | Survey CPUE (5) | NMFS 2006; ASMFC 2008; Figs 4, 5 this report |
| | Swept area biomass, total | Recent values ca 67% of those in late 1980s | Smoothed values 2001-5 ca 400 Kt, 1986-93 ca 600 Kt | Northwest Atlantic (US) 1980-2006 | Survey CPUE (5) | NMFS 2006; Fig. 5 this report |

Table 3 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| | Swept area biomass, total | Recent values ca 200% of those in late 1960s | Smoothed values 2001-5 ca 400 Kt, 1968-72 ca 200 Kt | Northwest Atlantic (US) 1980-2006 | Survey CPUE (5) | NMFS 2006; Fig. 5 this report |
| | Average catch per tow | 4-fold increase | Average values 2003-7 ca 50 kg, 1970-4 ca 12.4 kg | Scotian Shelf summer 1970-2007 | Survey CPUE (5) | DFO 2007, Fig 7 this report |
| | Average catch per tow | EOD 99.3% | Average values 2003-7 0.4 kg, 1986-90 55 kg | Eastern Scotian shelf spring 1986-2007 | Survey CPUE (5) | DFO 2007, Fig 8 this report |
| | Average catch per tow | EOD 98% | Average values 2003-7 3 kg, 1986-90 110 kg | George's Bank survey, February, 1986-2007 | Survey CPUE (5) | DFO 2007, Fig 9 this report |
| Northeast Pacific | Longline CPUE | Increases 1985-99 | Inspection of graphs | Gulf of Alaska | IPHC Longline survey CPUE (5) | Wright and Hulbert 2000 |
| | Trawl survey biomass | Increasing 1984-2003 | Inspection of graph | Gulf of Alaska | Survey biomass (5) | Courtney et al 2004, Fig 10 this report |
| | DFO Trawl survey, CPUE | No overall trend 1984-2003 | Inspection of graph | Hecate Strait, Canada | Trawl survey CPUE (5) | Wallace et al in press, Fig 11 this report |
| | IPHC Longline survey CPUE | No overall trend 1993-2004 | Inspection of graph | Pacific continental shelf of Canada | Longline survey CPUE (5) | Wallace et al in press, Fig 12 this report |
| | NMFS Trawl survey biomass and numbers | No overall trend 1980-2001 | Inspection of graph | Vancouver Region, Canada-US | Survey biomass (5) | Wallace et al in press, Fig 13 this report |

Table 3 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| Northwest Pacific | CPUE trawl | Extent of decline ca 74% | Average 42.6 kg/haul 1971-1975, average 11.2 kg/haul 1999-2003 | Sea of Japan | Standardised (?) CPUE (4?) | Fisheries Agency of Japan 2004, Fig 16 (right) this report |
| | CPUE Danish Seine | Extent of decline ca 90% | Inspection of figure | Shiriyazakai | Standardised (?) CPUE (3?) | Fishery Agency of Japan 2003, Fig 17 this report |
| | CPUE Danish Seinc | Extent of decline ca 81% | Inspection of figure | Erimo | Standardised (?) CPUE (4?) | Fishery Agency of Japan 2004, Fig 18 this report |
| | CPUE bull trawl | Early high to low and stable | Inspection of figure | Iwate | Standardised (?) CPUE (4?) | Fishery Agency of Japan 2003, Fig 17 this report |
| | CPUE Otter trawl, Danish seine | No trend | Inspection of figure | Iwate | Standardised (?) CPUE (4?) | Fishery Agency of Japan 2003, Fig 17 this report |
| Southwest Pacific | Trawl survey CPUE | No trend early 1990s to 2005/6 | Description of results in assessment document | New Zealand waters | Survey CPUE (5) | NZ Ministry of Fisheries 2006 |
| Southwest Atlantic | Trawl survey biomass | Decrease to 20% of historical | From 5,000 t 1994 to appr 1,000 t 1999-2005 | Argentina – Bonaerense Region | Survey biomass (5) | Massa et al 2007; Fig. 16A this report |
| | Trawl survey biomass | Decrease to 50% of historical | From ca 80,000 t 1997-99 to ca. 40,000 t 2003-05 | Argentina – Central Region | Survey biomass (5) | Massa et al 2007; Fig. 16B this report |
| | Trawl survey biomass | No trend | Fluctuating ca 40,000-100,000 t 1992-2006 | Argentina – southern region | Survey biomass (5) | Massa et al 2007; Fig. 16C this report |

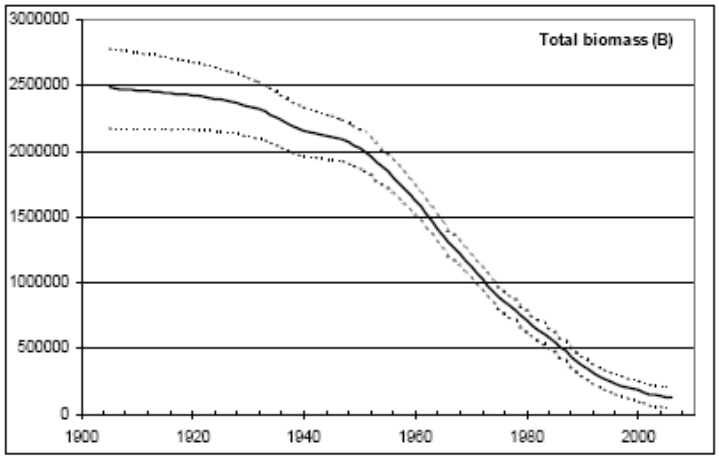


Figure 1. Total biomass, Northeast Atlantic Spiny dogfish; model base case. Source: ICES WGEF 2006 Figure 2.1.3.

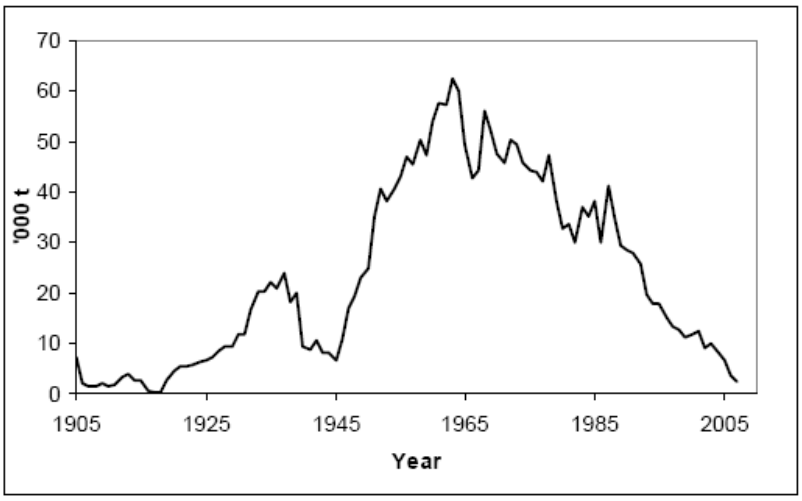


Figure 2. Landings of Spiny dogfish, Northeast Atlantic. Source: ICES WGEF 2008 Figure 2.1.

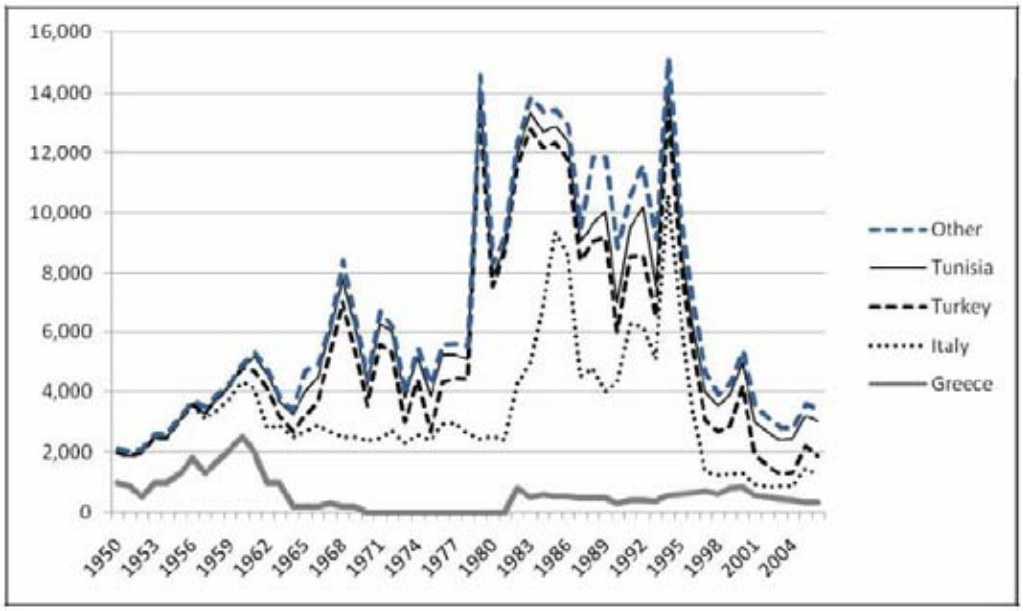


Figure 3. Reported landings by country (tonnes) of 'dogfish sharks nei', 'Smooth-hounds nei' and *Squalus acanthias* from the Mediterranean and Black Sea, 1950–2007 (Source FAO Fishstat, proposal)

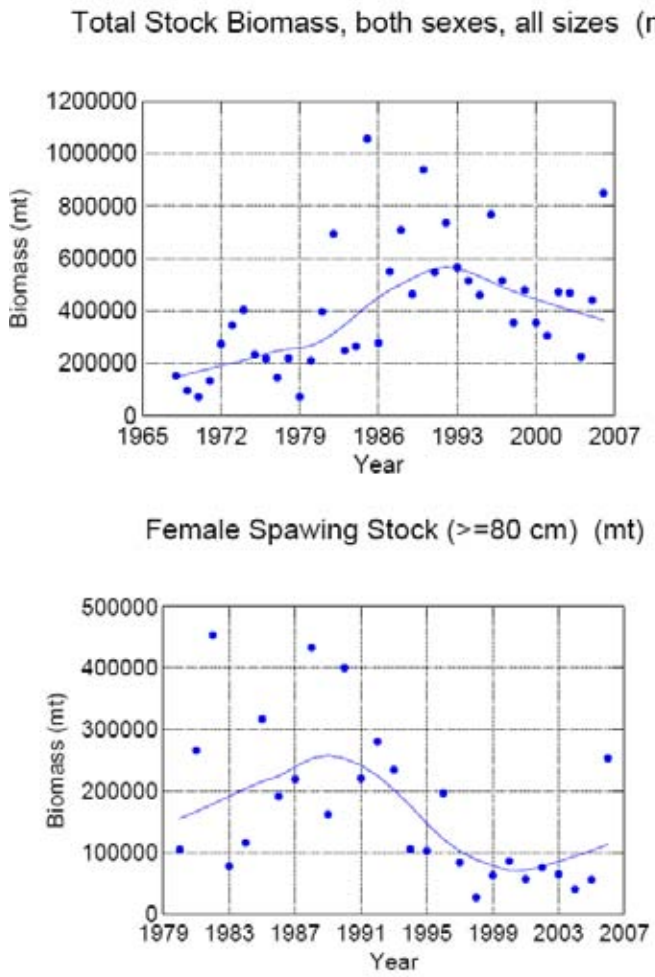


Figure 4. Swept area estimates of total dogfish biomass (tonnes), 1968–2006 (top), and for mature females only (bottom), 1980–2006, NEFSC spring R/V trawl surveys. Line represents Lowess smooth with tension factor 0.5. Source: NMFS, 2006.

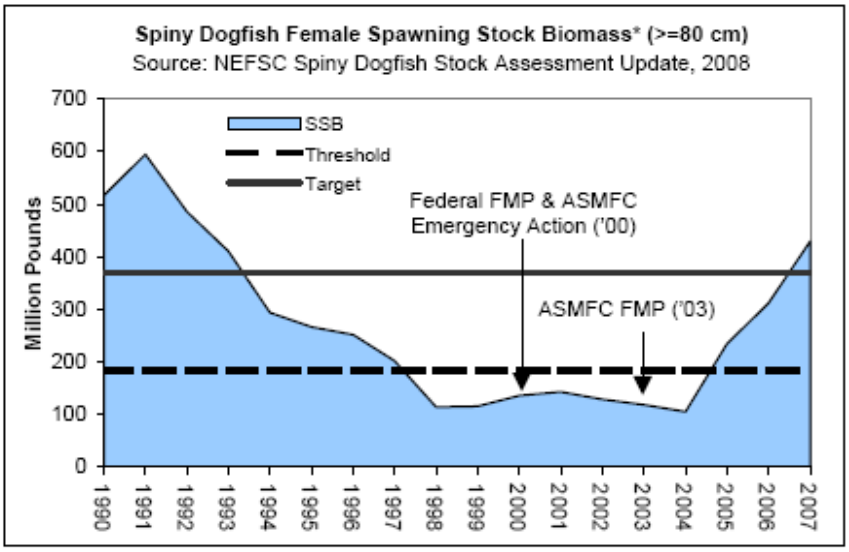


Figure 5. Female spawning stock biomass, US trawl survey. Source: ASMFC 2008.

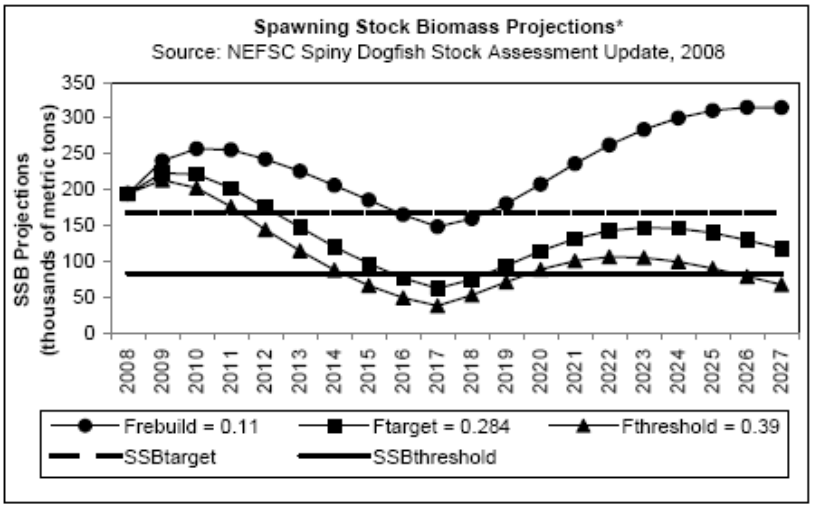


Figure 6. Spawning stock biomass projections, Northwest Atlantic Spiny dogfish. Source: ASMFC 2008.

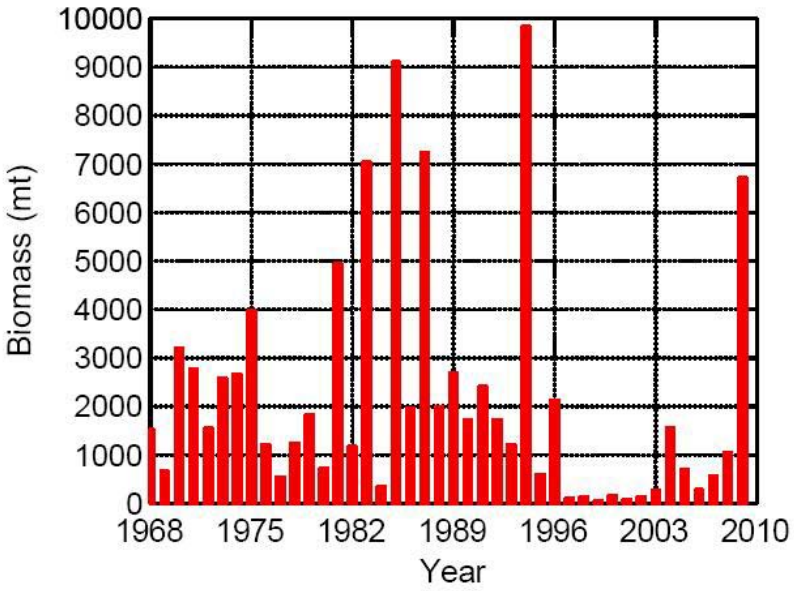


Fig. 7. Swept area biomass of Spiny dogfish recruits (< 1 yr old and < 36 cm TL), based on NEFSC Spring Bottom Trawl Survey, 1968-2009. both sexes combined. ( Source: MAFMC 2009).

