FAO Fisheries and Aquaculture Report No. 925 **FIRF/R925 (En)**

ISSN 2070-6987

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

Copies of FAO publications can be requested from:
Sales and Marketing Group
Office of Knowledge Exchange, Research and Extension
Food and Agriculture Organization
of the United Nations
E-mail: publications-sales@fao.org
Fax: +39 06 57053360
Web site: www.fao.org/icatalog/inter-e.htm

FAO Fisheries and Aquaculture Report No. 925 FIRF/R925 (En)

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

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2010

ISBN 978-92-5-106705-5

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 the FAO Regular Programme and the Governments of Japan and the United States of America.

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 and Aquaculture Report. No. 925. Rome, FAO. 2010. 150p.

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 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 Chairperson of the Panel and Ms Pamela Mace was elected Vice-Chairperson. 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 – 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 ICCAT 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 CoP14), 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. CoP14) (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 Appendixes 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 2a Criteria for inclusion of species in Appendix II in accordance with Article II, paragraph 2(a) of the Convention

14. 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 second Meeting of the Expert Advisory Panel in March 2007. Document CoP14 Inf. 64[3], prepared by the FAO Secretariat and submitted to the fourteenth Conference of the Parties to CITES in 2007, also provides an explanation of the interpretation of the Annex 2a criteria for inclusion of species in Appendix II as applied by the Panel.

General comments by the Panel on the proposals

15. 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.

16. 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: 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.

---

[1] Comments were received from Italy, Monaco, the International Commission for the Conservation of Atlantic Tunas (ICCAT), the 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 2a (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: www.cites.org/common/cop/14/inf/E14i-64.pdf

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

22. In evaluating such proposals, the Panel took note of the wording of CITES Resolution Conf. 9.24 (Rev. CoP14) 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).

23. 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).

24. 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

25. 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.

26. 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

27. The report, including all Appendixes, 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 Chairperson
5. Panel terms of reference, objectives and work programme for the meeting
6. Overview of the CITES listing criteria (Res.Conf. 9.24 [Rev. CoP14])
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, United States of America 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

ABU TALIB Ahmad
Special Department Coordinator
Marine Fishery Resources Development
and Management Department (MFRDMD)
Southeast Asian Fisheries Development Center
(SEAFDEC)
21080 Chendering, Terengganu
Malaysia
Tel.: (+609) 61 77 867 / 61 75 940
Fax: (+609) 61 71 543
E-mail: abutalib@seafdec.org.my

BJORGE Arne
Chief Scientist
Institute of Marine Research (IMR)
Gaustadalléen 21
0349 Oslo
Norway
Tel.: (+47) 22 95 87 51
E-mail: arne.bjorge@imr.no

BROOKS, Elizabeth
Operations Research Analyst
NOAA/NMFS, Northeast Fisheries
Science Center
166 Water Street
Woods Hole, MA 02543 :
United States of America
Tel.: (+1) 508 495 2238
Fax: (+1)508 495 2393
E-mail: liz.brooks@noaa.gov

BUTTERWORTH Doug
Professor
Department of Mathematics and Applied
Mathematics
University of Cape Town
Rondebosch 770 1
South Africa
Tel.: (+27) 21 6502343
Fax: (+27) 21 6502334
E-mail: doug.butterworth@uct.ac.za

DICKEY-COLLAS Mark
Senior Research Scientist Fisheries
Institute for Marine Resources
and Ecosystem Studies (IMARES)
PO Box 68
1970 AB IJmuiden
The Netherlands
Tel.: (+31) 317 48 71 66
Fax : (+31) 317 48 73 26
Mark.dickeycollas@wur.nl

MACE Pamela
Chief Scientist
Ministry of Fisheries
Level 12, 101-103 The Terrace
PO Box 1020
Wellington 6001
New Zealand
Tel.: (+644) 819 4266
Fax: (+644) 819 4261
E-mail: Pamela.Mace@fish.govt.nz

SANCHEZ Ramiro Pedro
Director de Planificación Pesquera
Subsecretaría de Pesca y Acuicultura
Paseo Colón 892
Ciudad Autónoma de Buenos Aires
Argentina
Tel.: (+54) 11 4349 2590
Fax: (+54) 11 4349 2594
E-mail: rasanc@minagri.gob.ar
sanchez.ramiro@speedy.com.ar

UOZUMI, Yuyi
Director General
National Research Institute of Far Seas
Fisheries
Fishery Research Agency Japan
5-3-1 Orido Shimizu Shizuoka
Japan 424-8633
Tel.: (+81) 543 36 6000
Fax: (+81) 543 35 9642
E-mail: uozumi@affrc.go.jp

SPECIES AND IMPLEMENTATION EXPERTS

CORALS

BENAYAHU Yehuda
Professor of Marine Biology
Department of Zoology
George S. Wise Faculty of Life Sciences
Tel Aviv University, Ramat Aviv, Tel Aviv
69978
Israel
Tel.: (+972) 3 64 09 090/7292
Fax: (+972 3 64 09 403
E-mail: YehudaB@tauex.tau.ac.il

KENCHINGTON Ellen
Benthic Ecologist
Ecosystem Research Division
Department of Fisheries and Oceans
Bedford Institute of Oceanography
PO Box 1006, 1 Challenger Drive
Dartmouth, Nova Scotia
B2Y 4A2 Canada
Tel.: (+1) 902 426 2030
E-mail: Ellen.Kenchington@dfo-mpo.gc.ca

KOSUGE Sadao
Director
Institute of Malacology
6-36 Midoricho 3 Cheme
Nish – Tokyo City
Japan 188 – 0002
Tel.: (+81) 42 463 0851
Fax: (+81) 42 463 0851
E-mail: i.m.t.kosuge@excite.co.jp

TSOUNIS Georgios
Postodoctoral Researcher
Institut de Ciències del Mar, CMIMA (CSIC)
Passeig Marítim de la Barceloneta, 37-49
08003 Barcelona
Spain
Tel.: (+34) 932 309 546
Fax: (+34) 93 2 309 555
E-mail: georgios@icm.csic.es

SHARKS

CAMPANA Steven E.
Population Ecology Division
Bedford Institute of Oceanography
1 Challenger Drive
PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2
Canada
Tel.: (+1) 902 426-3233
Fax: (+1) 902 426-1506
E-mail: campanas@mar.dfo-mpo.gc.ca

CHARVET ALMEIDA, Patricia
Professor
Serviço Nacional de Aprendizagem Industrial
(SENAI-PR)
Rua Senador Accioly Filho, 250
CIC 81319–000
Curitiba – Paraná
Brazil
Tel.: (+55) 41 9665 2204
Fax : (+55) 41 3039 8268
E-mail : pchalm@gmail.com

STEHMANN, Matthias F.W.
ICHTHYS, Ichthyological Research
Laboratory and Consultant
Hildesheimer Weg 13, D-22459 Hamburg
Germany
Tel./Fax: (+ 49) - 40 - 30 89 72 49
Mobile: (+49) (0)176 – 62435514
E-mail: stehmann@ichthys-fisch.info

STEVENS, John D.
Senior Principal Research Scientist
Commonwealth Scientific and Industrial
Research Organisation (CSIRO)
Marine and Atmospheric Research
Castray Esplanade
Hobart
Tasmania 7001
Australia
Tel.: (+61) 3 62 325 353
E-mail: John.D.Stevens@csiro.au

TUNA

ALLEN Robin
Consultant
PO Box 5159 Springlands
Blenheim 7241
New Zealand
Tel.: (+64) 3 572 88 91
E-mail: rjallen98@gmail.com;
rjallen98@ihug.co.nz

NEILSON John D.
Head, Large Pelagics Program
Canada Department of Fisheries and Oceans
Biological Station, 531 Brandy Cove Road
St. Andrews, New Brunswick E5B 2L9
Canada
Tel.: (+1) 506 529 5913 (direct)
Fax: (+1) 506 529 5862
E-mail: John.Neilson@dfo-mpo.gc.ca

POWERS Joseph
Associate Professor
2147 Energy, Coast and the Environment
Building
School of Coast and Environment
Louisiana State University
Baton Rouge, LA 70803
United States of America
Tel.: (+1) 225 578 7659
Fax: (+1) 225 578 6513
E-mail: jepowers@lsu.edu

IMPLEMENTATION

KROESE Marcel
Director Training and Liaison
International Monitoring, Control and
Surveillance Network
8484 Georgia Ave., Suite 415
Silver Spring, MD 20910
United States of America
Tel.: (+1) 301 427 2 300
Fax: (+1) 301 427 20 55
E-mal: marcel.kroese@imcsnet.org

JENKINS Robert W.G.
President
Species Management Specialists
PO Box 390
Belconnen ACT 2616
Australia
Tel.: (+612) 62 58 34 28
Fax: (+612)-62 59 87 57
E-mail: hank.jenkins@consol.net.au

SANT Glenn
Director
TRAFFIC INTERNATIONAL
PO Box U115
University of Wollongong
Wollongong, NSW, 2522
Australia
E-mail: Glenn.Sant@traffic.org

CITES OBSERVER

MORGAN David H.W.
Chief, Scientific Support Unit
CITES Secretariat
Maison internationale de l'environnement
Chemin des Anémones
CH-1219 Châtelaine, Geneva
Switzerland
Tel.: (+41) 22 917 81 23
Fax: (+41) 22 797 34 17
E-mail: david.morgan@cites.org

FAO SECRETARIAT

Viale delle Terme di Caracalla
00153 Rome, Italy

COCHRANE Kevern
Chief
Fisheries Management and Conservation
Service (FIMF)
Fisheries and Aquaculture Management
Division (FIM)
Fisheries and Aquaculture Department
Tel.: (+39) 06 570 56109
Fax: (+39) 06 570 53020
E-mail: kevern.cochrane@fao.org

FISCHER, Johanne
Senior Fishery Resources Officer
Fisheries Management and Conservation
Service (FIMF)
Fisheries and Aquaculture Management
Division (FIM)
Fisheries and Aquaculture Department
Tel.: (+39) 06 570 54851
Fax: (+39) 06 570 53020
E-mail: johanne.fischer@fao.org

POWLES Howard
Consultant
Natural Resource Management
53, rue Lortie
Gatineau
Québec, J9H 4G6
Canada
Tel.: (+1) 819 684 7730
Fax: (+1) 819 684 7730
E-mail: powlesh@sympatico.ca

VASCONCELLOS Marcelo
Consultant
Federal University of Rio Grande
Av. Itália Km 08, Rio Grande,
Caixa postal 474
96201-900 RS, Brazil
Tel: +55 53 81144512
E-mail: marcelovasconcellos@furg.br

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 CoP14 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 an Ad Hoc Expert Advisory Panel for Assessment of Proposals to CITES[1]

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

[1] Taken from Appendix E of the Report of the twenty-fifth Session of COFI, FAO, Rome, 24-28 February 2003
[2] 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 overexploited 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.

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 China, Hong Kong Special Administrative Region (SAR) 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 United States of America which are 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 organized 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, Pinhal and

Shivji, 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, Jiao and Cortes (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 (Figure 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, Hayes and Cortes (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) summarized abundance trends for scalloped hammerhead and other shark species from a number of survey and commercial catch per unit of effort (CPUE) databases. A 31-year survey in North Carolina coastal waters (University of North Carolina) showed an instantaneous rate of decline of 0.127 for scalloped hammerhead, equivalent to a 98% extent of decline over the series (Figure 2). A SEAMAP survey in coastal waters of the southeast United States of America 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 (Figure 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 (Figure 4), and noted that this species group had declined in all fishing areas examined (Figure 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, Kehler and Myers (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 United States of America 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 (Figure 6) (Hayes, Jiao and Cortes, 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 (Figure 7). Surface gillnet CPUE varied without trend (Figure 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, Klippel and Galina (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, i.e. an extent of decline of 65% (Figure 12).

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

Western Pacific Ocean

De Jong and Simpfendorfer (2009) reported a decline of over 85% in scalloped hammerhead standardized CPUE over 44 years in a beach protection net programme 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 1980s to the early 2000s (Figure 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, Jiao and Cortes (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 (Figure 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) (Figure 15).

Assessment relative to quantitative criteria

Decline

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP14), 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, Jiao and Cortes, 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 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% for 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 CoP14). 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 organizations, 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 United States of America (Hayes, Jiao and Cortes, 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 China, Hong Kong SAR fin market has helped clarify amounts of scalloped hammerhead fins in trade.

The China, Hong Kong SAR 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 China, Hong Kong SAR ’s share of world trade is attributed to increasing trade through mainland China, where statistics are difficult to obtain (Clarke, Milner-Gulland and Cemare, 2007). Despite the estimated decline over time in share of the world trade transiting China, Hong Kong SAR , total imports to China, Hong Kong SAR 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, Milner-Gulland and Cemare, 2007).

Fins of scalloped hammerhead and Smooth hammerhead (*S. zygaena*) together made up 4.4% of fins traded in the China, Hong Kong SAR 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).

China, Hong Kong SAR 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 China, Hong Kong SAR 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 China, Hong Kong SAR 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 difficult 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, Jiao and Cortes, 2009; Jiao, Hayes and Cortes, 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, Jiao and Cortes, 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.

References supporting the Panel assessment

Baum, J.K., Kehler, D. and R.A. Myers. 2005. Robust estimates of decline for pelagic shark populations in the Northwest Atlantic and Gulf of Mexico. Fisheries 20 (10): 27–29.

Baum, J.K., Myers, R.A., Kehler, D.G., Worm, B, Harley, S.J.and P.A.Doherty. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299: 389–392 plus supplementary material.

Burgess, G.H., Beerkircher, L.R, Cailliet, G.M., Carlson, J.K., Cortes, E., Goldman, K.J., Grubbs, R.D., Musick, J.A., Musyl, M.K. and C.A. Simpfendorfer. 2005. Is the collapse of shark populations in the Northwest Atlantic Ocean and Gulf of Mexico real? Fisheries 20 (10): 19–26.

Camhi, M.D., Valenti, S.V., Fordham, S.V., Fowler, S.L. and C. Gibson. 2009. *The Conservation Status of Pelagic Sharks and Rays: Report of the IUCN Shark Specialist Group Pelagic Shark Red List Workshop*. IUCN Species Survival Commission Shark Specialist Group. Newbury, UK. x + 78p.

Carlson, J. National Marine Fisheries Service, United States of America. Communication to the Panel December 8 2009.

Chapman, D.D., Pinhal, D. and M.S. Shivji. 2009. In review. Genetic stock identification in endangered scalloped hammerhead sharks, Sphyrna lewini. Endangered Species Research

Chen, G.C., Leu, T., Joung, S. and N.C.H. Lo. 1990. Age and growth of the scalloped hammerhead, *S. lewini*, in Northeastern Taiwan waters. California Wild (formerly known as Pacific Science) 44(2):156–170. *Cited in the proposal*

Clarke, S. 2008 Use of shark fin trade data to estimate historic total shark removals in the Atlantic Ocean. Aquatic Living Resources 21: 373–381.

Clarke, S., Milner-Gulland, E. J. and T.B. Cemare. 2007. Social, economic, and regulatory drivers of the shark fin trade. Marine Resource Economics 22: 305–327.

Clarke, S. C., Magnussen, J.E., Abercrombie, D.L., McAlllister M.K. and M.S. Shivji. 2006. Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. Conserv. Biol. 20: 201–211.

Compagno, L.J.V. 1984. Sharks of the World. Part II Carcharhiniformes. FAO Fish. Synopsis 125, Vol. 4, Part II pp 545–546.

Cortes, E. 2002. Incorporating uncertainty into demographic modeling: application to shark populations and their conservation. Conserv. Biol. 16: 1048–1062.

De Jong, S. and C. Simpfendorfer. 2009. The Queensland shark control program: a fisheries-independent assessment of shark stocks in far north Queensland. Abstract A71 for Fish Conference and 2009 ASFB Workshop and Conference, 31 May – 5 June 2009, Fremantle, Western Australia.

Dudley, S. and C. Simpfendorfer. 2006. Population status of 14 shark species caught in the protective gillnets off KwaZulu-Natal beaches, South Africa, 1978–2003. Marine and Freshwater Research 57: 225–240.

Duncan, K.M., Martin, A.P., Bowen, B.W. and H.G. DeCouet. 2006. Global phylogeography of the scalloped hammerhead shark (*S. lewini*). Molecular Ecology 15:2239–2251.

FAO. 2001. A background analysis and framework for evaluating the status of commercially-exploited aquatic species in a CITES context. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. 23 pp. Available at www.fao.org/DOCREP/MEETING/003/Y1455E.HTM

FAO. 2004. Report of the Expert Consultation on Implementation Issues Associated with Listing Commercially-exploited Aquatic Species on CITES Appendices. FAO Fisheries Report No. 741: Rome, 25–28 May 2004. vi + 21 pp.

Ferretti, F., Myers, R.A., Serena, F. and H. K. Lotze. 2008. Loss of large predatory sharks from the Mediterranean Sea. Conserv. Biol. 22: 952–964.

Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Simpfendorfer, C.A. and Musick, J.A. eds. 2005. *Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes. Status Survey*. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. x + 461 pp. Section on *S. lewini*, pp. 314–316, authored by J. E. Kotas.

Gribble, N., Whybird, O., Williams, L. and R. Garrett. 2005. Fishery assessment update 1988–2003: Queensland East Coast shark. Information Series QI04070, Northern Fisheries Centre. Queensland Government, Cairns. 26 pp.

Hayes, C.G., Jiao, Y. and E. Cortes. 2009. Stock assessment of scalloped hammerheads in the western north Atlantic Ocean and Gulf of Mexico. N. Am. J. Fish. Management 29: 1406–1417.

Ingram, W., Henwood, T., Grace, M., Jones, L., Driggers, W. and K. Mitchell. 2005 Catch rates, distribution and size composition of large coastal sharks collected during NOAA Fisheries bottom longline surveys from the U.S. Gulf of Mexico and U.S. Atlantic Ocean. NOAA Fisheries Document LCS05/06-DW-27, 62pp.
www.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=11&FolderType=Data

Jiao, Y., Hayes, C. and E. Cortes. 2009. Hierarchical Bayesian approach for population dynamics modelling of fish complexes without species-specific data. ICES J. Mar. Sic. 66: 367–377.

Kotas, J.E., Petrere Jr., M., Fiedler, F., Mastrochirico, V. and G. Sales. 2008. A pesca de emalhe-de-superficie de Santa Catarina direcionada a captura dos stubaroes-martelo, *Sphyrna lewini* (Griffith and Smith 1934) e *Sphyrna zygaena* (Linnaeus 1758). Atlantica, Rio Grande, 30 (2): 113–128.

Myers, M.C., Vaughan, C., Bin, O., Polasky, S. and A. Klampfer n.d.. Trends in shark and ray abundance in the Cocos Island Marine Conservation Area, Costa Rica. Abstract for International Conference for the Conservation and Management of Wildlife, Feb. 21–25, Unversidad Nacional, Heredia, Costa Rica.

Myers, R.A., Baum, J.K., Shepherd, T.D., Powers, S.P. and C.H. Peterson. 2007. Cascading effects of the loss of apex predatory sharks from a coastal ocean. Science, 30 March 2007, 315: 1846–1850, plus supplementary material.

NMFS. 2006. Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 1600 pp.

NMFS. 2008. Final Amendment 2 to the Consolidated Atlantic Highly Migratory Species. Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 726 pp.

Piercy, A.N., Carlson, J.K., Sulikowski, J.A. and G. Burgess, 2007. Age and growth of the Scalloped hammerhead shark, *S. lewini*, in the north-west Atlantic Ocean and Gulf of Mexico. Mar. Freshw. Research 58: 34–40.

Smith, S.E., Au, D.W. and C. Show. 1998. Intrinsic rebound potentials of 26 species of Pacific sharks. Mar. Freshw. Research 49(7):663–678.

Tolentino, V.A. and C.R. Mendoza. 2001. Age and growth for the scalloped hammerhead shark, *S. lewini* (Griffith and Smith, 1834) along the central Pacific coast of Mexico. Ciencias Marinas 27:501–520.

Vooren, C.M., Klippel, S. and A. B. Galina. 2005. Biologia e status de conservaçao dos tubaroes-martelo Sphyrna lewini e S. Zygaena. Chapter 6 in Vooren, C. M. and S. Klippel. 2005 (Eds). Ações para a conservação de tubarões e raias no sul do Brasil. IGARE. Porto Alegre. 261 pp.

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 (λ = 1.086) b. W. Pacific – 0.472 (λ = 1.600) c. W. Indian Ocean r = 0.103 d. R_{2M} = 0.028	a. Low b. High c. Low d. Low	a. Cortes, 2002 b. Cortes, 2002 c. Dudley and Simpfendorfer, 2006 d. Smith *et al.*, 1998
Natural mortality	M = 0.129	Low	Smith *et al.*, 1998
Age at maturity	a. W. Indian Ocean – 11 yr b. Females – 15 yr	a. Low b. Low	a. Dudley and Simpfendorfer 2006 b. Smith *et al.*, 1998
Maximum age	a. NW Atlantic – 30.5 yr b. W. Indian Ocean – 30 yr c. 35 yr	a. Low b. Low c. Low	a. Piercy *et al.*, 2007 b. Dudley and Simpfendorfer 2006 c. Smith *et al.*, 1998
von Bertalanffy K	a. NW Atlantic – Male 0.13 Female 0.09 b. W. Indian Ocean – 0.057 c. W. Pacific – Male 0.222 Female 0.249 d. E. Pacific – Male 0.131 Female 0.156	a. Low b. Low c. Medium d. Low	a. Piercy *et al.*, 2007 b. de Bruyn 2000 cited in Dudley and Simpfendorfer 2006 c. Chen *et al.*, 1990 cited in proposal d. Tolentino and Mendoza 2001
Generation time	a. NW Atlantic – 16.7 yr b. W. Indian Ocean – 18.3 yr c. W. Pacific – 5.7 yr	a. Low b. Low c. Medium (H)	a. Cortes 2002 b. Dudley and Simpfendorfer 2006 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 United States of America	Assessment based on multiple surveys (5)	Hayes *et al.*, 2009
	Abundance estimate from population assessment	EOD 91% to 93%	Surplus production model for mixed hammerhead species, probabilistic, multiple indices, 1980–2005	Atlantic coast United States of America	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	United States of America 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
	CPUE, SEAMAP survey	Increase	Instantaneous increase 0.094 over 17 yr (1989–2005)	Southeast United States of America 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.)

Criterion	**Index**	**Trend**	**Basis**	**Coverage**	**Reliability**	**Source**
	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 United States of America	Pooled coastal sharks, scalloped hammerhead is 6% of total (1–2)	Ingram *et al.*, 2005 Figure 39
	CPUE, longline survey	No trend	Inspection of figure, 1995–2003	Gulf of Mexico, United States of America	Pooled coastal sharks, scalloped hammerhead is 7% of total (1–2)	Ingram *et al.*, 2005 Figure 42
Southwest Atlantic	CPUE, surface gillnet	Decline 80% or more	Inspection of figure, 2000–2008	Southern Brazil	Unstandardized 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	Unstandardized 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.)

Criterion	Index	Trend	Basis	Coverage	Reliability	Source
	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, standardized 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)			
		50	69	100	150
Time frame	No catch	(2 068)	(2 853)	(4 135)	(6 203)
10 years	95	85	70	58	20
20 years	99	96	92	86	50
30 years	99	98	96	91	63

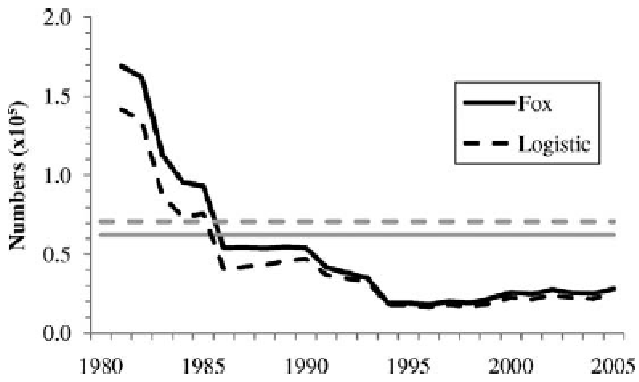


Figure 1. Scalloped hammerhead population estimates from two models, 1981–2005. Grey lines are MSY levels for the two models. Source: Hayes *et al.*, 2009.

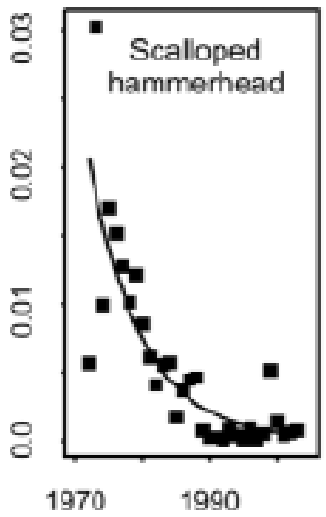


Figure 2. Abundance trend, scalloped hammerhead, UNC survey. Source: Myers *et al.*, 2007, Figure 1.

