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Report of the

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

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Rome, 26-30 March 2007

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

This is the report of the 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, held at FAO headquarters from 26 to 30 March 2007. The meeting of the Panel was funded by FAO Regular Programme and by the FAO Project GCP/INT/987/JPN "CITES and Commercially-Exploited Aquatic Species, including the Evaluation of Listing Proposals".

Distribution:

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

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ABSTRACT

The 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 was held at FAO headquarters from 26 to 30 March 2007. 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 ad hoc 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 seven proposals submitted to the CITES fourteenth Conference of the Parties:

- CoP14 Prop. 15. Proposal to include *Lamna nasus* (porbeagle shark) on CITES Appendix II in accordance with Article II paragraph 2(a).
- CoP14 Prop. 16. Proposal to include *Squalus acanthias* (spiny dogfish) on CITES Appendix II in accordance with Article II paragraph 2(a).
- CoP14 Prop. 17. Proposal to include all species of the family Pristidae (sawfishes) in Appendix I of CITES in accordance with Article II paragraph 1.
- CoP14 Prop. 18. Proposal to include *Anguilla anguilla* (European eel) on Appendix II in accordance with Article II paragraph 2(a).
- CoP14 Prop. 19. Proposal to include *Pterapogon kauderni* (Banggai cardinalfish) on Appendix II in accordance with Article II paragraph 2(a).
- CoP14 Prop. 20. Proposal to include the species of *Panulirus argus* and *P. laevicauda* of the Brazilian lobster population on Appendix II of CITES, in accordance with Article II paragraphs 2(a) and 2(b).
- CoP14 Prop. 21. Proposal to include all species in the genus *Corallium* (red/pink corals) in Appendix II of CITES in accordance with Article II paragraph 2(a).

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

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BACKGROUND AND PURPOSE OF THE EXPERT ADVISORY PANEL

1. The 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 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 ad hoc 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 Ad Hoc 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 26 to 30 March 2007, hosted by FAO with funding from the FAO Regular Programme and the project “CITES and commercially-exploited aquatic species, including the evaluation of listing proposals” funded by the Government of Japan. The Agenda adopted for the meeting is included as Appendix A.

5. The Panel consisted of a core group made up of nine members, thirteen species and implementation experts covering European eel, spiny lobster, red/pink corals, Banggai cardinalfish, and sharks, and by 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 ad hoc Advisory Panel and the importance of its task. He drew attention to a concern that the recommendations produced in the previous Ad Hoc Panel meeting were sometimes not completely clear and left doubts with respect to the Panel position in relation to the proposals. He stressed that the Panel recommendations should be as clear and unambiguous as possible, indicating whether the proposal is supported or not and if there is enough information to judge the relevance and potential benefits of the listing proposal. Referring to the expected of outputs of the Panel meeting, Mr Nomura re-emphasized that the relationship between FAO and CITES is based

on mutual trust and that CITES Parties are not obliged to follow the recommendations of FAO. The text of his statement is reproduced in Appendix C.

7. Mr Arne Bjorge was elected Chair of the Panel and Ms Pamela Mace was elected Vice-Chair. Messrs Doug Butterworth, Robin Mahon, John Pope, John Carlson, Howard Powles and Ms Anna Willock were elected Rapporteurs.

8. The agenda of the meeting was adopted with minor modifications in the order that the proposals would be addressed. It was also agreed to address any issues pertaining to the formatting of the proposals submitted to CITES on the last day of the meeting.

9. Discussions were held on the interpretation of paragraphs A and B of Annex 2a of Resolution Conf. 9.24 (Rev. CoP13) and it was clarified that the two paragraphs were collectively addressed with respect to the application of biological listing criteria by the relevant sections of Annex 5 of Resolution Conf. 9.24 (Rev. CoP13) (see paragraph 13).

10. In response to a question about the availability of the comments on the proposals received by the proponent Parties through the process of consultation with range States, it was noted that neither the CITES Secretariat nor FAO have access to any of the responses, apart from the information reported in the proposals.

OUTCOME OF THE MEETING

Evaluation of the proposals

11. The Panel considered the following seven proposals submitted to the fourteenth Conference of the Parties to CITES:

CoP14 Prop. 15. Proposal to include *Lamna nasus* (porbeagle shark) on CITES Appendix II in accordance with Article II paragraph 2(a), 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 the related technical and administrative issues, such as the possible designation of an additional Management Authority".

CoP14 Prop. 16. Proposal to include *Squalus acanthias* (spiny dogfish) on CITES Appendix II in accordance with Article II paragraph 2(a), 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 the related technical and administrative issues, such as the possible designation of an additional Management Authority".

CoP14 Prop. 17. Proposal to include all species of the family Pristidae (sawfishes) in Appendix I of CITES in accordance with Article II paragraph 1.

CoP14 Prop. 18. Proposal to include *Anguilla anguilla* (European eel) on Appendix II in accordance with Article II paragraph 2(a).

CoP14 Prop. 19. Proposal to include *Pterapogon kauderni* (Banggai cardinalfish) on Appendix II in accordance with Article II paragraph 2(a).

CoP14 Prop. 20. Proposal to include the species of *Panulirus argus* and *P. laevicauda* of the Brazilian lobster population on Appendix II of CITES, in accordance with Article II paragraphs 2(a) and 2(b).

CoP14 Prop. 21. Proposal to include all species in the genus *Corallium* (red/pink corals) in Appendix II of CITES in accordance with Article II paragraph 2(a).

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

General comments and observations

Comments from Member Countries received by the FAO Secretariat

12. 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 ad hoc Advisory Panel. They were invited to send any comments or relevant information to the FAO Secretariat, for consideration by the Panel. Six countries and three organizations responded to this request and one trade organization also sent comments.[1] The responses were made available to the Panel and provided some information on management and trade of the proposed species and also expressed a range of views on the listing proposals and on the role of CITES in relation to commercially-exploited aquatic species. One of the Member countries reiterated the need for the Ad Hoc Panel to provide CITES with definitive recommendations, as best as possible, for listing proposals. In addition, IUCN made available to the Panel the fact sheets for the species considered by the Panel compiled by that organization to assist in its review of proposals.

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

13. The Annex 2 a criteria state that:

> "A species should be included in Appendix II when, on the basis of available trade data and information on the status and trends of the wild population(s), at least one of the following criteria is met:
>
> 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; or
>
> 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."

[1] Comments were received from the Republic of the Philippines, Ecuador, Honduras, Canada, Japan, New Zealand, the European Commission, SEAFDEC, GFCM and ASSOCORAL.

In Annex 5 of CITES Resolution Conf. 9.24 (Rev. CoP 13) it is stated that with respect to application of decline to commercially exploited aquatic species:

> "In general, historical extent of decline should be the primary criterion for consideration of listing in Appendix I. However, in circumstances where information to estimate extent-of-decline is limited, rate-of-decline over a recent period could itself still provide some information on extent-of-decline.
>
> For listing in Appendix II, the historical extent of decline and the recent rate of decline should be considered in conjunction with one another. The higher the historical extent of decline, and the lower the productivity of the species, the more important a given recent rate of decline is."

In relation to the application of decline criteria for aquatic species in marine and large freshwater bodies, Annex 5 of Conf. 9.24 (Rev. CoP 13) considers an historical extent of decline in the range of 5–20% to be more appropriate in most cases, with a range of 5–10% being applicable for species with high productivity, 10–15% for species with medium productivity and 15–20% for species with low productivity. Nevertheless some species may fall outside this range. Also according to Annex 5:

> "A general guideline for a marked recent rate of decline is the rate of decline that would drive a population down within approximately a 10-year period from the current population level to the historical extent of decline guideline (i.e. 5–20% of baseline for exploited fish species)."
>
> "Even if a population is not declining appreciably, it could be considered for listing in Appendix II if it is near the extent-of-decline guidelines recommended above for consideration for Appendix-I-listing. A range of between five and ten percent above the relevant extent-of-decline might be considered as a definition of 'near', taking due account of the productivity of the species."