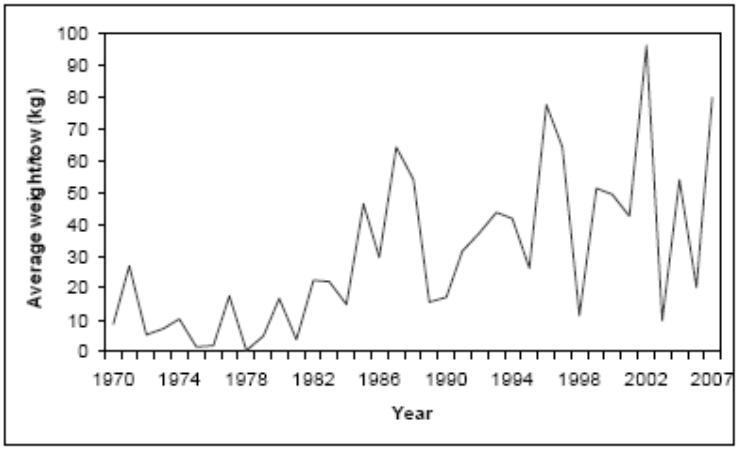


Figure 8. Relative biomass of Spiny dogfish on Scotian Shelf, summer research vessel surveys. Source: DFO 2007.

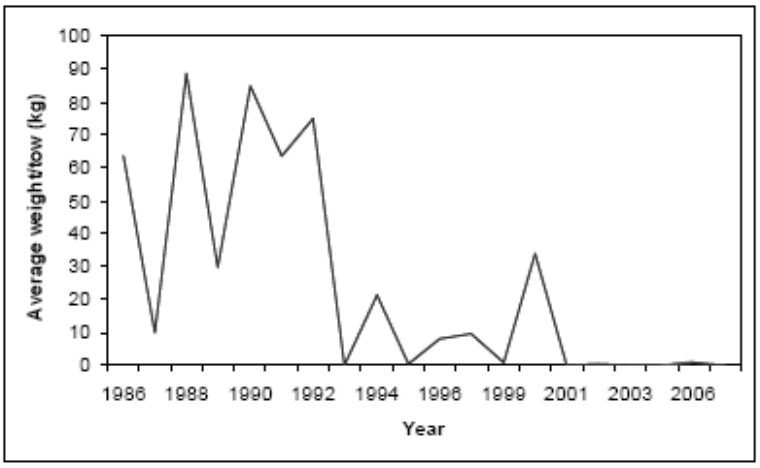


Figure 9. Relative biomass of Spiny dogfish on eastern Scotian Shelf, spring research vessel surveys. Source: DFO 2007.

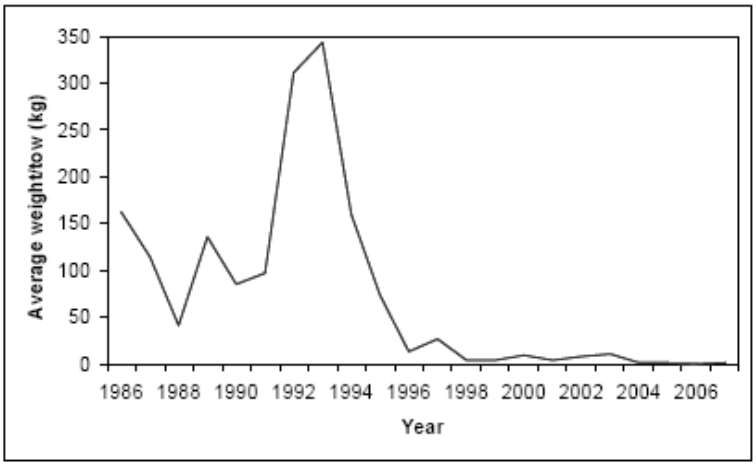


Figure 10. Relative biomass of Spiny dogfish on George's Bank, February research vessel surveys. Source: DFO 2007

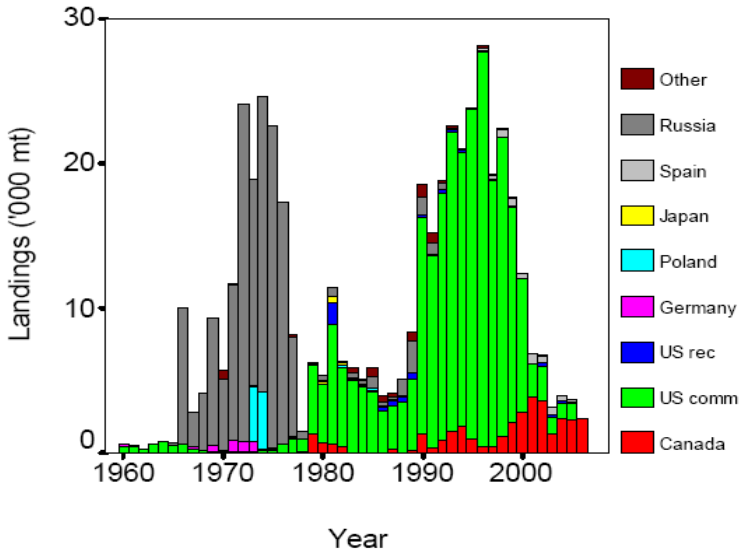


Figure 11. Reported landings, NAFO Areas 2-6 (Northwest Atlantic). Source: DFO 2007.

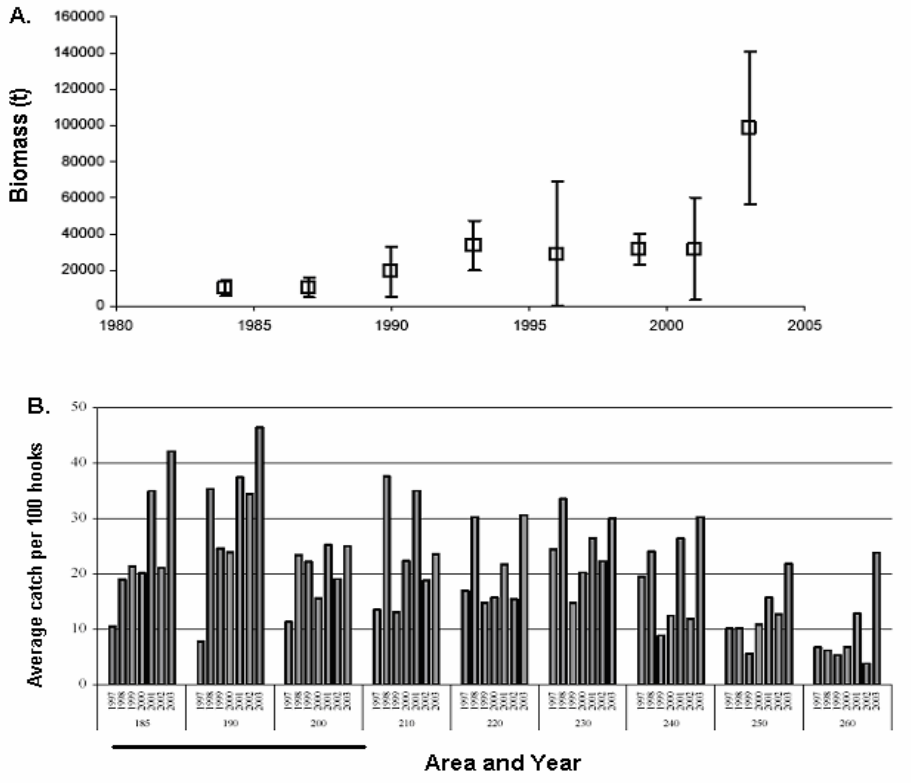


Figure 12. Trends in the abundance of Spiny dogfish in Gulf of Alaska from (A.) biomass estimates (t) derived from the AFSC bottom trawl survey (error bars represent 95% confidence intervals); and (B.) catch rates in the IPHC set survey. Waters adjacent to Canada off Southeast Alaska are represented by IPHC areas 185, 190, and 200. Figure modified from Courtney *et al.* (2004). Source: FAO 2007, Wallace et al (2009).

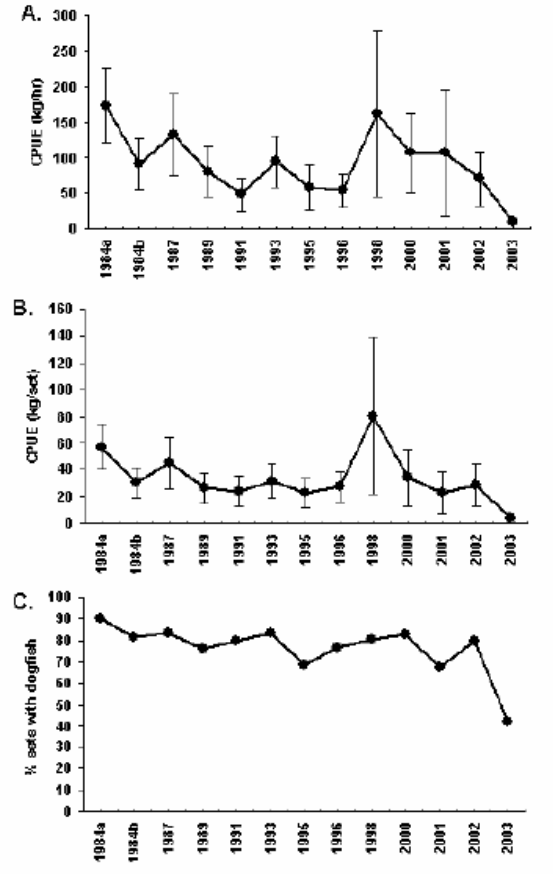


Figure 13. Trends in the abundance of Spiny dogfish from Hecate Strait trawl surveys between 1984–2003 using (A) mean CPUE (kg/hour); and (B) mean CPUE (kg/set); and (C) percentage of sets with Spiny dogfish. Error bars represent 95% confidence intervals around the mean. Source: FAO 2007, Wallace et al (2009).

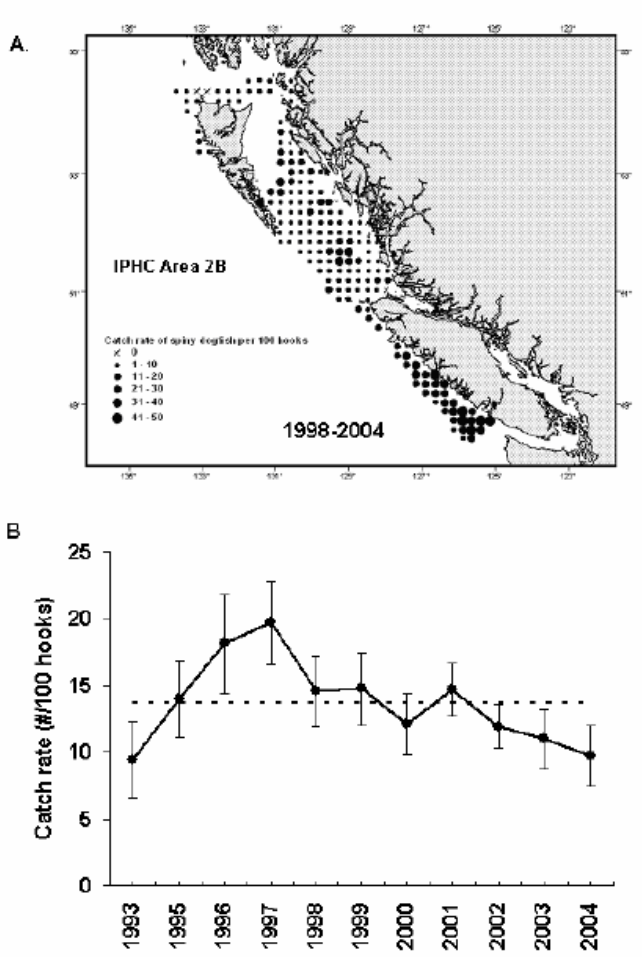


Figure 14. A) Distribution of Spiny dogfish in IPHC Area 2B shown by relative catch rates from 1998–2004 at IPHC survey stations; and (B) mean catch rate by year (error bars represent 95% confidence intervals around the mean). Dashed lined represents the series average. Data provided from the International Pacific Halibut Commission standardized stock assessment survey 1993– 2004. Note: no survey in 1994. Source: FAO 2007, Wallace et al (2009)

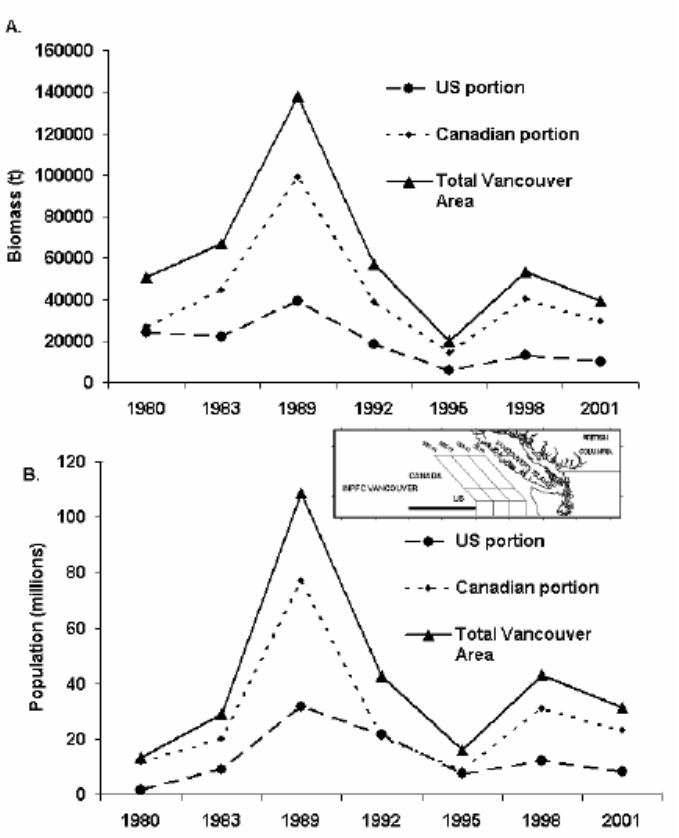


Figure 15. Swept area abundance estimates expressed as (A) biomass; and (B) population in both the Canadian and U.S. portions of the *INPFC Vancouver* region. Data from the National Marine Fisheries Service triennial trawl survey database. Source: FAO 2007, Wallace et al (2009).

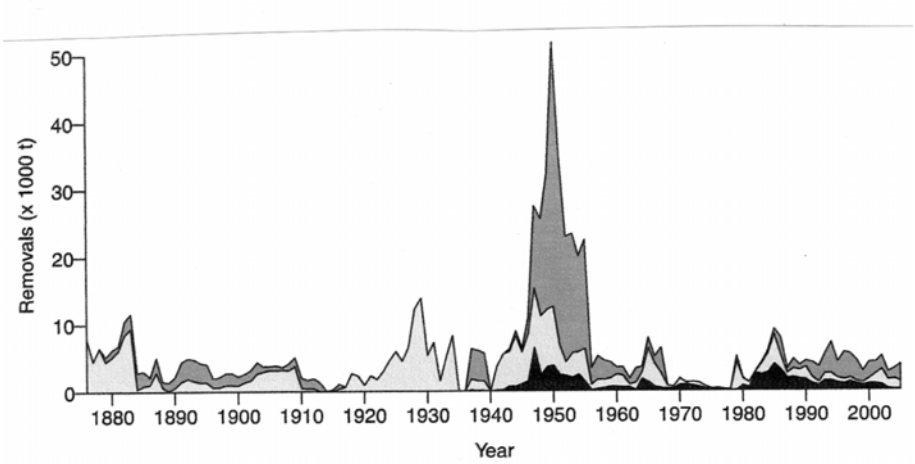


Figure 16. Reported landings of Spiny dogfish in the Northeast Pacific. Solid areas: Puget Sound; lightly shaded areas: Strait of Georgia; darkly shaded areas: coastal waters between Alaska and Baja California. Source: Taylor and Gallucci 2009.