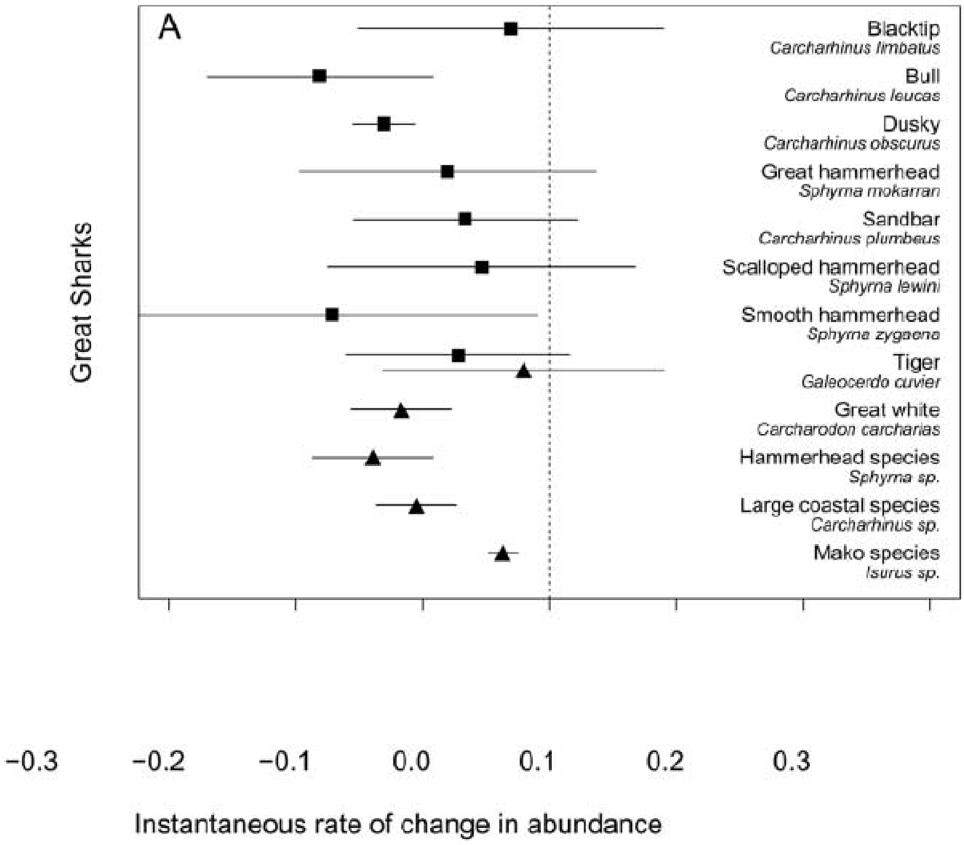


Figure 3. Instantaneous rate of change in abundance, meta-analysis of multiple research surveys. Mean time span of surveys 28 yrs. Source: Myers *et al.*, 2007 Figure 2.

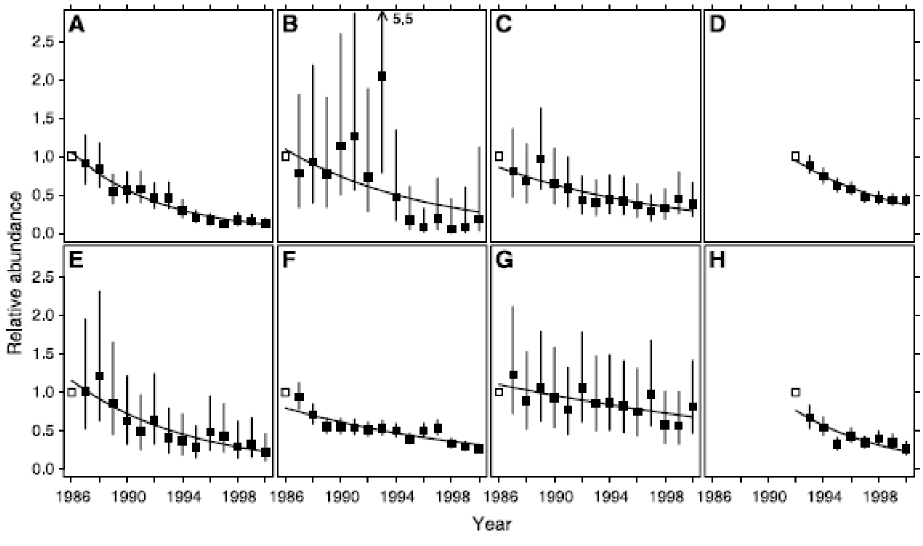


Figure 4. Changes in abundance indices. A = hammerhead sharks pooled. Source: Baum *et al.*, 2003 Figure 2.

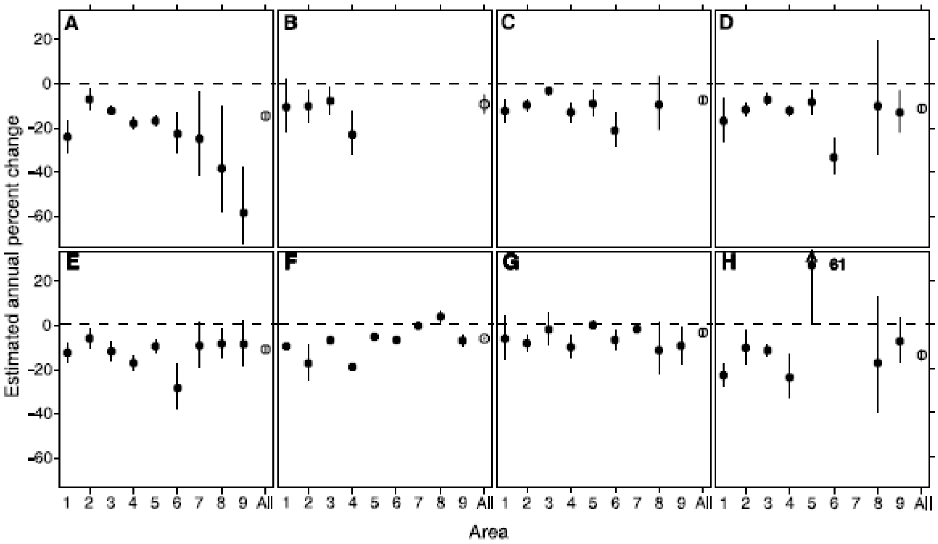


Figure 5. Annual rate of change in abundance, 1986–2000, in 10 subareas of the Northwest Atlantic. A = hammerhead sharks pooled. Source: Baum *et al.,* 2003 Figure 3

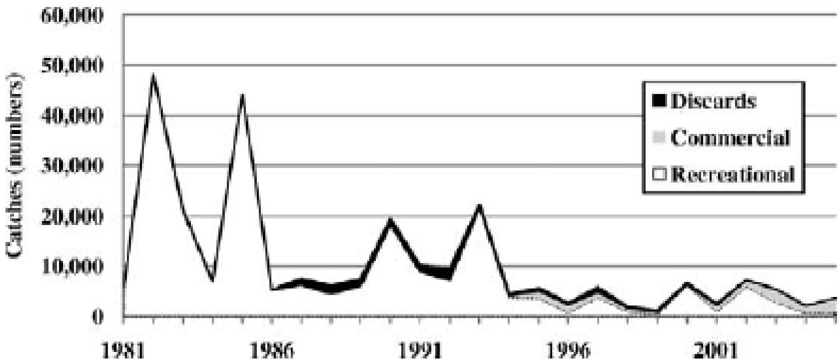
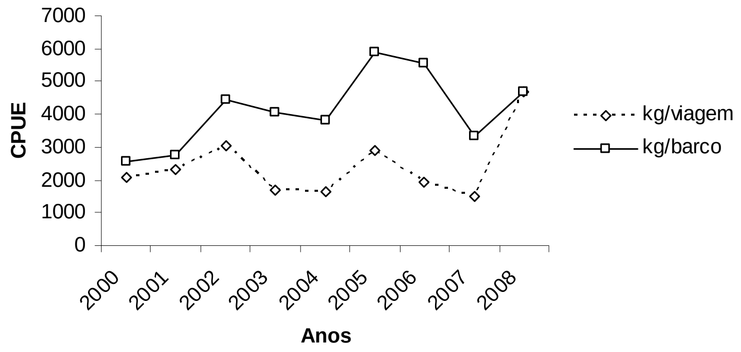
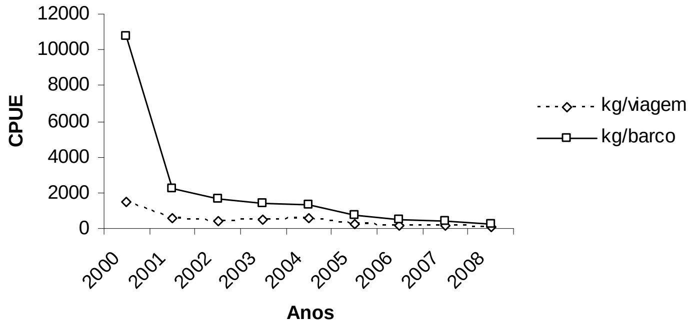


Figure 6. US catches of scalloped hammerhead. Source: Hayes *et al.,* 2009.

Emalhe-de-superfície, Estado de SC



Espinhel-de-superfície, Estado de SC



Emalhe-de-fundo, Estado de SC

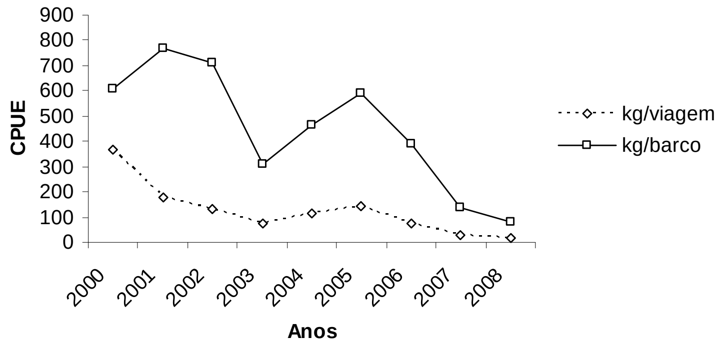
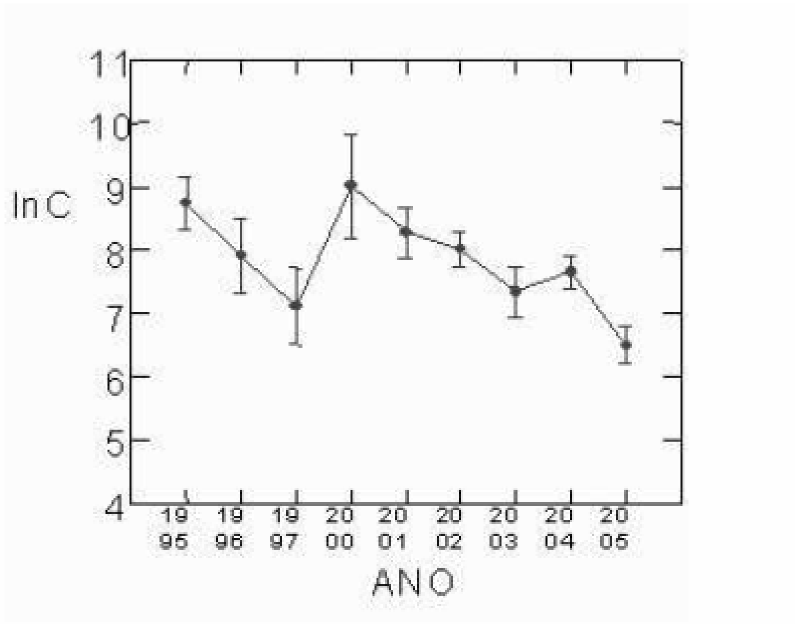


Figure 7. CPUE, scalloped hammerhead, southern Brazil. Dashed lines: kg/trip; solid lines: kg/vessel. Top: surface gillnet; middle: surface longline; bottom: bottom gillnet. Source: Kotas, pers. comm.



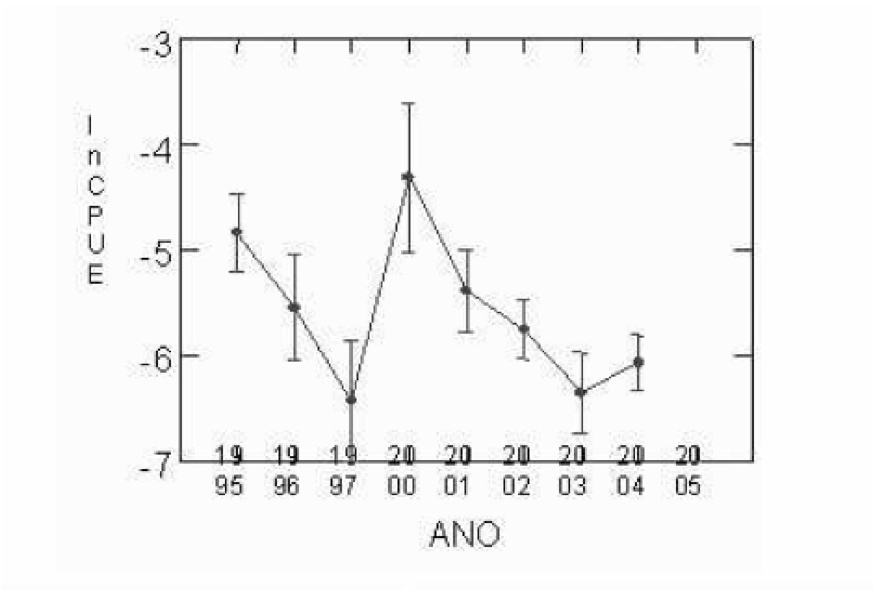


Figure 8. Catch (kg) (top) and CPUE (kg/m2 of net) (bottom) of pooled scalloped and smooth hammerheads, surface gillnets, southern Brazil. Source: Kotas *et al.*, 2008.

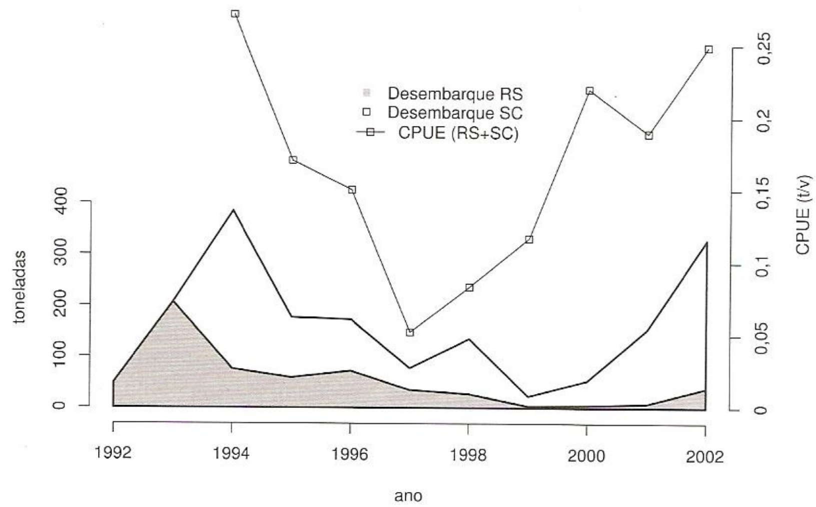


Figure 9. Landings and cpue of oceanic gillnet fisheries in southern Brazil (Vooren *et al.*, 2005).

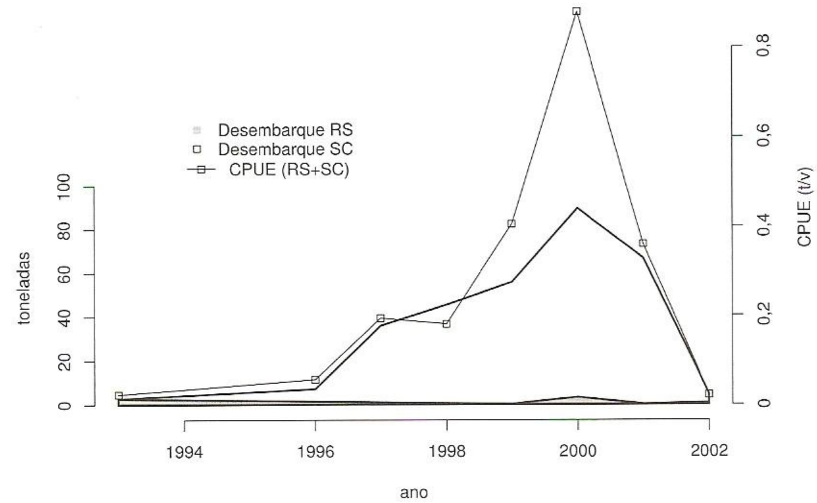


Figure 10. Landings and cpue of longline fisheries in southern Brazil (Vooren *et al.*,, 2005)

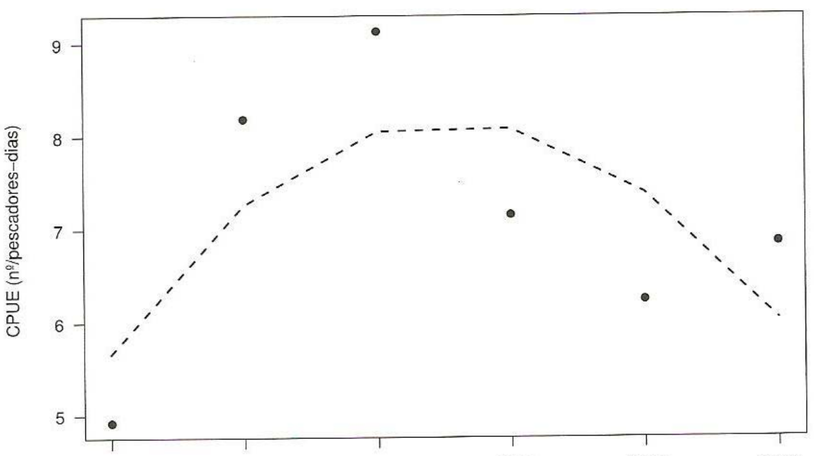


Figure 11. Catch per unit of effort (numbers/fisher/day) of the recreational fishery targeted to neonate hammerheads in southern Brazil (Vooren *et al.*, 2005).

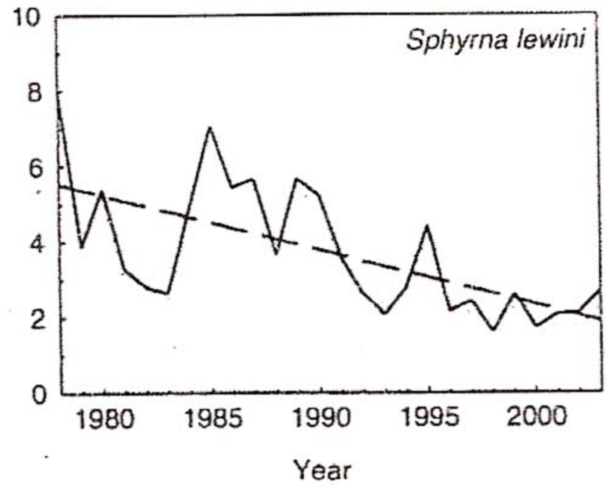


Figure 12. Annual CPUE of scalloped hammerhead in the KwaZulu-Natal beach protection programme, 1978–2003. Units are number/km net/yr. Source: Dudley and Simpfendorfer (2006).

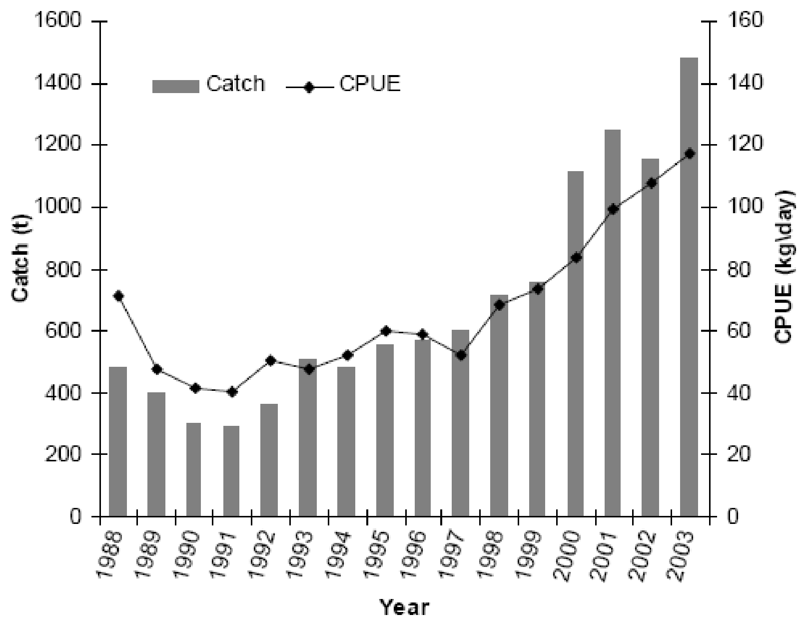


Figure 13. Annual catch and catch per unit, all fisheries combined, all shark species combined, Australian east coast. *S. lewini* made up 18% of the total catch on 4 observed trips. Source: Gribble *et al.*, 2005.

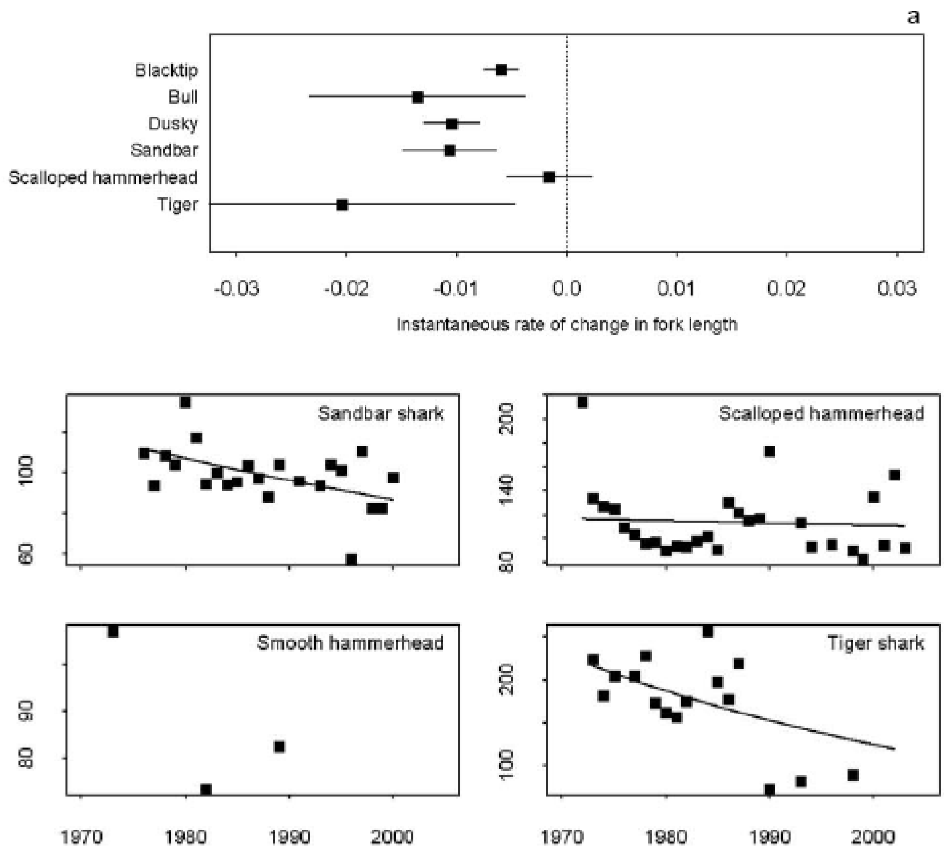


Figure 14. Changes in fork length, scalloped hammerhead, North Carolina shark survey. In lower figure, y-axis is fork length. Source: Myers *et al.*, 2007, supplementary material, Figure S3.