Further, it is stated,

> "In considering the percentages indicated above, account needs to be taken of taxon- and case-specific biological and other factors that are likely to affect extinction risk."

These guidelines were based on the FAO recommendations to CITES[2] which advised that

> "Criterion C, the decline criterion, was considered to be the one likely to be employed most frequently for exploited fish species."

In the view of FAO, these decline guidelines encompass the intentions of both Annex 2 a A and 2 a B.

14. In relation to the Annex 1 criteria for listing on Appendix II, FAO considers that[2] (underlining added in this report):

[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.

"In Annex 5 as applied to criterion A of Annex 1, the definition of small population size should be changed, at least where applied to most exploited fish species, to place greatest emphasis on historical extent-of-decline."

"The historical-extent-of-decline in area of distribution should be used in preference (to any absolute threshold). 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."

General comments by the Panel on the proposals

15. The Panel review of the seven proposals provided an opportunity to critically review the format of the proposals and to evaluate their overall usefulness for an evaluation against CITES listing criteria. The Panel considered that generally the proposals could have been more explicit on the quantitative indices used to compare with the listing criteria guidelines. All proposals included some information on indices, and some provided helpful summaries of indices in tabular form, but several issues were noted as being common:

- extents or rates of decline were mentioned in text without details on how these had been calculated;
- data for calculation of indices were not provided to allow the reader to check estimates or apply alternative methods;
- values were selected from time series which did not give unbiased estimates of decline;
- life history characteristics necessary to assess productivity level were not provided in an organized or explicit way.

16. In noting the above issues, the Panel proposed the following suggestions for improving the presentation of biological indices in the proposals to CITES concerning commercially exploited aquatic species:

- life history characteristics necessary to assess productivity level should be described in the text and summarized in a table; the information presented should be supported by as many sources as possible;
- methods for calculating extents or rates of declines should be clearly described;
- relevant biological indices (small population, restricted distribution, decline) should be summarized in tables;
- when graphs of abundance trends are the basis for decline estimates, tables of the values going into the graphs should be included to allow readers to repeat calculations or explore alternative methods;
- to the extent possible, uncertainties associated with the various indices should be described (e.g. aging problems; index estimation problems).

17. The Panel also noted that guidelines on standard methods for calculation of extent or rate of decline for commercially exploited aquatic species would be useful, and indicated the potential contribution that FAO could make in this area.

18. Assessing proposals against the listing criteria also requires an assessment of the importance of international trade as a factor driving exploitation and affecting species status.

Although all proposals provided information that the species under consideration were in international trade, few provided quantitative information on the impact of international trade on species status, particularly in relation to other factors such as national utilization, incidental harvest, and habitat degradation.

19. In noting the above issues, the Panel proposed the following suggestions for improving the presentation of information on the importance of international trade in the proposals to CITES concerning commercially exploited aquatic species:

- proposals should include, as far as possible, information on the proportion of harvest which enters international trade;
- proposals should include information on the extent to which changes in international trade (e.g., price regimes, opening of new markets, etc.) have driven changes in the species exploitation.

20. The Panel also drew attention to the suggestions made in paragraphs 11 to 15 of the FAO Ad Hoc Expert Advisory Panel for the Assessment of Listing Proposals to CITES, held in Rome, 13 – 16 July, 2004, in relation to the overall format and presentation of information in the listing proposals concerning commercially exploited aquatic species.

For consideration in reading the reports

21. As was done in the previous Ad Hoc 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.

22. 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

23. The report, including all Appendixes, was adopted by the ad hoc Advisory Panel on Friday 30 March 2007.

APPENDIX A

Agenda

Monday, 26 March 2007

1. Arrival and registration
2. Welcome by Ichiro Nomura (Assistant Director-General, FAO Fisheries and Aquaculture Department)
3. Introduction of participants
4. Nomination of Chairperson and vice-Chairperson of the meeting.
5. Designation of rapporteur(s) for each proposal.
6. Adoption of the agenda
7. Overview of the Terms of Reference of the Panel and the CITES listing criteria (Res.Conf. 9.24 [Rev. CoP 13]).
8. Preliminary discussion on the seven amendment proposals to identify complexity of each proposal and approximate time required for evaluation, additional tasks required e.g. analyses of data, examination of relevant literature. Finalization of the structure and format of the reports on each proposal
9. Consideration of proposal on European eel *Anguilla anguilla*

Tuesday, 27 March 2007

10. Consideration of proposal on spiny lobster *Panulirus argus* and *P. laevicauda*
11. Consideration of proposal on red/pink coral *Corallium* spp.

Wednesday, 28 March 2007

12. Consideration of proposal on Banggai cardinalfish *Pterapogon kauderni*
13. Consideration of proposal on porbeagle shark *Lamna nasus*

Thursday, 29 March 2007

14. Consideration of proposal on spiny dogfish *Squalus acanthias*
15. Consideration of proposal on sawfishes, family Pristidae

Friday, 30 March 2007

16. Review of Discussion on draft rapporteur's reports
17. Rapporteurs revise reports based on discussion and Secretariat consolidates draft report
18. Plenary discussion/adoption of final report.

APPENDIX B

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APPENDIX C

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

It is my pleasure to welcome you to this second meeting of the FAO ad hoc 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. We have a long and distinguished group of Panellists attending this meeting and I would like to thank you all for making the effort to participate in this important work and to assist the Organization in providing scientific and technical advice of the highest quality to assist CITES Parties to make sound and effective decisions on the proposals to CoP 14 for listing commercially exploited aquatic species. Both FAO and CITES take the work of this Panel very seriously and without your participation and contribution, FAO would not be able to meet the expectations of our member countries.

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 the first meeting in July 2004. That was a successful meeting and both FAO and CITES were pleased with the report. Those of you who were present at the CITES CoP 13 know that the Panel report was welcomed and taken seriously by the CITES Parties. Nevertheless, that was the first meeting of the Panel and we were feeling our way into a difficult and potentially controversial role. The 2004 Panel dealt with three amendment proposals, covering the listing of white shark, humphead wrasse and Mediterranean date mussel on Appendix II. After deliberation, the Panel considered that there was insufficient information to determine whether or not white shark met the biological criteria for Appendix II. It concluded that humphead wrasse met the Appendix II criteria and that a CITES listing could make a significant contribution to conservation of the species. In the case of the Mediterranean date mussel, the Panel was of the opinion that the species did not meet the biological criteria and it reported, in rather ambiguous wording in my view, that a CITES listing would not assist in conservation of the species. CITES Parties voted to list all three species. Thus, in the land of the current soccer World Cup holders, we can think of the Panel recommendations as leading to one victory (humphead wrasse), one loss (Mediterranean date mussel) and one draw (white shark).

For a first meeting, and a small sample number, this is not a bad result but, of course, we should aim for a situation in which the advice of the Panel is trusted and respected by all Parties to the extent that it will only rarely be over-ridden by the Parties when they vote. To help in achieving that goal we can learn some lessons from the first meeting. One of those was the length of time it took to evaluate each proposal rigorously and thoroughly. Based on that observation, for this meeting, with the help of consultants, we prepared preliminary evaluations to serve as working documents for the Panel. We hope that these will allow the Panel to consider each proposal more efficiently, to focus quickly on the more difficult or uncertain aspects, if any, in each proposal, and to formulate solid and justified conclusions.