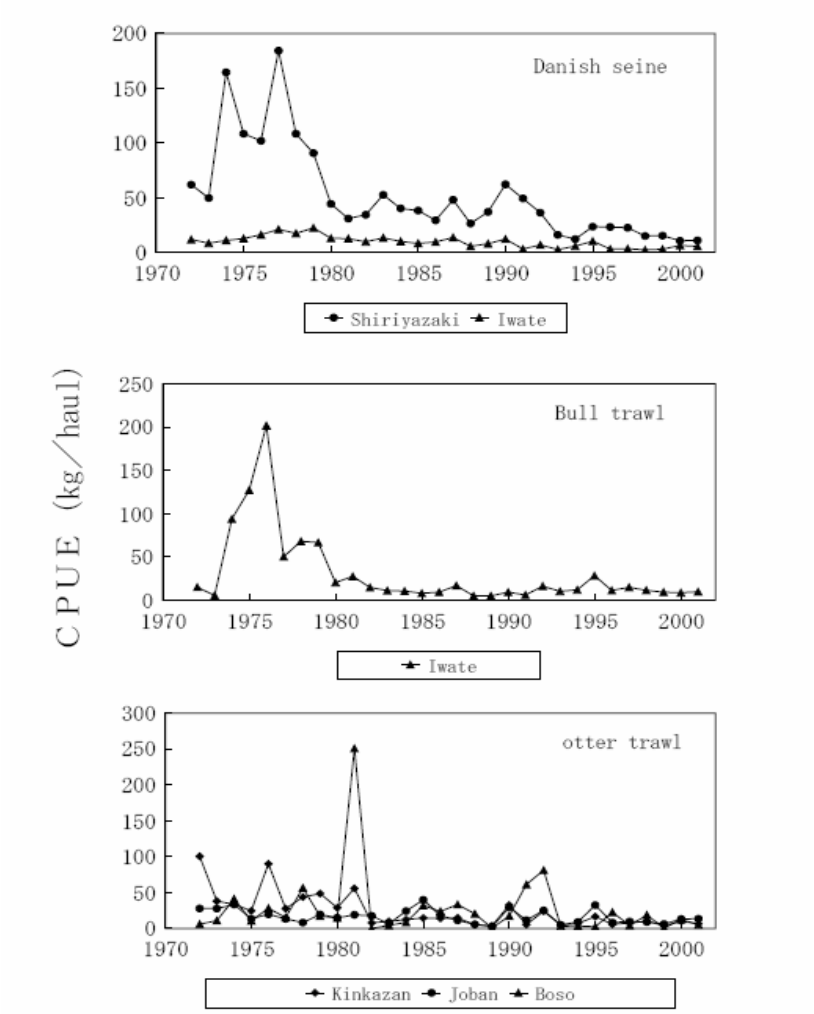


Figure 17. Eastern Japan CPUE series. Source: Fishery Agency 2003

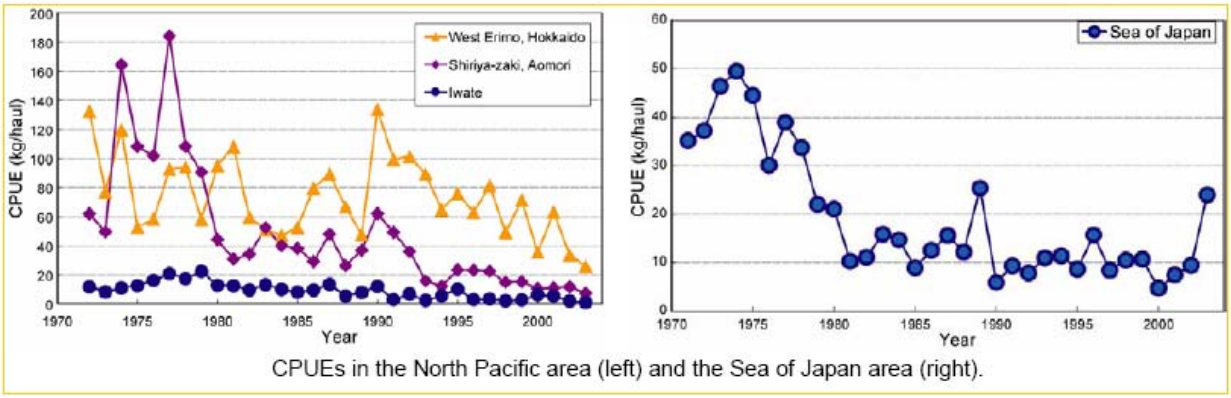


Figure 18. Catch per unit effort of Spiny dogfish in several areas fished by Japan. Source: Fishery Agency 2004.

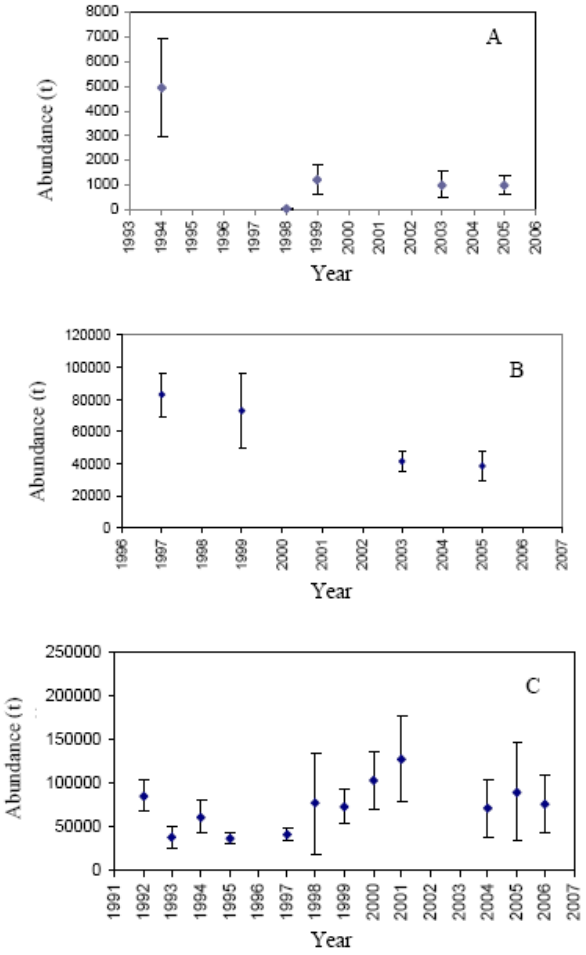


Figure 19. Swept area estimates of Spiny dogfish biomass (tonnes) on the Argentinean shelf. (A) Bonaersense region (B) central region (C) southern Patagonian shelf. Source: Massa et al. 2007

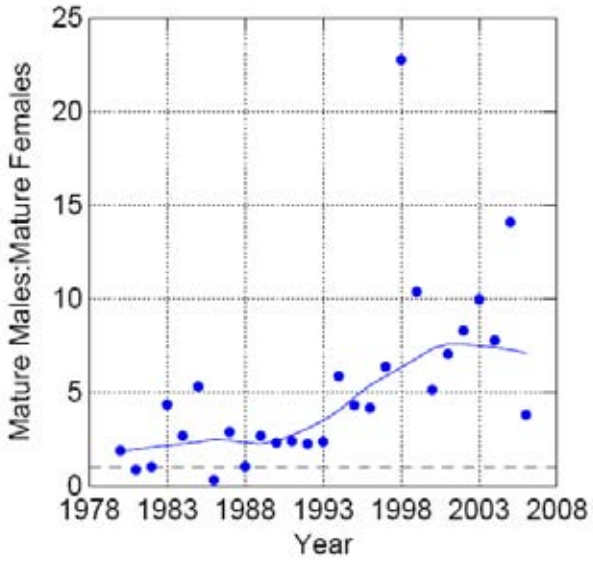


Figure 20. Ratio of number of Spiny dogfish mature males ( 60 cm) to mature females ( 80 cm) per tow in NEFSC spring trawl surveys, 1980-2006. Line represents Lowess smooth with tension =0.5. Source: NMFS 2006.

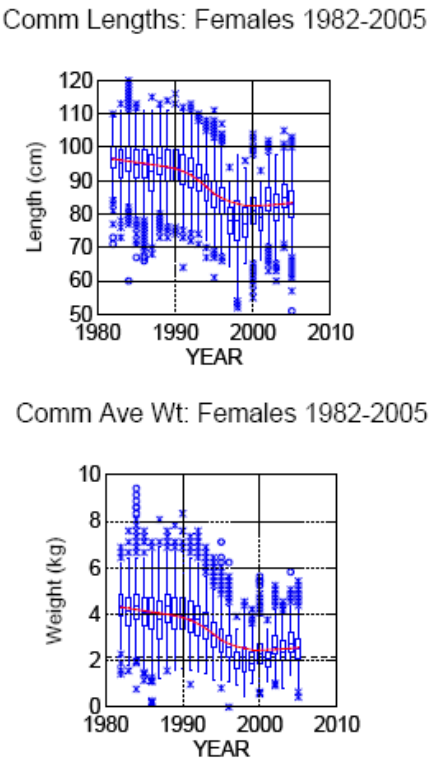


Figure 21. Length and weight of females in commercial fishery samples. Source: NMFS 2006.

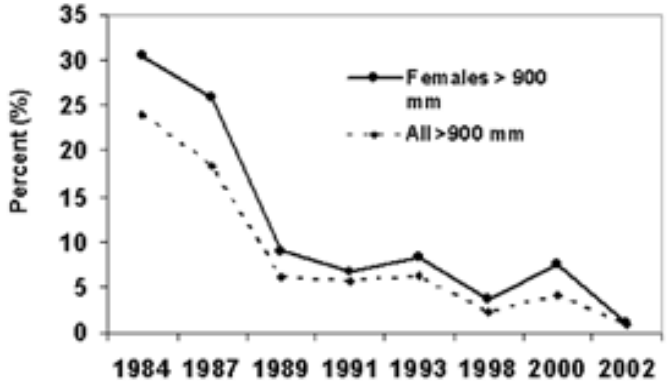


Figure 22. Proportion of Spiny dogfish greater than 900 mm length in Hecate Strait trawl survey 1984-2002. Female length at maturity is 940 mm. Source: Wallace et al 2009.

## APPENDIX I

## FAO Expert Advisory Panel: Atlantic bluefin tuna

**CoP15 Proposal 19**

**Species**: *Thunnus thynnu*s – Atlantic bluefin tuna

**Proposal**: Inclusion of *Thunnus thynnus* (Linnaeus, 1758) in Appendix I in accordance with Article II paragraph 1.

**Basis for proposal**: The proposal states that the listing of Atlantic bluefin tuna on Appendix I is consistent with Annex 1A and 1C of Resolution Conf. 9.24 (Rev. CoP 14):

*Annex 1 A. The wild population is small, and is characterized by at least one of the following: iii) a majority of individuals being concentrated geographically during one or more life-history phases; or v) a high vulnerability to either intrinsic or extrinsic factors*. Estimates of the genetically effective population size of subpopulations in the Mediterranean (400 – 700 individuals) is close to or below the minimum threshold related to the maintenance of genetic diversity and evolutionary potential in the long term. In addition the species displays strong aggregating behavior during feeding and spawning which makes it highly vulnerable to fishing.

*Annex 1 C . A marked decline in the population size in the wild, which has been either: i) observed as ongoing or having occurred in the past (but with a potential to resume); ii) inferred or projected on the basis of any of the following: levels of patterns of exploitation; or a high vulnerability to either intrinsic or extrinsic factors; or a decreasing recruitment (only West stock)*. The East and West stocks of Atlantic bluefin have shown declines in standing stock biomass which meets the decline criteria for a low productivity species.

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**ASSESSMENT SUMMARY**

A majority of the FAO Expert Advisory Panel considered that the available evidence supported the proposal to include Atlantic bluefin tuna, *Thunnus thynnus* (Linnaeus, 1758), in CITES Appendix I.

The Panel's deliberations were assisted especially by the Report of the Extension of the ICCAT Standing Committee on Research and Statistics (SCRS) Meeting to Consider the Status of Atlantic Bluefin Tuna Populations with respect to the CITES Biological Listing Criteria held in October, 2009. The Panel concurred with the view of that meeting that the species did not meet the criterion that the wild population was sufficiently small to warrant listing under Appendix I.

In terms of the decline criterion for listing, the Panel again concurred with the view of that SCRS meeting that Atlantic bluefin tuna as a whole were near the borderline between a low and a medium productivity species, and consequently followed that meeting's approach of considering depletion to below 15% of a baseline (expressed in terms of spawning biomass as is customary for commercially-exploited aquatic species) level as the threshold guideline for an Appendix I listing.

The key consideration for the Panel was the choice of the baseline biomass level to use in computing the current extent of depletion. If the maximum spawning biomasses ($B_{max}$) in the period assessed (which commenced in 1970) are taken to be the baselines against which these depletions are evaluated, then both the Eastern (including Mediterranean) and Western populations are assessed to be above the 15% threshold. They are however sufficiently close to this threshold to meet the decline criterion for an Appendix II listing. Alternatively, if the estimated pre-exploitation spawning biomasses ($B_0$) are used for this baseline, both populations of Atlantic bluefin tuna are below this 15% threshold and meet the decline criterion for listing on Appendix I.

Some members of the Panel considered that $B_{max}$ was an adequate proxy for pre-exploitation spawning biomass $B_0$ as in their view the two were unlikely to differ substantially. They considered that the alternative of

estimating $B_0$ in the manner adopted by the ICCAT SCRS was highly sensitive to certain key assumptions, such as for the relationship between spawning stock and recruitment which has proven to be problematic to estimate for bluefin tuna. Estimates of $B_0$ obtained by the SCRS for the Eastern (including Mediterranean) population may be too high for various reasons. If the assessment is undertaken commencing in the early 1950s, it does not yield higher biomasses than the maximum obtained in the 1970+ assessment. As the annual catches prior to the 1950s are typically appreciably smaller than those that followed, the population was thus probably not greatly reduced by harvesting prior to the 1950s. Furthermore recruitment has shown systematic trends over recent decades, suggesting that $B_0$ also changes over time. Since recent recruitment has been above average levels, the values estimated for $B_0$ could be above the long-term average appropriate for a baseline.

However, the majority of members of the Panel considered that estimates of $B_0$ were preferable to use for the baseline because they took account of the reduction of the population by removals prior to the start of the assessment series, noting that the CITES Resolution Conf. 9.24 (Rev. CoP 14) states that data used to estimate or infer a baseline for extent of decline of a commercially-exploited aquatic species should extend as far back into the past as possible. Furthermore, for the Western population any net bias in the estimate of $B_0$ is likely to be less than for the east. Catches off Brazil early in the fishery's history could well have belonged to the Western population and so should probably be taken into account in its assessment. Finally, the Western population likely has lower productivity than its eastern counterpart. Thus conclusions concerning this Western population meeting the Appendix I decline criteria are more strongly founded.

There was consensus in the Panel that the evidence available supported the inclusion of Atlantic bluefin on Appendix II.

An Appendix I listing would be likely to reduce the bluefin catches from both component populations. This would assist to ensure that recent unsustainable catches in the East Atlantic and Mediterranean are reduced.

Although reported catches from the Western population have not exceeded the Total Allowable Catch over the past 2-3 decades, there have been serious flaws in the recent management of the Eastern component, including TACs set above scientific recommendations at unsustainable levels, and a large illegal component of the fishery making appreciable catches. However, in 2009 there have been important improvements in ICCAT's Eastern management approach, with the TAC for 2010 being reduced to 13 500 t, a commitment to tie future TACs to SCRS advice, and a rebuilding plan based upon projections of reaching $B_{MSY}$ in 2023 with 60% probability (assuming perfect implementation). The 2009 report of the ICCAT SCRS also comments that the appreciable differences between reported and estimated catches noted for 2007 had declined considerably for 2008, which could reflect improved implementation of regulatory and control mechanisms in the Mediterranean.

The proponent argued that the listing proposal included provision for downlisting to Appendix II, should stock status improve. It should be noted that implementation of a listing on Appendix I would impact many of the indices and the associated catch at size/age from the various bluefin fisheries, with unknown impacts on ability to monitor stock trends.

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

The Atlantic bluefin tuna, *Thunnus thynnus* is a highly migratory species found throughout the North Atlantic Ocean and adjacent seas, particularly the Mediterranean Sea. The species is managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) as two separate stocks: the Eastern and Western stocks. The separation of the two stocks was established based on evidences of 1) two separate spawning grounds (in the Mediterranean Sea on the Eastern side and in the Gulf of Mexico on the Western side); 2) differences in age at sexual maturity; 3) presence of juveniles and adults on both sides of the Atlantic; and 4) no spawning activity in the middle of the North Atlantic (Fromentin 2008).