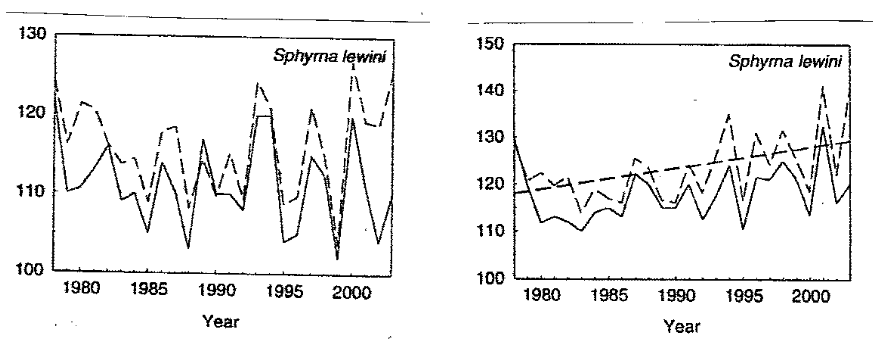
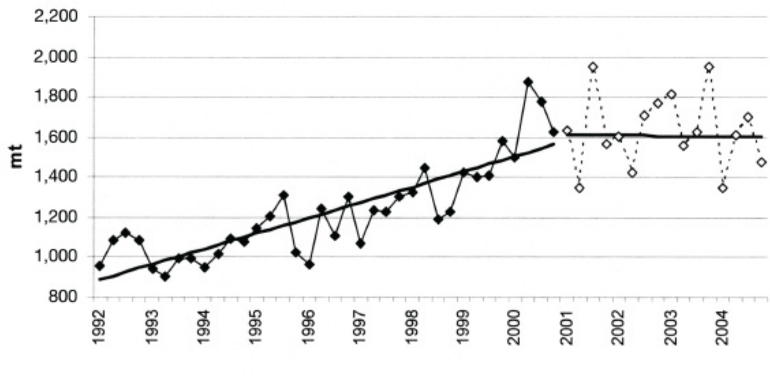


Figure 15. Annual median (solid line) and mean (dashed line) sizes (precaudal length) of scalloped hammerhead caught in the KwaZulu-Natal beach protection program, 1978–2003. Left panel: females; right panel: males. Straight line fit to male data indicates a significant regression.



Hong Kong

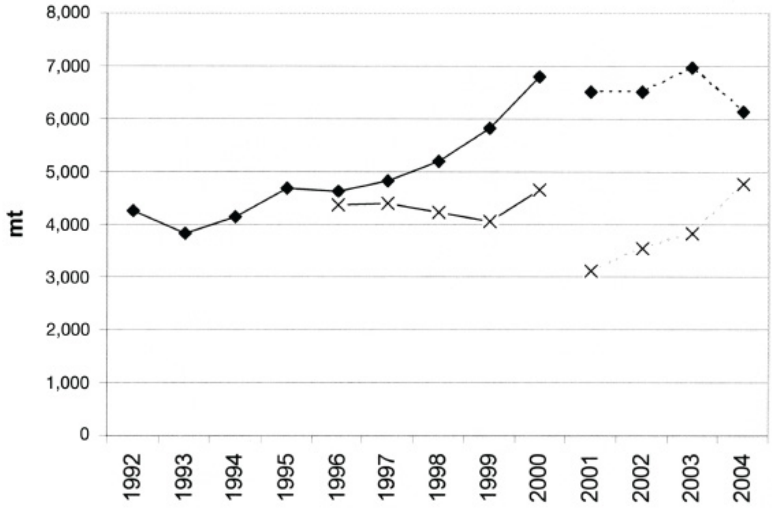


Figure 16. Imports of shark fins to China, Hong Kong SAR and mainland China. Upper figure: quarterly imports to China, Hong Kong SAR (a change in statistical reporting means values before and after 2001 are not strictly comparable). Lower figure: annual imports to China, Hong Kong SAR (solid symbols) 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.

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 years) 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 standardize 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 standardize 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, Casey and Turner, (1998, p. 49) summarize 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, Marcante S. and Pagleranil., 1999) and the western Pacific (Seki, Taniuchi and Hakano, 1998). This information has been used to derive rate of increase and generation time estimates (Smith, Au and Show, 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 (Figure 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 (Figure 2), and indicated that declining CPUE trends had been observed in almost all subareas of the fishery area (Figure 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, Kehler and Myers (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, Kehler and Myers (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, Brown and beerkircher (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) (Figure 4). They estimated a 10-fold decrease in CPUE, to 0.099 over the time period 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, Bigelow and Sender (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 (Figure 5). This is based on an unstandardized 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

Unstandardized 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, Marcante and Paglerani, 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/1 000 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 640 tonnes to 80 tonnes. 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 1 000 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 (Figure 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 CoP14), 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, Brown and Beerkircher (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 years 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 years), 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, Bigelow and Sender (2009). The Ward and Myers and Walsh, Bigelow and Sender 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 years (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 unstandardized 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 characterized 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, Clarke and Nakano, 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, Bigelow and Sender, 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, Bigelow and Sender, 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, Bigelow and Sender, 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) (Figure 7) estimated total annual catches of Oceanic whitetip, based on trade data from the China, Hong Kong SAR 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; Vannuccini, 1999). Skins may be used for leather products in the United States of America 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 China, Hong Kong SAR fin market (Vannuccini, 1999). Oceanic whitetip fins reportedly command high prices in the China, Hong Kong SAR 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 China, Hong Kong SAR fin market has provided information on the relative importance of Oceanic whitetip fins in trade.

The China, Hong Kong SAR 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 China, Hong Kong SAR’s share of world trade is attributed to increasing trade through mainland China, where statistics are difficult to obtain (Clarke, Milner-Gulland and Cemare, 2007). Despite the estimated decline over time in share of the world trade transiting China, Hong Kong SAR, total imports to China, Hong Kong SAR 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, Milner-Gulland and Cemare, 2007).

Fins of Oceanic whitetip made up 1.8% of fins traded in the China, Hong Kong SAR 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[1] and the UN Fish Stocks Agreement[2] 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 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 China, Hong Kong SAR 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.

---

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

[2] 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

"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.

References supporting the Panel assessment

Baum, J.K. and R.A. Myers. 2004. Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. Ecology Letters 7: 135–145.

Baum, J.K., Kehler, D. and R.A. Myers. 2005. Robust estimates of decline for pelagic shark populations in the Northwest Atlantic and Gulf of Mexico. Fisheries 20 (10): 27–29.

Baum, J.K., Myers, R.A., Kehler, R.A., Worm, B., Harley, S.J. and P.A. Doherty. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299: 389–392 plus supplementary material.

Bonfil, R., Clarke, S. and H. Nakano 2008. The biology and ecology of the oceanic whitetip shark, Carcharhinus longimanus. pp128–139 in Camhi, M.D., Pikitch, E.K. and E.A. Babcock, "Sharks of the Open Ocean-Biology, Fisheries and Conservation". Blackwell, Oxford.

Burgess, G.H., Beerkircher, L.R., Cailliet, G.M., Carlson, J.K., Cortes, E., Goldman, K.J., Grubbs, R.D., Musick, J.A., Musyl, M.K. and C.A. Simpfendorfer. 2005. Is the collapse of shark populations in the Northwest Atlantic Ocean and Gulf of Mexico real? Fisheries 20 (10): 19–26.

Camhi, M.D., Valenti, S.V., Fordham, S.V., Fowler, S.L. and C. Gibson. 2009. *The Conservation Status of Pelagic Sharks and Rays: Report of the IUCN Shark Specialist Group Pelagic Shark Red List Workshop*. IUCN Species Survival Commission Shark Specialist Group. Newbury, UK. x + 78p.

Castro, J.A. and J. Mejuto. 1995. Reproductive parameters of blue shark, *Prionace glauca*, and other sharks in the Gulf of Guinea. Marine and Freshwater Research 46: 967–973.

Clarke, S. 2008 Use of shark fin trade data to estimate historic total shark removals in the Atlantic Ocean. Aquatic Living Resources 21: 373–381.

Clarke, S.C., McAllister, J.K., Milner-Gulland, E.J., Kirkwood, G.P., Michielsens, C.G.J., Agnew, D.J., Pikitch, E.K., Hakano, H. and M.S. Shivji. 2006a. Global estimates of shark catches using trade records from commercial markets. Ecology Letters 9: 1115–1126.

Clarke, S.C., Magnussen, J.E., Abercrombie, D.L., McAlllister, M.K. and M.S. Shivji. 2006b. Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. Conserv. Biol. 20: 201–211.

Clarke, S., Milner-Gulland, E.J. and T.B. Cemare. 2007. Social, economic, and regulatory drivers of the shark fin trade. Marine Resource Economics 22: 305–327.

Compagno, L.J.V. 1984. Sharks of the World. Part II Carcharhiniformes. FAO Fish. Synopsis 125, Vol. 4, Part II pp 545–546.

Cortes, E. 2002. Incorporating uncertainty into demographic modeling: application to shark populations and their conservation. Conserv. Biol. 16: 1048–1062.

Cortes, E. 2008. Comparative life history and demography of pelagic sharks. Chapter 27, pp 309–322 in M. D. Camhi, E. K. Pikitch and E. A. Babcock eds "Sharks of the Open Ocean – Biology, Fisheries and Conservation". Blackwell Science, Oxford.

Cortes, E., Brown, C.A. and L.R. Beerkircher. 2007. Relative abundance of pelagic sharks in the western North Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. Gulf Caribb. Research 19: 37–52.

Cortes, E., Arocha, F., Beerkircher, L., Carvalho, F., Domingo, A., Heupel, M., Holtzhausen, H., Santos, M.N., Ribera, M. and C. Simpfendorfer. 2008. Ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries. Collective Volume of Scientific Papers ICCAT 138

Domingo, A. 2004. ¿Adónde fue el *longimanus*? *Elasmovisor***,** Bol. SBEEL, Julio, Brasil; pp: 6.

Domingo, A., Miller, P., Forselledo, R., Pons M. and L. Berrondo. 2007. Abundancia del tiburon loco (Carcharhinus longimanus) en el Atlantic sur. Col. Vol. Sic. Pap. ICCAT 60(2): 561–565.

FAO. 2001. A background analysis and framework for evaluating the status of commercially-exploited aquatic species in a CITES context. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. 23 pp. www.fao.org/DOCREP/MEETING/003/Y1455E.HTM.

FAO. 2004. Report of the Expert Consultation on Legal Issues Related to CITES and Commercially-exploited Aquatic Species. FAO Fisheries Report. No. 746; Rome. 21p.

Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Simpfendorfer, C.A. and J.A. Musick, eds. 2005. *Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes. Status Survey*. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. x + 461 pp. Section on *C. longimanus*, pp. 295–296, authored by M.J. Smale.

Hazin, F.H, Humberto G., Hazin and Paulo Travassos 2007. CPUE and catch trends of shark species caught by Brazilian longliners in the southwestern Atlantic Ocean. SCRS/2006/175 Col. Vol. Sci. Pap. ICCAT, 60(2): 636–647

IATTC. 2007a. Proposal for a comprehensive assessment of key shark species caught in association with fisheries in the eastern Pacific Ocean. IATTC WG to Review Stock Assessments, 8th Meeting, Document SAR-8-15. 4 pp.

IATTC. 2007b. Proposal for a comprehensive assessment of key shark species. SAR-8-15. Powerpoint presentation in support of IATTC 2007a, 9 pp.

Ingram, G.W. Jr., Driggers¸ W.B. III, Grace, M.A., Carlson, J.K. and E.Cortes in preparation. Effects of wire leader use and species-specific distributions on shark catch rates off the southeastern United States.

Kohler, N.E., Casey, J.G. and P.A. Turner. 1998. NMFS cooperative shark tagging program, 1962–93: an atlas of shark tag and recapture data. Mar. Fish. Rev. 60 (2): 1–87.

Lessa, R., Marcante S., F., and R. Paglerani. 1999. Age, growth and stock structure of the oceanic whitetip shark, *Carcharhinus longimanus*, from the southwestern equatorial Atlantic. Fisheries Research 42: 21–30.

Matsunaga, H. and H. Nakano 1999. Species composition and CPUE of pelagic sharks caught by Japanese longline research and training vessels in the Pacific Ocean. Fisheries Science 65: 16–22.

Polacheck, T. 2006. Tuna longline catch rates in the Indian Ocean: did industrial fishing result in a 90% rapid decline in the abundance of large predatory species? Marine Policy 30: 470–482.

Roman-Verdesoto, M. and M. Orozco-Zoller 2005. Bycatches of sharks in the tuna purse-seine fishery of the eastern Pacific Ocean reported by observers of the Inter-Americann Tropical Tuna Commission, 1993–2004.

Rose, D.A. 1996. An overview of world trade in sharks. TRAFFIC International. 106 pp.

SCRS. 2009. Report of the Standing Committee on Research and Statistics. International Commission for the Conservation of Atlantic Tunas. Madrid, Spain, October 5–9, 2009. 270 pp

Seki, T., Taniuchi, T., Hakano, H. and M. Shimizu. 1998. Age, growth and reproduction of the oceanic whitetip shark from the Pacific Ocean. Fisheries Science 64: 14–20.

Smith, S.E., Au, D.W. and C. Show. 1998. Intrinsic rebound potentials of 26 species of Pacific sharks. Mar. Freshw. Research 49(7):663–678.

Vannuccini, S. 1999. Shark utilization, marketing and trade. FAO Fish. Tech. Pap. 389. 470 pp.

Walsh, W.A., Bigelow, K.A. and K.L. Sender. 2009. Decreases in shark catches and mortality in the Hawaii-based longline fishery as documented by fishery observers. Mar. Coastal Fisheries 1: 270–282.

Ward, P. and R.A. Myers. 2005. Shifts in open-ocean fish communities coinciding with the commencement of commercial fishing. Ecology 86: 835–847.

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 General – 0.067 (from λ = 1.069) Western/Central Pacific – 0.11 (from λ = 1.117)	Low Low Low	Smith *et al.*, 1998 Cortes 2008 Cortes 2002
Natural mortality			
Age at maturity	Southwest Atlantic – 6–7 years (both sexes) West Pacific – 4–5 years (both sexes)	Medium Medium	Lessa *et al.*, 1999 Seki *et al.*, 1998
Maximum age			
von Bertalanffy K	Southwest Atlantic – 0.075 back-calculated lengths (0.099 observed lengths) West Pacific – 0.103	Low Low	Lessa *et al.*, 1999 Seki *et al.*, 1998
Generation time	General – 10 years General – 11.1 years Western/Central Pacific – 7 years	Low/Medium Low Medium	Cortes *et al.*, 2008 cited in proposal Cortes 2008 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

Table 2 (cont.)

Criterion	Index	Trend	Basis	Coverage	Reliability	Source
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 unstandardized CPUEs from different sources (3–)	Domingo *et al.*, 2007
SE Atlantic	CPUE longline	Decrease from mid 1990s to 2006	Comparison of observations from different sources	Southeast Atlantic	Comparison of unstandardized 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	Unstandardized 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	Unstandardized 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	Standardized, 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

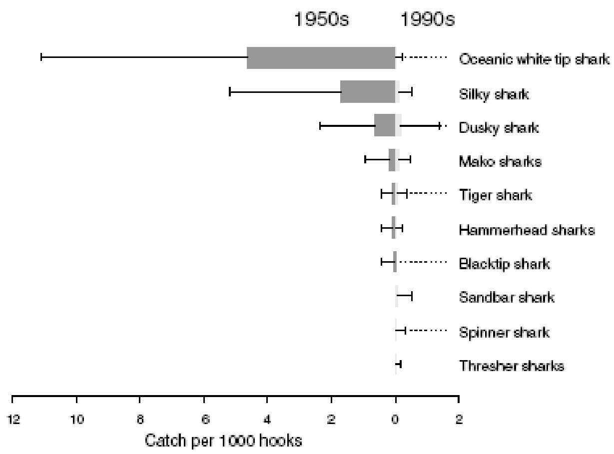


Figure 1. Mean catch rates (+/- SD) in 1950s (longline research survey) and 1990s (commercial observer from longline fleet) from Gulf of Mexico. Source : Baum and Myers 2004.

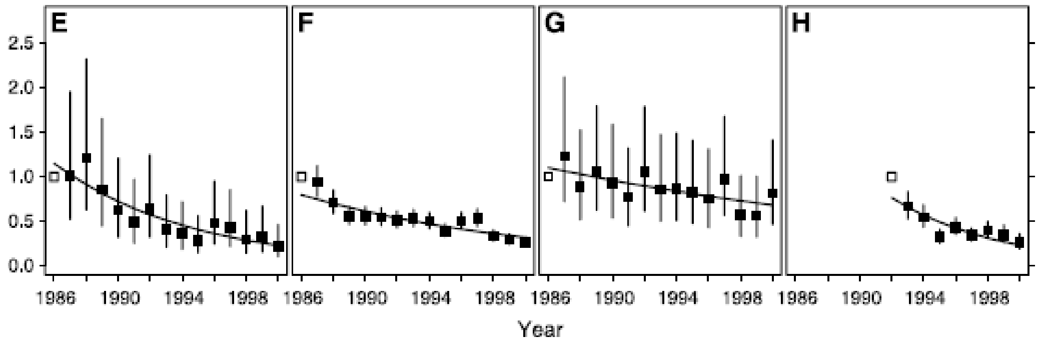


Figure 2. Relative abundance index (CPUE) of oceanic sharks in the NW Atlantic from logbook records in the pelagic long line fishery. H = Oceanic whitetip. Source: Baum *et al.,* 2003.

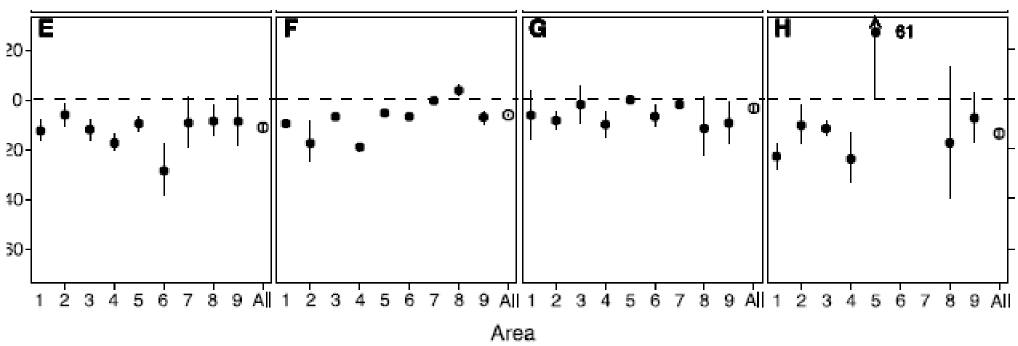


Figure 3. Rate of change in abundance over time in subareas of the NW Atlantic. H = Oceanic whitetip. Source: Baum *et al.,* 2003.

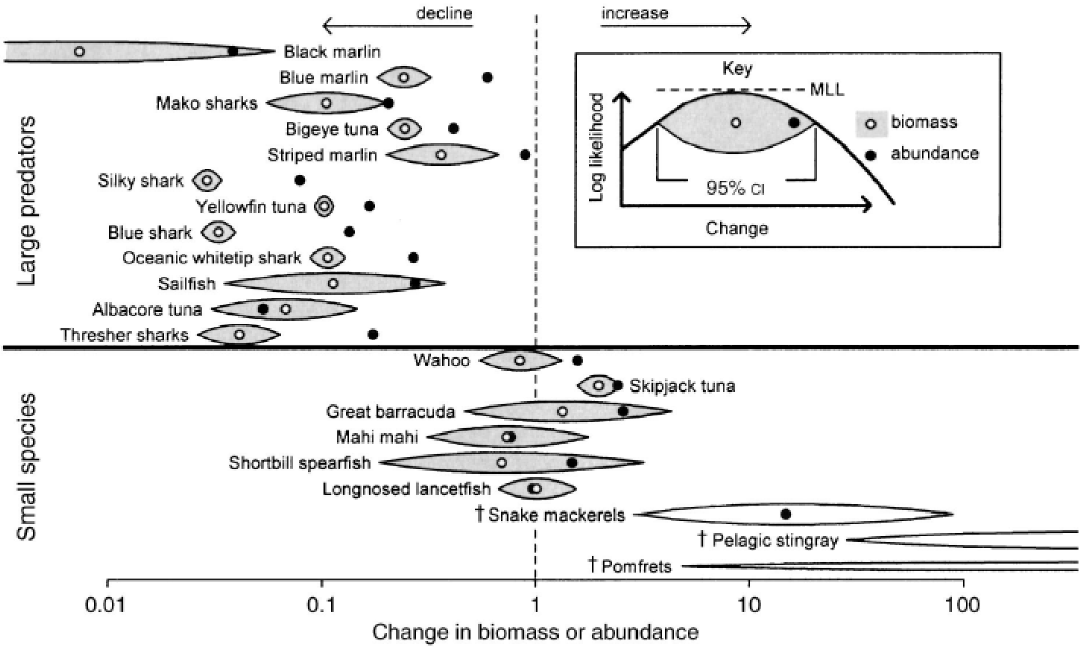


Figure 4. Change in biomass and abundance between 1950s and 1990s, Central Pacific Ocean. Source: Ward and Myers 2005.

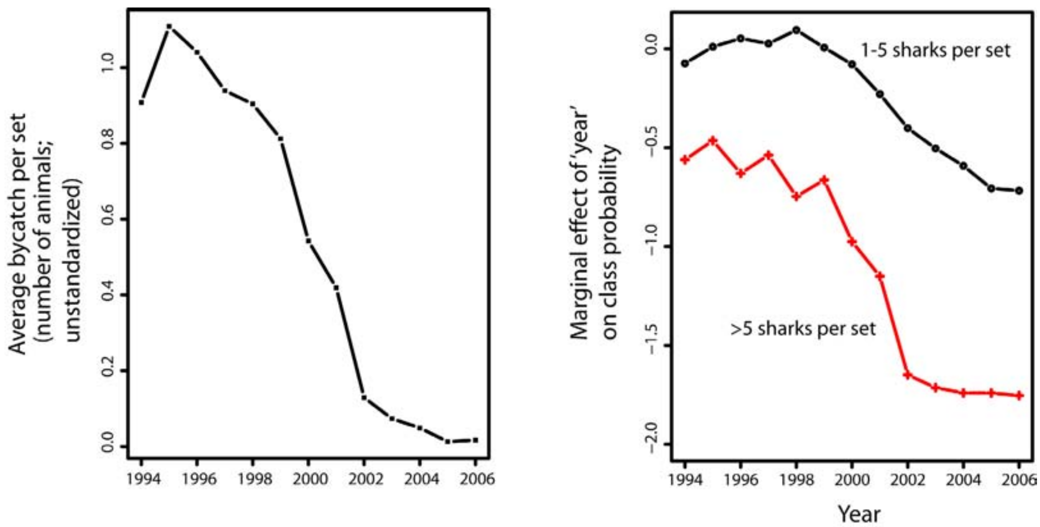


Figure 5. CPUE of Oceanic whitetip sharks, purse seine research surveys, eastern Pacific Ocean (left panel). Source: IATTC 2008.