FAO Members have also been watching the process with interest and at its 27th Session earlier this month, the FAO Committee on Fisheries expressed appreciation for the work of the Panel and emphasised the need for the FAO's views on proposals to be heard and taken

into account by CITES. To this end, COFI agreed that after each CITES Conference of the Parties, FAO should undertake an evaluation of whether the recommendations of the Ad Hoc Expert Advisory Panel had been taken into account and, if not, why they had not been. This demonstrates how seriously COFI views the work of the Panel and its determination to ensure it is effective.

It is also significant for this Panel meeting that several FAO Members, in COFI and its Sub-Committee on Fish Trade, have called for the Panel to give clear and unambiguous guidance to CITES on the proposals. The FAO Secretariat has taken note of this call and I urge you to take it into account in your deliberations and preparation of the report. Of course, it will not always be possible for the Panel to reach agreement on the evaluation of all proposals and there are likely to 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 must 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.

Having lowered the full weight of the importance of this Panel meeting on to your shoulders, I do also hope that you also find some time to relax in Rome and to enjoy some of the attractions that the Eternal City has to offer.

Finally, I would like to thank the government of Japan for the financial assistance they have provided that has made this meeting of the ad hoc Expert Advisory Panel possible.

I wish you a fruitful and enjoyable meeting.

APPENDIX D

Terms of Reference for Ad Hoc Expert Advisory Panel for Assessment of Proposals to CITES[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 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 Ad Hoc Expert Advisory Panel assessment report: porbeagle shark

PROPOSAL No. 15

SPECIES: *Lamna nasus* – porbeagle shark

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

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, 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.

ASSESSMENT SUMMARY

The FAO Ad Hoc Expert Panel concluded that the available evidence does not support the proposal to include the porbeagle shark, *Lamna nasus*, in CITES Appendix II.

Globally, the species does not meet the biological decline criteria for listing in CITES Appendix II. The decline in population abundance of the northwest Atlantic population meets the Appendix II criterion, but risk to the northwest Atlantic population is mitigated by population rebuilding and the existence of both Canadian and United States management plans designed to rebuild stocks. Porbeagles in the northeast Atlantic Ocean may meet Appendix II criteria, but the limited data that were available were not sufficient to assess the extent of the decline. In the southern hemisphere, porbeagle populations are relatively lightly exploited and Appendix II criteria are likely not met.

Though adequate management measures are in place in some regions, there are others where some form of management is urgently needed. Sustainable management requires that, where they had not done so, range States develop and implement National Plans of Action for sharks.

In the event of a CITES listing, porbeagle caught in European Union (EU) waters would likely be traded within the EU, and thus avoid CITES trade limitations. In the northwest Atlantic, most porbeagles are harvested within the Exclusive Economic Zones and the basis for non-detriment findings should follow the current Canadian Total Allowable Catch (TAC) for porbeagle, which is based on results from a population model. Introduction from the Sea would only be a significant issue for high seas longline fleets, which catch porbeagle shark only as bycatch.

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. Porbeagles generally occur 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). Recent evidence from Japanese catches in high seas longline fishing fleets could indicate the potential for a third stock of porbeagle off Iceland (Matsumoto, 2005; S. Campana, personal communication).

Productivity level
Biological information indicates that the species falls into the category of "low" productivity (Campana *et al.,* 2001; Natanson *et al.,* 2002; Table 1). Age determination has been validated up to at least 26 years but ages may be underestimated in older fish (Campana *et al.,* 2002; Francis *et al.,* 2007). Fecundity in porbeagle is very low at an average of 3.9 pups per female with females giving birth annually (Campana *et al.,* 2001). There is no relationship between fecundity and age (Jensen *et al.,* 2002). The intrinsic rate of increase in an unfished population was estimated between 0.05 and 0.07.

Porbeagle shark off New Zealand may be less productive than stocks in the North Atlantic Ocean. A recent study estimated age at maturity at 8–11 years for males and 15–18 years for females, while longevity may be around 65 years (Francis *et al.,* 2007).

Population status and trends

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 done using abundance indices from as many parts of the species' distribution as possible.

Trend information is summarized in Table 2 and further information on the individual indices is provided in the text below. Percentage declines in indices reported in the proposal (Proposal Table 1) are difficult to assess because the basis for the estimates is not given (for French longline CPUE, it appears that the percent difference between the maximum and minimum value in the series was the basis).

Northeast Atlantic
Landings and catch data are unlikely to provide an accurate index of abundance as they are strongly influenced by market conditions and management measures. Thus, the Panel felt that the basis for much of the decline in abundance presented for the northeast Atlantic was

ambiguous and it was difficult to discern how the declines were estimated. Some of the landings reported in the proposal were different than what was reported in the International Council for the Exploration of the Sea (ICES) Working Group on Elasmobranch Fishes document (ICES, 2006b). Landings time series for the northeast Atlantic as a whole was variable, with a generally declining trend. Overall, for total landings between 1973–2004, a decline to 64% of the original was estimated. Norwegian landings have declined to about one percent of values in the 1930s, while recent French landings are about 40% of those around 1980. French landings are level over the time series. Spanish landings fluctuate more widely. Longline CPUE and cumulative landings suggest a steady trend in decline. It was also noted that the ICES Working Group on Elasmobranch Fishes was unable to perform an assessment on porbeagle due to the lack of data. However, the ICES Working Group on Elasmobranch Fishes also recommended to the European Union that no fishery should be permitted on this stock.

The panel concluded that much of the data demonstrating a decline, with the exception of the French CPUE series, was based on catch. The Norwegian catch trends are likely to have been influenced by a decline in heavily fished inshore areas and redirection of effort to previously lightly exploited offshore areas based on economics. Sequential depletion of fishing areas was supported by a shift in European landings among different statistical areas between 1973 and 2005. Such a pattern could explain a relatively low decline in total landings coincident with population depletion. Though such a pattern seems difficult to reconcile with the picture of a highly migratory species, relatively distinct sub-populations are possible. A potential problem of species misidentification in the early catch statistics was also noted.

Mediterranean
Some of the observations suggest that porbeagle may always have been rare in the Mediterranean (proposal). The panel concluded that the information provided made it difficult to determine whether the observations support a real decline or other factors (for example rarity for many years combined with misreporting or a sporadic occurrence to explain the reported catches in the 1970s).

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 (Gibson and Campana, 2005). Recent catches are 8% of the historical maximum levels (Table 2) due to strict quota regulations. The 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 3).

A standardized longline catch per unit effort (CPUE) index from three fished areas off eastern Canada (Figure 1, Table 2) indicated declines in the abundance of mature individuals between the late 1980s and recent years. Immature porbeagle CPUE increased substantially in 2002–2004 relative to earlier values, following earlier declines. The reliability of recent index values was affected by a recent decrease in area fished, lack of overlap in vessels between the early and late years in the time series, and seasonal catchability differences (Gibson and Campana, 2005). Integrating mutually compatible tag-recapture, CPUE, and length-frequency information, an age- and sex-structured forward projecting model of the northwest Atlantic population indicated that the total population is currently 21–24% of its size in 1961, while number of mature females is

currently 12–15% of the 1961 level (DFO, 2005a). However, population viability analysis indicates that the decline in the porbeagle population has ceased and is beginning to increase (DFO, 2005b).

In the high seas of the North Atlantic, standardized Japanese longline CPUE from bycatch declined at a rate equivalent to a 60% decline over 10 years during 1993–2000 (Matsunaga and Nakano, 2002), although there is considerable variability around this slope estimate. High seas North Atlantic catches during the period 1994 to 2003 were low but catches from 1999–2003 were near zero compared to catches of near 1000 individuals per year 1994–1997 (Matsunaga and Nakano, 2005).