The hypothesis of only two stocks in the North Atlantic has been challenged by recent studies. On the one hand tagging and chemical signature studies have showed the mixing of bluefin tuna of different origins throughout the east coast of North America and the North Atlantic Ocean (Block et al. 2005). On the other hand recent mitochondrial DNA studies revealed significant population subdivision among the Gulf of Mexico, the Western Mediterranean and Eastern Mediterranean (Boustany et al. 2008). These results suggest that despite the mixing of individuals from different origins in the North Atlantic, individuals show strong natal homing to their spawning grounds in the Gulf of Mexico, west Mediterranean and east Mediterranean. In addition to the studies above, the proposal refers to the work of Riccioni et al. (2009) which suggests that Atlantic bluefin tuna population in the Mediterranean is composed of genetically differentiated subpopulations of small size.

Despite the uncertainties on the structure of the population, the separation of Western and Eastern North Atlantic stocks is strongly supported by the available information and remains the most accepted and utilized hypothesis for management purposes today.

***Productivity level***

According to the information provided in the proposal, the Atlantic bluefin tuna falls into the category of low productivity species for all parameters, with the exception of age at maturity (Table 1; ages 4-6 for the Eastern stock and 8-12 for the Western). The former suggests a medium productivity level for the Eastern stock, whereas the latter suggests low productivity for the Western stock. Therefore, following SCRS (2009), in this evaluation of the proposal the Atlantic bluefin tuna was considered a "low-medium" productivity species.

**Population status and trends**

***Small population size***

The most recent stock assessment of Atlantic bluefin tuna estimated that the Eastern stock included about 5 million individuals in 2007, of which about 1million were spawners (SCRS 2008; 2009). The estimated number of individuals in the Western stock was about 225 000 in the same year.

Riccioni et al.(2009) estimated effective genetic population sizes in the Mediterranean in the order of 400-700 individuals. According to SCRS (2009) these estimates would translate into abundances of reproductive units in the order of $10^6$ to $10^7$ individuals.

***Restricted distribution***

Atlantic bluefin tuna is widely distributed throughout the North Atlantic and Mediterranean Sea. Important changes in the spatial and temporal patterns of distribution of the species have been observed since the early part of the 20$^{th}$ century (proposal). For instance, the species is now absent or rare from areas formerly occupied, such as the North Sea and Black Sea. On the other hand areas such as Eastern Mediterranean and the central North Atlantic have been supporting large catches in recent years. The reasons for the changes are unclear but these seem to result from interactions between biological, environmental, trophic and fishing processes (proposal, SCRS 2008). As noted by SCRS (2009), despite the fact that the population is managed as two stocks separated by the 45 W meridian, there are many uncertainties about the population structure. Complex spatial genetic structuring of the population in the Mediterranean suggests for instance the existence different isolated subpopulations in the region. However the area occupied by the distinct populations is probably wide, considering that individuals from different populations migrate and mix in the North Atlantic, as demonstrated by tagging studies (Block et al. 2005).

***Decline***

The main source of information about the extent of decline of the Atlantic bluefin tuna population used in the proposal is the outcome of the stock assessment of Eastern and Western stocks conducted by the Standing Committee on Research and Statistics (SCRS) of ICCAT in 2008 (SCRS, 2008).

Results from the same assessment were used by the SCRS in 2009 to evaluate the status of Atlantic bluefin tuna in relation to CITES listing criteria (SCRS 2009). The methods and results reported in SCRS (2009) are described below for the Western and Eastern stocks. Additional sources reported in the proposal are also included.

The calculation of the extent of decline of both stocks conducted by SCRS (2009) was based on two approaches:

1. From a historical perspective, by comparing current population size (as measured by the spawning stock biomass, SSB) against the (a) unexploited population size ($SSB_0$), and (b) the maximum historical population size ($SSB_{max}$) estimated in the stock assessment.
2. From a future perspective, by comparing future (2019) population size (as measured by SSB) against either (a) unexploited population size or (b) the maximum historical population size estimated in the stock assessment, and by comparing population size in 2019 against the current population size (2009).

Both stocks were assessed using Virtual Population Analysis (VPA). Results are expressed in terms of the probability of the spawning stock biomass being less than 10%, 15% or 20% of the baseline (SSB0 or SSBmax) in 2009 and 2019.

*Western stock*

The proposal states that spawning stock biomass of the Western stock declined from 49 482 tonnes in 1970 to 8 693 tonnes in 2007. That represents an extent of decline of 82.4% since the start of the time series. Using the data reported in SCRS (2008; Figure 1), the extent of extent of decline was recalculated comparing the 5-year average biomass at the beginning (1970-74) and end (2003-07) of the time series. The average spawning stock biomass declined from 44 798 tonnes in 1970-74 to 8 440 in 2003 – 07, representing a decline of 81.1% between the two periods.

Most of the decline occurred between 1970 and 1985. Since then the spawning stock biomass has remained relatively stable, varying from 18% to 27% of the 1975 level (SCRS 2008). The stock has been under a rebuilding plan since 1998.

It should be noted that the numbers reported in the proposal are from one of the sensitivity runs of the assessment model. Results from 13 sensitivity runs of the model to the various indexes of abundance used in the assessment are reported in SCRS (2008). The extent of decline of the spawning stock biomass between 1970 and 2007 estimated in these runs varied from 65% to 90%, with an average extent of decline of 80%.

One limitation of the results reported above is that the estimated biomass in the early 1970s is used as baseline to calculate the extent of decline, while it is known that the peak catches from the west stock occurred in the mid-1960s (Figure 2). Therefore the calculated historical extent of decline is likely to be an underestimate of the level of depletion of the stock.

There are two studies that provide estimates of extent of decline going back to the earlier phases of the fishery. The study by Taylor et al. (2009), referred to in the proposal, uses a spatial age-structured model to assess the Eastern and Western stocks of Atlantic bluefin tunas simultaneously by accounting for movement of fish between the two stocks. The results, considered preliminary by the authors since the model has not been adequately tested yet, suggest that the total biomass of the west stock has declined substantially since 1950, probably by more than 80%.

The other study, more recent, was undertaken by SCRS (2009). In this study two recruitment scenarios were used for calculating the unexploited population size ($SSB_0$) as baseline for evaluating extent of decline: a “high recruitment” scenario reflecting a hypothesis that the potential productivity of the stock has shown no trend over the assessment period; and a “low recruitment” scenario reflecting the hypothesis that productivity potential has shifted to a lower level after the late 1970s. The other baseline used by SCRS (2009) was the maximum spawning stock biomass ($SSB_{max}$) estimated in the period 1970-2007. The estimated $SSB_{max}$ is not affected by the assumptions made about recruitment.

SCRS (2009) also used two management scenarios to simulate future trends in the status of the stock: 1) following the recommended TACs in SCRS Rec. [08-04], i.e., 1 900 t in 2009, 1 800 t in 2010 with 1 800 t carried forward until 2019; and 2) a projection of zero catch allowed after 2009.

Results of the evaluations undertaken by SCRS (2009) are shown in Table 2. If the maximum spawning stock biomass ($SSB_{max}$) is used as baseline, the probability that the current population size is below 10%, 15% and 20% of the baseline is 8.8%, 30% and 54.2% respectively, independent of the recruitment scenario used (Table 2A). If the unexploited population size ($SSB_0$) is used as baseline, the probabilities associated with the three decline thresholds are 30.2%, 92.6% and 99.6% for a low recruitment scenario, and 99.6%, 100% and 100% for the high recruitment scenario (Table 2A).

The projected trends for the next ten years are summarized in Table 2B. Assuming full compliance with the established TAC in Rec [08-04], the probability that SSB in 2019 will remain below 20% of $SSB_{max}$ is less than 9%. If $SSB_0$ is used as baseline, there is a 15% probability that the stock will be below the 20% decline threshold for the low recruitment scenario and a 95% probability if a high recruitment scenario is used. The potential to recover to levels above 20% of the baseline is near 100% if no catches are allowed after 2009, the only exception being under the high recruitment scenario, where there is a probability of 62.6% that the stock will be below 20% of $SSB_0$ (SCRS, 2009).

*Eastern stock*

The proposal indicates that, according to the VPA analysis conducted by SCRS (2008) using data from 1955 to 2007, the spawning stock biomass of the Eastern stock declined from 305 136 tonnes in 1958 to 78 724 tonnes in 2007, representing a decline of 74,2 % . The proposal also notes that the bulk of the decline occurred since 1997, when the spawning stock biomass was estimated at 201 479 tonnes.

Of the model runs evaluated by SCRS (2008), four were considered satisfactory in fitting historical data: runs 6 and 7, based on catch at age data from 1970 to 2007; and runs 13 and 14, based on a longer time-series of data starting in 1955. While runs 6 and 13 were based only on reported catches, runs 7 and 14 accounted for unreported catches of 50 000 tonnes between 1998 and 2006 and of 60 000 tonnes in 2007. The results reported in the proposal are from run 14 (Figure 3).

Using the results from the two longer time series (runs 13 and 14), the extent of decline was recalculated comparing the average estimated biomass in 1955-59 and in 2003-07. In run 13, the spawning stock biomass declined from 293 176 tonnes in 1955-59 to 110 803 in 2003-07, representing a decline of 62,2% between the two periods. In run 14, the spawning stock biomass declined from 297 318 tonnes in 1955-59 to 117 443 in 2003-07, representing a decline of 60,5% between the two periods.

Since 2000 there has been a rapid increase in fishing mortality especially for large (ages 8+) fish and a rapid decline in spawning stock biomass (SCRS 2008). The 2008 assessment results indicate that the spawning stock biomass continues to decline while fishing mortality is increasing rapidly, especially for large bluefin. As noted by SCRS (2008) the increase in mortality for large bluefin is consistent with a shift in targeting towards larger individuals destined for farming.

Therefore, in contrast to the Western stock, where biomass seems to have stabilized in recent years, the recent rate of decline of the Eastern stock is of concern. Based on the 2000-2007 spawning stock biomass estimates (run 13), the recent rate of decline would be approximately 3.2% /year. Projecting the SSB forward from 2008 to 2017 (10 years) would bring a decline to 51 201 tonnes, which is equivalent to 17.4% of the average spawning stock biomass in 1955-59.

Mackenzie et al. (2009) used an age-structured stochastic modeling approach based on SCRS 2008 for predicting future trends in the Eastern stock under the full implementation of ICCAT's 2006 recovery plan, which includes the application of decreasing TACs between 2007 and 2010. Their conclusions were that "even if a near-complete ban on all bluefin tuna fishing in the Northeast Atlantic and Mediterranean were implemented immediately in 2008 and enforced until 2022, the population will probably fall to record lows in the next few years, unless environmental conditions promote exceptionally high recruitment". One of the reasons for the

projected trends is the decrease of the proportion of older fish in the population observed in recent years, which according to the authors causes a reduction of the buffering capacity of the stock to unfavorable environmental conditions affecting reproductive success.

Two additional studies evaluated the historical extent of decline of the Eastern stock. Taylor et al. (2009), cited in the proposal (and considered in the 2008 SCRS assessment), used a spatial age-structured model to assess the Eastern and Western stocks of Atlantic bluefin tuna simultaneously by accounting for movement of fish between the two stocks. Preliminary results indicated that total biomass of the Eastern stock has probably declined by more than 80% since 1950. SCRS (2009) evaluated historical extent of declines and projected future declines of the Eastern stock according to different scenarios, described as follows (SCRS, 2009):

> "Thirty-six projections were made for the following combinations, assuming that catches in 2009 and thereafter would follow the TACs in Rec. [08-05]:
>
> - 3 steepness levels (0.5, 0.75, 0.99)
> - 2 recent catch levels in the VPA (reported or adjusted)
> - 3 periods of SSB-R observations for the SRR (1970-1980, 1970-2002, and 1990-2002)
> - 2 implementation levels (perfect, and 20% overages, as was assumed in 2008)".
>
> "In addition, the Committee agreed that it would be useful to provide ICCAT with additional advice that reflects the management recommendations made by SCRS in 2009. For this reason, additional scenarios were considered with 2010-2019 catches of 15 000t (approximating an Fmax strategy), 8 500t (approximating an F0.1 strategy), and zero catches, with the "base case" steepness and the three recruitment levels, and perfect implementation".

The results of the simulations indicated that (SCRS 2009):

> "The probability of $SSB_{2009}$ being lower than 15% of the maximum SSB were about 0.19 for the case of reported catches and approximately 0.23 for the adjusted catches. In both cases, these results were the same for the three recruitment scenarios (low, medium, and high). The probabilities with respect to $SSB_{2009} < 0.15SSB_0$ were between approximately 0.88 and 1.00 depending on the recruitment scenario. In the case of projections, the probability of $SSB_{2019} < 15\%$ of the maximum SSB ranged from 0.27 to 0.43 while the probability of $SSB_{2019} < 0.15\ SSB_0$ ranged from 0.67 to 1.00" (SCRS, 2009; Figure 4).

**Assessment relative to quantitative criteria**

***Small population***

The estimate of total population size for the Eastern and Western stocks (5 million and 225 000 individuals, respectively) are well above the general guideline (5000) for small population size provided in the CITES definitions (CITES Conf. Res. 9.24 Rev CoP14). Riccioni et al. ( 2009) estimated effective genetic population sizes in the Mediterranean in the order of 400-700 individuals. These estimates would translate into abundances of reproductive units in the order of $10^6$ to $10^7$ individuals, which are also above the general CITES guidelines (framed in terms of number of individuals) for small population size,

As noted by FAO (2001), the CITES guideline for small population is considered generally inappropriate for populations of commercially-exploited marine species, except for a few species such as some sessile or semi-sessile species, some species with extremely low productivity, and some small endemics. The Atlantic bluefin tuna does not fit in any of these typologies of species.

***Restricted distribution***

No guidelines for restricted area of distribution are provided in the CITES Criteria, which indicate that thresholds should be taxon-specific (Conf Res 9.24 Rev CoP 14). FAO (2001) recommended that historical

extent of decline in area of distribution would be a better measure of extinction risk than absolute value of distributional area, but that if no other suitable information is available and absolute area of distribution has to be used for an exploited fish population, analyses should be on a case-by-case basis as no numeric guideline is universally applicable.

The Atlantic bluefin tuna is widely distributed in the North Atlantic and is not characterized by restricted distribution.

***Decline***

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 14), a decline to 15-20% of the historical baseline for a low productivity species and to 10-15% for a medium productivity species might justify consideration for Appendix I. While there seems to be supporting evidence that the Western stock could be considered of low productivity, the situation is less clear for the Eastern stock, for which the age at maturity characterizes a medium productivity species. Therefore a decline threshold of 10-20% of the historical baseline, corresponding to a low-medium productivity species, was considered below in the evaluation of bluefin population decline.

According to the evaluation undertaken by SCRS (2009) the probabilities that the current spawning biomass is below 10%, 15% and 20% of the maximum estimated spawning biomass are 8.8%, 30% and 54,2% respectively. According to the same study, if the estimated pre-exploitation population size is used as the baseline, the probabilities associated with the 10%, 15% and 20% decline thresholds vary from 30.2 – 99.6%, 92.6 - 100% and 99.6 -100%, respectively. On this basis, the Western stock of bluefin tuna meets the decline level criterion for listing a low-medium productivity species in Appendix I.

The evaluation of the status of the Eastern stock against the CITES decline criteria undertaken by SCRS (2009) concluded that "there is a 96% probability that SSB in 2009 is less than 15% of long term potential (i.e. the probability that $SSB_{2009}$ is less than 0.15 times $SSB_0$ is greater than 96%). The probability that $SSB_{2009}$ is less than 15% of the maximum SSB estimated since 1970 is about 21%".

The recent of rate of decline of the Eastern stock is also of concern. The 2008 assessment results indicate that the spawning stock biomass continues to decline while fishing mortality is increasing rapidly, especially for large bluefin which are targeted for farming. According to the stock projections conducted by SCRS (2009), even with the perfect implementation of ICCAT's then recommended TACs through 2019 there is more than 85% chance that spawning stock biomass in 2019 will be less than 15% of long term potential ($SSB_0$). The same study concluded that there is a 35% chance that the spawning stock biomass in 2019 will be less than 15% of the maximum spawning biomass estimated since 1970.

The key consideration for the Panel was the choice of the baseline biomass level to use in computing the current extent of depletion. If the maximum spawning biomasses ($B_{max}$) in the period assessed (which commenced in 1970) are taken to be the baselines against which these depletions are evaluated, then both the Eastern and Western populations are assessed to be above the 15% threshold. They are however sufficiently close to this threshold to meet the decline criterion for an Appendix II listing. Alternatively, if the estimated pre-exploitation spawning biomasses ($B_0$) are used for this baseline, both populations of Atlantic bluefin tuna are below this 15% threshold and meet the decline criterion for listing on Appendix I.