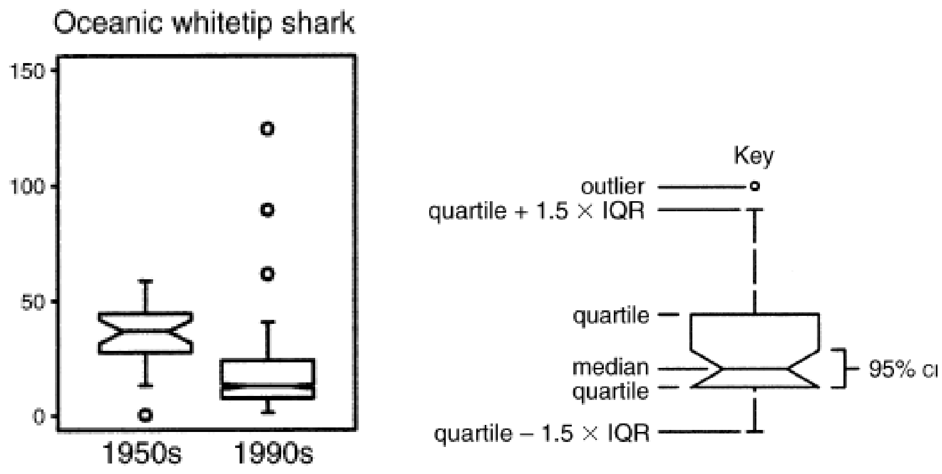


Figure 6. Change in mean body mass (kg), longline-caught individuals, Central Pacific Ocean. Source: Ward and Myers (2005)

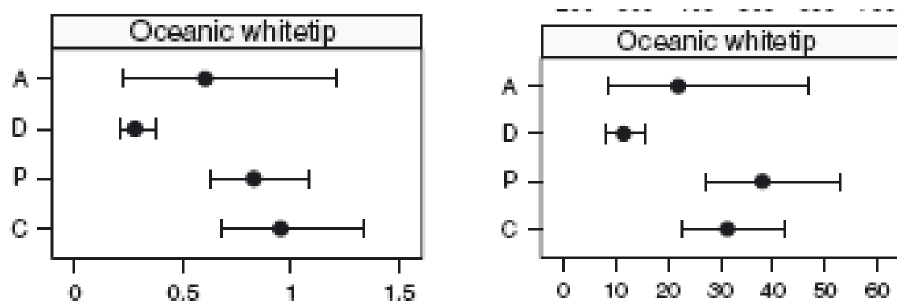


Figure 7. Estimated annual catches of Oceanic whitetip based on trade data from China, Hong Kong SAR fin market. Left panel – thousands of individuals. Right panel – tonnes. Estimates based on dorsal fins (D), pectoral fins (P), caudal fins (C) and a mixture distribution (A). Source: Clarke *et al.*,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

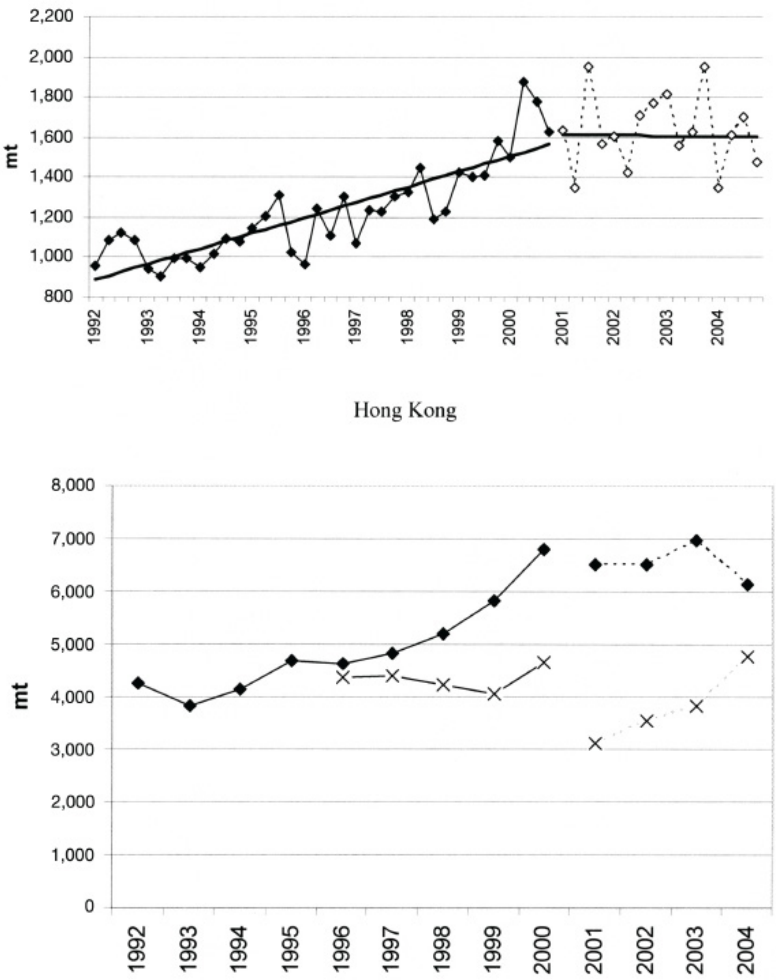


Figure 8. Imports of shark fins to China, Hong Kong SAR and mainland China. Upper figure: quarterly imports to China, Hong Kong SAR (a change in statistical reporting means values before and after 2001 are not strictly comparable). Lower figure: annual imports to China, Hong Kong SAR (solid symbols)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

APPENDIX G

FAO Expert Advisory Panel assessment report: 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.

ASSESSMENT SUMMARY

The FAO Expert Panel concluded that the available evidence supports the proposal to include porbeagleshark, *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. CoP14) 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 the European Union 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, Mello and Campana, 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, Natanson and Myklevoll, 2002; Francis, Campana and Jones, 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, Campana and Jones, 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 (Figure 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 tonnes 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 (Figure 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 (Figure 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 (Figure 7). According to the age structured model the current population size is about 22% to 27% of its size in 1961 (Figure 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 (Figure 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 (Figure 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 (Figure 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 tonnes 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;Figure 15).

Assessment relative to quantitative criteria

Small population

The estimate of total population size for the Northwest Atlantic is 11 000–14 000 mature females, and 196–207 thousand total individuals. For the Northeast Atlantic total population size is 127 000– 204 000 individuals. The total population size in the North Atlantic would be therefore at least 323 000 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 CoP14). 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 CoP14), 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 United States of America, 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. CoP14) 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 the European Union 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 United States of America and EU, from Japan to the EU, and from the EU to the United States of America 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 China Hong Kong, SAR 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 tonnes 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 UNITED STATES OF AMERICA 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 United States of America 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. CoP14) 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.

References supporting the Panel assessment

Anonymous, 2008. Results of the International Expert Workshop on CITES Non-Detriment Findings. Cancun, Mexico, November 17th to 22nd, 2008. www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/ Links-Documentos/WG-CS/WG8-Fishes/WG8-FR.pdf

Campana, S. and A. J. F. Gibson. 2008. Catch anad stock status of Porbeagle shark (Lamna nasus) in the Northwest Atlantic to 2007. NAFO Doc. 08⁄36.

Campana, S., Marks, L., Joyce, W. and S. Harley. 2001. Analytical assessment of the Porbeagle shark (*Lamna nasus*) in the northwest Atlantic, with estimates of long-term sustainable yield. Can. Sci. Adv. Sect. Res. Doc. 2001/67: 39 pp. Available at: www.dfo-mpo.gc.ca/csas/Csas/ publications/ResDocs-DocRech/2001/2001_067_e. htm.

Campana, S.E., Natanson, L.J. and S. Myklevoll. 2002. Bomb dating and age determination of large pelagic sharks. Can. J. Fish. Aquat. Sci. 59:450–455.

Clarke, S.K., Magnussen, J.E., Abercrombie, D.L., Mcallister, M.K. and M.S. Shivji. 2006. Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. Conservation Biology 20: 201– 211.

COSEWIC. 2004. COSEWIC assessment and status report on the Porbeagle shark (*Lamna nasus*) in Canada. Committee on Status of Endangered Wildlife in Canada, Ottawa. viii+43 pp. Available at www.sararegistry.gc.ca/status/status_e.cfm.

FAO. 2001. A background analysis and framework for evaluating the status of commercially-exploited aquatic species in a CITES context. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. 23 pp. Available at: www.fao.org/DOCREP/MEETING/003/Y1455E.HTM, consulted February 5, 2007.

FAO. 2007. Second FAO expert advisory panel for the assessment of proposals to amend Appendices I and II of CITES concerning commercially-exploited aquatic species. Rome 26–30 March 2007. FAO Fisheries Report No. 833: v + 133 pp.

Ferretti, F., Myers, R.A., Serena, F. and H.K. Lotze. 2008. Loss of Large Predatory Sharks from the Mediterranean Sea. Conserv. Biol. 22: 952–964

Fowler, S., Raymakers, C. and U., Grimm. 2004. Trade in and conservation of two shark species, Porbeagle (*Lamna nasus*) and spiny dogfish (*Squalus acanthias*).

Francis, M.P., Campana, S.E. and C.M. Jones 2007. Age under-estimation in New Zealand Porbeagle sharks (*Lamna nasus*): is there an upper limit to ages that can be determined from shark vertebrae? Mar. Freshw. Res. 58: 10–23.

Gibson, A.J. and S.E. Campana. 2005. Status and recovery potential of Porbeagle shark in the Northwest Atlantic. CSAS Res. Doc. 2005/53. 79pp.

ICES. 2006a. Northeast Atlantic Porbeagle. ICES Advice 2006, Volume 9: 81–85. Available at: www.ices.dk/committe/acfm/comwork/report/2006/oct/nea%20Porbeagle.pdf).

ICES. 2006b. Porbeagle in the northeast Atlantic (Subareas I – XIV). pp. 115–124 in Report of the Working Group on Elasmobranch Fisheries (WGEF), 14–20 June 2006. ICES CM 2006/ACFM: 31.

Jensen, C.F., Natanson, H.L., Pratt Jr., L.J., Kohler N.E. and S.E. Campana. 2002. The reproductive biology of the Porbeagle shark (*Lamna nasus*) in the western North Atlantic Ocean. Fish. Bull. 100:727–738.

Matsumoto, H. 2005. Report of observer program for Japanese tuna longline fishery in the Atlantic Ocean from August 2004 to January 2005, Col. Vol. Sci. Rap. ICCAT, 59(2): 663–681).

Matsunaga, H. 2009. CPUE trend for Porbeagle caught by the Japanese tuna longline in the SBT fishery ground during 1992–2007. SCRS 2009–91. 6 pp.

Natanson, L.J., Mello J.J. and S.E. Campana. 2002. Validated age and growth of the Porbeagle shark, *Lamna nasus*, in the western North Atlantic ocean. Fish. Bull. 100: 266–278.

Rose, D.A. 1966. An overview of world trade in sharks and other cartilaginous fishes. TRAFFIC International, Cambridge. 106 pp.

Rosser, A.R. and M.J. Haywood. (compilers). 2002. Guidance For CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports. IUCN, Gland, Switzerland and Cambridge, U.K. 146pp.

SCRS. 2009. Report of the 2009 Porbeagle stock assessments meeting. Copenhagen, Denmark, June 22 to 27, 2009. SCRS/2009/014. 57 pp.

Shivji, M.S., Clarke, M., Pank, L., Natanson, L.J., Kohler, N. and M. Stanhope. 2002. Genetic identification of pelagic shark body parts for conservation and trade monitoring. Cons. Biol. 16: 1036–1047.

Vannuccini, S. 1999. Shark utilization, marketing and trade. FAO Fish. Techn. Pap 389. Available at www.fao.org/docrep/005/x3690e/x3690e00.htm

Waessle, J.A. 2007. Analisis de las capturas *Squalus acanthias* y *Lamna nasus* en las Flotas Congeladora y Factoria (Convencionla y Surimera) con observadores a bordo. Periodo 2003–2006. Inf. de Asesoramiento y Transferencia INIDEP N05/07, 12p.

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) 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 Male: 50% mature at 8 yr (N. Atlantic), 8–10 yr (S. Pacific)	Low (greater than 8 yr)	Proposal; Campana *et al.*, 2001; Francis, Campana and Jones., 2007
Maximum age	> 29 – 45 years (Northwest Atlantic) 60 years (Southern hemisphere)	Low (greater than 25 yr)	Proposal; Francis, Campana and Jones., 2007, SCRS, 2009.
K	0.07, Northwest Atlantic	Low (less than 0.15)	Natanson, Mello and Campana., 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.)

Area	Index	Trend	Basis	Coverage	Reliability	Source
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)

Table 2 (cont.)

Area	Index	Trend	Basis	Coverage	Reliability	Source
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)

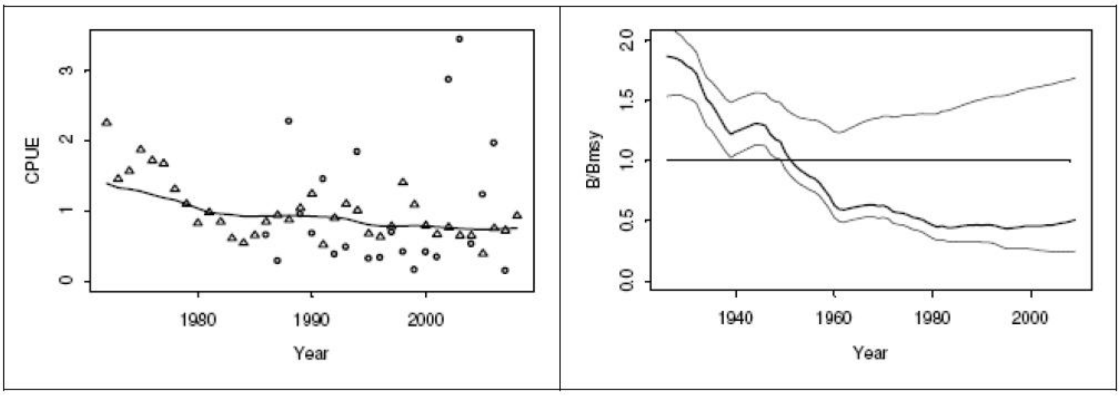


Figure 1. Results of a Bayesian surplus production model of the Northeast Atlantic porbeagle stock. Left: French and Spanish CPUE and fitted biomass trend. Right: biomass (B) relative to biomass at MSY (B_{msy}). (Source: SCRS, 2009).

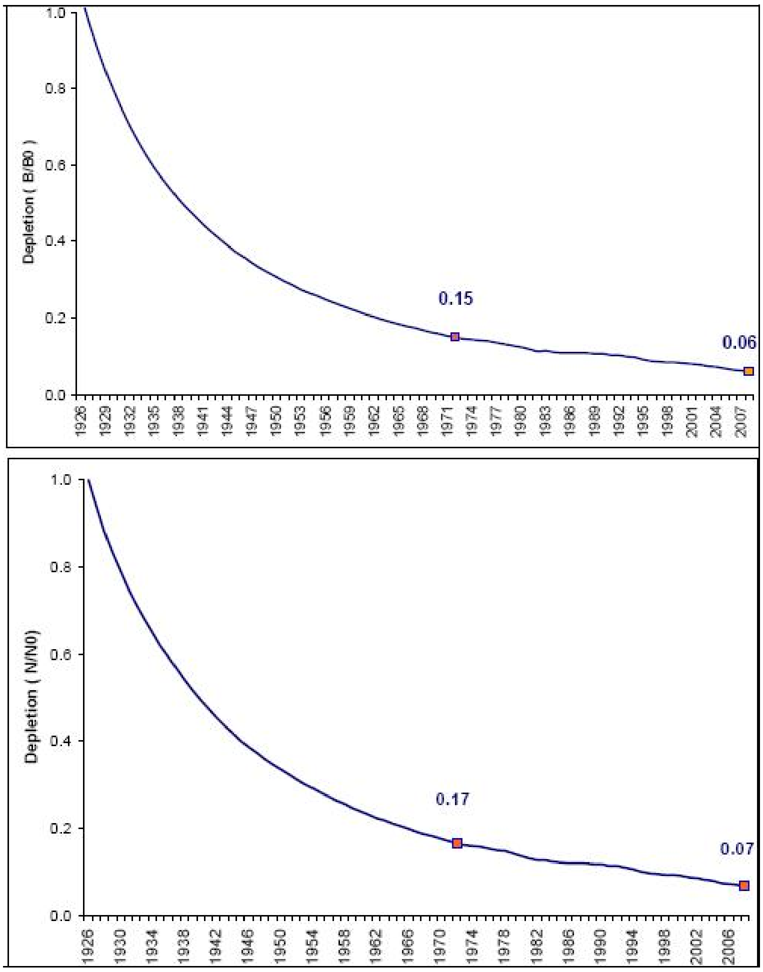


Figure 2. Depletion in total biomass (upper panel) and numbers (lower panel) for the age-structed production model assuming virgin conditions in 1926 for Northeast Atlantic porbeagle shark. The dots indicated on the line correspond to depletion at the beginning of the modern period (1972) and current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

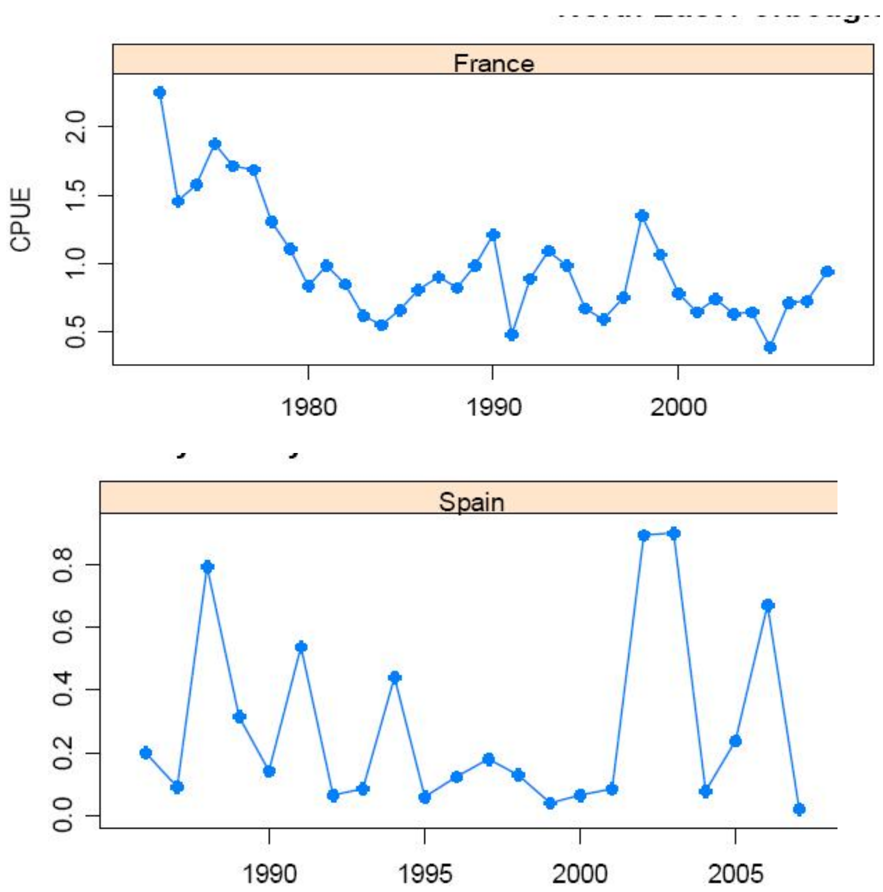


Figure 3. French and Spanish porbeagle CPUE from longline fisheries in the Northeast Atlantic (SCRS, 2009).

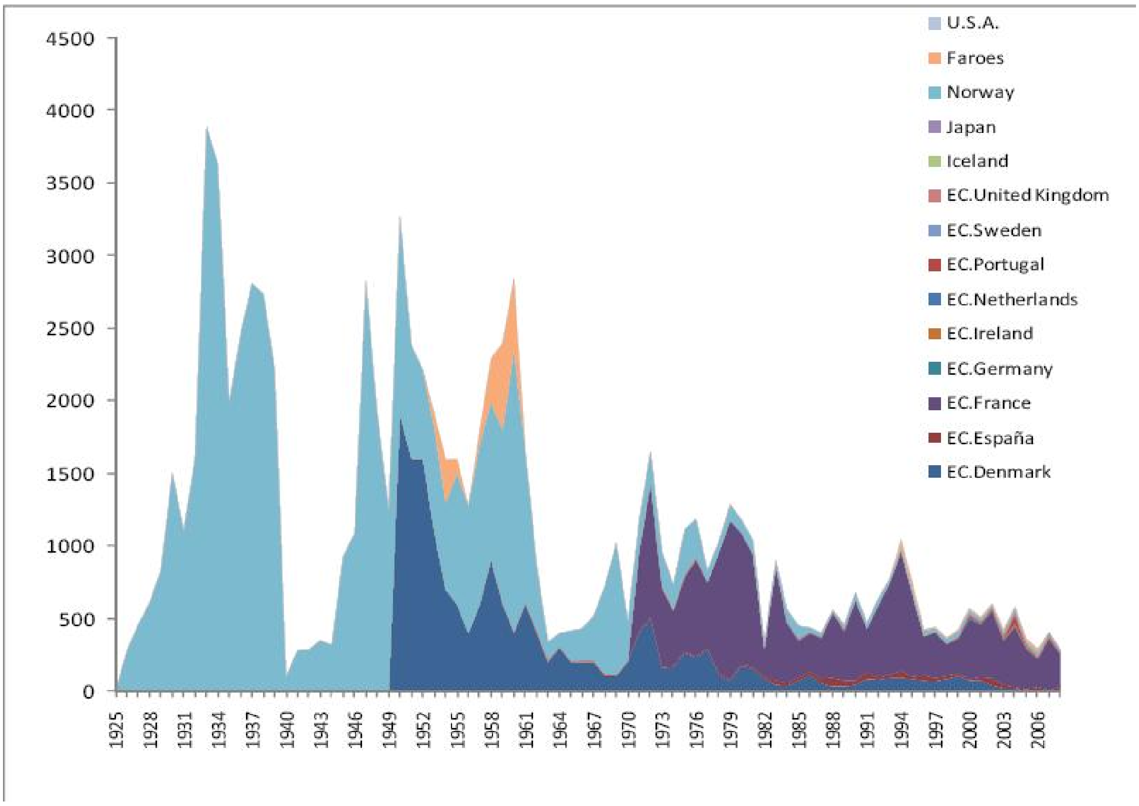


Figure 4. Catch of porbeagle sharks from the northeastern Atlantic by country used in the assessment undertaken by SRCS (2009).

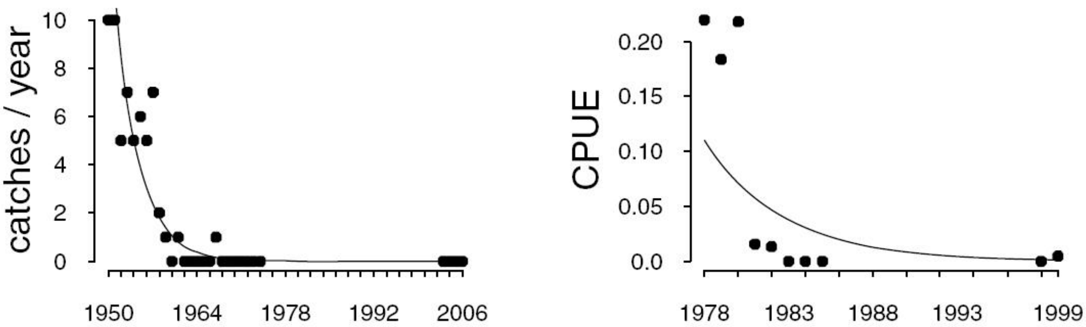


Figure 5. Trends in lamnid shark standardized annual catches in tuna traps in the Ligurian Sea (left) and in catch per unit effort (CPUE, sharks landed per 1000 hooks) for the Ionian sea (Ferretti *et al.*, 2008).

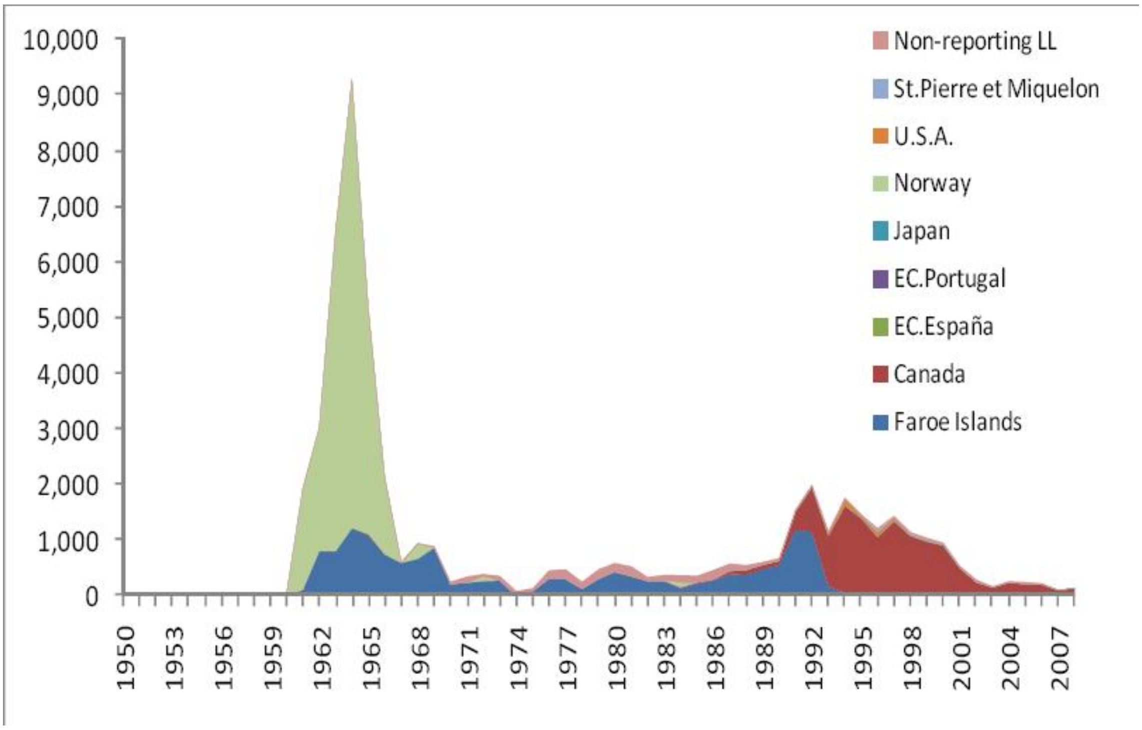


Figure 6. Catch of porbeagle sharks from the northwestern Atlantic by country used in the assessment undertaken by SRCS (2009).