Southern hemisphere
Japanese longline catches in the South Atlantic were below 10 000 individuals per year between 1994 and 2003 and fluctuated without trend (Matsunaga and Nakano, 2005), while CPUEs in the south Atlantic were essentially without trend from 1993 to 2000 (Matsunaga and Nakano, 2002). Standardized Japanese longline CPUE in the Southern Ocean high sea southern bluefin tuna fishery showed large fluctuation without trend from 1992 to 2004 (Matsunaga, 2006).

The harvesting of porbeagle off Argentina and Uruguay is exclusively as bycatch and is a minor component of catch in other fisheries: tuna in Uruguay (Domingo, 2000), Patagonian toothfish and other demersal fisheries in Argentina (Waessle, 2007). Longline CPUE in tuna fisheries off New Zealand suggests a declining trend from 1993 to 2002 (proposal; New Zealand Ministry of Fisheries, 2006). CPUE may not reflect stock abundance in this region because of low observer coverage and variations in vessel, gear, location and season (proposal) but recent values are much lower than earlier values in the series (about 30%). Annual landings in these fisheries have declined to around 40% of the original levels between 1997 and 2003, following an increase from very low levels 1989–1995 (Matsunaga, 2006).

Small population size
For the northwest Atlantic population, the most recent estimates from an age- and sex-structured forward projecting model are 9–13 thousand mature females, 33–38 thousand mature individuals, and 188–195 thousand total individuals (DFO, 2005a). 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). 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. 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.

Assessment relative to quantitative criteria

Decline

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 13), 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%).

For the northwest Atlantic population, the current mature female population is 12–15% of the historical baseline prior to major fisheries (1961), while the total population is 21–24% of that historical baseline. This result from the population model is consistent with the catch history and with CPUE information. Number of spawners in 2005 was 86–92% of that in 2002, while the total number of individuals in the population remained relatively stable during this period (DFO, 2005a). This indicates the population meets the criterion for Appendix II. However, population viability projections in the stock assessment indicate that the population decline has ceased and that the population is expected to increase under the new, conservation-oriented management plan.

For the northeast Atlantic, assessment against the decline criterion is difficult. Long-term trends in catch have declined substantially, most notably in the Norwegian fishery, which is now at about one percent of historical values (1920s). Total catches (1926–2004), if summed over periods of 5–10 year periods, would be much lower recently than in the 1930s to 1950s, on the order of 40% of historical catches. However the calculation of decline was sensitive to the choice of periods used for calculation. Nevertheless, as previously stated, 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. There was some evidence of sequential depletion of fisheries in ICES areas, although this seemed inconsistent with the migratory nature of the species. The only CPUE series available (French longline) has declined to 64% of the level in the early 1990s. Other than a landings decline in one fishery (Norwegian) there appears to be no clear signal in the landings information.

For the southern hemisphere, information was patchy and the time series were short. There was indication of a recent (about 10 years) decline in New Zealand longline landings and CPUE (to ca. 40% and 30% respectively). There has been no recent trend in Japanese longline landings or CPUE in the south Atlantic and in the southern Indian Ocean. The proposal indicates that Uruguayan longline CPUE has declined 80–90% in 10 years, but also notes that this decline may have been due to a change in the distribution and depth of fishing operations.

In summary, southern hemisphere populations were unlikely to meet Appendix II criteria. The northwest Atlantic population met the criteria, but the population is currently being rebuilt and thus would not benefit from a CITES listing. There were insufficient data to judge the status of the population which is potentially in greatest need of population growth (the northeast Atlantic). Overall, the panel concluded that the global status of porbeagle populations did not meet the Appendix II criteria.

Small population
The estimate of total population size for the northwest Atlantic is 33–38 thousand mature individuals, and 188–195 thousand total individuals. Total population size worldwide would be well above this. This species is therefore not characterized by a small population size.

Restricted distribution
The panel concluded that this species is not characterized by a "restricted" distribution.

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

Risk and mitigating factors
Porbeagle sharks have life history characteristics that make them particularly vulnerable to mortality from human activities including fishing. Fecundity is among the lowest of the sharks, and maturation and growth schedules are typical of large sharks, making for high vulnerability (Musick *et al.*, 2000). Products from the species (meat, fins) are of high value in markets (Fowler *et al.*, 2004), and 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.

Risk to the northwest Atlantic population is mitigated by the existence of management plans in the United States and Canada based on an analytical assessment of population status and an explicit goal of rebuilding population abundance (DFO, 2005b). Catch quotas have already been reduced by Canada and United States to levels which are believed to support population recovery. There are currently a low number of vessels (11 licensed vessels in Canada) fishing directly for porbeagle. Model predictions show stock recovery is currently underway but will take decades to be completed. The Canadian management authority is requiring a fishery independent survey to monitor the population and if results indicate the population is not recovering, the directed fishery will be closed altogether.

In the southern hemisphere, mitigating factors include a regulation that requires all live captures of sharks greater than 1.6 metre to be released by Argentinean longline and trawl fisheries (Consejo Federal Pesquero Argentinia, Res. 13/2003). Moreover, Argentina has a 100 percent observer coverage requirement for longline fisheries which provides accurate catch estimates for porbeagle. Off New Zealand, tuna and swordfish fisheries are currently more valuable than porbeagle fisheries and directed porbeagle fisheries are unlikely to develop. New Zealand is developing management plans for highly migratory species, and the opinion of the panel is that if a directed porbeagle fishery were to be developed, New Zealand would enact suitable measures to prevent overexploitation. Moreover, Regional Fishery Management Organizations (RFMOs) around the world are moving toward more specific management measures for sharks.

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). This is one of the few large shark species for which there have been directed fisheries, driven by the quality of the meat. International trade from Canada to the European Union (EU) has been a factor driving fisheries for this species both in the past and at present. Canadian processors have reported that their main

competitor to their trade to European markets is European countries. However, the panel found that it was not possible to quantify international trade in porbeagle products, since the species does not have its own customs code under systems in use (Harmonized System) internationally. Accordingly porbeagle products are lumped with products from other shark species in international trade. Limited information from market surveys and other studies is available to provide indications of the importance of international trade in this species. Most studies available date from the mid to late 1990s and conditions may have changed since that time.

Exports of porbeagle meat from Canada to the USA and EU, from Japan to the EU, and from the EU to the USA have been documented in available studies (proposal). Trade in porbeagle meat between France, Spain and Italy has been documented (Vannuccini, 1999) but this is within the EU so not "international". All the countries mentioned are producers as well as consumers of porbeagle, except for Italy that is not a producer (Vannuccini, 1999). Porbeagle fins are found in markets in China, Hong Kong, Special Administrative Region, and internationally (proposal; Shivji *et al.*, 2002), but are apparently not one of the common species in the Hong Kong dried fin market, possibly because fins in that market primarily come from areas other than those where porbeagle is most abundant (northwest and northeast Atlantic) (Table 2 in Clarke *et al.*, 2006).

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 avoid 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.

Implementation issues

Introduction from the sea
Most porbeagles are harvested within the Exclusive Economic Zones (EEZs). As such, Introduction from the Sea would only be a significant issue for this species for high seas longline fleets, in particular for porbeagle shark harvested off Iceland by Japan. Japanese longline fleets capture porbeagle as bycatch (Matsunaga and Nakano, 2002, 2005) and may land catches at ports outside Japan (referenced in proposal).

Basis for findings: legally-obtained, not detrimental

Non-detriment findings
Non-detriment findings (NDFs) are the responsibility of the exporting country and must show that exports are non 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 (2004a, paras 28–29) provides some guidance on NDFs in a fisheries context.

For the northwest Atlantic population, the basis for non-detriment findings should follow the current Canadian Total Allowable Catch (TAC) for porbeagle, which is based on results from a

population model. For northeast Atlantic, scientific advice is available on which NDF could be based although a closer alignment between management measures and scientific advice would be required. For porbeagle introduced from the sea, existing RFMOs could be used to provide the basis for NDFs.