Some members of the Panel considered that $B_{max}$ was an adequate proxy for pre-exploitation spawning biomass $B_0$ as in their view the two were unlikely to differ substantially. They considered that the alternative of estimating $B_0$ in the manner adopted by the ICCAT SCRS was highly sensitive to certain key assumptions, such as for the relationship between spawning stock and recruitment which has proven to be problematic to estimate for bluefin tuna. Estimates of $B_0$ obtained by the SCRS for the Eastern population may be too high for various reasons. If the assessment is undertaken commencing in the early 1950s, it does not yield higher biomasses than the maximum obtained in the 1970+ assessment. As the annual catches prior to the 1950s are typically appreciably smaller than those that followed, the population was thus probably not greatly reduced by harvesting prior to the 1950s. Furthermore recruitment has shown systematic trends over recent decades, suggesting that $B_0$

also changes over time. Since recent recruitment has been above average levels, the values estimated for $B_0$ could be above the long-term average appropriate for a baseline.

However, the majority of members of the Panel considered that estimates of $B_0$ were preferable to use for the baseline because they took account of the reduction of the population by removals prior to the start of the assessment series, noting that the CITES Resolution Conf. 9.24 (Rev. CoP 14) states that data used to estimate or infer a baseline for extent of decline should extend as far back into the past as possible. Furthermore, for the Western population any net bias in the estimate of $B_0$ is likely to be less than for the Eastern. Catches off Brazil early in the fishery's history could well have belonged to the Western population and so should probably be taken into account in its assessment. Finally, the Western population likely has lower productivity than its eastern counterpart. Thus conclusions concerning this Western component of the population meeting the Appendix I decline criteria are more strongly founded.

There was consensus in the Panel that the evidence available supported the inclusion of Atlantic bluefin on Appendix II.

**Were trends due to fluctuations or management action?**

Long term fluctuations in bluefin catches in the Mediterranean have been associated with fluctuations in the environmental conditions. Analyzing long-term time series of bluefin tuna catches from traditional Mediterranean and Atlantic trap fisheries, Ravier and Fromentin (2001) showed that the Eastern Atlantic bluefin population displays fluctuations with a period of 100-120 years and also cyclic variations of about 20 years. The long-term fluctuations were strongly and negatively correlated to trends in temperature. Ravier and Fromentin (2004) concluded that the relationship between catches and temperature seemed to be best explained by changes in the migration patterns of bluefin tunas, and consequently changes in their availability to the fixed gears, imposed by modifications in oceanographic conditions of spawning areas. The role played by these natural fluctuations in the observed decline of the stock since the second half of the 20th century is unknown but probably minor compared to effect of biomass removals from fisheries. There seems to be wide recognition that management actions adopted by ICCAT have failed to maintain the Eastern stock at sustainable levels of exploitation.

**Risk factors and mitigating factors**

Several factors increase the risk to the population. Changes in the age structure of the population, with the decrease in abundance of older year classes, is expected to decrease the resilience of the stock to fluctuations in environmental conditions controlling recruitment. Bluefin displays strong schooling behavior during feeding and spawning which increases the catchability of stocks and consequently the risk of continued stock decline due to overfishing. The latter factor is applicable for the Eastern stock in particular, where most of the landings are currently made by purse seine operations.

The combination of high fishing mortality, low stock biomass and overcapacity of the fleet increased the risk of continued declines in the Eastern and Western stocks. According to SCRS (2008) the potential catch of the active fleet in the East Atlantic and Mediterranean (ca. 73 000 tonnes) was at least 3 times the level needed to fish at a level consistent with the Convention objective. Likewise, the estimated capacity of the tuna farms in the Mediterranean represented as much as twice the agreed TAC for 2008 (SCRS 2008).

Substantial illegal catches, above the recommended catch levels by ICCAT, increased fishing mortality above sustainable levels. Also fishing for bluefin tuna to supply capture-based farming activities in the Mediterranean have exacerbated the fishing pressure in recent years, particularly on older age classes.

The high value of the Atlantic bluefin meat in international markets, particularly in the Japanese sashimi market, constitutes another risk factor for supporting the maintenance of high fishing pressure on the stock. Bluefin products are easily and rapidly transported with current technology which facilitates their movement in trade.

Among factors mitigating risk, in 2009 there have been important improvements in ICCAT's Eastern stock management approach, with the TAC for 2010 being reduced to 13 500 t (the short-term sustainable yield at $F_{max}$ was estimated by the ICCAT SCRS to be 15 000 t), a commitment to tie future TACs to the SCRS advice, a scheme to reduce fleet capacity, and a rebuilding plan with the objective of reaching $B_{MSY}$ in 2023 with 60% probability (assuming perfect implementation). The 2009 report of the ICCAT SCRS also notes that the appreciable differences between reported and estimated catches noted in 2007 had declined considerably in 2008, which could reflect improved implementation of regulatory and control mechanisms in the Mediterranean.

The Western stock has been under formal rebuilding plans since 1998. This represents an important mitigation measure. However recent assessments indicate that the stock is not rebuilding as rapidly as was projected under the plan initially. In response, ICCAT adopted harvest plans in 2008 that included a higher probability of reaching the rebuilding target (which implies lower future yields).

**Trade considerations**

Catches of bluefin tuna supply both domestic and international markets, with the bulk of the catches exported to Japan where they fetch high prices. The main types of products in trade are belly meat, dressed fish, fillets, loins and gilled and gutted fish.

According to the proposal, the large Japanese market has been responsible for the growth of the tuna farming activities in the Mediterranean in recent years. Domestic markets in the EU involve mainly the principal fishing nations, including Spain, France and Italy. However, statistics of the volume traded domestically are likely to be underestimated (proposal). According to the Eurostat data on exports of Atlantic bluefin tuna from the Eastern population (data reported in the proposal), about 77% of the total processed bluefin tuna reported in 2007 were exported to countries outside the EU, while 49% of the live bluefin were traded internally in the EU.

In the Mediterranean the bulk of the catches are made by purse seiners and transferred as live fish to tuna fattening farms. This transfer of live tuna may also be considered international trade, since vessels are not necessarily from the same countries as those in which the farms are located. The level of illegal catches in trade is considered substantial. According to the information presented in the proposal, Japan reported to ICCAT the import of 32 356 tonnes of processed Atlantic bluefin tuna in 2007, when the legal quota for the same year was 29 500 tonnes. The estimated total catches (including from IUU sources) for the same year was about 61 000 tonnes (SCRS 2008).

No information is reported in the proposal about the importance of international trade for the Western stock. Information available to the Panel suggests that some varying level of domestic consumption in Canada and USA exists, but the bulk of the revenues are derived from the catches traded internationally.

**Implementation Issues**

***Introduction from the sea***

Under the CITES Convention, specimens captured in international waters (outside the jurisdiction of any State) and brought into the jurisdiction of a State, are considered to be undergoing a process analogous to international trade.

Since under an Appendix I listing, international trade is only permitted in exceptional circumstances, introduction from the sea is not expected to be a major problem for Atlantic bluefin tuna if an Appendix I listing is accepted. No commercial harvesting of Atlantic bluefin on the high seas, either for direct use or for supplying tuna farms, would be allowed. Any Atlantic bluefin introduced from the sea for non-commercial purposes would require a certificate from the State of introduction that the introduction would not be detrimental to the survival of the species.

***Non-detriment findings***

An Appendix I listing places strict restrictions on international trade. Both an export and an import permit are required for any shipment and a number of conditions must be met before any shipment is made. The principal condition for permits is that shipments not be for primarily commercial purposes, implying that shipments would only be made rarely, and for scientific or display purposes. Once this condition is met, a non-detriment finding and a finding that the specimen was legally-obtained are required as part of the permitting process.

The basis for non-detriment findings (NDF) for the Atlantic bluefin tuna should be straightforward considering that the species is regularly assessed by the SCRS of ICCAT. The assessment conducted by SCRS leads to recommendations on the optimal levels catch levels to achieve management objectives and target reference points, which could be easily translated into non-detriment findings.

***Findings that specimens were legally obtained***

The management of the Atlantic bluefin tuna is under the competence of ICCAT. ICCAT adopts at its annual meeting specific legislation with management measures that are binding for its 48 contracting Parties. All bluefin tuna fishing and farming nations are contracting Parties of ICCAT and are thus obliged to comply with its legislation. Management measures elaborated by ICCAT are also adopted by the GFCM (General Fisheries Commission for the Mediterranean) and by member countries of the European Union. Therefore the basis for establishing if exports of bluefin tuna are from legal harvesting is well established. Compliance with the rules has been however a problem, particularly in the east Atlantic and Mediterranean where the levels of unreported catches have been high.

***Identification of products in trade and "look-alike" issues***

The identification of processed Atlantic bluefin tuna (e.g. loins and belly meat) and differentiation among other bluefin tuna species (Pacific and Southern bluefin) and some tropical tunas (Yellowfin and Bigeye) may pose difficulties to customs officers. Morphologically the 3 bluefin species are very similar and once processed it may be very difficult to distinguish among these species or Yellowfin and Bigeye. The use of genetic techniques is a solution for the accurate identification of specimens or products in trade. However the cost of such techniques can be an issue for some countries.

The Convention allows for listing species for "look-alike" reasons when enforcement officers who encounter specimens of CITES-listed species are unable to distinguish between them and closely-related, non-listed species. If the trade in by-products under the guise of non-listed related species was undermining the conservation effectiveness of a bluefin listing, and tools such as identification guides and DNA tests were not adequate to bring the illegal trade under control, there could be a basis for listing other tuna species on the grounds that their products resemble those of Atlantic bluefin in trade.

***Monitoring future stock status***

The proponent argued that the listing proposal included provision for downlisting to Appendix II, should stock status improve. It should be noted that implementation of a listing on Appendix I would impact many of the indices and the associated catch at size/age from the various bluefin fisheries, with unknown impacts on ability to monitor stock trends.

**Likely effectiveness of a CITES Appendix I listing for species status**

The impact of a CITES Appendix I listing on species status depends on several factors including the extent to which trade (as opposed to exploitation for national utilization) is driving exploitation; the relative importance of directed harvest for trade and of other sources of mortality including incidental catch; and the actual effects of the listing.

An Appendix I listing would essentially eliminate legal commercial international trade in Atlantic bluefin products. Currently a large proportion of the catches of the Eastern stock supplies, either directly or through tuna

farming activities, the Japanese market. It is expected that without the international demand for bluefin products, harvesting would be conducted only to supply domestic markets in the EU. With a reduced demand it could be expected that harvest levels are more likely to be commensurate with or lower than the recommended TACs for allowing stock recovery.

It is important to note, however, that a substantial part of the catches in the East Atlantic and Mediterranean are made in international waters, and these catches when introduced from the sea would also be considered international trade and therefore would not be allowed under an Appendix I listing. As a result it is very likely that legal harvesting from the Eastern stock of Atlantic bluefin tuna will be substantially reduced, thus benefiting the conservation of species.

It is unclear whether the listing would benefit the Western stock. There is no trade information related to the Western population of Atlantic bluefin tuna in the proposal, but most if not all of the product harvested in Canada would be exported. US catches may supply mainly the North American domestic market. The Western stock is also already under a rebuilding plan with reduced TACs. With the listing, the proportion of catches taken in the high seas would be eliminated, benefiting the rebuilding of the stock. Considering the hypothesis that Eastern and Western stocks are mixing, the reduced pressure on the Eastern stock would also benefit the Western stock and *vice versa*.

Illegal fishing constitutes one important threat to the effectiveness of the listing. As noted above, the recent level of illegal catches in trade was substantial (the estimated volume traded illegally in 2007 being higher than the TACs for the Eastern population of Atlantic bluefin in the same year). It is expected that a CITES listing would add some tools to combat illegal trade. Enforcement by customs would be facilitated because any specimen or product in trade would probably be illegal. Identification of products in trade could be assisted by DNA tests.

Mortality caused by incidental catch in other fisheries does not seem to be a concern for the Eastern stock but can be important for the Western stock because it is taken as bycatch in other Gulf of Mexico fisheries.

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## TABLES AND FIGURES

Table 1. Information for assessing productivity level of the Atlantic bluefin tuna. Unless otherwise indicated, information is from the proposal. Productivity levels refer to guidelines in FAO (2001).

| Parameter | Information | Productivity | Source |
|---|---|---|---|
| Intrinsic rate of increase | 0.03 – 0.06 | Low | Proposal; McAllister and Carruthers (2007) |
| Natural mortality | Eastern stock: 0.18 (mean of all age classes), 0.16 (mean of sexually mature age classes).<br>Western stock: 0.14 (all ages) | Low<br><br><br>Low | Proposal; SCRS (2008)<br>Proposal, SCRS (2008) |
| Age at maturity | Eastern stock: 4 – 6 years<br><br>Western stock: 8 – 12 years | Medium<br><br>Low | Proposal; Fromentin (2006), SCRS (2008) |
| Maximum age | 27 years<br><br>Eastern stock: > 20 years<br>Western stock: 32 years | Low<br><br>Low?<br>Low | Proposal; Nichy and Berry (1975)<br>SCRS (2008)<br>SCRS ( 2008) |
| K | 0.003 – 0.120<br><br>Eastern stock: 0.079<br>Western stock: 0.093 | Low<br><br>Low<br>Low | Proposal; Restrepo et al. (2007)<br>SCRS (2008)<br>SCRS (2008) |
| Generation time | 11 – 17 years (6 to 9 generations per 100 years) | Low | Proposal |

Table 2. Calculated probabilities that the spawning stock biomass of the Western stock is below decline thresholds (A) and is projected to be below decline thresholds in 10 years time (B). Source (SCRS, 2009).

A)

| Recruitment scenario | Probability that SSB2009 is below historical decline threshold | | |
|---|---|---|---|
| | *<10% SSBmax* | *<15% SSBmax* | *<20% SSBmax* |
| Low | 0.088 | 0.298 | 0.542 |
| High | 0.088 | 0.300 | 0.542 |
| | *<10% SSB0* | *<15% SSB0* | *<20% SSB0* |
| Low | 0.302 | 0.926 | 0.996 |
| High | 0.996 | 1.000 | 1.000 |

B)

| TAC | Recruitment scenario | Probability that SSB2019 will be below historical decline threshold | | |
|---|---|---|---|---|
| Rec [08-04] | | *<10% SSBmax* | *<15% SSBmax* | *<20% SSBmax* |
| | Low | 0.004 | 0.016 | 0.056 |
| | High | 0.012 | 0.038 | 0.090 |
| 0 t | | | | |
| | Low | 0.000 | 0.000 | 0.000 |
| | High | 0.000 | 0.000 | 0.000 |
| | | | | |
| Rec [08-04] | | *<10% SSB0* | *<15% SSB0* | *<20% SSB0* |
| | Low | 0.006 | 0.036 | 0.152 |
| | High | 0.544 | 0.848 | 0.952 |
| 0 t | | | | |
| | Low | 0.000 | 0.000 | 0.000 |
| | High | 0.096 | 0.298 | 0.626 |

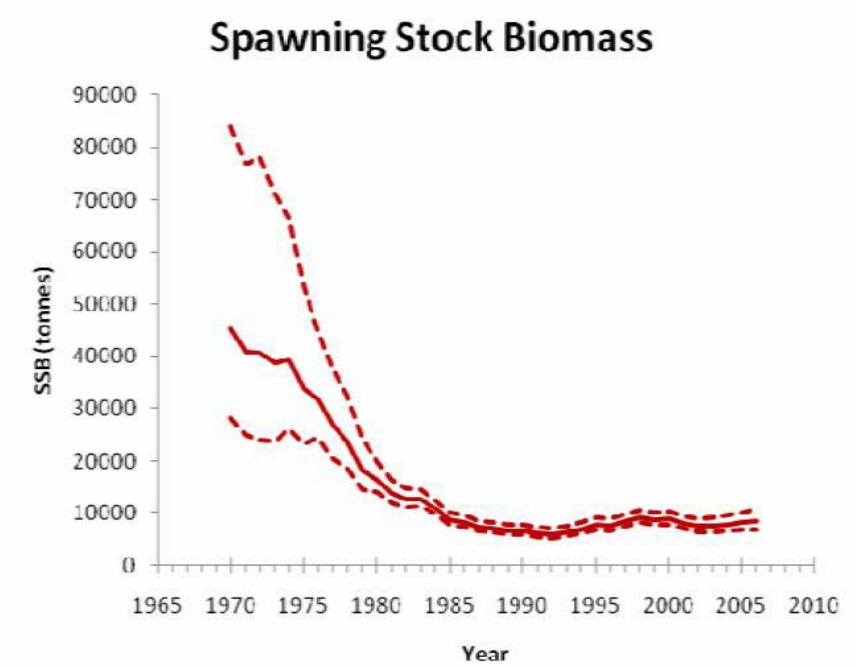


Figure 1. Annual median estimates of spawning stock biomass of the Western stock. Dashed lines indicate the 80% confidence interval. Source: SCRS, 2008.