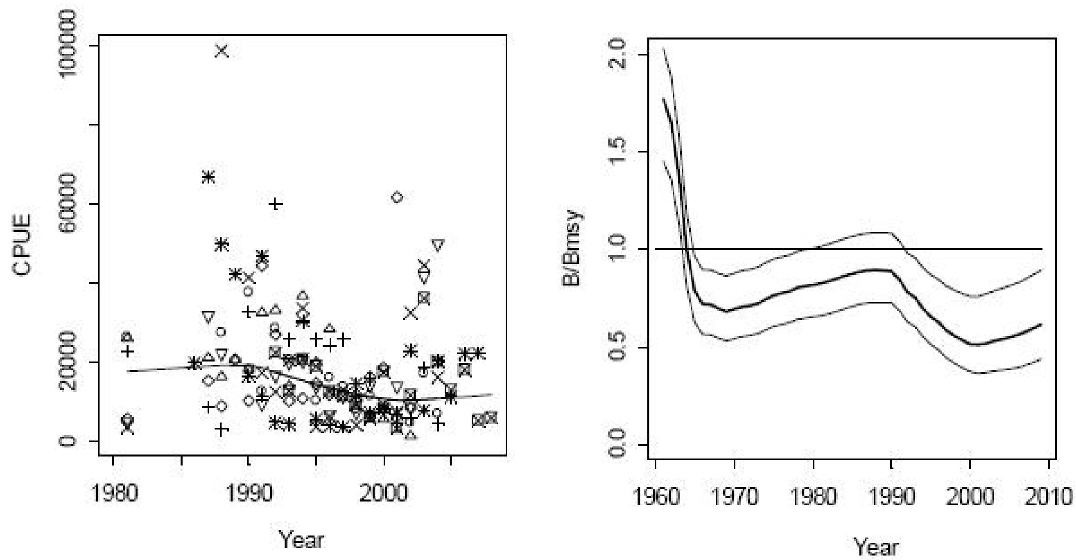


Figure 7. Results of a Bayesian Surplus Production model of the Northwest Atlantic porbeagle stock. Left: Canadian, US and Spanish CPUE and fitted biomass trend. Right: biomass (B) relative to biomass at MSY (B_{MSY}) (Source: SCRS, 2009).

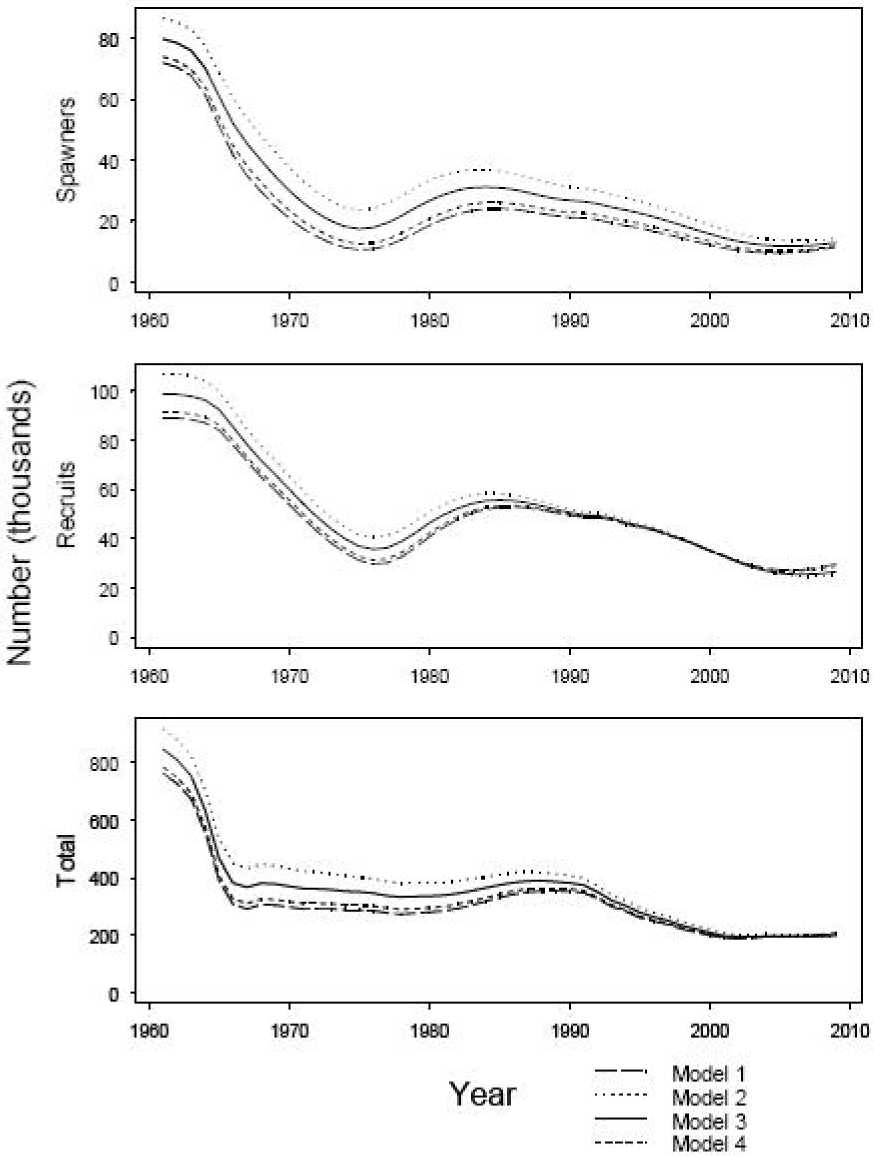


Figure 8. Estimated numbers of mature females (top), age-1 recruits (centre) and total number of *Lamna nasus* in Canadian waters, 1961–2008. (Source: Campana and Gibson, 2008).

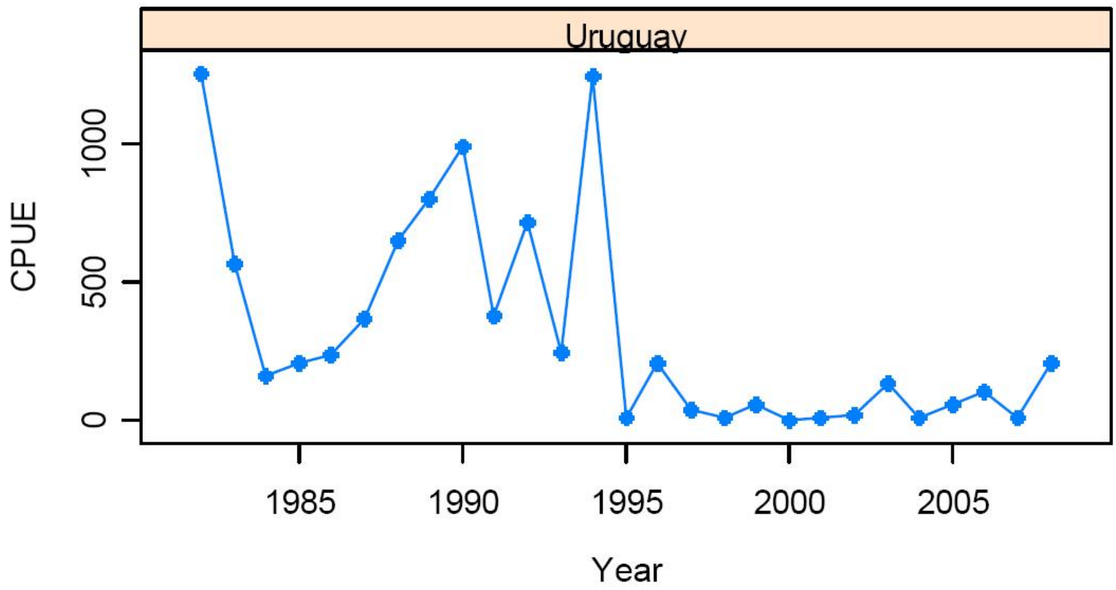


Figure 9. Uruguay porbeagle CPUE from longline fisheries in the Southwest Atlantic (SCRS, 2009).

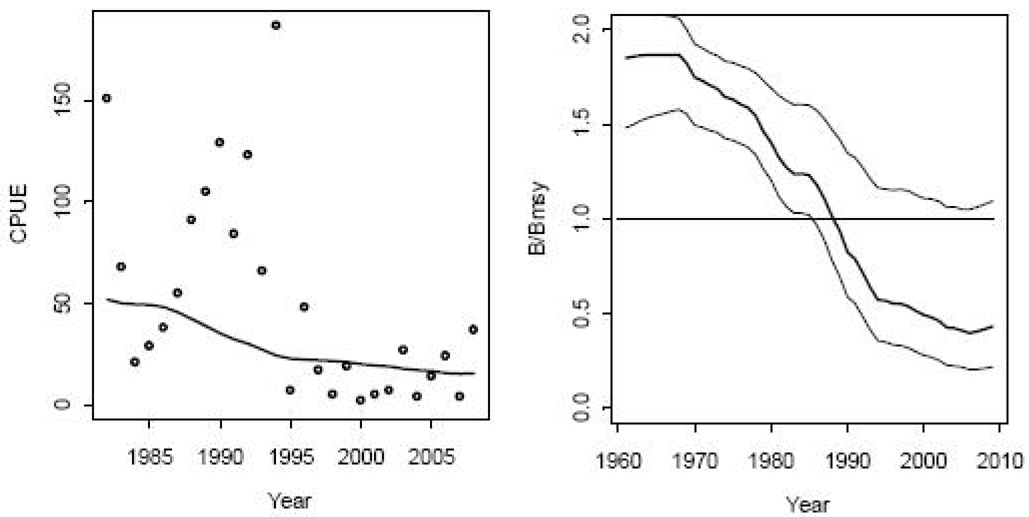


Figure 10. Results of a Bayesian Surplus Production model of the Southwest Atlantic porbeagle stock, assuming that catches are proportional to effort. Left:Uruguayan CPUE and fitted biomass trend. Right: biomass (B) relative to biomass at MSY (Bmsy) (Source: SCRS, 2009).

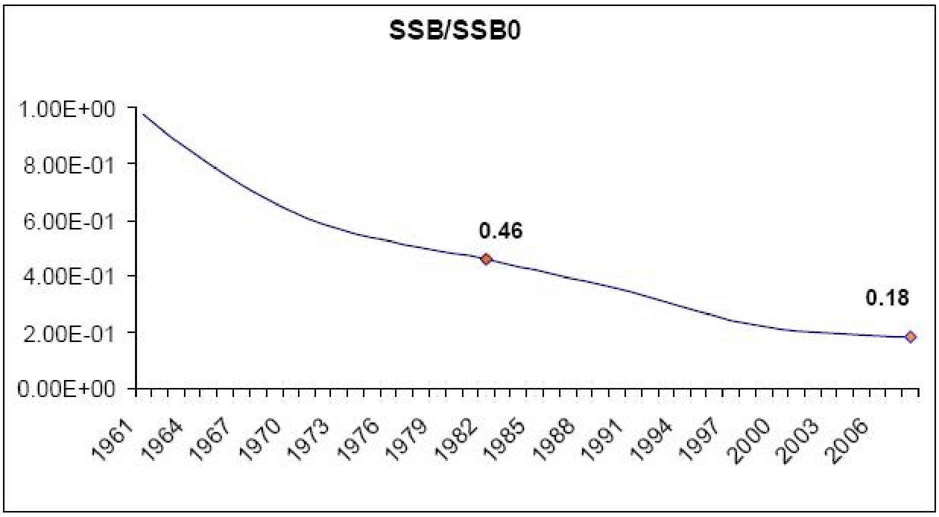


Figure 11. Relative spawning stock biomass (SSB) trend for the catch-free age structured production model assuming virgin conditions in 1961 for Southwest Atlantic porbeagle shark. Dots indicate the depletion at the beginning of the modern period (1982) and current depletion (2008) (SCRS, 2009).

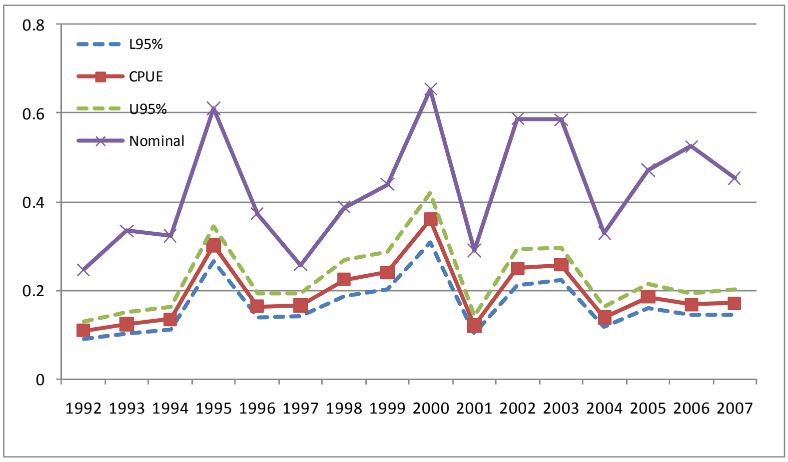


Figure 12. Trend of standardized CPUE and 95% CI and nominal (unstandardized) CPUE for porbeagle using Japanese observer data (Source: Matsunaga, 2009).

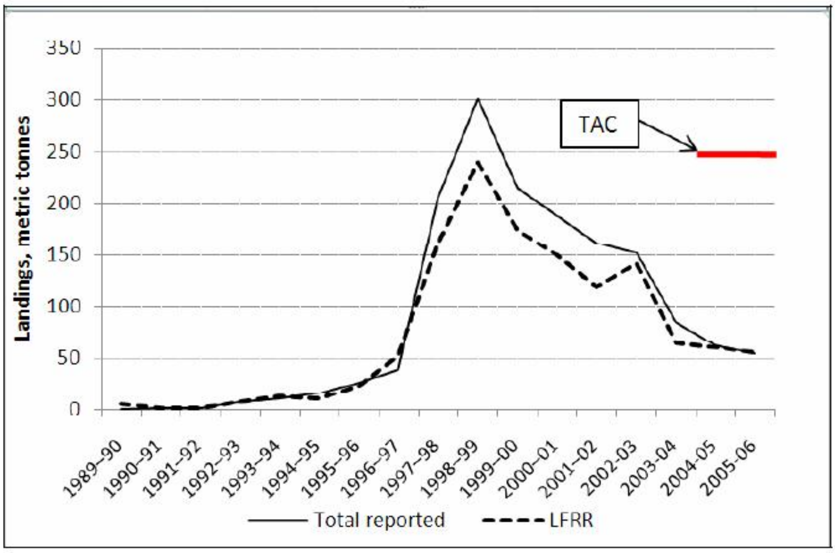


Figure 13. New Zealand commercial landings of porbeagle sharks reported by fishers and processors, 1989/90 to 2004/05. (Source: proposal).

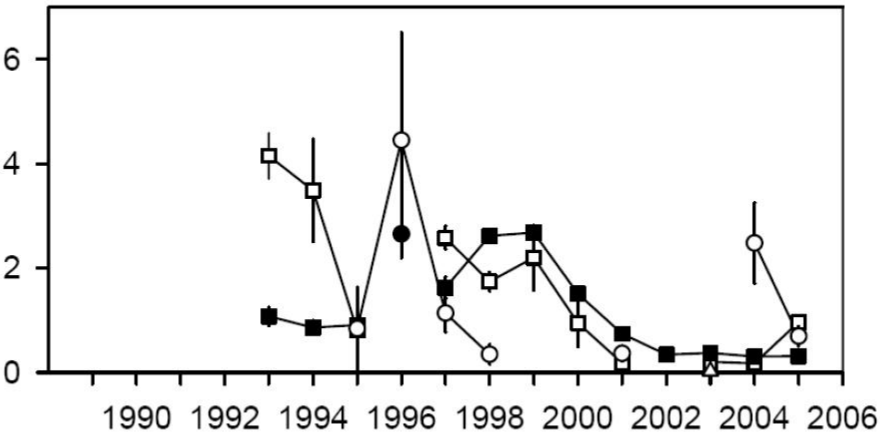


Figure 14. Unstandardized CPUE indices (number of *Lamna nasus* per 1000 hooks) for various New Zealand tuna longline fishery based on observer reports. (Source: proposal).

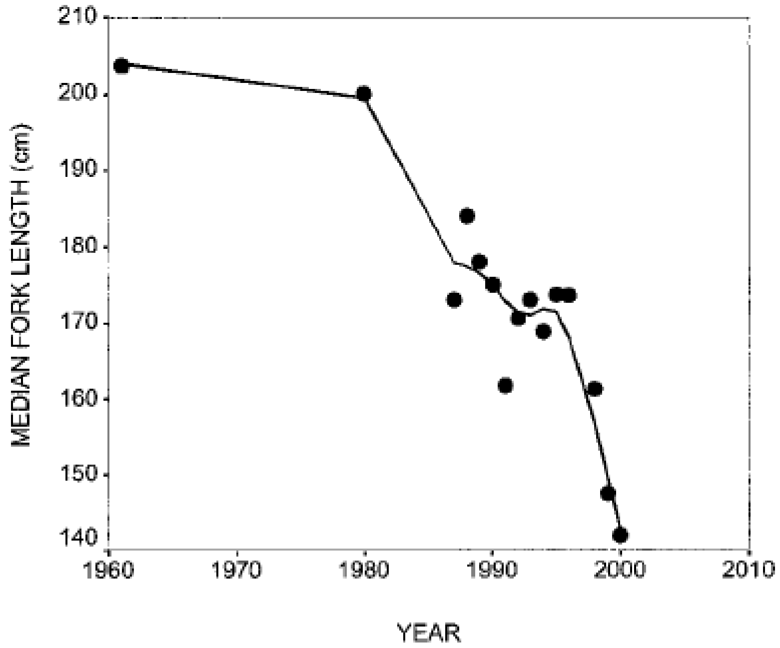


Figure 15. Change in median fork length of Porbeagle in commercial catch in September-November on mating grounds off southern Newfoundland. A LOESS smoothing line is fitted to the data. (Source: Campana *et al.*, 2001).

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)[1]

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 the European Union 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.

[1] 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.

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.

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 European Union 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 (United States of America 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 the 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 the 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. CoP14) 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, Au and Show, 1998); an estimate of 0.034 for the Northwest Atlantic (Smith e1998) 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) (Figure 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, Figure 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 (Figure 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 Figures 18–19). Landings in the Mediterranean and Black Sea (Figure 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 United States of America, 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 (Figure 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 (Figure 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 (Figure6) (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 (Figure 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 theUnited States of America 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 (Figure 8), while an eastern Scotian Shelf survey in spring (Figure 9) and a George’s Bank survey in February (Figure 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 tonnes/yr (Figure 11) (DFO, 2007). Recent landings are below 20% of these historical values, coincident with reduced TACs in the United States of America. Fisheries in theUnited States of America 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-United States of America 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 tonnes/yr since the late 1800s, with a large increase to 25 000–50 000 tonnes/yr from the mid-1940s to mid-1950s (Figure 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 tonnes 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 tonnes in 1974–79 to around 200 tonnes in the late 1990s and early 2000s. In the Sea of Japan catches were 7 500 to 11 250 tonnes 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) (Figure 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) (Figure 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 summarized 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 (i.e. 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 (United States of America 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 (e.g. 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 (Figure 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 (Figure 20), and the mean length and weight of females taken in surveys declined substantially over the past two decades (Figure 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 1 000–10 000 tonnes 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 (Figure 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 80 cm in length in the North Sea (ICES WGEF, 2006), while very few females have been greater than 80 cm 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 80 cm (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 (Figure 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 (Figure 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 EU is a significant importer (proposal Tables 5, 6), and consumed 65% of world production in 2001 (Fowler Fig. 2004). the EU countries took 77% of exports from the United States of America 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 theUnited States of America increased substantially in the 1990s, then declined, while Canadian landings increased in the late 1990s and early 2000s (Figure 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 the 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 United States of America.

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 theUnited States of America 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 the EU markets.

References supporting the Panel evaluation

ASFMC. 2008. Overview of stock status – Spiny dogfish, *Squalus acanthias*. www.asmfc.org/speciesDocuments/dogfish/stockStatus.pdf

ASMFC. 2009. Review of the Atlantic States Marine Fisheries Commission's interstate fishery management plan for Spiny dogfish (*Squalus acanthias*). May 2007–April 2008 Fishing Year. Spiny Dogfish Plan Review Team. 21 pp. www.asmfc.org/speciesDocuments/dogfish/annualreports/fmpReviews/Spiny Dogfish07-08FMPReview.pdf

Campana, S.W., Gibson, A.J.F., Marks, L., Joyce, W., Rulifson, R. and M. Dadswell. 2007. Stock structure, life history, fishery and abundance indices for Spiny dogfish (*Squalus acanthias*) in Atlantic Canada. Can. Sci. Adv. Sect. Res. Doc. 2007/089: iv + 132 pp. www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2007/2007_089_e.htm

Campana, S.E., Joyce, W. and Kulka, D.W. 2009. Growth and reproduction of Spiny dogfish off the eastern coast of Canada, including inferences on stock structure. pp. 195-208. In: Gallucci, V.F., McFarlane, G.A., and Bargmann, G. G. [eds]. Biology and management of dogfish sharks. American Fisheries Society. Bethesda, Maryland

Cortes, E. 2002. Incorporating uncertainty into demographic modeling: application to shark populations and their conservation. Conserv. Biol. 16: 1048-1062.

CITES. 2006. Implementation of CITES shark listings. CITES AC22 Doc. 17.2: 5 pp. www.cites.org/eng/com/ac/22/E22–17–2.pdf.

Courtney, D., Gaichas, S.J., Boldt, S.K., Goldman, J. and C. Tribuzio. 2004. Sharks in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. Pp.1009–1074. in NPFMC (eds.). Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region, North Pacific Fishery Management Council, North Pacific Fishery Management Council, Anchorage, Alaska.

DFO. 2006. Pacific Region, Integrated Fisheries Management Plan, Groundfish; April 1, 2006 to March 31, 2007. 137 pp.

DFO. 2007. Assessment of Spiny dogfish in Atlantic Canada. Can. Sci. Adv. Sect. Sci. Adv. Rep. 2007/046: 23 pp. www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_046_E.pdf

FAO. 1997. Stock assessment of commercial fish species in the Black Sea – Spiny dogfish, *Squalus acanthias* Linnaeus. pp 16–22. In Environmental management of fish resources in the Black Sea and their rational exploitation. General Fisheries Council for the Mediterranean, Studies and Reviews 68. ftp://ftp.fao.org/docrep/fao/006/W5020E/W5020E04.pdf

FAO. 2004. Report of the Expert Consultation on Implementation Issues Associated with Listing Commercially-exploited Aquatic Species on CITES Appendices. Rome, 25–28 May 2004. FAO Fisheries Report No. 741: vi + 21 pp.

FAO. 2007. Second FAO ad hoc expert advisory panel for the assessment of proposals to amend Appendices I and II of CITES concerning commercially-exploited aquatic species. Rome 26-30 March 2007. FAO Fish. Rep. 833: v + 133 pp.

FAO. 2009. Technical Workshop: Status, limitations and opportunities for improving the monitoring of shark fisheries and trade. Country Report – Argentina. FAO, Rome, November 3-6 2008.

Fishery Agency, Government of Japan. 2003. Report on the assessment of implementation of Japan's National Plan of Action for the Conservation and Management of Sharks for FAO (Prelim. Version). CITES AC19 Doc. 18.3, 66 pp.

Fishery Agency, Government of Japan. 2004. Spiny dogfish, *Squalus acanthias*, around Japan. 2 pp.

Fishery Agency, Government of Japan 2008. Spiny dogfish *Squalus acanthias* around Japan. In: The Current Status of International Fishery Stocks. Fishery Agency of Japan, 5 pp. In Japanese.

Fowler, S., Raymakers, C. and U. Grimm. 2004. Trade in and conservation of two shark species, porbeagle (*Lamna nasus*) and spiny dogfish (*Squalus acanthias*). CITES CoP13 Inf. 16: 58 pp. www.cites.org/common/cop/13/inf/E13i–16.pdf

Hall, S.J. 1999. The Effects of Fishing on Marine Ecosystems and Communities. Blackwell Science, Oxford. 274 pp.

ICES WGEF. 2006. Spurdog in the Northeast Atlantic. pp 19–76 in Report of the Working Group on Elasmobranch Fishes (WGEF), 14–21 June 2007. ICES Advisory Committee on Fisheries Management, ICES CM2006/ACFM:31. www.ices.dk/reports/ACFM/2006/WGEF/WGEF2006.pdf

ICES WGEF. 2008. Spurdog in the Northeast Atlantic. pp 26-36 in Report of the Working Group Elasmobranch Fishes (WGEF) 3-6 March 2008. ICES CM 2008/ACOM:16. www.ices.dk/products/CMdocs/CM-2008/ACOM/ACOM1608.pdf

Link, J.S., Garrison, L.P. and F.P. Almeida. 2002. Ecological interactions between elasmobranchs and groundfish species on the Northeast US continental shelf. I. Evaluating predation. N. Am. J. Fish. Management 22: 550-562.

MAFMC. 2009. Briefing material provided to the Mid-Atlantic Fishery Management Council, 24 Nov 2009. 64 pp.

Massa, A., Mari, N., Giussi, A. and N. Hozbor. 2007. Indices de abundancia de *Squalus acanthias* en la Plataforma Continental Argentina. INIDEP, Inf. Tecn. 006/2007, 17 pp.