Findings that specimens were legally obtained
Porbeagle harvests from the northwest Atlantic population are regulated under the Canadian management plan. Exports of products based on legal harvesting under this management plan would qualify as legally obtained for CITES. The United States has been landing porbeagle from this population since 2000 but recent landings have been low (less than 1 mt over the last 4 years).

Although the ICES Working Group on Elasmobranch Fishes recommended that no fishery should be permitted on the northeast Atlantic stock, and RFMOs have the authority to regulate porbeagle stocks, porbeagle harvest levels are not currently regulated by states or international organizations in the northeast Atlantic or in the southern hemisphere. Only a 294 t annual TAC in New Zealand (well above recent landings) and high, non-restrictive TACs for Norwegian and Faroese fisheries in the northeast Atlantic (proposal) are available. Accordingly, exports of porbeagle products from fisheries in these areas would qualify as legally-obtained under CITES.

Identification of products in trade
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 with skin on 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).

"Look-alike" issues
Listing for "look-alike" reasons (i.e., listing on Appendix II under Article II, para 2b 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 product 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.

Potential socio-economic impacts of proposed listing
Under an Appendix II listing, socio-economic impacts of the listing would probably be quite limited. Some additional costs would be imposed on exporters to apply for permits, and delays in exports could be experienced while permitting processes were completed, adding to storage costs. Such costs would probably be greatest in the months following a listing, as exporters and CITES Authorities adapted to a new listing.

Likely effectiveness of a CITES Appendix II listing for species conservation

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 (which under Appendix II should relate to regulation and monitoring of trade, but which might include reductions in levels of trade under some circumstances).

Porbeagle products are certainly traded internationally, but the relative proportion of harvests going to international and to national markets is not known. Much of the harvest in the EU is apparently for internal markets, and thus would not be subject to CITES provisions. Landings at distant-water ports by Japanese, Taiwanese and Korean fleets would be subject to CITES provisions related to Introduction to the Sea. 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.

Much of the porbeagle shark catch is from incidental harvest in pelagic longline fisheries, in addition to that from directed fisheries. Incidentally caught fish are probably retained because of the high value. There appear to be no sources of anthropogenic mortality other than fisheries. It was noted that if an Appendix II listing was enacted for this species, discards of porbeagles by longline fleets might increase because much of the catch is incidental.

Fisheries management considerations

The management plans in the United States and Canada have an explicit goal of rebuilding population abundance (DFO, 2005b). Catch quotas have already been reduced by Canada to levels which are believed to support population recovery. The Canadian Department of Fisheries is requiring a fishery independent survey to monitor the population and if results indicate the population is not recovering, the directed fishery will be closed altogether.

In other regions, sustainable harvesting regimes covering the species as a whole would have benefits for conservation of the species. New Zealand is currently developing general management plans for highly migratory species which will include porbeagle shark; thus if a directed porbeagle fishery were to be developed, New Zealand would enact suitable measures to prevent overexploitation. Argentina has regulations that require all live captures of sharks greater than 1.6 metre to be released by Argentinean longline and trawl fisheries (Consejo Federal Pesquero Argentinia, Res. 13/2003). Moreover, RFMOs around the world are moving toward more specific management measures for sharks.

Some range states for this species have National Plans of Action for Sharks (NPOA) (FAO, 1998) and there is work towards aiding other countries in developing and implementing NPOAs (FAO, 2006). The Panel noted agreement of states to implement effective management of the International Program of Action for sharks and further noted that sustainable management would require that, where they had not done so, range States develop and implement National Plans of Action for sharks to ensure that catches of porbeagle (and other sharks) from both directed and non-directed fisheries are sustainable.

Overall conclusions

The FAO Ad Hoc Expert Panel concluded that the available evidence does not support the proposal to include the porbeagle shark, *Lamna nasus,* in CITES Appendix II.

Globally, the species does not meet the biological decline criteria for listing in CITES Appendix II. The decline in population abundance of the northwest Atlantic population meets the Appendix II criterion, but risk to the northwest Atlantic population is mitigated by population rebuilding and the existence of both Canadian and United States management plans designed to rebuild stocks. Porbeagles in the northeast Atlantic Ocean may meet Appendix II criteria, but the limited data that were available were not sufficient to assess the extent of the decline. In the southern hemisphere, porbeagle populations are relatively lightly exploited and Appendix II criteria are likely not met.

Though adequate management measures are in place in some regions, there are others where some form of management is urgently needed. Sustainable management requires that, where they had not done so, range States develop and implement National Plans of Action for sharks.

In the event of a CITES listing, porbeagle caught in EU waters would likely be traded within the EU, and thus avoid CITES trade limitations. In the northwest Atlantic, most porbeagles are harvested within the EEZs and the basis for non-detriment findings should follow the current Canadian TAC for porbeagle, which is based on results from a population model. Introduction from the Sea would only be a significant issue for high seas longline fleets, who catch porbeagle shark only as bycatch.

References supporting the Panel evaluation

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TABLES AND FIGURES

Table 1. Information for assessing the 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	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 *et al*., 2007
Maximum age	a. unfished: not well known; 40+ years based on estimates from natural mortality b. fished: maximum observed 25 yr	Low (greater than 25 yr)	a. Various b. Campana *et al.*, 2001
Von Bertalanffy K	0.07, northwest Atlantic	Low (less than 0.15)	Natanson *et al.*, 2002
Generation time	a. derived from "median" natural mortality and female age at maturity, NW Atlantic: G = t_{mat} + 1/M = 15 yr + 1/0.15 = 22 yr b. at least 20–50 yr	Low (greater than 10 yr)	a. derived from information in sources b. proposal

Table 2. Decline indices for porbeagle. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
NE Atlantic	Landings	Recent landings perhaps 40% of historical	Inspection, rough estimation	Northeast Atlantic, 1926–2004	Catch data (2)	Proposal
	Landings	Recent landings are 64% of those in late 1970s	Average landings 2000–2004 vs average 1975–1979	Northeast Atlantic population	Catch data (2)	Proposal; ICES, 2006b; Table 6.1
	Landings	ICES areas show sequential loss of landings	Inspection	Northeast Atlantic population	Catch data (2)	Proposal; ICES, 2006b; Fig 6
	Landings	Norwegian landings decline from several thousand t/yr in 1930s to almost nil 1990–present (to 1% of original?)	Inspection	Norwegian fleet	Catch data (2)	Proposal
	Landings	French landings decline from over 800 t/yr 1978–82 to less than 300 t/yr 1998–present (current is 38% of original)	Inspection	French fleet	Catch data (2)	Proposal; ICES, 2006b
	Longline CPUE	Decline to 64% of original, early 1990s to early 2000s	Average values 1990–94 vs average values 2001–2005	French longline fleet	Catch per unit effort (3)	ICES, 2006b
Mediterranean	Compiled observations, landings	"Virtually disappeared"	Landings 2–3 t/yr in 1970s; v. rare otherwise	Mediterranean	Catch data (2), observations (1)	Proposal
NW Atlantic	Landings	Recent catches are 8% of historical highs	Average catch 2000–2004 vs average catch 1961–1965	Northwest Atlantic fishery	Catch data (2)	Proposal; numbers from Gibson and Campana, 2005
	Longline CPUE - immatures	Decline mid–1980s to 2000; recent increase	Inspection	Three fished areas	Standardized CPUE (4)	DFO, 2005a (Fig. 1 this report)