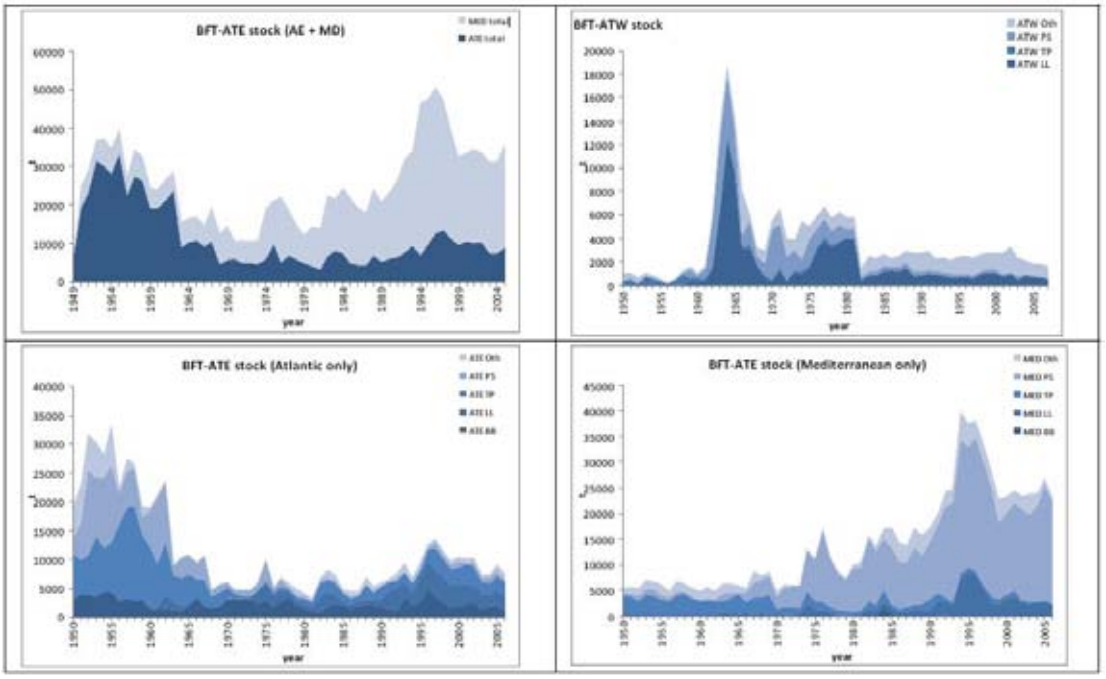


Figure 2. Bluefin reported annual catches by area and gear. BFT-ATE: Eastern stock; BFT-ATW: Western stock. TP: tuna trap; PS: purse seine; LL: longline; BB: bait boat Source : SCRS 2008.

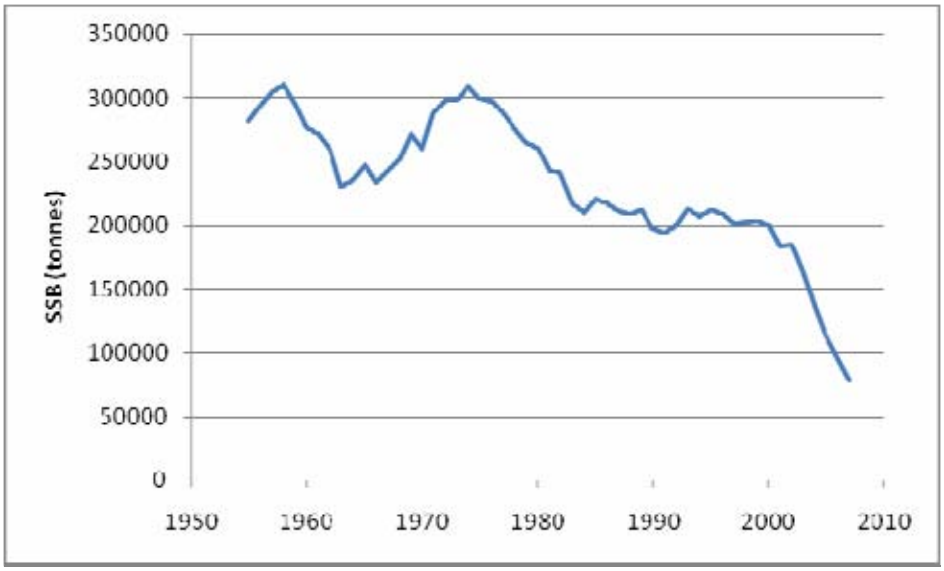


Figure 3. Estimated spawning stock biomass of the Eastern stock (results from run 14; SCRS 2008).

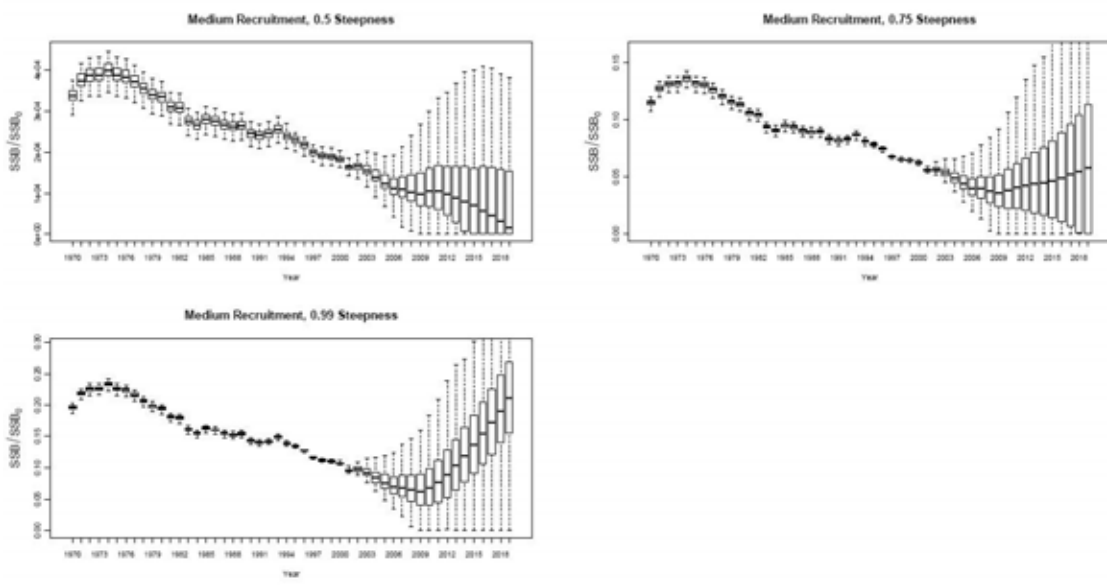


Figure 4. Trends in spawning biomass for the Eastern stock relative to the baseline biomass estimated with different assumptions (note that the Y-axis scale differs between the various panels). The baseline is $SSB_0$ estimated with assumed steepness values of 0.5, 0.75 and 0.99, and using all of the SSB-R observations. The boxes contain the central 50% of the observations and the whiskers 95%. Source: SCRS 2009.

## APPENDIX J

### FAO Expert Advisory Panel assessment report: family Coralliidae

**CoP15 Proposal 21**

**SPECIES**: All species in the family Coralliidae.

**PROPOSAL**: Inclusion of all species in the family Coralliidae in Appendix II of CITES in accordance with Article II paragraph 2(a) and 2(b).

**Basis for proposal**: According to the proposal seven species of Coralliidae (*C. rubrum, C. secundum, C. lauuense (C. regale), P. japonicum, C. elatius, C. konojoi,* and *Corallium* sp.nov*)* qualify for listing in Appendix II in accordance with Article II, paragraph 2 (a) of the Convention. These species are intensively harvested to supply international demand for jewelery and other products and have life-history characteristics that make them vulnerable to over-exploitation. Therefore regulation in trade in these species is required to "ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences" (Annex 2a, Criterion B). The other 24 species of Coralliidae qualify for listing in Appendix II in accordance with Article II, paragraph 2 (b) of the Convention, because they resemble the seven species proposed to be listed under Article II paragraph 2(a). Their listing is therefore justified to avoid implementation problems caused by the difficult identification of specimens or products of the listed species by enforcement officers.

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**ASSESSMENT SUMMARY**

The FAO Expert Panel concluded that the available evidence does not support the proposal to include all species in the family Coralliidae (*Corallium* spp. and *Paracorallium* spp.) in CITES Appendix II.

The Panel considered that populations representing a large proportion of the abundance of the seven species proposed for listing under Article II paragraph 2(a) (*Corallium rubrum, C. japonicum, C. secondum, C. elatius, C. konojoi, Corallium* sp. nov., *C. lauuense* (*C. regale*)) globally did not meet the decline criteria for Appendix II.

The Panel considers *Corallium rubrum* to be a low productivity species. Little is known about the life-history characteristics of the other 6 species under consideration but it is highly likely that they are also low productivity species.

The proposal depends heavily on catch statistics to support inclusion of the seven species for listing under the Appendix II decline criterion. The Panel considered that these data were not very reliable, as landings are influenced by economics (such as price of coral, price of fish, price of fuel), management practices (such as size limits, area closures), difference in spatial coverage, mixing of live and dead coral weights (Japan targets dead coral in some fisheries), differences in collection methods (SCUBA, submersibles, drags), and other factors. Nevertheless, these data can be useful to observe the extreme "boom and bust" cycles characteristic of this fishery when new beds are discovered.

The Panel observed that some fished areas in the Mediterranean demonstrate a historical extent of decline in a few metrics (trends in number of polyps per colony and population fecundity) commensurate with the Annex 5 guidelines on extent of decline for low productivity species. Decline to a lesser extent was found in the catches, maximum size of colonies, mean height and proportion of older colonies per stock. There has been a clear over-exploitation of shallow water beds which has led to a shift in harvesting to deeper water colonies. In some areas in the Mediterranean (for example the Costa Brava) only 9% of the colonies are sexually mature. However, in other areas (for example Sardinia) management measures have been implemented and recruitment appears strong.

In the Pacific including Hawaii, Japan, Taiwan Province of China, and in international waters there is no evidence to show extents of decline that meet the criteria for inclusion in Appendix II. In Hawaii, harvest of the family Coralliidae is under a management scheme and there has been an increase in population density since 1971. In Japan only three out of twenty-eight known areas with coral beds have been assigned for harvest. Little quantitative analysis has occurred of population dynamics in Japan or Taiwan Province of China. In the Philippines all areas with coral beds are closed to fishing (at least 11) and have never been exploited. Pacific seamounts have been overexploited, with catches exhibiting classic boom and bust dynamics. No fisheries occur on international sea mounts at present. The Panel concluded that the recent fisheries (last 20 years) in the Pacific appear to be small-scale and managed. The Panel noted that of the seven species proposed for listing under the Appendix II decline criterion, no data are presented for *C. lauuense* (*C. regale*) to support its listing. *C. lauuense* is described by Baco and Hank (2005) as one of the more common deep-sea octocorals on the seamounts and islands of the Hawaiian Archipelago.

The data from all areas indicate that uncontrolled fisheries have depleted coral beds in the past. Some populations rely on refugia in inaccessible areas that might become accessible to the fisheries through new technology (ROVs, mixed gas diving etc). These exploited long-lived corals require effective local management to prevent unsustainable harvesting and this is not occurring across their full geographic distribution. Recovery of these low productivity species may take several decades. There is a risk that new fishing activities could be initiated in international waters leading to over-exploitation of coral on sea mounts.

The Panel considered the difficulty of identifying products in trade and the substantial administrative burden of issuing CITES trade documents and of recording for the large number of individual specimens in trade as key issues affecting the effective implementation of CITES regulations for these species. It recognises efforts by the proposing parties to address these issues.

The Panel considered that, despite a lack of reliable statistics, it seems probable that a substantial fraction of the production of *Corallium* spp. and *Paracorallium* spp. is in international trade and that international trade was an important driver of the harvest of these species.

In the 2007 deliberations of the Panel, the Panel concluded that the genus *Coralllium* did not meet the biological decline criteria for listing in CITES Appendix II. The additional information available to the current Panel included a consideration about decline in number of polyps and a shift in depths of harvesting in the Mediterranean. The current proposal also increased the requested listing to the family Coralliidae. The additional information and scope of the proposal did not lead the Panel to change its previous conclusion related to the genus *Corallium.*

## PANEL COMMENTS

### Biological considerations

#### *Population assessed*

The proposal is to include all species of the family Coralliidae in Appendix II of CITES, including 24 species of the genus *Corallium* and 7 species of the genus *Paracorallium*. The family Coralliidae (Octocorallia) has a broad distribution extending throughout the world in tropical, subtropical and temperate oceans, including the Mediterranean Sea and the Atlantic, Indian and Pacific Oceans (Fig. 1). They are found from shallow subtidal waters to depths of 1500 m.

*Corallium rubrum* is endemic to the Mediterranean Sea (primarily central and western basins) with smaller populations in the eastern Atlantic off the coast of Morocco. The other six species proposed for listing in accordance with Article II paragraph 2(a) are found in the Pacific. *P. japonicum, C. elatius,* and *C. konojoi* are found in Japan, Taiwan Province of China, Philippines, Vietnam, Indonesia, Palau and Vanuatu and are the most commercially valuable of the Pacific species. *C. secundum* and *Corallium* sp. nov. are found in Hawaii and on Pacific seamounts in international waters (e.g., Emperor). *C. lauuense* has so far only been identified in Hawaii.

All are or have been commercially exploited with the possible exception of *C. lauuense*. This species does not appear in the catch data but does appear in trade documents.

***Productivity level***

The life-history characteristics of *C. rubrum* are very well studied and associated with low productivity. It has a long life-expectancy, slow growth rate, limited larval dispersal, lacks asexual reproduction through fragmentation (unlike most other corals), prolonged oogenesis (~12 months) and a low number of oocytes per polyps (2-3). Despite the relatively early age of first reproduction (year 2-10) (Torrents et al. 2005), only one third of the population reproduce per year. Little is known about the life-history characteristics of the other six species under consideration. *C. secundum* is known to reproduce at age 12 to 13 years and is considered to be a broadcast spawner (Grigg 1993).

Available life history information suggests that the species in the family would fit into the low productivity category (Tables 1, 2). This is different from the considerations of FAO (2007) who considered it low-medium. The Panel considered the extremely low production of eggs per polyp in *C. rubrum* to be important. The interaction between size and fecundity is particularly important for smaller, younger colonies of this species. There is little information on the other species but we do know that at least one of them has a later age at first reproduction.

**Population status and trends**

When considering the CITES criteria, the Panel clarified that the coral colony is equivalent to an individual, that colony size is an important indicator of reproductive potential, and that colonies are found in coral beds which themselves are found in larger "areas". Coral growth is three dimensional and the reproductive unit is the polyp; these are distributed along the branches (Fig. 2). Therefore colony height is a linear measure of a three-dimensional metric. Reproductive potential therefore increases exponentially with colony size.

***Small population size***

The total number of colonies of all species in the family Coralliidae is unknown. The number of colonies in three of the largest Coralliidae beds off Hawaii (USA) were 120 000 (Makapu'u), 7 000 (Keahole Point) and 2 500 (Cross Seamount) (Grigg 2002) for a total of 129 500 colonies. The proposal reports estimates of the density of colonies in different parts of the species distribution, but the actual number of colonies is not reported.

***Restricted distribution***

No estimates of distribution area were available in the proposal. The Family Coralliidae (Octocorallia) has a broad distribution extending throughout the world in tropical, subtropical and temperate oceans, including the Mediterranean Sea and the Atlantic, Indian and Pacific Oceans (Fig. 1). The Panel determined that in Japan there are 28 known areas with coral beds and in the Philippines at least 11 areas with coral beds have been documented. In Hawaii Coralliidae are distributed throughout the Hawaiian archipelago. In the Mediterranean, *C. rubrum* is more common in the central and western basins.