McFarlane, G.A.and J.R. King. 2003. Migration patterns of Spiny dogfish (*Squalus acanthias*) in the North Pacific Ocean. Fish. Bull. 101: 358–367

Nammack, M.F., Musick, J.A. and J.A. Colvocoresses. 1985. Life history of Spiny dogfish off the Northeastern United States. Trans. Am. Fish. Soc. 114: 367–373.

New Zealand Ministry of Fisheries. 2009. Report from the Fishery Assessment Plenary, May 2009. Spiny dogfish (SPD) (*Squalus acanthias)*. pp 927-937. Available at www.fish.govt.nz

NMFS. 2006. 43rd Northeast Regional Stock Assessment Workshop; 43rd SAW Assessment Summary Report, July 2006. US Department of Commerce, Northeast Fisheries Science Center Reference Document 06–14: 46 pp. Available at www.nefsc.noaa.gov/nefsc/publications/crd/crd0614/

NPFMC. 1997. Summary of the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan. www.fakr.noaa.gov/npfmc/fmp/bsai/BSAIFMP/bsfmp97.htm#species%20categ,

NPFMC. 2001. Summary of the Gulf of Alaska Groundfish Fishery Management Plan. www.fakr.noaa.gov/npfmc/fmp/goa/GOASummary.pdf

NPFMC. 2006. Pacific coast groundfish fishery management plan. 167 pp. www.pcouncil.org/groundfish/gffmp/fmpthru19.html

Sinclair, A.F. and S.A. Murawski. 1997. Why have groundfish stocks declined? pp 71–94 in J. Boreman, B.S., Nakashima, J. A. Wilson and R. L. Kendall, editors. Northwest Atlantic groundfish: perspectives on a fishery collapse. American Fisheries Society, Bethesda, Maryland.

Smith, S.E., D.W. Au and C. Show. 1998. Intrinsic rebound potentials of 26 Pacific sharks. Mar. Freshw. Res. 49: 663–678

Taniuchi, T. 1990. The role of elasmobranch research in Japanese fisheries. NOAA Tech. Rep. NMFS 90: 415-426

Taylor, I.G. and V.F. Gallucci. 2009. Unconfounding the effects of climate and density dependence using 60 years of data on Spiny dogfish (*Squalus acanthias*). Can. J. Fish. Aquat. Sci. 66: 351-366.

Vannuccini, S. 1999. Shark utilization, marketing and trade. *FAO Fish. Techn. Pap* 389. Available at www.fao.org/docrep/005/x3690e/x3690e00.htm

Wallace, S.S., McFarlane, G.A., Campana, S.E., and J.R. King, 2009. Status of Spiny dogfish in Atlantic and Pacific Canada. pp. 313-334. In: Gallucci, V.F., McFarlane, G.A. and G. G Bargmann,. [eds]. Biology and management of dogfish sharks. American Fisheries Society. Bethesda, Maryland

Wright, B.A. and L. Hulbert. 2000. Shark abundance increases in the Gulf of Alaska. PICES Press 8(2): 16–17, 22. www.pices.int/publications/pices_press/volume8_issue2/default.aspx

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 b. NE Pacific - r_{2M} = 0.017	a. Low b. Low	a. Smith, Au and Show, 1998 b. Smith, Au and Show, 1998
Natural mortality	a. NE Atlantic – 0.1 b. NW Atlantic – 0.1 c. NE Pacific – 0.065	a. Low b. Low c. Low	a. ICES WGEF, 2006 b. NMFS, 2006 c. Smith, Au and Show, 1998
Age at maturity	a. NE Atlantic females – 11 yr b. NW Atlantic females – 12 yr; males – 6.5 yr c. NW Atlantic females – 16 yr; males – 10 yr d. NE Pacific females – 43 yr (1940s); 32 yr (2000s) e. SW Pacific females – 10 yr; males – 6 yr	Females a. Low b. Low c. Low d. Low e. Low	a. ICES, 2006a b. Nammack, Musick and Colvocoresses, 1985 c. DFO 2007 d. Taylor and Gallucci, 2009 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) b. NW Atlantic – 0.1057 (female), 0.1481 (male) c. NW Atlantic – 0.042 (female), 0.099 (male)	Females a. Low b. Low c. Low	a. ICES WGEF, 2006 b. Nammack, Musick and Colvocoresses, 1985 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 – United States of America (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[2] 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		16 605		1 040

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

[2] 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 (80 000 tonnes) to 1982 (220 000 tonnes), declined to 1992 (80 000 tonnes)	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 160 Kt, 1987-91 ca 250 Kt	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 160 Kt, 1980-84 ca 150 Kt	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 2001–2005 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.)

Area	Index	Trend	Basis	Coverage	Reliability	Source
	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 Fig. 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 Fig. 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 Fig. 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 Fig. in press, Fig. 13 this report
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	Standardized (?) CPUE (4?)	Fisheries Agency of Japan 2004, Fig. 16 (right) this report

Table 3 (cont.)

Area	Index	Trend	Basis	Coverage	Reliability	Source
	CPUE Danish Seine	Extent of decline ca 90%	Inspection of figure	Shiriyazakai	Standardized (?) CPUE (3?)	Fishery Agency of Japan 2003, Fig. 17 this report
	CPUE Danish Seinc	Extent of decline ca 81%	Inspection of figure	Erimo	Standardized (?) CPUE (4?)	Fishery Agency of Japan 2004, Fig. 18 this report
	CPUE bull trawl	Early high to low and stable	Inspection of figure	Iwate	Standardized (?) CPUE (4?)	Fishery Agency of Japan 2003, Fig. 17 this report
	CPUE Otter trawl, Danish seine	No trend	Inspection of figure	Iwate	Standardized (?) 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 tonnes 1994 to appr 1 000 tonnes 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 tonnes 1997-99 to ca. 40 000 tonnes 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 tonnes 1992-2006	Argentina – southern region	Survey biomass (5)	Massa *et al.*, 2007; Fig. 16C this report

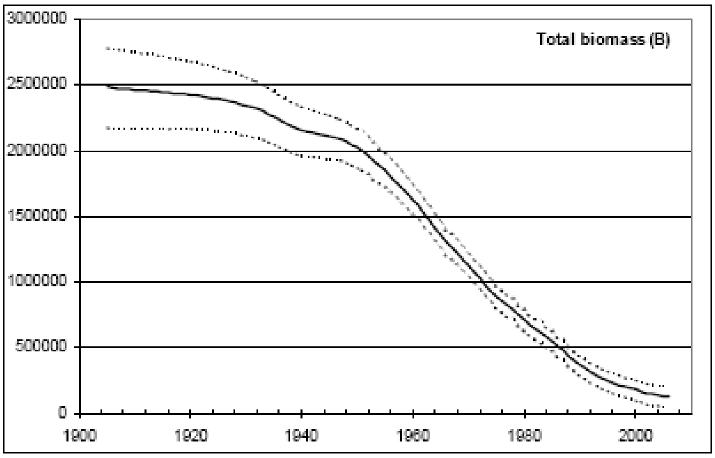


Figure 1. Total biomass, Northeast Atlantic spiny dogfish; model base case. Source: ICES WGEF, 2006; Figure 2.1.3.

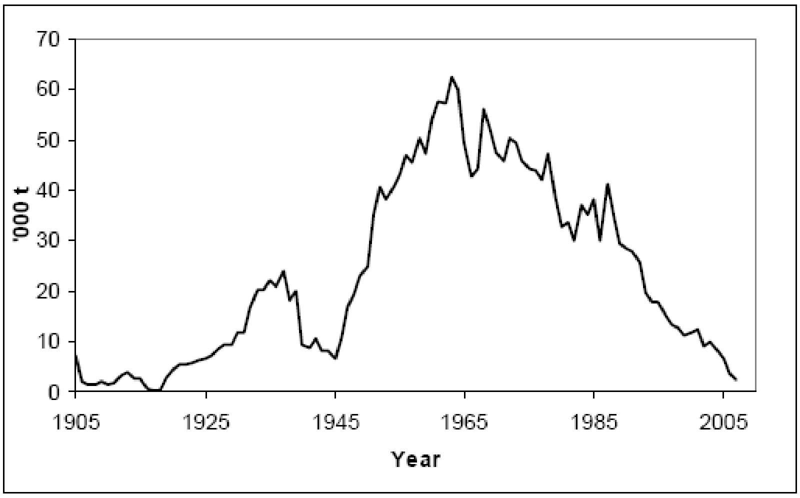


Figure 2. Landings of spiny dogfish, Northeast Atlantic. Source: ICES WGEF, 2008; Figure 2.1.

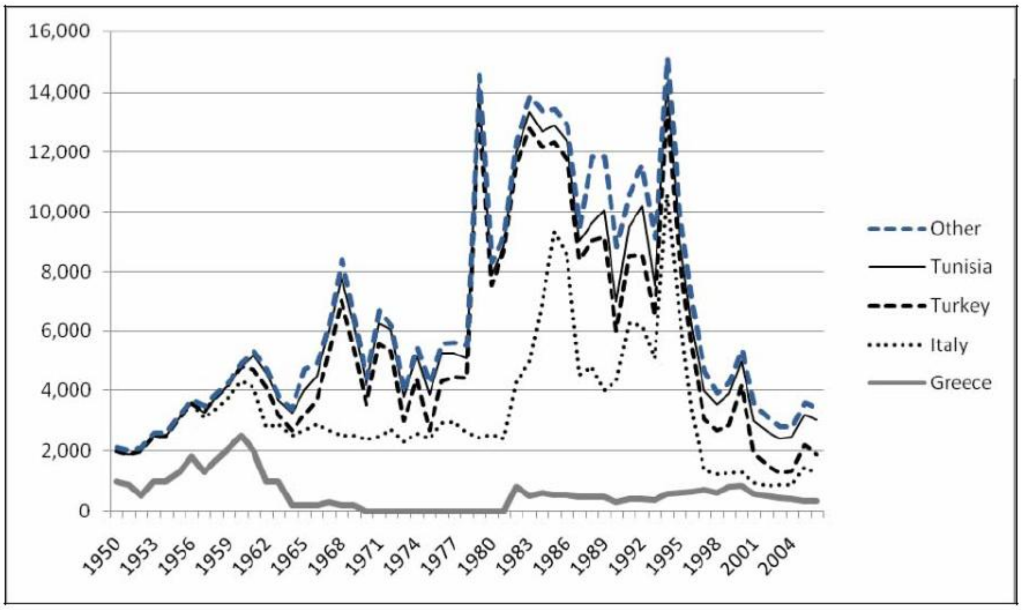
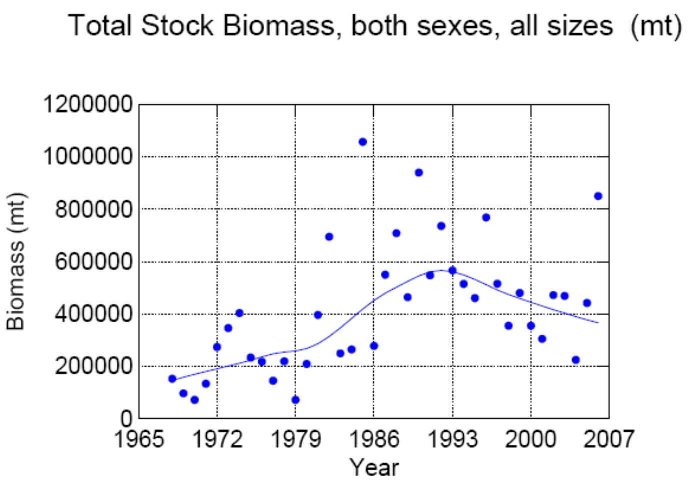


Figure 3. Reported landings by country (tonnes) of "dogfish sharks nei", "smooth-hounds nei" and *Squalus acanthias* from the Mediterranean and Black Sea, 1950–2007 (Source: FAO FishStat, proposal).



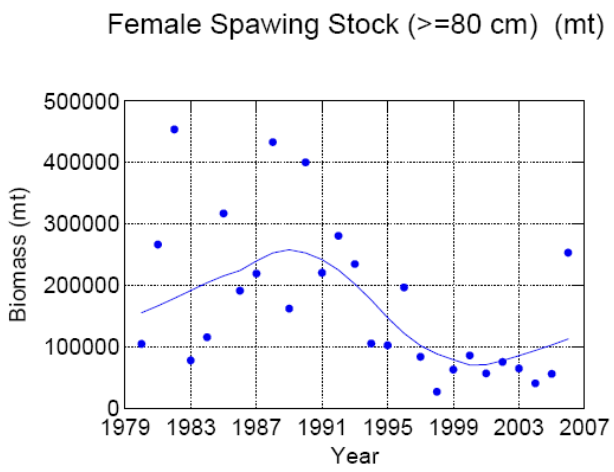


Figure 4. Swept area estimates of total dogfish biomass (tonnes), 1968–2006 (top), and for mature females only (bottom), 1980–2006, NEFSC spring R/V trawl surveys. Line represents Lowess smooth with tension factor 0.5. Source: NMFS, 2006.

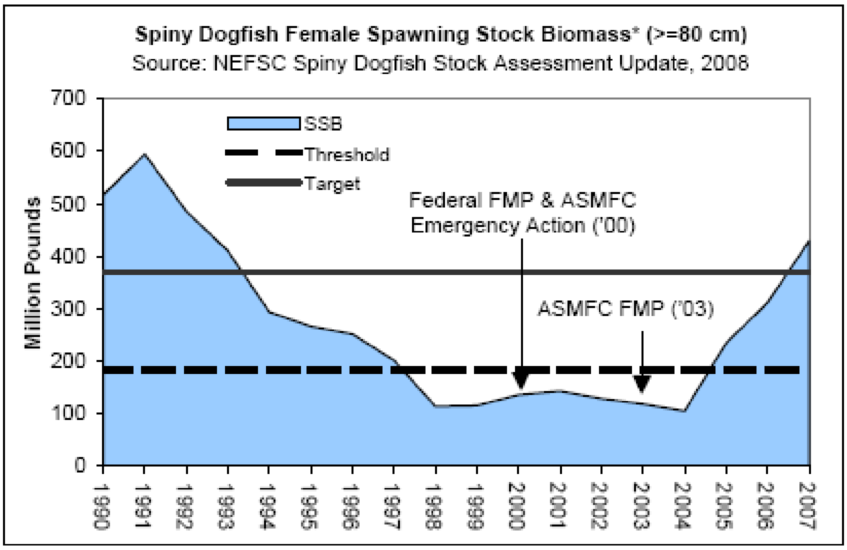


Figure 5. Female spawning stock biomass, US trawl survey. Source: ASMFC, 2008.

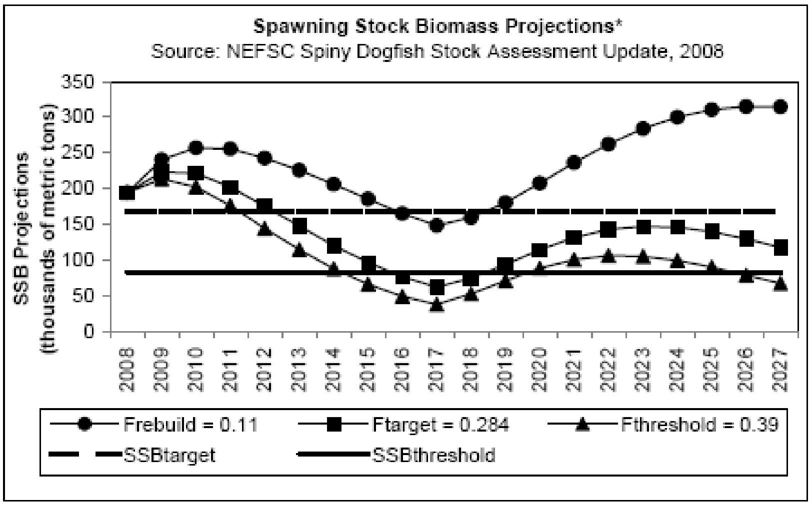


Figure 6. Spawning stock biomass projections, Northwest Atlantic spiny dogfish. Source: ASMFC, 2008.

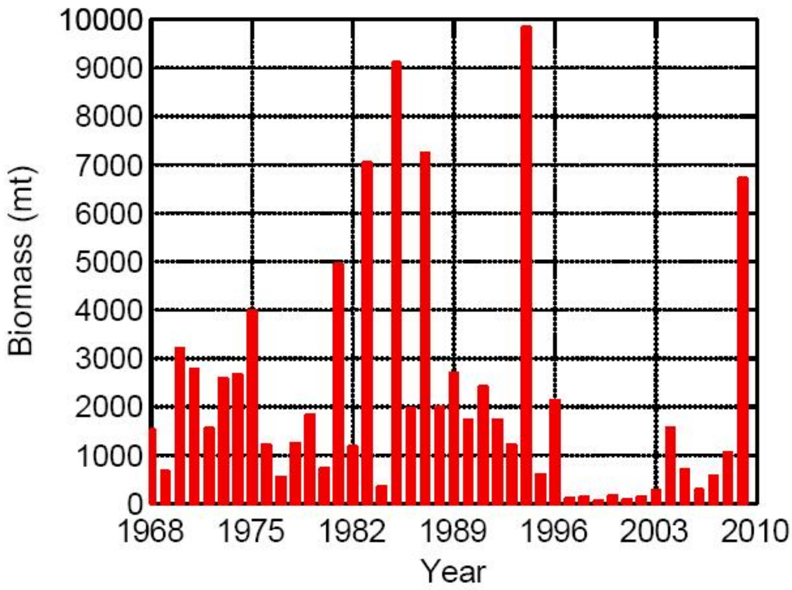


Figure 7. Swept area biomass of spiny dogfish recruits (< 1 yr old and < 36 cm TL), based on NEFSC spring bottom trawl survey, 1968-2009. Both sexes combined. Source: MAFMC, 2009.

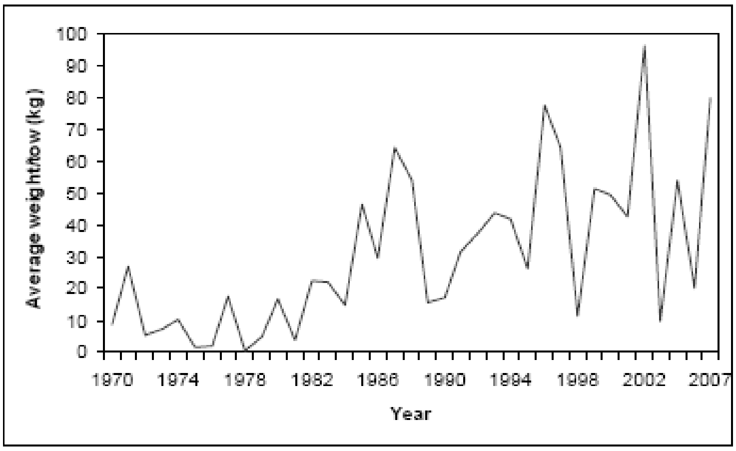


Figure 8. Relative biomass of spiny dogfish on Scotian Shelf, summer research vessel surveys. Source: DFO, 2007.

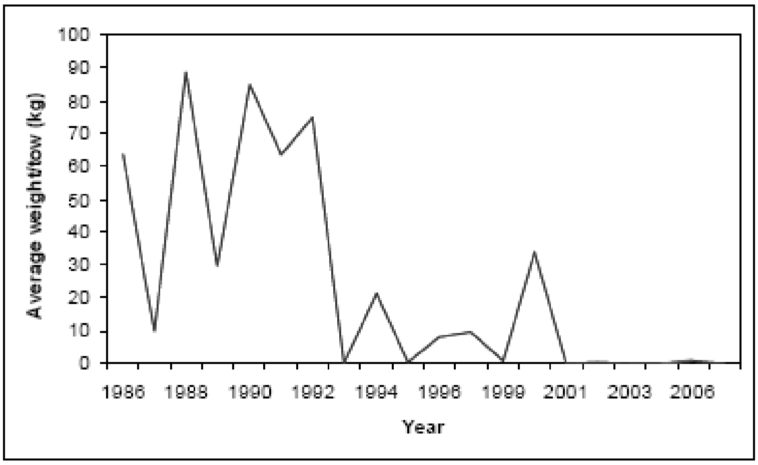


Figure 9. Relative biomass of spiny dogfish on eastern Scotian Shelf, spring research vessel surveys. Source: DFO, 2007.

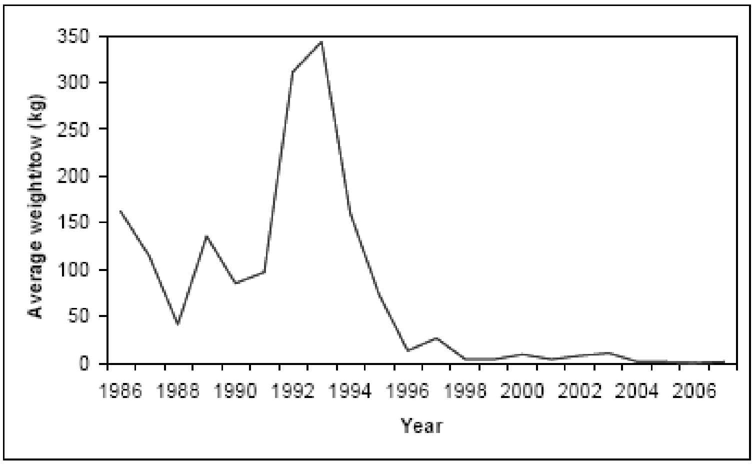


Figure 10. Relative biomass of spiny dogfish on George's Bank, February research vessel surveys. Source: DFO, 2007.

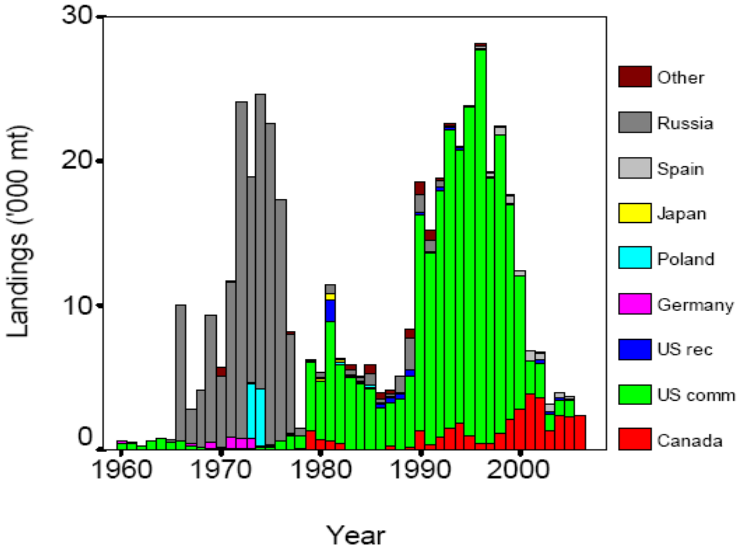


Figure 11. Reported landings, NAFO Areas 2-6 (Northwest Atlantic). Source: DFO, 2007.