Area	Index	Trend	Basis	Coverage	Reliability	Source
	Longline CPUE - mature	Declines to 10–30% of original, 1990 to early 2000's	Mean of values 1988–1992 vs mean of values 2000–2005	Three fished areas	Standardized CPUE (4)	DFO, 2005a (Fig. 1 this report)
	Model estimate of number in population	Current total population 21–24% of virgin size in 1961	Model output	Northwest Atlantic population	Model estimate (5)	Proposal; DFO, 2005
	Model estimate of number in population	Current female mature population 12–15% of virgin size in 1961	Model output	Northwest Atlantic population	Model estimate (5)	Proposal; DFO, 2005
North Atlantic	Catches	Near-zero catches 1999–2003, ca. 1000/yr 1994–1997	Inspection	Catches in North Atlantic, Japanese longline, 1994–2003	Catch data (2)	Matsunaga and Nakano, 2005
	Longline CPUE	Decline with slope -0.6 1993–2000	Fit to numbers read from graph	Combined CPUE for NW and NE Atlantic, Japanese longline, 1993–2000	Standardized CPUE (4)	Matsunaga and Nakuno, 2002
Southern hemisphere	Catches	Values 2003/4–2004/5 less than 40% values 1997/8–1998/9	Inspection	Landings and discards, NZ tuna fishery 1989–2004	Catch data (2)	Proposal
	Catches	Variable, no trend	Inspection	Numbers caught, Japanese longline fishery, south Atlantic, 1994–2003	Catch data (2)	Matsunaga and Nakuno, 2005
	Longline CPUE	Values 2000–2002 ca 30% of 1993–1996	Inspection	New Zealand tuna fishery	Unstandardized CPUE (3)	Proposal; Ministry of Fisheries NZ
	Longline CPUE	Values variable with no trend	Inspection, fit to values read from graph	Japanese longline fishery, South Atlantic, 1993–2000	Standardized CPUE (4)	Matsunaga and Nakuno, 2002

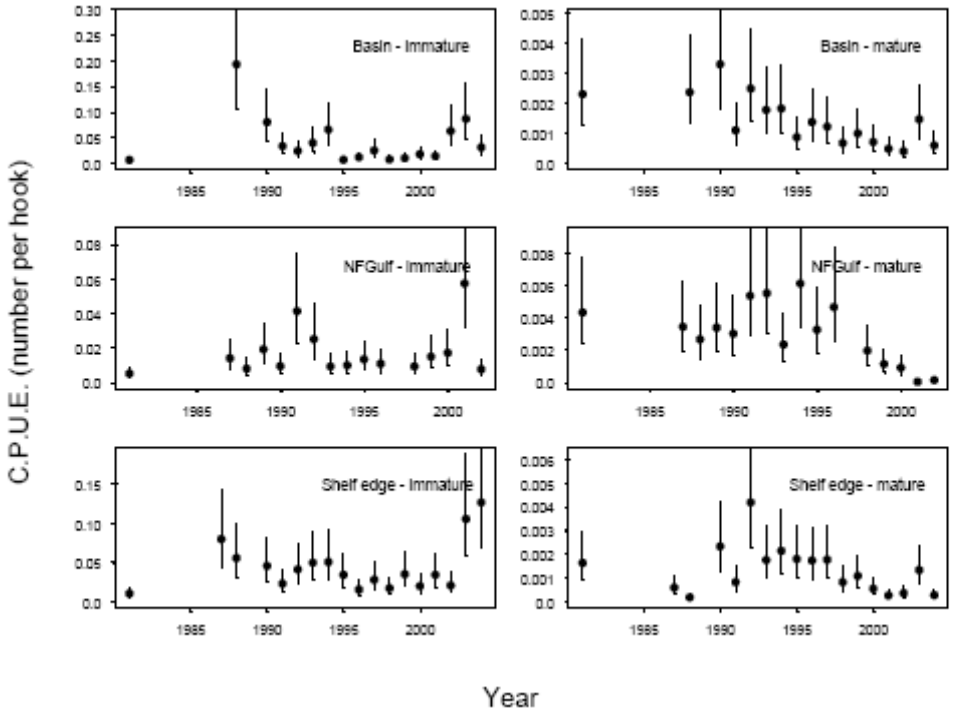

Figure 1. Longline catch per unit effort from three fished areas off eastern Canada (source: DFO, 2005a)

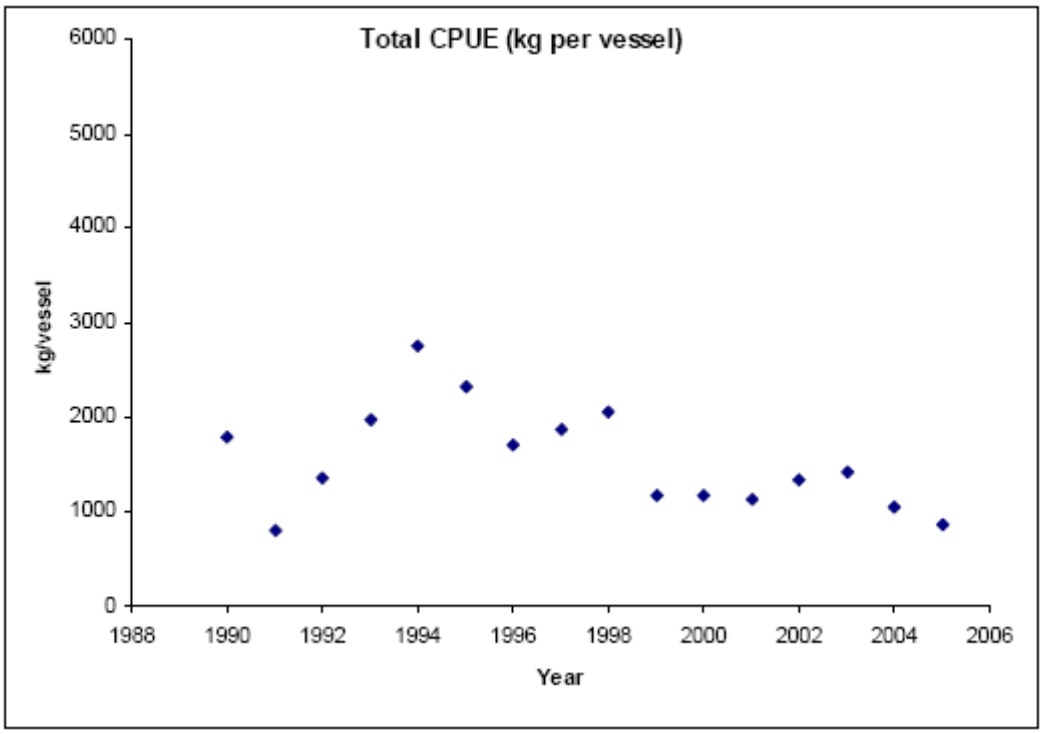

Figure 2. French longline catch per unit effort (source: ICES, 2006a and b)

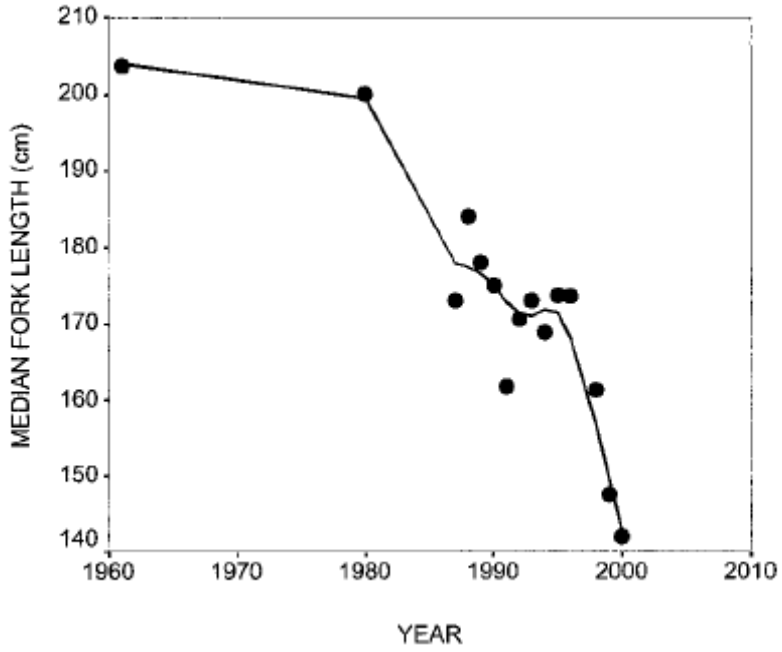

Figure 3. Change in median fork length of porbeagle in commercial catch in September-November on mating grounds off southern Newfoundland. A LOESS line is fitted to the data (source: Campana *et al.*, 2001).