***Decline***

Although density estimates are provided for some areas, no time trends in densities (which might be useful as indices of abundance) are provided in the proposal to evaluate decline in population abundance.

Surveys conducted in the Makapu'u Bed off Oahu, Hawaii (the largest known population of *Corallium* in the U.S. Pacific (Bruckner and Roberts 2009)), estimated that the density of *C. secundum* increased from 0.02 colonies $m^{-2}$ in 1971 to 0.022 colonies $m^{-2}$ in 1983/1985 to 0.3 colonies $m^{-2}$ in 2001 (Grigg 2002). The recovery of the population from harvesting in the 1970s was also demonstrated by the increase in frequency of older year classes in 2001 compared to 1971, 1983 and 1985 (Fig. 3).

The proposal depends heavily on catch statistics as a proxy for decline to support inclusion of the 7 species for listing under the decline criterion. The Panel considered that these data were not very reliable as landings are influenced by economics (for example price of coral, price of fish, price of fuel), management practices (for example size limits, area closures), difference in spatial coverage, mixing of live and dead coral weights (Japan targets dead coral in some fisheries), differences in collection methods (SCUBA, submersibles, drags), and other factors. Nevertheless, these data can be useful to observe the extreme "boom and bust" cycles characteristic of this fishery when new beds are discovered.

In the Pacific, these pooled catch data incorporate the dynamics of two different kinds of harvesting. One is the exploitation of newly discovered seamounts, and a second, regional fisheries that are moving towards management and thus restricting catch and avoiding over-harvesting. Grigg (1984) highlighted the interaction of price and catch of *Corallium* in the Pacific. As stated above these factors will influence any detailed interpretation of Pacific catch data and figures.

Overall, pooled regional catch statistics are the only information in the proposal available to describe historical declines in the different parts of the Coralliidae range (Table 3). Total harvesting of *Corallium* in the Emperor Seamounts, western Pacific, by Japan and Taiwan Province of China declined to small fractions of their maximum values between 1979-81 and 1989-91 – 4% and 1% respectively (Table 2 in proposal). Total reported landings of Coralliidae in the Pacific declined to about 3% of the historical peak of 350 tonnes between 1984-86 and 2004-07 (Fig. 4).

In the Mediterranean the reported landings of *C. rubrum* have similar issues surrounding the data as are detailed for the Pacific (for example, new areas were exploited in Algeria and Morocco within the time series), with the addition of the phasing out of dredging and the shift of SCUBA harvesting to deeper water being major factors.

*C. rubrum* declined to about 40% of the historical maximum of 88 tonnes between 1978-80 and 2004-07 (Fig. 4). As noted by Santangelo et al. (2009) catch figures from the Mediterranean are probably underestimated because they are reported by coral wholesalers, while illegal fishing and trade are known to be common.

Trends in catches were also used as an indicator of decline in population abundance when the listing of the genus *Corallium* in Appendix II was proposed to CITES CoP14. In evaluating that proposal for listing *Corallium* in Appendix II, FAO (2007) considered that catch data alone are unlikely to represent abundance trends precisely since changes in fishing intensity will change catch values. The same conclusion is valid for the current proposal.

**Other indices**

Other indices examined by the Panel have only been estimated for *C. rubrum* in the western Mediterranean. The proposal states that colony size in a population is a more important indicator of population status for these colonial animals than abundance. The Panel concluded, however, that colony size should be considered in addition to abundance. This is justified, for instance, by the exponential increase in larval production with the increase in colony size and complexity (more branches).

Some local estimates of changes in the size of colonies are reported in the proposal. In Spain the mean height of colonies exploited above 60 m depth decreased from 61.8 mm to 27 mm from 1986 to 2003 (Table 3) (Tsounis et al. 2006). This would represent a decrease of at least 56% in the reproductive potential of colonies (Bruckner and Roberts 2009 indicate a loss of 80-90% of reproductive modules in a colony with a decrease in height from 20-50 cm to 5 cm). In France colony height decreased to 10% of the maximum height in historical records (Bruckner 2009 cited in the proposal). For the Pacific, Grigg (2002) demonstrated an increase in the frequency of older age classes in the population of *C. secundum* off Hawaii, which also reflects an increase in colony size, between 1971 and 2001 (Fig. 3).

Bruckner and Roberts (2009) reported results of drop camera surveys conducted in areas formerly targeted by coral drag fisheries off Koko Seamount, in international waters of the North Pacific. Although no data from

these surveys are provided, it is stated that "out of 44 drop camera surveys conducted during these surveys, *Corallium* was only identified in one area". The authors noted that this area is now proposed as a closed area for trawl fisheries.

Table 3 shows other indices that were calculated with new information available to the Panel. The Panel observed that some fished areas in the Mediterranean demonstrate an historical extent of decline in a few metrics (trends in number of polyps per colony and population fecundity) commensurate with the Resolution Conf 9.24 (Rev. CoP 14) Annex 5 decline criterion for low productivity species. Decline to a lesser extent was found in the catches, maximal size of colonies, mean height and proportion of older colonies per stock.

**Assessment relative to quantitative criteria**

***Small population***

In relation to absolute population size, there are estimates of density from different parts of the Coralliidae distribution, as provided in the proposal, but no estimates of total population size are available. The family is widely distributed and probably occurs in relatively large numbers worldwide.

***Restricted distribution***

The family is distributed widely across tropical, sub-tropical and temperate regions. Notwithstanding some local extirpations, there is no reason to suspect a decline in area of distribution has taken place and distribution is relatively wide in large areas of the ocean. Certain of the seven species are limited geographically, such as *C. rubrum* which is endemic to the Mediterranean.

***Decline***

For an Appendix II listing, assessment of whether the species is near Appendix I levels or likely to become so in the foreseeable future is required. For a low productivity species, a decline to less than 15–20% of the historical baseline might justify consideration for Appendix I. For a medium productivity species decline to 10–15% would be of concern. To be near the Appendix I threshold, values 5–10% above these (i.e. 15–30% of the historical baseline) either now or in the foreseeable future might justify consideration for Appendix II.

With the exception of the time series of *C. secundum* densities estimated for Hawaii (Grigg 2002), there are no abundance data available to infer the trend of Coralliidae populations in other parts of their range. The increase in the frequency of older age classes in the Hawaii population also supports the finding that the population is recovering from harvesting during the 1970s (Grigg 2002).

Overall, the only data used in the proposal to infer declines in Coralliidae populations are changes in pooled catches over wide areas. As noted before, catch information is not an adequate measure of population abundance because it responds also to changes in fishing intensity. In the Mediterranean the decline as indicated by catches has been to about 40 percent which is not within the Appendix II levels. However, the decreases of the number of polyps per colony in *C. rubrum* in the western Mediterranean fit the Appendix II decline criterion. Reported declines to 1 – 4% of the maximum catches in the Pacific are unlikely to represent declines in population abundance.

In terms of declines in colony size, the only trend data reported in the proposal are from local studies in the Mediterranean. It is difficult to judge if these declines are representative of the whole population in the Mediterranean or of global populations. It seems for instance that colonies in deeper waters are larger due to less intensive harvesting (Rossi et al. 2008).

In summary available information does not demonstrate global levels of decline in Coralliidae populations consistent with listing under the CITES decline criterion.

**Were trends due to fluctuations or management action?**

There is no evidence available that observed negative trends in population abundance were due to environmental fluctuations. Mass mortality events of *C. rubrum* observed since the late 1990s have been linked to elevated temperature anomalies (Garrabou et al. 2001; 2003). However these events cannot explain the observed longer term declines in catches, which are consistent with harvesting.

**Risk and mitigating factors**

Life history (long lifetime, low natural mortality rate) and ecological characteristics (isolated subpopulations, limited dispersal potential) of Coralliidae species contribute to risk of severe declines. Small colony size and local depletions associated with intensive harvesting could add to these risks. Overfished populations would be more susceptible to natural impacts associated with climate change, such as increased temperatures, which have been linked to population die-offs, and ocean acidification that is expected to affect calcification of skeletons and colony growth.

The Panel considers that the available information on the life history and population genetic structure of *Corallium* species is highly relevant while assessing the proposal.
It is well established that in the Mediterranean Sea *C. rubrum* is a brooder which releases planulae to the water (Vighi 1972; Weinberg 1979), whereas the other species (*C. secundum, C. lauuense*) of the family studied so far are broadcaster spawners, that is the gametes are externally fertilized (Grigg 1993, Baco & Shank 2005). Early genetic studies have shown that *C. rubrum* planulae exhibit limited dispersal that promotes population differentiation (Abbiati et al. 1993). Recent microsatellite studies have provided evidence for significant heterozygote deficiencies in *C. rubrum* and chaotic genetic structuring at spatial scales of 1 m and thus occurrence of genetically distinct pools of colonies at meter distances (Costantini & Abbiati 2006). Further studies that have quantified levels of genetic divergence among coastal populations and estimated numbers of migrants among populations suggested that the planulae of *C. rubrum* have short-range dispersal. Geographic distances greater than 100 km can be considered as the threshold for genetic divergence between populations.

For the broadcast spawner *C. lauuense* in Hawaii heterozygote deficiency was noted in every studied population at least within one locus thus indicating that the population is suffering from inbreeding depression (Baco & Shank 2005).

Destructive fishing methods, such as dredges and trawls are still in use in Japan and Taiwan Province of China. Poor fishing practices, such as the scraping of basal plates, occur in the Mediterranean, and prevent the regeneration of colonies, thus contributing to the risk of population decline (FAO 2007).

The high value of products from some Coralliidae species is also a factor increasing risk for the species. IUU harvesting seems to be an issue of concern in the Mediterranean (proposal). Other secondary risk factors include pollution, sedimentation, recreational diving and incidental takes associated with bottom fishing gear (longline and trawl).

Different management measures have been put in place in different parts of the species range. If effectively implemented, these measures can mitigate risks to localized populations. In the USA, a Precious Corals Fisheries Management Plan, in place since 1983, sets the norms for the exploitation of Coralliidae in Hawaii and other USA territories in the western Pacific. In the Philippines all coral harvesting is prohibited. In Japan and in Taiwan Province of China harvesting is regulated by licensing, harvest zones, maximum harvest days per year and maximum harvest. Fishing gear restrictions are in effect in the EU and in Japan. Marine protected areas and depth and other refugia exist in the Mediterranean, around the northwestern Hawaiian Islands, Japan and Taiwan Province of China. Other measures (e.g. minimum size limits, licenses and fishing seasons, rotational closed areas) are also adopted in some countries. However, in large parts of the range, particularly in international waters in the Pacific, this species group is essentially unmanaged.

Since 2008, China has listed four species of Coralliidae on Appendix III of CITES (*P. japonicum*, *C. elatius*, *C. konojoi*, and *C. secundum* (which does not occur in China)). Although the listing is too recent to evaluate its effectiveness, the main intention of an Appendix III listing is to curtail the illegal trade of specimens and products. This is achieved by means of export permits issued by the country of origin certifying that the species in trade were legally obtained.

The species of Coralliidae in international waters should be considered by the appropriate regional fishery management organizations in their response to U.N. General Assembly Resolution 95 by 2012. This non-binding resolution that prohibits destructive fishing practices that have adverse impacts on vulnerable marine ecosystems is expected to benefit the protection of Coralliidae species in international waters against, for instance, bottom trawling (proposal).

**Trade considerations**

The family Coralliidae includes species highly valued for jewelry and art objects. The most valuable species, making up the bulk of landings, are *C. rubrum*, *C. secundum*, *P. japonicum*, *C. elatius*, *C. konojoi* and *Corallium* sp. nov. (Cairns 2007; FAO 2007).

Products in trade include whole dried colonies, branches and fragments, beads and polished stones, manufactured jewelry, and powder (pills, granules, ointment and liquid) (proposal; FAO, 2007). There are no customs codes specific to Coralliidae species under the Harmonized System; a single code applies to all unworked coral and shell (Green and Shirley 1999).

Although international trade is recognized as a significant factor in driving fisheries for precious corals (FAO 2007), relatively little information is provided in the proposal. All quantitative information deals with imports to the USA.

According to the proposal the main centers for processing Coralliidae includes Italy, India, China, Japan, and the United States. The Italian industry imports around 70% of its raw Coralliidae material from Pacific sources, particularly Japan and Taiwan Province of China (FAO 2007). Japan imports from Taiwan Province of China, France, Italy, Spain and Tunisia. The USA is the main consumer of all precious corals. According to the information presented in the proposal, between 2001 to 2008 the USA imported Coralliidae specimens and products from 55 countries, mostly from China, Taiwan Province of China and Italy. About 90% of all precious corals produced by Italy and China are exported to the USA (proposal). In 2008 the USA imported 22 tonnes of unprocessed *C. rubrum* (Figure 5). This represents more than half of the total reported catches of *C. rubrum* in the Mediterranean from 2004-07 (37 tonnes) (FAO data). In the last few years China has taken an increasing amount of Coralliidae production.

FAO (2007) noted that re-export may be a significant factor for this species given the widely dispersed nature of the trade. For instance it is mentioned that 70% of trade from Italy is re-exported. Considering that existing international trade figures do not account for re-export, there could potentially be some double counting in existing trade statistics (FAO 2007).

**Implementation issues**

***Introduction from the sea***

Species in the family Coralliidae are harvested in waters both within State jurisdiction and outside the jurisdiction of any State. Harvest in the Mediterranean may be primarily within national jurisdiction, since continental shelves are narrow in this area. In the western Pacific, harvesting in areas between Japan and the Philippines and in waters under US jurisdiction from the Hawaiian Islands northwest along the Emperor Seamount chain would be within national jurisdiction. Harvesting in international waters has occurred around the Emperor Seamounts and near Midway Island, apparently primarily by Japan and Taiwan Province of China

(proposal). According to the proposal, the two largest peaks in Coralliidae landings from the Pacific (1960s and 1980s) were from international waters.

Should the family Coralliidae be listed on CITES Appendix II, certificates for introduction from the sea (supported by non-detriment findings) would be necessary for specimens harvested in international waters.

**Basis for findings: legally-obtained, not detrimental**

***Non-detriment findings***

Non-detriment findings are the responsibility of the exporting state and must show that exports are not detrimental to survival of the species, that is, that they are consistent with sustainable harvesting. Development of an NDF requires appropriate scientific capacity, biological information on the species, and an approach to demonstrating that exports are based on sustainable harvest.

If the species of Coralliidae were listed on CITES Appendix II, a finding that export and introduction from the sea are not detrimental to species status would be required to support both export permits and certificates of introduction from the sea. The making of NDFs for exports of species harvested in international waters would require some form of international co-ordination, including mechanisms for assessment and management which currently do not exist.

***Findings that specimens were legally obtained***

In countries of the Mediterranean and in waters under national jurisdiction in the Pacific, specimens harvested consistent with management measures in place could be certified as legally obtained. In international waters and in national jurisdictions where no restrictions on harvesting are in place, there would also be a basis for certifying that specimens were legally obtained but this would be of little value in terms of ensuring sustainable use. In all cases some form of demonstration of the place of origin of the harvested coral would be necessary to support the finding.

However, as noted by FAO (2007) the high prices of Coralliidae products might encourage illegal harvest and trade. Illegal harvesting has been a problem in the past and continues in some areas (proposal). Certifying harvest as originating from international waters when it had been illegally harvested within a national jurisdiction would appear to be a potential problem, especially in the western Pacific (FAO 2007). In addition, because some of the products in trade may be highly processed (for example, worked into beads or based on specimens ground into powder), it is possible that legally and illegally obtained specimens are included in the same product. Detecting illegally obtained specimens at the time of shipment of such products would be difficult (FAO 2007).

**Identification of products in trade and "look-alike" issues**

The conclusions reached by FAO (2007) with respect to *Corallium* are also relevant for the current Coralliidae proposal. "Whole dried specimens of *Corallium* can be identified relatively easily to the genus level by specialists but taxonomic characteristics necessary for identification of *Corallium* are lost when the coral is processed into jewellery or when coral fragments are ground into powder for powder-based products. Moreover given the range in color of *Corallium* spp. and the appearance on the market of other species dyed to resemble *Corallium* … identification by nonspecialists at customs posts might be a problem". "In addition, specimens in jewellery may include coral from more than one species and from various origins, as well as pre-convention corals. This would seriously complicate the issuance of CITES trade documents and trade recording".