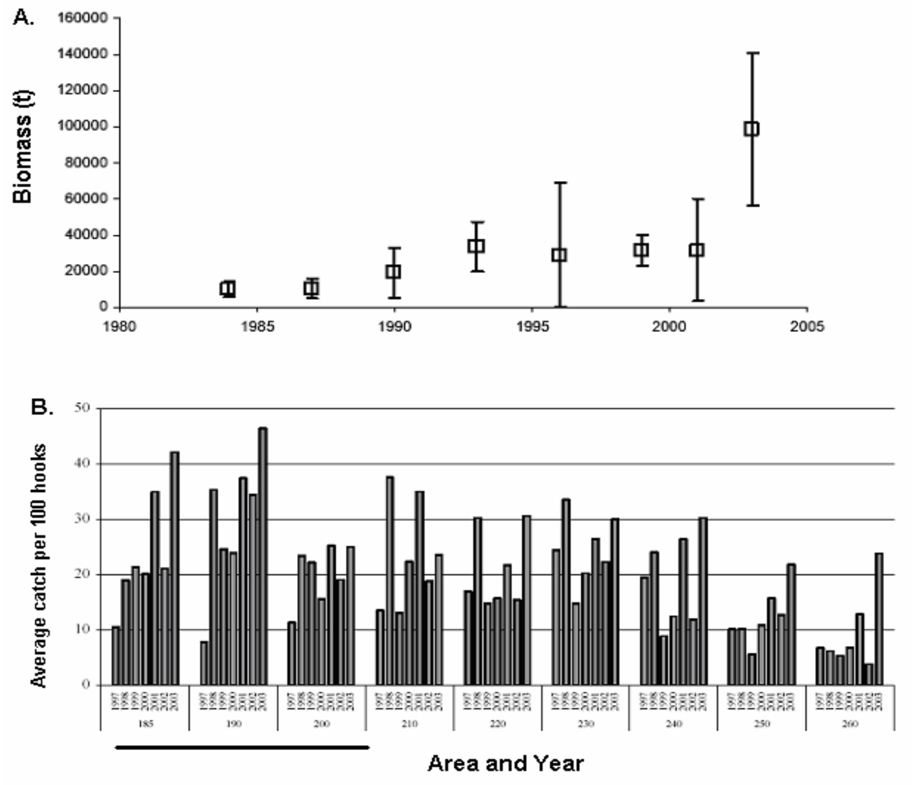


Figure 12. Trends in the abundance of spiny dogfish in the Gulf of Alaska from (A) biomass estimates (t) derived from the AFSC bottom trawl survey (error bars represent 95% confidence intervals); and (B) catch rates in the IPHC set survey. Waters adjacent to Canada off Southeast Alaska are represented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

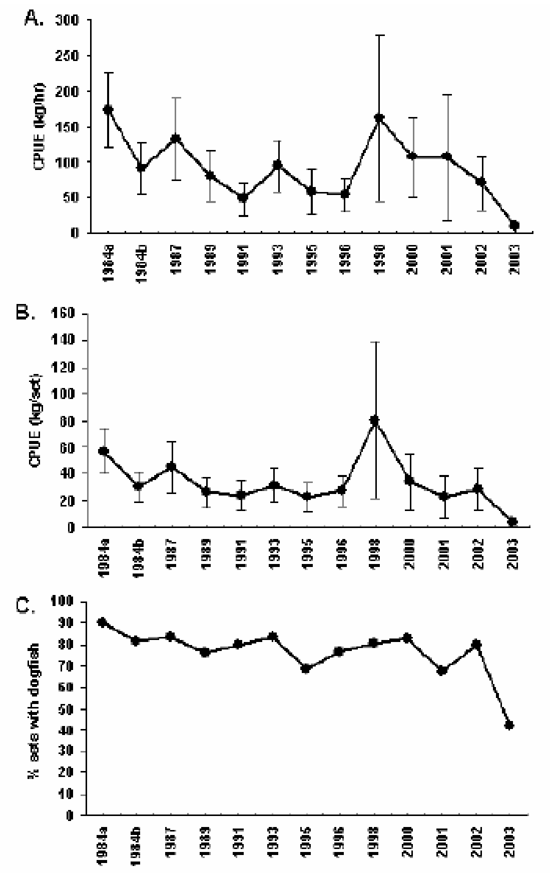


Figure 13. Trends in the abundance of Spiny dogfish from Hecate Strait trawl surveys between 1984–2003 using (A) mean CPUE (kg/hour); and (B) mean CPUE (kg/set); and (C) percentage of sets with Spiny dogfish. Error bars represent 95% confidence intervals around the mean. Source: FAO, 2007; Wallace *et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

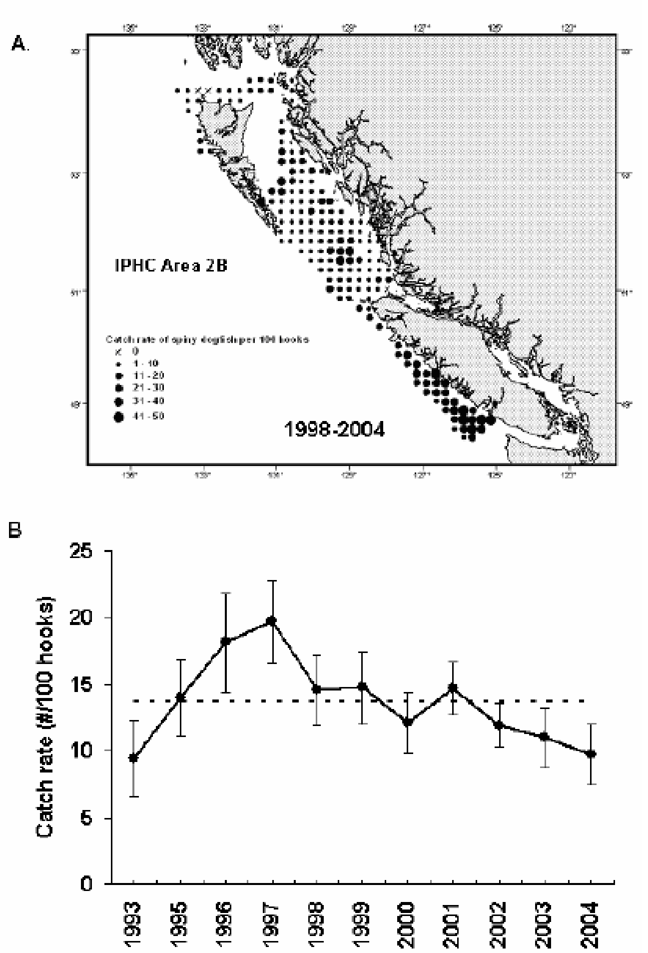


Figure 14. (A) Distribution of spiny dogfish in IPHC Area 2B shown by relative catch rates from 1998–2004 at IPHC survey stations; and (B) mean catch rate by year (error bars represent 95% confidence intervals around the mean). Dashed lined represents the series average. Data provided from the International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

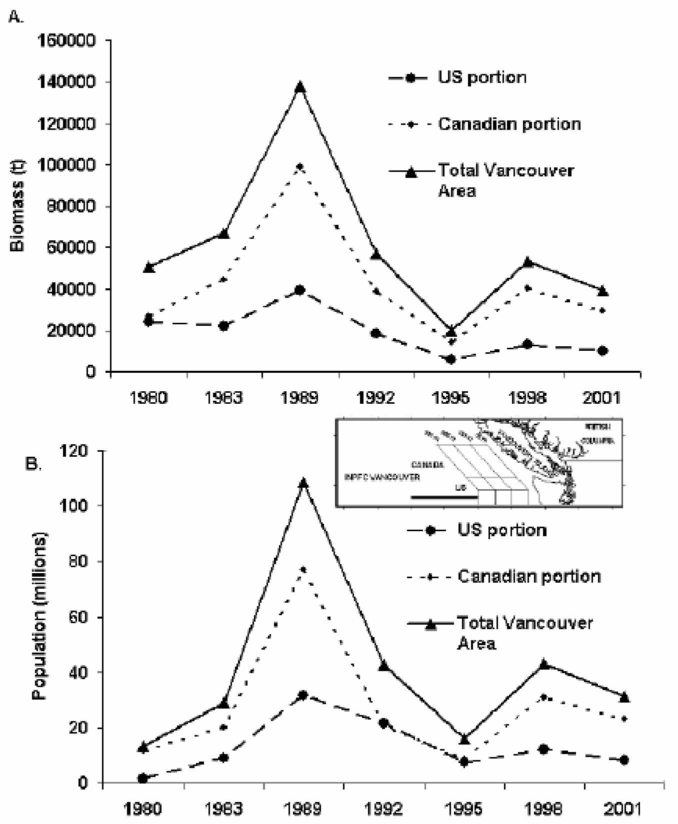


Figure 15. Swept area abundance estimates expressed as: (A) biomass; and (B) population in both the Canadian and US portions of the *INPFC Vancouver* region. Data from the National Marine Fisheries Service triennial trawl survey database. Source: FAO, 2007; Wallace *et al.*, 2009.

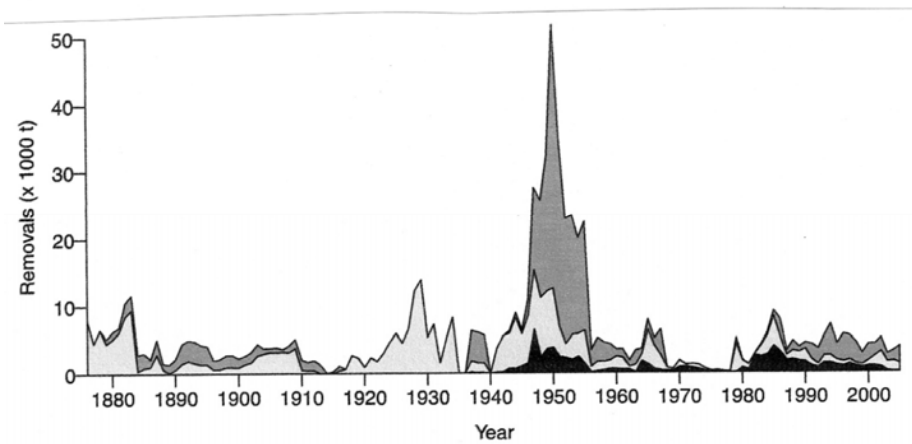


Figure 16. Reported landings of spiny dogfish in the Northeast Pacific. Solid areas: Puget Sound; lightly shaded areas: Strait of Georgia; darkly shaded areas: coastal waters between Alaska and Baja California. Source: Taylor and Gallucci, 2009.

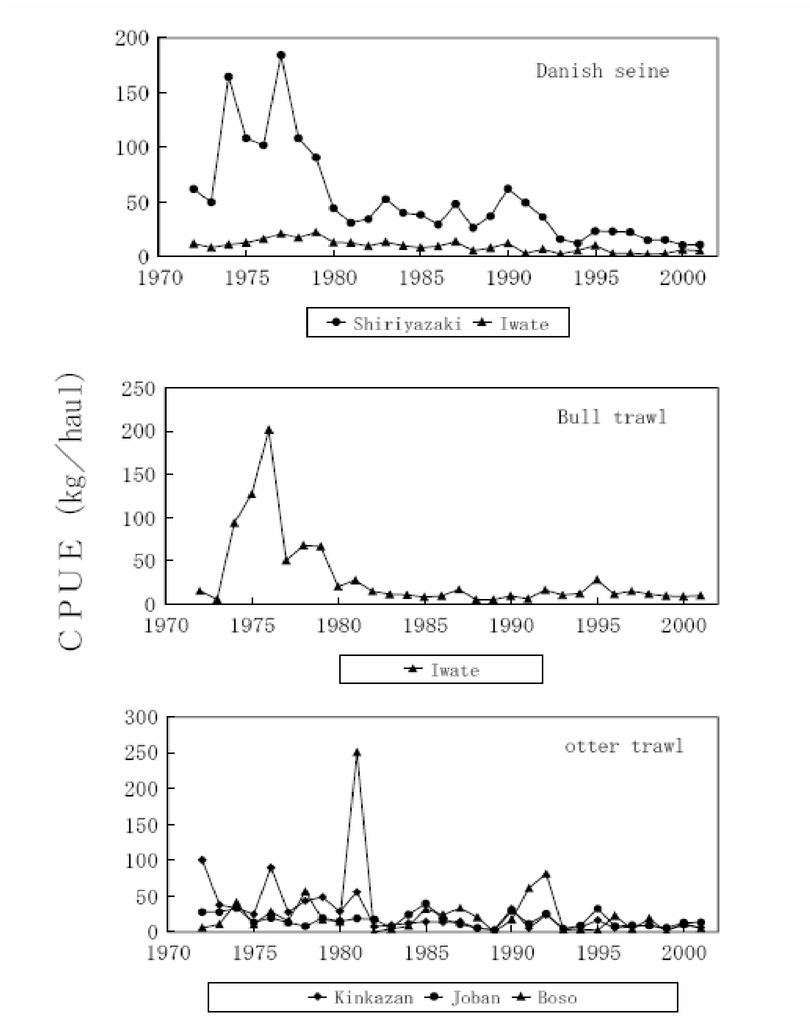


Figure 17. Eastern Japan CPUE series. Source: Fishery Agency 2003.

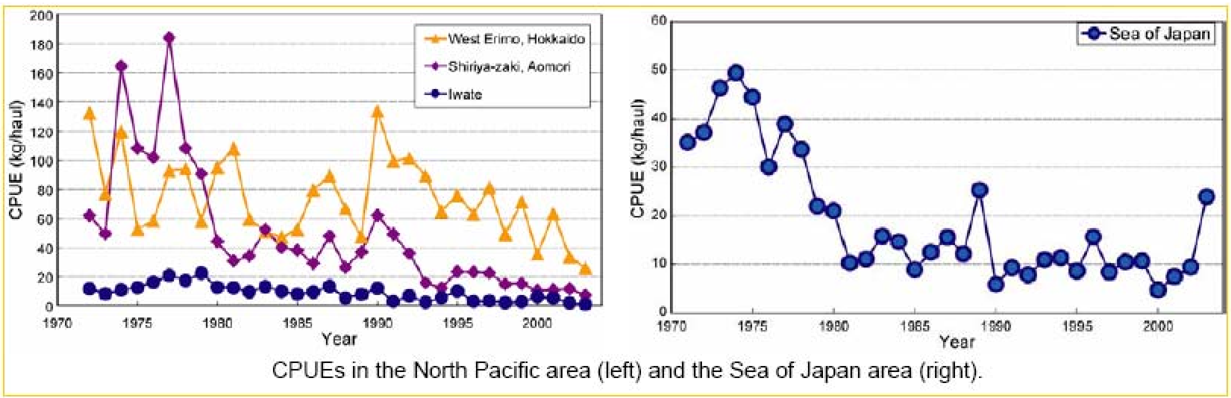


Figure 18. Catch per unit effort of spiny dogfish in several areas fished by Japan. Source: Fishery Agency 2004.

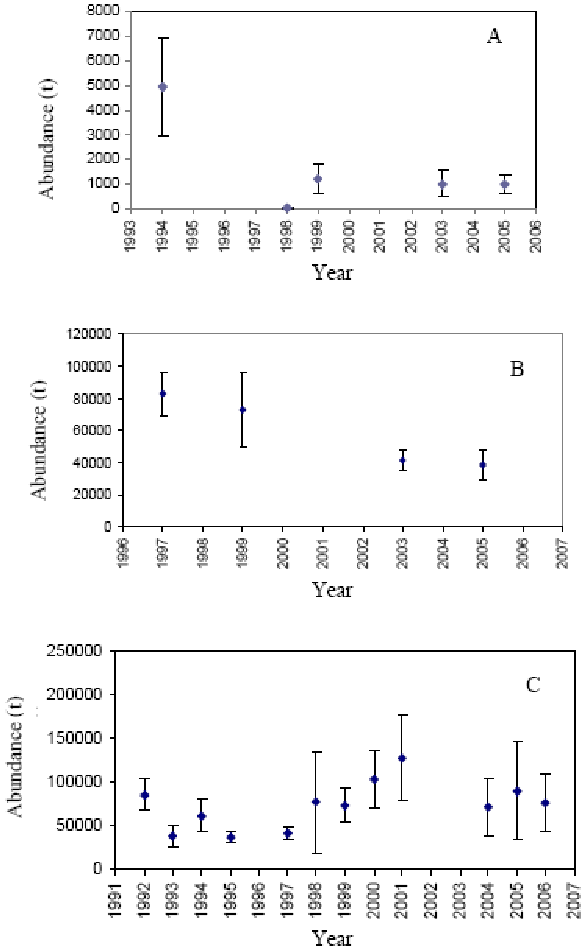


Figure 19. Swept area estimates of spiny dogfish biomass (tonnes) on the Argentinean shelf. (A) Bonaersense region; (B) central region; (C) southern Patagonian shelf. Source: Massa *et al.*, 2007.

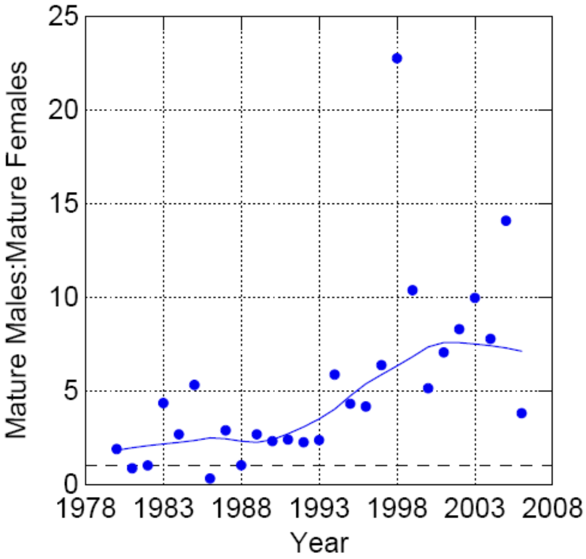


Figure 20. Ratio of number of spiny dogfish mature males (60 cm) to mature females (80 cm) per tow in NEFSC spring trawl surveys, 1980-2006. Line represents Lowess smooth with tension = 0.5. Source: NMFS, 2006.

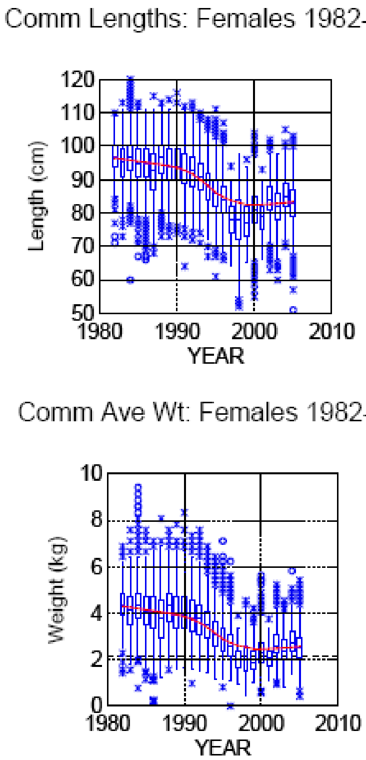


Figure 21. Length and weight of females in commercial fishery samples. Source: NMFS, 2006.

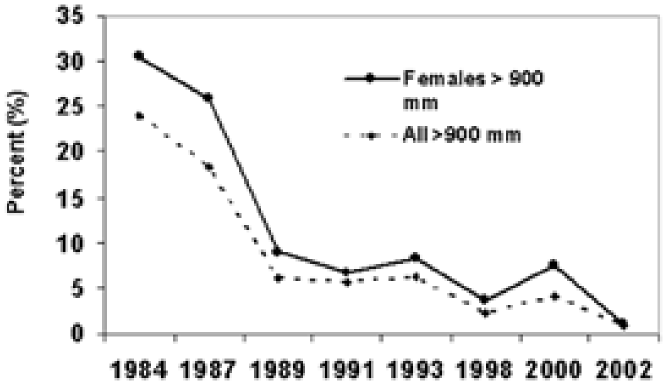


Figure 22. Proportion of spiny dogfish greater than 900 mm length in Hecate Strait trawl survey 1984–2002. Female length at maturity is 940 mm. Source: Wallace *et al.*, 2009.

APPENDIX I

FAO Expert Advisory Panel assessment report: 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. CoP14):

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.

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. CoP14) 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 (TAC) 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 tonnes, 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, Reeb and Block, 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 20th 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 tonnes in 2009, 1 800 tonnes in 2010 with 1 800 tonnes 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, Moseegard and Rosenberg (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 15 000 tonnes (approximating an F_{max} strategy), 8 500 tonnest (approximating an $F_{0.1}$ 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 CoP14). 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 CoP14), 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. CoP14) 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 tonnes (the short–term sustainable yield at F_{max} was estimated by the ICCAT SCRS to be 15 000 tonnes), 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.

References supporting the Panel evaluation

Block, B.A., Teo, S.L.H., Wall, A., Boustany, A., Stokesbury, M.J.W., Farwell, C.J., Weng,, K.C., Dewar, H. and T.D. Williams. 2005. Electronic tagging and population structure of Atlantic bluefin tuna. Nature 434: 1121–1127.

Boustany, A.M., Reeb, C.A., and B.A. Block. 2008. Mitochondrial DNA and electronic traching reveal population structure of Atlantic bluefin tuna (*Thunnus thynnus*). Marine Biology. DOI 10.1007/s00227–008–1058–0 http://tagagiant.org/media/Boustany%20et%20al_Marine%20Biol_genetics.pdf.

Fromentin, J.M. 2006. Chapter 2.1.5 : Atlantic Bluefin. In: ICCAT Field Manual www.iccat.int/Documents/SCRS/Manual/CH2/2_1_5_BFT_ENG.pdf

Fromentin, J.M. 2008. Le thon rouge, une espèce surexploitée. Ifremer, Paris wwz.ifremer.fr/institut/content/download/35340/290161/file/08_10_20_DP%20thon%20rouge.pdf.

MacKenzie, B.R., Mosegaard, H. and A.A. Rosenberg. 2009. Impending collapse of bluefin tuna in the northeast Atlantic and Mediterranean. Conservation Letters 2:25–34

McAllister, M.K. and T. Carruthers. 2007. Stock assessment and projections for Western Atlantic bluefin tuna using a BSP and other SRA methodology. Collect. Vol. Sci. Pap. ICCAT, 62(4): 1206–1270.

Nichy, F. and H. Berry. 1975. Age determination in Atlantic bluefin tuna. Col.Vol.Sci.Pap. ICCAT, 5 (2): 302–306.

Ravier, C. and J.M. Fromentin. 2001. Longterm fluctuations in the Eastern Atlantic and Mediterranean bluefin tuna populations. ICES Journal of Marine Science 58: 1299–1317.

Ravier, C. and J.M. Fromentin, 2004. Are the long–term fluctuations in Atlantic bluefin tuna (*Thunnus thynnus*) population related to environmental changes. Fisheries Oceanograph*y*, 13(3):145–160.

Restrepo, V.R., Rodríguez–Marín, E., Cort, J.L. and C. Rodríguez–Cabello. 2007. Are the growth curves currently used for Atlantic bluefin tuna statistically different? Col. Vol. Sci. Pap. ICCAT, 60(3): 1014–1026.

Riccioni, G., Ferrara, G., Landi, M., Sella, M., Piccinetti, C., Barbujani, G. and G. and F. Tinti. 2009. Spatio–temporal genetic patterns in Mediterranean bluefin tuna: population structuring and retention of genetic diversity. ICCAT SCRS/2009/186.

SCRS. 2008. Report of the 2008 Atlantic bluefin tuna stock assessment session. Madrid, Spain–June 23 to July 4, 2008. www.iccat.int/Documents/Meetings/Docs/2008_BFT_STOCK_ASSESS_REP.pdf.

SCRS. 2009. Extension of the 2009 SCRS Meeting to Consider the Status of Atlantic Bluefin Tuna Populations with Respect to CITES Biological Listing Criteria. Madrid, Spain, October 21–23, 2009. Doc. No. PA2–604 / 2009.

Taylor, N., McAllister, M., Lawson, G. and B. Block. 2009. Review and refinement of the multistock age–structured assessment tag integrated model for Atlantic bluefin tuna. SCRS/2009/182.

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). Western stock: 0.14 (all ages)	Low Low	Proposal; SCRS (2008) Proposal, SCRS (2008)
Age at maturity	Eastern stock: 4 – 6 years Western stock: 8 – 12 years	Medium Low	Proposal; Fromentin (2006), SCRS (2008)
Maximum age	27 years Eastern stock: > 20 years Western stock: 32 years	Low Low? Low	Proposal; Nichy and Berry (1975) SCRS (2008) SCRS (2008)
K	0.003 – 0.120 Eastern stock: 0.079 Western stock: 0.093	Low Low Low	Proposal; Restrepo *et al.* (2007) SCRS (2008) 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

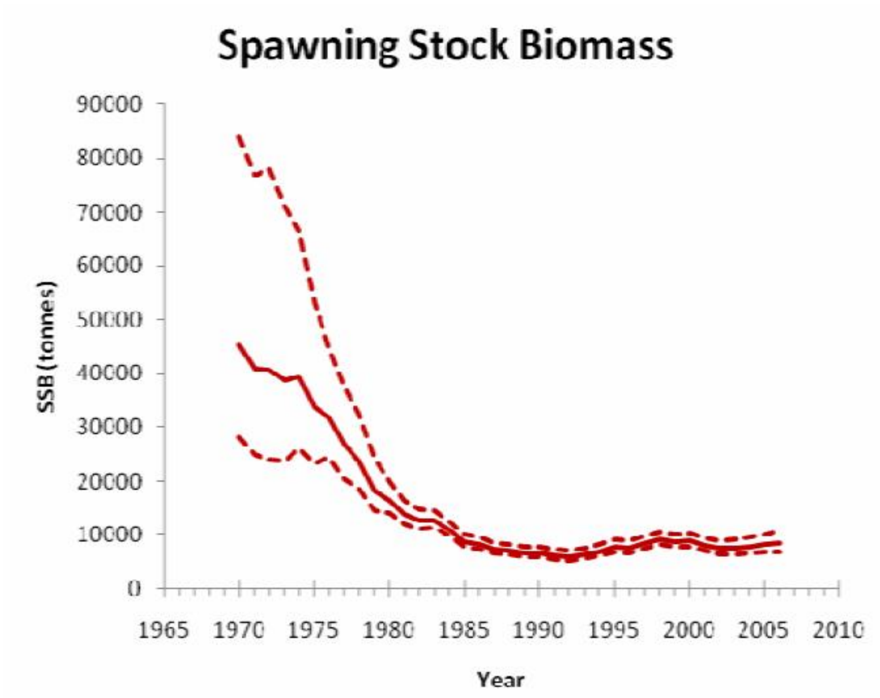


Figure 1. Annual median estimates of spawning stock biomass of the western stock. Dashed lines indicate the 80% confidence interval. Source: SCRS, 2008.