APPENDIX F

FAO Ad Hoc Expert Advisory Panel assessment report: spiny dogfish

PROPOSAL No. 16

SPECIES: *Squalus acanthias* – spiny dogfish

PROPOSAL: Inclusion of *Squalus acanthias* in Appendix II in accordance with Article II 2(a)

Basis for proposal:

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
(North Atlantic, Mediterranean, Black Sea and North Pacific stocks). Marked decline in population size which meets CITES' guidelines for the application of decline to commercially exploited aquatic species for a low productivity species (to less than 20%), rapid recent rates of decline.

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 the level at which its survival might be threatened by continued harvesting or other influences. Species is subjected to unsustainable fisheries in several other parts of its range, because of international trade demand for its high meat value; other stocks likely to experience similar declines unless trade regulations provide an incentive to introduce sustainable management.

ASSESSMENT SUMMARY

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence does not support the proposal to include *Squalus acanthias* under CITES Appendix II.

Globally, the species does not meet the biological decline criteria for listing under CITES Appendix II. The northeast Atlantic population meets the decline criterion for listing on Appendix II. The northwest Atlantic population does not meet the criterion if the entire population is taken into account, although it may if mature females alone are considered. The northeast Pacific has not shown declines consistent with the Appendix II criteria, while in the northwest Pacific a decline to the threshold level was evident only in a small area believed to be at the margins of the distributional range. In the southern hemisphere, surveys in the southwest Atlantic and southwest Pacific indicate stable or increasing abundance.

International trade of *Squalus acanthias* is the key driver of exploitation in all areas, except the northeast Atlantic where most of the catch is traded internally within EU markets. The catch imported into the EU from harvests by non-EU members from the northeast Atlantic stock is, however, appreciable.

There are serious fisheries management failures for some individual populations. Catches from the northeast Atlantic stock, both internally traded in the EU and imported, need to be curtailed. Federal and state U.S. fishery management plans exist for the northwest Atlantic stock and have succeeded in reducing catches, but they are not well coordinated. 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 had 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, and the requirement for a closer alignment between management measures and scientific advice to underpin non-detriment findings.

PANEL COMMENTS

Biological considerations

Population assessed

This species is widely distributed in temperate and boreal waters of the northern and southern hemispheres, and is most common at depths of 10–200m. Although long-distance migrations are known to occur (proposal, McFarlane and King, 2003), populations within the distribution of the species have been identified.

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

Individuals in the northwest Atlantic are also considered to be a single population for fisheries management purposes in the USA (NMFS, 2006). The species is most common between Nova Scotia and Cape Hatteras but is found from Labrador to Florida. There are indications of population structuring within this large area and more work on population structure is required (NMFS, 2006).

For the north Pacific there does not appear to be an agreed population structure, although the concept of western and eastern populations is consistent with tagging observations available 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 2 940 recaptures were recorded near Japan (McFarlane and King, 2003).

Spiny dogfish occur off South America, South Africa, Australia and New Zealand (proposal) but there appears to be little information on movements or population structure in these areas. The assumption that there are separate populations in these areas is consistent with information from the north Atlantic and north Pacific.

Productivity level
Information available in the proposal and other sources (Table 1) indicates that spiny dogfish fit into the low productivity category, and that there are variations in productivity between populations. Productivity of the northeast Pacific population is lower than Atlantic populations.

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, 2006a). Females give birth every two years on average.

Population status and trends

Recent peer-reviewed analytical assessments are available for the northeast Atlantic (ICES 2006a) and northwest Atlantic (NMFS, 2006). Relatively little information is available from fishery agencies in the northeast Pacific, northwest Pacific, and for the southern hemisphere.

Decline
Information on declines is summarized in Table 2.

Northeast Atlantic
The "base case" of the model runs in the most recent ICES assessment indicates that current total biomass level is 5% of that in 1905 (unexploited) and 7% of that in 1955 (lightly exploited) (proposal, ICES, 2006a).

Landings increased during the 1920s and early 1930s, dropped to low levels in 1940–1945, increased to very high levels during the 1950s and 1960s and subsequently declined. Recent landings have been about 15% of the values in the early 1950s.

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). No details of the analysis are given. Landings in the Black Sea followed roughly the same pattern during this period (FAO, 1997).

Mediterranean
Two indices cited in the proposal indicate no trend in abundance in parts of the Mediterranean: for the eastern basin 1994–2004 and for the Adriatic Sea 1948–1998. The basis for the statement that the species disappeared from the western Mediterranean in recent years (proposal) is not clear.

Northwest Atlantic
The most recent NMFS assessment (NMFS, 2006) reviews recent information and results of a population assessment. A primary source of information on abundance trends is the NMFS spring trawl survey which is considered to represent trends in the US component of the population (Figure 1).

This assessment is somewhat more optimistic than the prior assessment (NMFS, 2003, referred to in proposal), primarily because the most recent trawl survey point (2006) was substantially higher than those for the previous five years, a result considered unlikely in a review of the assessment (Cook, 2006). Analyses of extent of decline (Table 2) do not include this most recent point.

Total biomass increased by a factor of three from the late 1960s to the early 1990s and then declined to about 60 percent of maximum values (Figure 1). The biomass of mature females has declined to about 20 percent of the observed maximum between the late 1980s and recent years. An increase in female biomass was observed during the 1980s and recent values are around 30 percent of those in the early 1980s. It is possible that recent female biomass is a larger fraction of that found prior to the 1980s, if the increase in total biomass observed from the 1960s to the 1980s was also true for females.

The NMFS assessment does not discuss possible reasons for the increase in biomass from the 1960s to late 1980s. Peak landings occurred in the mid–1970s (Figure 2) so the increase following that period could have been a response to a reduction in fishing mortality.

Landings in the northwest Atlantic show two peaks, in the early 1970s and the mid/late 1990s, both with maximum landings of around 20 000 t/year (NMFS, 2006, Figure 2). Recent landings are around 40 percent of these historical values. Fisheries in the USA have targeted mature females which are preferred by markets (NMFS, 2006).

The summer trawl survey abundance index from the Scotian Shelf Canadian waters shows a clear increasing trend over the period from about 1980 to the present (Figure 3) for total biomass. In recent years Canadian landings have accounted for almost half of total landings, but Canadian fisheries have not targeted mature females.

Northeast Pacific

Local abundance is reported to have decreased substantially in Puget Sound (Camhi, 1999 in proposal). In the Gulf of Alaska, trawl survey biomass (Figure 4) and longline survey catches (Wright and Hulbert, 2000) have been increasing in recent years. On Canada's continental shelf, trawl survey CPUE (Figure 5) and longline survey CPUE (Figure 6) 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 on both sides of the Canada-USA border have fluctuated without trend since 1980 (Figure 7).

Northwest Pacific

CPUE information from a small area in the Sea of Japan cited in the proposal indicates substantial declines (proposal). CPUE in Danish seines and bull trawls is reported to have declined by 90 percent from the 1970s to the 1990s, while CPUE in unspecified gear is reported to have declined 80–90 percent in the same period.