The Panel considered that identification to species level of raw coral by specialists is possible.

Recognizing such difficulties, it is mentioned in the proposal that proponents will submit a document to CoP 15 requesting Parties to amend Resolution Conf. 12.3 (Rev. CoP14) to allow worked specimens of Coralliidae to be identified on CITES permits and certificates at the genus or family level.

**Likely effectiveness of a CITES Appendix II listing for species status**

The panel reiterated the view of the FAO (2007) assessment. The Panel does not recommend a CITES Appendix II listing for Coralliidae spp. Nevetheless, since international trade is a driver of their harvesting, if such a listing resulted in a tightening of their management, it could lead to an improvement in their status. However, this improved status would be bought at the cost of a considerable administrative overhead and Government efforts would be better employed in enacting and enforcing appropriate local management regimes.

The Panel cautions that if Coralliidae were included in Appendix II, aspects of the implementation would be problematic, particularly the identification at the species level of processed products and providing a suitable protocol for pre-convention specimens. The Panel noted that a very large number (many thousands) of small, individual specimens is in trade, meaning that a significant amount of paperwork would be required to track all items in trade.

The Panel is convinced that the Coralliidae do require to be managed within EEZs and in areas beyond national jurisdiction in a fashion which takes account of their long life and their ecological role. The Panel considered that these long-lived species require appropriate and effective local management such as harvest restrictions and rotational closures and protected areas to facilitate their sustainable harvest.

**References supporting the Panel assessment**


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## TABLES AND FIGURES

Table 1. Information for assessing productivity of Coralliidae. Reference levels in "productivity" column are from FAO (2001). Note corrections from proposal.

| Parameter | Information | Productivity | Source |
|---|---|---|---|
| Natural mortality | 0.04-0.07 (4-7% per year)<br>0.027 - 0.048 (2.7 – 4.8% per year)<br>0.06 (*C. secundum*) | Low (<0.2) | FAO (2007), Grigg (1976, 1984, 1993) , Santangelo et al. (2009) |
| Age at maturity | 7-13 years (*C. rubrum* 2-10 yr; *C. secundum* 12- 13 yr) | Low/medium<br>(Low >8 yr)<br>(Med 3.3-8 yr) | Grigg (1993) and Marschal et al. (2004), Santangelo et al. (2009) |
| Maximum age | 75-100 years | Low (>25 yr) | Proposal |

Table 2: Biology of precious coral species. Different values cited are from different published sources. Source: Table 1 in Tsounis et al.(in press)

| Species | Zoogeographic distribution | Max. height | Growth rate (height) | Growth rate (diam.) mm $y^{-1}$ | Max. Age |
|---|---|---|---|---|---|
| *Corallium rubrum* | Mediterranean and neighbouring Atlantic shores | 50 cm | 1.78 + 0.7 mm $year^{-1}$ | 0.24 ± 0.05<br>0.34 ± 0.15<br>0.62 ± 0.15 | ca. 100 yr |
| *Corallium secundum* | Hawaiian Archipelago | 75 cm | 0.9 cm yr-1 | 0.17 | 45<br>> 90 |
| *Corallium sp. nov.* | Midway Island to Emperor Seamounts (W. Pacific) | - | - | | |
| *Corallium japonicum (Paracorallium japonicum)* | Japan, Okinawa and Bonin Islands | 30 cm | | 0.3 ± 0.14 | |
| *Corallium konojoi* | Japan to northern Philipine Islands | 30 cm | - | 0.58 | |
| *Corallium elatius* | Northern Phillipines to Japan | 110 cm | | 0.19 ± 0.15<br>0.15 | |
| *Corallium lauuense (C. regale)* | Hawaii | - | 0.58 | | |

Table 3. Decline indices for red/pink corals (Coralliidae).

| Area | Index | Trend | Basis | Coverage | Reliability | Source |
|---|---|---|---|---|---|---|
| Pacific | Population density | Increase | 1971, 1983/85, 2001, | Hawaii Makapu'u Bed, managed fishery | Fishery independent survey (5) | Grigg, 2002 |
| Pacific | Catches | Decline to 15% | 1979-1989, kg, 3 year average | Western Pacific, pooled species | Combines species and areas. Includes live and dead coral (2) | Grigg 1993 |
| Pacific | Catches | Decline to <2% | 1979-1989, kg, 3 year average | Midway grounds, pooled species | Combines species and areas. Includes live and dead coral (2) | Grigg 1993 |
| Pacific | Catches | Increase | 1979-1991, kg, 3 year average | Japan/ Hawaii Submersible | Combines species and areas. Includes live and dead coral (2) | Grigg 1993 |
| Pacific | Catches | Decline to 1% | Average 1979-81 to 1989-91 | Taiwan Province of China fisheries, 1979-1991 | Anecdotal information (1) | Grigg 1993 |
| Pacific | Proportion Live:Dead in Catch 1. *C. japonicum*; 2. *C. elatius*; 3. *C. konojoi* | 1. no trend 10-16% live; 2. no trend 0-5% live; 3. Decline from 44 to 5% live | 1989-2008 | Japan Tosa Bay, Kochi Prefecture, (4 areas combined) | Commercial catches with observers (3) | Kosuge, Int. Forum Precious Coral 2009, Comm. |
| Pacific | Catches | Increase | 1989-2008, kg, pooled species | Japan, Tosa Bay, Kochi Prefecture (area A) | Observed catches, same small area fished over 20 years (3) | Kosuge Int. Forum Precious Coral 2009, Comm. |
| Pacific | Catches | Increase | 1989-2008, kg, pooled species | Japan, Tosa Bay, Kochi Prefecture, (area B) | Observed catches, same small area fished over 20 years (3) | Kosuge Int. Forum Precious Coral 2009, Comm. |

Table 3 (cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| Pacific | Catches | Increase | 1989-2008, kg, pooled species | Japan, Tosa Bay, Kochi Prefecture, (area C) | Observed catches, same small area fished over 20 years (3) | Kosuge Int. Forum Precious Coral 2009, Comm. |
| Pacific | Proportion of Areas Fished | Decline; 28 to 3 coral beds (all viable) | 1989-2008 | Japanese Waters | Reports from harvesters (3) | Sukumo Coral Assoc., Kochi Pref., Japan |
| Pacific | Catches | Decline to 3% | 1984-6-2004-07 Pooled species t | Pacific fisheries | Catches (2) | FAO |
| Mediterranean | Catches *C. rubrum* | Declined to ca. 40% of 1978 level | Average 1978-80 88 t, 2004-07 34 t | Mediterranean Fisheries pooled areas | Catches (2) | FAO |
| Mediterranean | Frequency of large colonies in populations *C. rubrum* | Decline to 30-50% | 1950s - 2004 | Mediterranean Fisheries | Surveys and catch (2) | Tsounis et al. in press |
| Mediterranean | Mean colony height *C. rubrum* | Decline to 35% (from 86.4 mm to 30 mm) | 1986 – 2004 | Spain | Surveys designed for the species (5) | Tsounis et al. 2007; Garcia-Rodriguez & Masso 1986 |
| Mediterranean | Mean colony height *C. rubrum* | Decline to 30% | 1980s–2006 | Mediterranean Fisheries | Historical data and surveys (3) | Liverino 1983; Garrabou & Harmelin 2002 |
| Mediterranean | Mean number of polyps per colony *C. rubrum* | Decline to 10% | Historical to 2004 | Shallow water Mediterranean Fisheries | Surveys (4) & anecdotal information (2) | Bruckner 2009 |
| Mediterranean | Proportion >7 mm diam in population *C. rubrum* | Decline to 31% | From 35% in 1986 to 11% in 2004 | Spain | Catch with observers (3) | Tsounis et al. 2006; Rodriguez & Masso 1986 |
| Mediterranean | Area available to SCUBA harvesting *C. rubrum* | Decline to 60% | Shift from 30-45 m in the 1950s to 90-130 m in the 1980s | Italy | Estimate from dive surveys (3) | Unpublished data Liverino 1983 |

Table 4. Comparison of *Corallium rubrum* population structure among geographic regions (source Tsounis et al., 2006, Table 6).

| Site | Source | Growth rate[a] (basal diameter) (mm year$^{-1}$) | Mean basal diameter (mm) | Colony height (mm) | Population size structure[b] |
|---|---|---|---|---|---|
| Marseille, France | Garrabou and Harmelin (2002) | 0.24 ± 0.05 | 6.4 ± 0.5 | 69.3 ± 12 | 95% are 7 mm |
| Livorno, Italy | Santangelo et al. (1993a) | 0.91 | 3.9 | 40 | 95% are 3.64 mm |
| Cap de Creus, Spain | Garcia-Rodriguez and Massò (1986a) | 1.32 | 7.2 | 61.8 | 99% are 15 mm |
| Costa Brava, Spain | Present study | – | 4.8 ± 2.1 | 27 ± 17.1 | 98% are 7 mm<br>43% are 4 mm |

Shown are means, or where available, means ± SD
[a]Annual increase of the colony's basal diameter in mm
[b]Percent of colonies with the given basal diameter in each population

Figure 1. Distribution of Coralliidae species as extracted from the Global Biodiversity Information Facility (GBIF) data portal (http://data.gbif.org) accessed on December 11, 2009.

Figure 2. Drawing of Coralliidae to show three-dimensional structure. Source: FAO

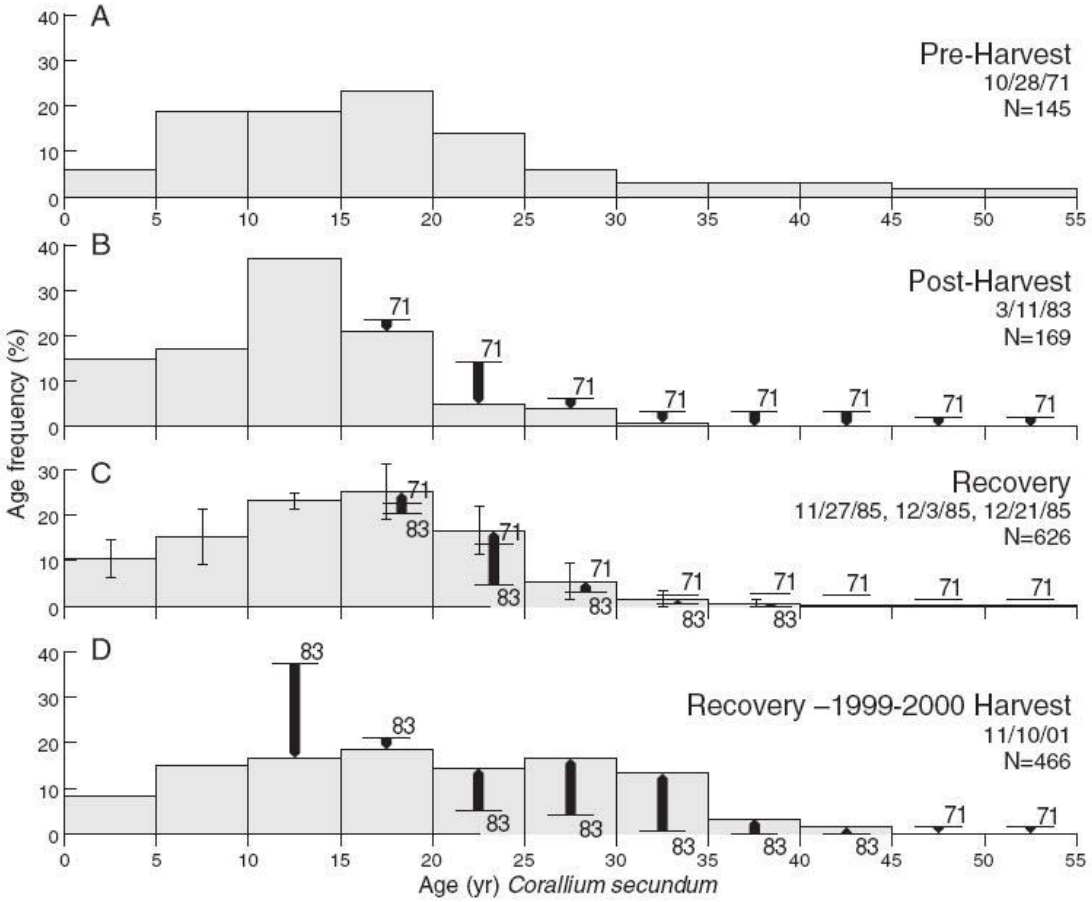


Figure 3. Age structure (frequency distribution) of pink coral in the Makapu'u Bed, Oahu, in 1971, 1983, 1985, and 2001. (source Grigg 2002).

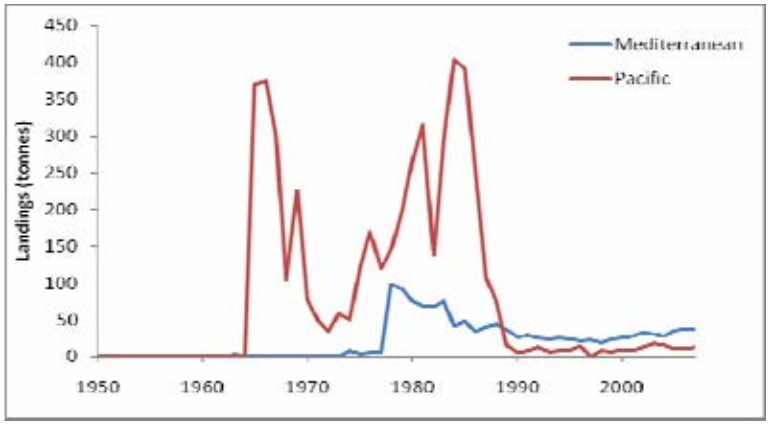


Figure 4. Reported landings of all species of Corallidade from the Pacific Ocean and Mediterranean Sea (source FAO).

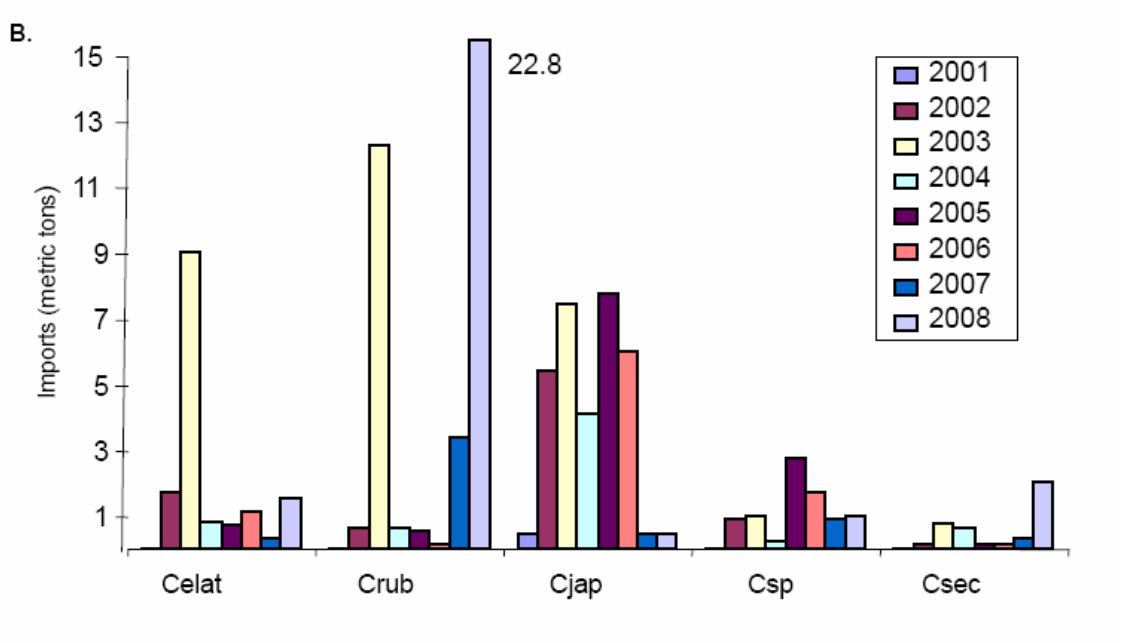


Figure 5. Total imports of unprocessed skeletons of five species of *Corallium* into the United States from 2001 to 2008. C. elatius = Celat,C. rubrum = Crub, C. japonicum = Cjap, Corallium sp. nov. = Csp, C. secundum = Csec. Source: U.S. Fish and Wildlife Service import data (proposal).