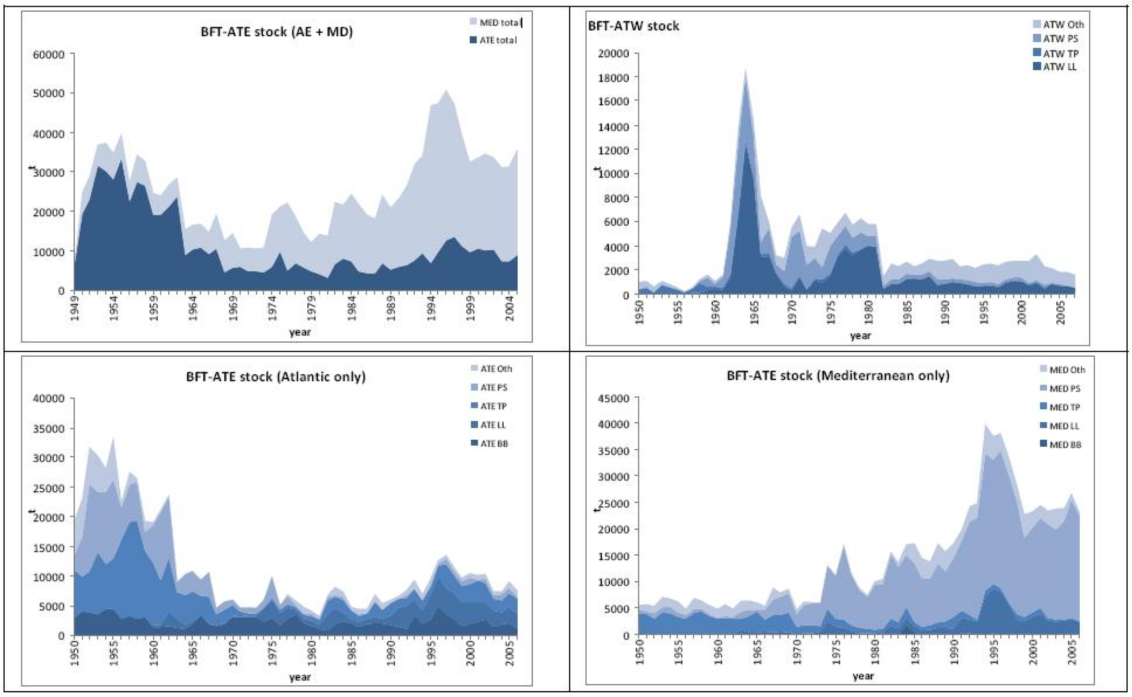


Figure 2. Bluefin reported annual catches by area and gear. BFT–ATE: eastern stock; BFT–ATW: western stock. TP: tuna trap; PS: purse seine; LL: longline; BB: bait boat. Source : SCRS 2008.

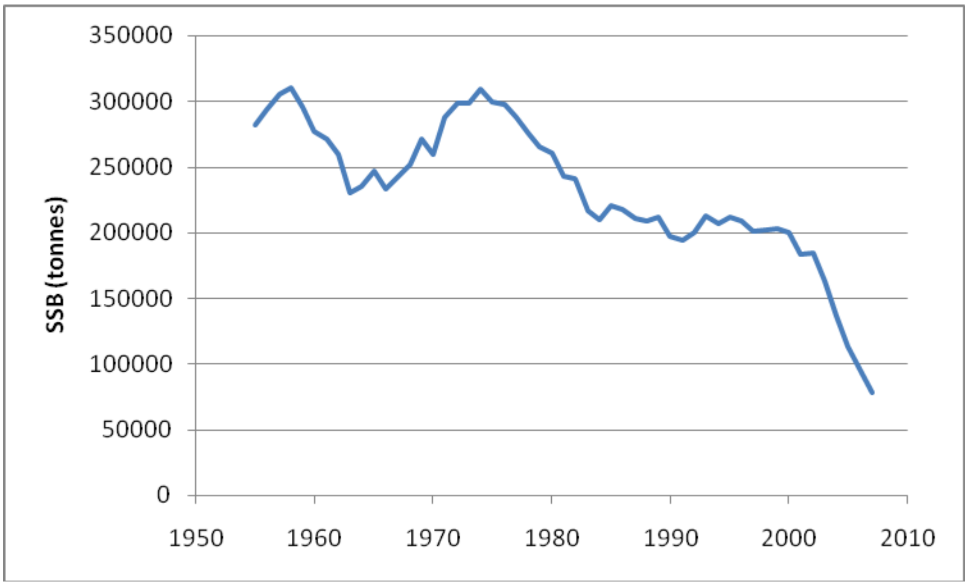


Figure 3. Estimated spawning stock biomass of the eastern stock (results from run 14; SCRS 2008).

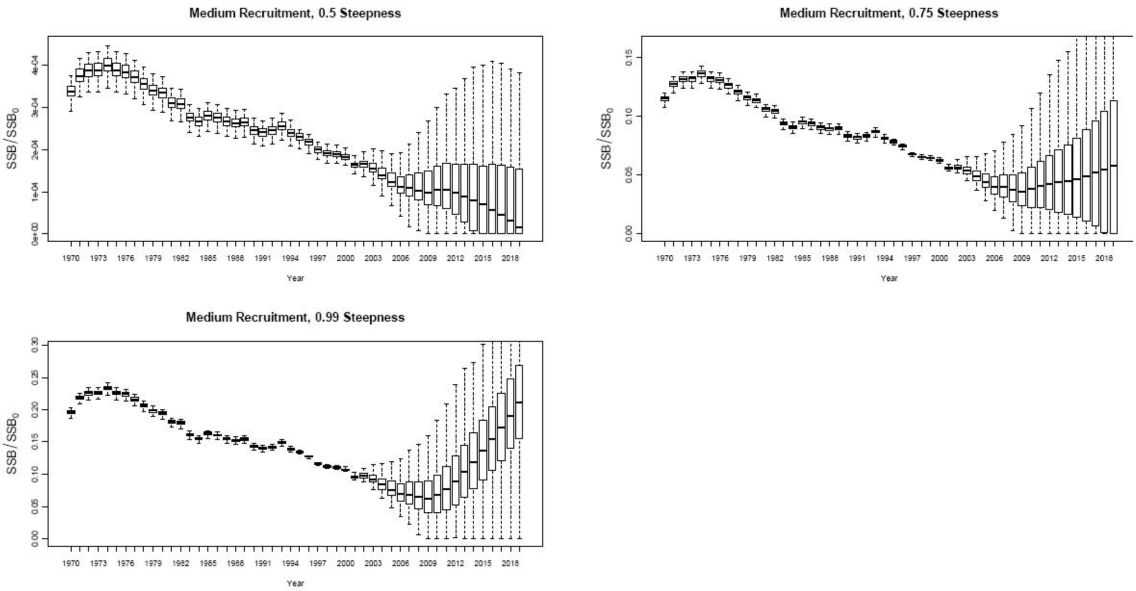


Figure 4. Trends in spawning biomass for the Eastern stock relative to the baseline biomass estimated with different assumptions (note that the Y–axis scale differs between the various panels). The baseline is SSB_0 estimated with assumed steepness values of 0.5, 0.75 and 0.99, and using all of the SSB–R 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 (*Corallium 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.

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 (Figure 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, Viet Nam, 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 (Figure 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 (United States of America) 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 (Figure 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 (Figure 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 (Figure 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 (Figure 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 (Figure 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. CoP14) 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 and Shank, 2005). Early genetic studies have shown that *C. rubrum* planulae exhibit limited dispersal that promotes population differentiation (Abbiati, Santangelo and Novell, 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 and 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 and 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 UN 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 United States of America.

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 United States of America are the main consumer of all precious corals. According to the information presented in the proposal, between 2001 to 2008, the United States of America 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 United States of America (proposal). In 2008 the United States of America 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 species. Nevertheless, 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

Abbiati, M., Santangelo, G. and S. Novell. 1993. Genetic population structure of *Corallium rubrum*. In Red Coral in the Mediterranean Sea: Art, History and Science, F. Cicogna and R. Cattaneo-Vietti (eds). Roma: Ministero delle Risorse Agricole, Alimentari e Forestali, 181-200.

Baco, A.R. and T.M. Shank. 2005. Population genetic structure of the Hawaiian Precious Coral *Corallium lauuense* using microsatellites. In Cold-water Corals and Ecosystems, A. Freiwald and J.M. Roberts (eds). Heidelberg: Springer, 663-678.

Bruckner, A.W. 2009. Rate and extent of decline in Corallium (pink and red coral) populations: existing data meet the requirements for a CITES Appendix II listing. Marine Ecology Progress Series (in press).

Bruckner, A.W. and G. G. Roberts (eds.). 2009. Proceedings of the First International Workshop on *Corallium* Science, Management, and Trade. NOAA Technical Memorandum NMFS-OPR-43 and CRCP-8, Silver Spring, MD 153 pp.

Cairns, S.D. 2007. Deep-water corals: an overview with special reference to diversity and distribution of deep-water scleractinian corals. Bulletin of Marine Science, 81(3): 311-322.

Costantini, F. and M. Abbiati. 2006. Development of microsatellite markers for the Mediterranean gorgonian coral *Corallium rubrum*. Molecular Ecology Notes. 6:521-523

FAO, 2001. A background analysis and framework for evaluating the status of commercially-exploited aquatic species in a CITES context. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. 23 pp. http://www.fao.org/DOCREP/MEETING/003/Y1455E.HTM

FAO, 2007. Second FAO expert advisory panel for the assessment of proposals to amend Appendices I and II of CITES concerning commercially-exploited aquatic species. Rome 26-30 March 2007. FAO Fish. Rep.833: v + 133 pp.

García-Rodríguez, M. and C. Massò. 1986. Modelo de exploitación por buceo del coral rojo (*Corallium rubrum* L.) del Mediterráneo. Boletin Instituto Español de Oceanografia 3, 75-82.

Garrabou, J.M. and J.G. Harmelin. 2002. A 20-year study on life-history traits of a harvested long-lived temperate coral in the NW Mediterranean: Insights into conservation and management needs. *Journal of Animal Ecology* 71, 966-978.

Garrabou, J., Perez, T., Chevaldonné, P., Bensoussan, N., Torrents, O., Lejeusne, C., Romano, J.C., Vacelet, J., Boury-Esnault, N., Harmelin-Vivien, M., Verlaque, M., Boudouresque, C.F. and J.G. Harmelin. 2003. Is global change a real threat for conservation of the NW Mediterranean marine biodiversity? Geophysical Research Abstracts 5, p. 10522.

Garrabou, J., Perez, T., Sartoretto, S. and G. Harmelin. 2001. Mass mortality event in red coral Corallium rubrum populations in the Provence Region (France, NW Mediterranean). Marine Ecology Progress Series 17:263-272.

Green, E.P. and F. Shirley. 1999. The Global Trade in Corals. World Conservation Monitoring Center. World Conservation Press, Cambridge UK. vii + 60 pp.

Grigg, R.W. 1976. Fisheries management of precious and stony corals in Hawaii. *UNIHI-SEAGRANT*, TR-77-03. Honolulu

Grigg, R.W. 1984. Resources management of precious corals: A review and application to shallow water reef building corals. Marine Ecology 5: 57-74.

Grigg, R.W. 1993. Precious coral fisheries of Hawaii and the U.S. Pacific Islands - Fisheries of Hawaii and U.S. - Associated Pacific Islands. Marine Fisheries Review 55: 50-60.

Grigg, R.W. 2002. Precious corals in Hawaii: Discovery of a new bed and revised management measures for existing beds. Marine Fisheries Review 64: 13-20.

Liverino, B. 1983. Il Corallo – Esperienze e ricordi di un corallaro. Banca di credito populare Torre del Greco. Li Causi Editore. Torre del Greco, Italy.

Marschal, C., Garrabou, J., Harmelin, J.G. and M. Pichon. 2004. A new method for measuring growth and age in precious red coral *Corallium rubrum* (L.). Coral Reefs 23:423-432.

Rossi, S., Tsounis, G., Padrón, T., Orejas, C., Gili, J.M., Bramanti, L., Teixidor, N. and J. Gutt. 2008. Survey of deep-dwelling red coral (*Corallium rubrum*) populations at Cap de Creus (NW Mediterranean). Mar Biol 154:533-545.

Santangelo, G., Bramanti, L.; Vielmini, I. and M. Iannelli. 2009 . What We Have Learned About Red Coral and What We Need to Learn for its Rational Management. pp. 71 – 86. In Bruckner, A.W. and G. G. Roberts (eds.). Proceedings of the First International Workshop on *Corallium* Science, Management, and Trade. NOAA Technical Memorandum NMFS-OPR-43 and CRCP-8, Silver Spring, MD 153 pp.

Torrents, O., Garrabou, J., Marschal, C. and J.G. Harmelin, J.G. 2005. Age and size at first reproduction in the commercially exploited red coral *Corallium rubrum* (L.) in the Marseilles area (France, NW Mediterranean). Biological Conservation 121, 391-397.

Tsounis, G, Rossi, S., Gili, J.M. and W. Arntz. 2006. Population structure of an exploited benthic cnidarian: the case study of red coral (*Corallium rubrum* L.). Mar. Biol. 149:1059-1070.

Tsounis, G, Rossi, S., Gili, J.M. and W.E. Arntz. 2007. Red coral fishery at the Costa Brava (NW Mediterranean): Case study of an overharvested precious coral. Ecosystems 10, 975-986.

Tsounis, G., Rossi, S., Grigg, R.W., Santangelo, G., Bramanti, L. and J.M. Gili. In press. The exploitation and conservation of precious corals. Oceanography and Marine Biology: An Annual Review, Volume 48, in press.

Vighi, M. 1972. Étude sur la reproduction du *Corallium rubrum* (L.). Vie Milieu **23**, 21–32.

Weinberg, S. 1979. The light dependent behaviour of planula larvae of *Eunicella singularis* and *Corallium rubrum* and its implication for octocorallian ecology. Bijdragen tot de Dierkunde **49**, 145-151.

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) 0.027 - 0.048 (2.7 – 4.8% per year) 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 (Low >8 yr) (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 0.34 ± 0.15 0.62 ± 0.15	ca. 100 yr
Corallium secundum	Hawaiian Archipelago	75 cm	0.9 cm yr-1	0.17	45 > 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 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 Submer-sible	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.)

Area	**Index**	**Trend**	**Basis**	**Coverage**	**Reliability**	**Source**
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 and Masso, 1986
Mediterranean	Mean colony height *C. rubrum*	Decline to 30%	1980s–2006	Mediterranean Fisheries	Historical data and surveys (3)	Liverino, 1983; Garrabou and Harmelin, 2002
Mediterranean	Mean number of polyps per colony *C. rubrum*	Decline to 10%	Historical to 2004	Shallow water Mediterranean Fisheries	Surveys (4) and anecdotal information (2)	Bruckner, 2009

Table 3 (cont.

Area	**Index**	**Trend**	**Basis**	**Coverage**	**Reliability**	**Source**
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 and 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	García-Rodríguez and Massó (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 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

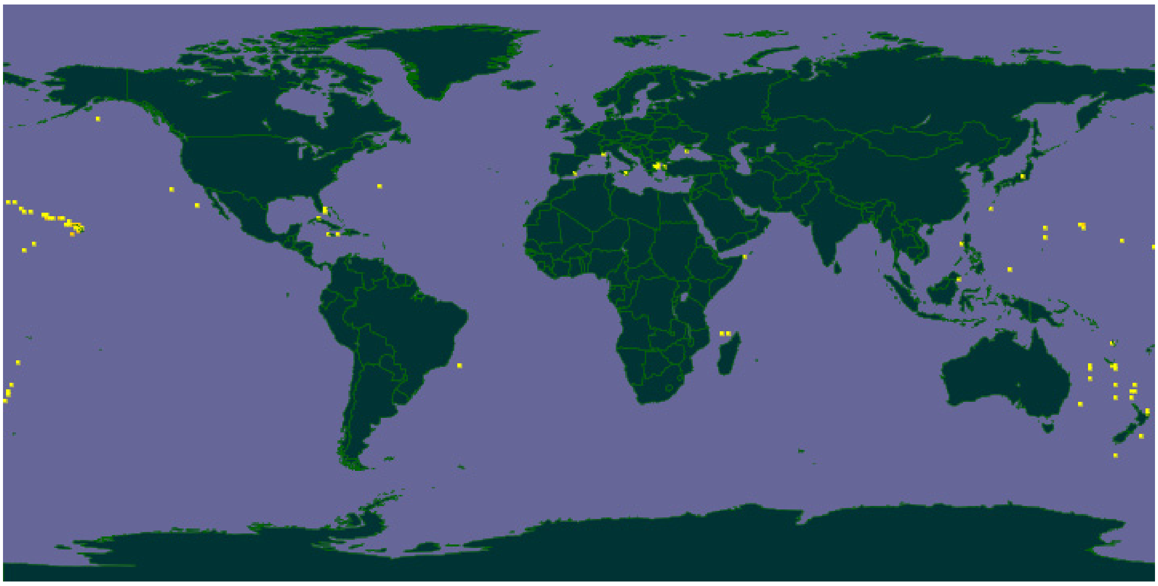


Figure 1. Distribution of Coralliidae species as extracted from the Global Biodiversity Information Facility (GBIF) data portal (http://data.gbif.org) accessed on December 11, 2009.

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

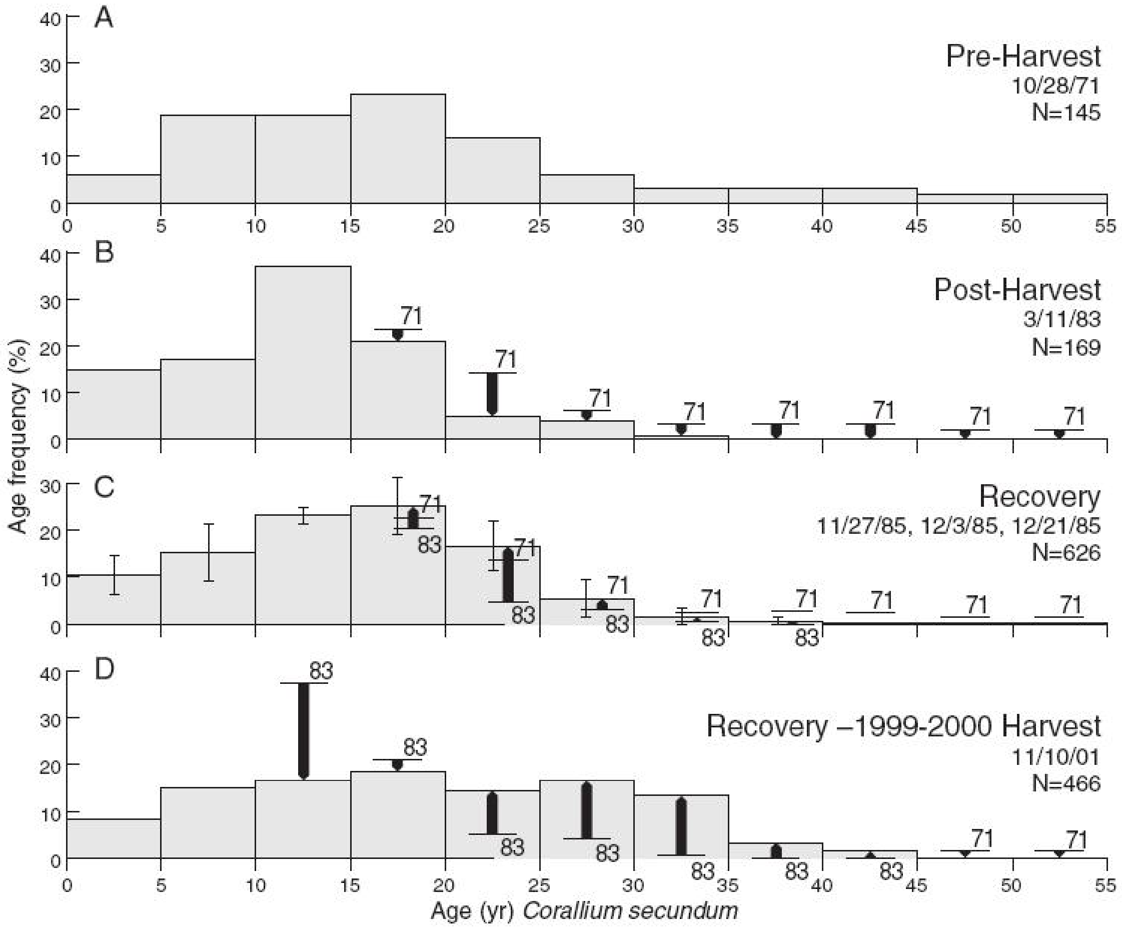


Figure 3. Age structure (frequency distribution) of pink coral in the Makapu'u Bed, Oahu, in 1971, 1983, 1985 and 2001. (Source Grigg 2002).

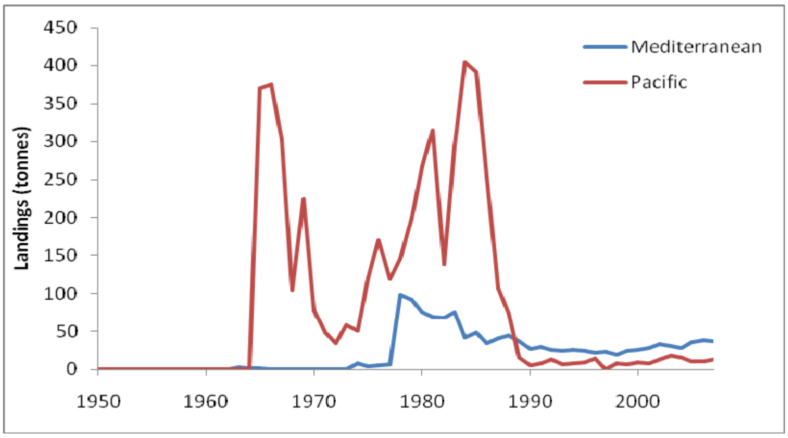


Figure 4. Reported landings of all species of Corallidade from the Pacific Ocean and Mediterranean Sea. (Source FAO).

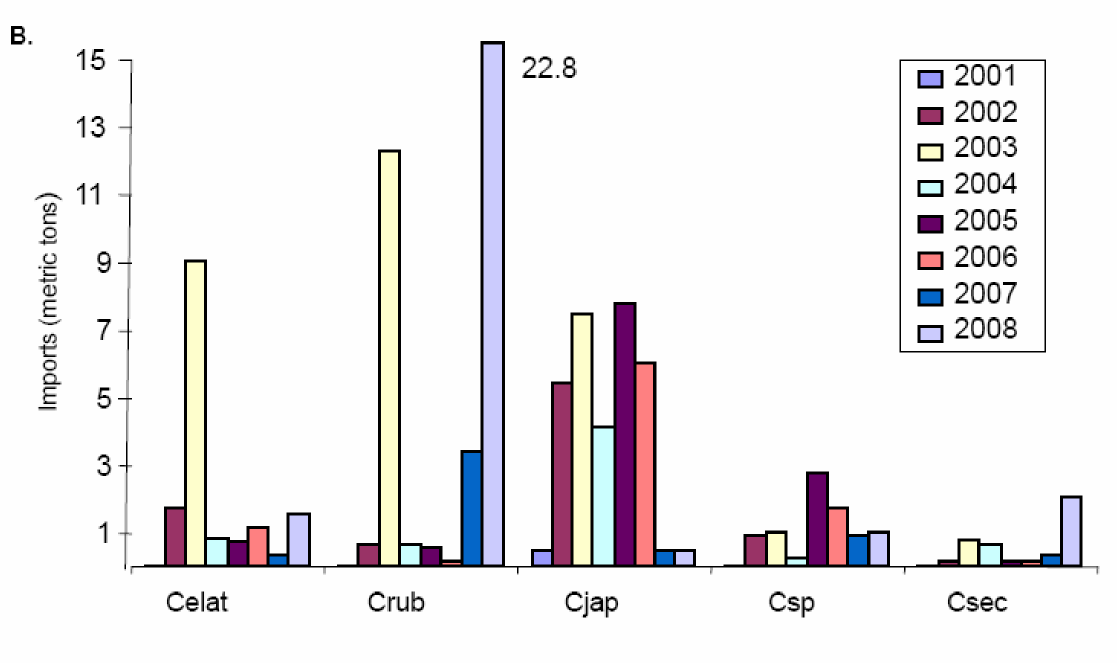


Figure 5. Total imports of unprocessed skeletons of five species of *Corallium* into the United States of America from 2001 to 2008. *C. elatius* = Celat, *C. rubrum* = Crub, *C. japonicum* = Cjap, *Corallium* sp. nov. = Csp, *C. secundum* = Csec. Source: US Fish and Wildlife Service import data (proposal).

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.

ISBN 978-92-5-106705-5 ISSN 2070-6987

9 789251 067055

I1899E/1/11.10