A summary document (Fisheries Agency of Japan, 2004) indicates that landings declined to around two percent of historical levels between the early 1950s and late 1990s. Landings in the early 2000s were around 34 percent of those in the early 1970s, while for the same periods trawl CPUE in the Sea of Japan decreased to 26 percent CPUE in other areas showed varying trends: low with no trend in Iwate Prefecture, a substantial decline (to about 10%) in Shiriya-

zaki/Aomori Prefectures, and a fluctuation without trend followed by a decline from 1990–2003 in West Erimmo/Hokkaido Prefectures (Fisheries Agency of Japan, 2004). However, these trends should be interpreted with caution as it is believed that these fishing areas occur at the extreme margins of the distribution of spiny dogfish. The areas covered by these indices are part of the Exclusive Economic Zone that extends off northern Japan, on the southern margin of spiny dogfish distribution in the northwest Pacific and a relatively small part of the distribution in this area.

Southern hemisphere
In New Zealand reported catches have been increasing since the early 1990s but this increase may be due to better reporting as well as to increased harvest (proposal, New Zealand Ministry of Fisheries, 2006). 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 (New Zealand Ministry of Fisheries, 2006).

Trawl surveys in the EEZ of Argentina indicate that, although there has been some localized decline of spiny dogfish in coastal areas, there have been no overall abundance trends over the last ten years (Massa *et al.*, 2007). In the Bonaerense region (Figure 8a) 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 8b), recent biomass estimates are about 50 percent of those in the late 1990s. In the southern region there has been no trend in survey biomass estimates since the early 1990s (Figure 8c).

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

Small population size
An approximate estimate of world population size of 1 000 million individuals was made based on a range of information and assumptions (Table 3).

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 oceans (Figure 2 of the proposal).

Assessment relative to quantitative criteria

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 percent of the historical baseline would lead to consideration for Appendix I. To be near the Appendix I threshold, values 5–10 percent above this (i.e. 20–30 percent of the historical baseline) either now or in the near future may justify consideration for Appendix II. Table 4 and Figures 9 and 10 summarize the Panel evaluation of the decline indices in relation to Appendix II criteria.

In the *northeast Atlantic*, the most recent peer-reviewed stock assessment indicates that recent total biomass is about 5–7 percent of historic values, within the 15–20 percent value that would qualify a species for Appendix I.

The limited information available for the *Mediterranean and Black Sea* does not indicate any trend in these populations.

In the US assessment in the *northwest Atlantic*, decline can be assessed for different population components (total biomass or mature females alone) and relative to different historical baselines (values in the late 1980s, following a population increase, or at earlier periods). 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, the earlier lower baseline population levels would be more appropriate.

Total biomass is currently about 67 percent of the recent baseline and 200 percent of the historical (early 1960s) baseline. Corresponding percentages for mature females are about 20 percent and 35 percent. The 20 percent estimate for mature females is close to or within the Appendix I threshold, but the other estimates are well above the Appendix I and Appendix II threshold.

It is arguable as to whether the population has been declining in recent years or is starting to increase. Projections for the US component indicate that biomass will remain stable at current exploitation rates (Figure 11), but should rebuild if exploitation rates are reduced.

Canadian surveys suggest that total biomass in Canadian waters has increased in recent years.

For the *northeast Pacific*, there appear to be no indications of severe decline other than for Puget Sound, a small enclosed part of the distribution area. 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 trend.

Information quoted in the proposal for the *northwest Pacific* (declines in CPUE of 80–90 percent in one fishery and 90 percent in another) would suggest that this population is near Appendix I territory, as would the observation that recent catches are less than two percent of those in the early 1950s. Declines in the Sea of Japan trawl CPUE to 26 percent of that in the early 1970s would also place this population near Appendix I. However, this decline was observed in only a small portion of the northwest Pacific in an area at the margins of its distributional range. There is other information indicating that abundance may be stable or increasing (proposal, Annex 4).

For the *southern hemisphere*, recent abundance indices appear to be stable or increasing in New Zealand and without trend off Argentina.

Although some populations or components meet the Appendix II decline criterion (northeast Atlantic, total population; northwest Atlantic, mature females) overall the species does not meet the decline criterion.

Small population
The global population size of *Squalus acanthias* is possibly as high as one billion fish (Table 3). 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
No estimates of area occupied by the species are available, but the species is widely distributed on continental shelves of northern and southern hemispheres (Figure 9).

Were trends due to natural fluctuations?
In one case, the northwest Atlantic population, observed trends may 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. Sinclair and Murawski, 1997; Hall, 1999), 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 fishery harvests which were at maximum levels in the early 1970s and subsequently dropped to about 20 percent of the maximum levels (Figure 2).

In other areas there appears to be no evidence for observed trends being due to natural fluctuations.

Risk and mitigating factors
Life history parameters of spiny dogfish make them particularly vulnerable to the impacts of mortality from human activities (Table 1). The 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, 2006a), although this may range from 1–20. Recent pup production in the northwest Atlantic has averaged 4–9 (NMFS, 2006).

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. The assessment of the US component in northwest Atlantic indicates that mean lengths and weights of females taken in surveys have declined substantially over the past two decades (Figure 12), and the ratio of mature males to females in survey catches increased 3–fold from 1993–2000 (NMFS, 2006; Figure B13), consistent with targeting of large females in the US fishery. 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 p. 16). Recruitment has been very poor in recent years, with recruit biomass near zero from 1997 to 2003 (compared with values of 1 000–10 000 tonnes in previous years) (NMFS, 2006 Figure B7), and individuals less than 60 cm in length (juveniles) have become rare in US survey catches since 1997 (NMFS, 2006, Figure B11). However, in Canadian surveys there has been a recent increase in abundance in individuals of both sexes less than 60 cm (information provided to the Panel by S. Campana).

Similar analysis of size and sex trends is not available in the ICES assessment (ICES, 2006a) 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, 2006a, Figure 2.9), while very few females have been greater than 80 cm off the Scottish west coast and in the Celtic Seas (ICES 2006a; Figure 2.10). In surveys in the Irish Sea, a large proportion of individuals are greater than 80 cm (ICES, 2006a, Figure 2.10), although some concern is expressed about whether this information is biased by availability.

At present, some fishery management measures are in place for several spiny dogfish populations but these do not appear to be restrictive and thus may not be considered mitigating factors at present.

In the northeast Atlantic, TACs have been substantially reduced since 2001 (8 870 tonnes) to 2005 (1 136 tonnes) and 2006 (1 051 tonnes), but the TAC only covers part of the distribution of the species, and landings throughout the distribution have been substantially above TACs (16 015 tonnes in 2001 and 5 636 tonnes in 2005) (ICES, 2006a). The species is caught as a bycatch in groundfish fisheries as well as in directed fisheries. ICES advice in 2006, as in 2005 (the first year in which advice was provided on this species) is that directed fisheries should not be permitted to continue, bycatch in mixed fisheries should be reduced to the lowest possible level, and the TAC should be set to zero, in all areas where the species is caught in the northeast Atlantic (ICES, 2006b). Norway has implemented a 70 cm minimum size (ICES, 2006a). Given the inconsistency between the advice and recent fishery practice, it would appear that although the fishery management regime may afford some protection to the species, it is likely to be inadequate for ensuring sustainability of the population.

For the northwest Atlantic population, fishery management plans are in place in both Canada and the USA. The USA has two management plans, one led by the National Marine Fisheries Service (NMFS) and one by the Atlantic States Marine Fishery Commission (ASMFC). Both plans have the goal of setting quota levels that should lead to rebuilding, but different quotas are set for U.S. waters in the two plans: 4 million pounds (1 800 tonnes) and 8.8 million pounds (4 000 tonnes) respectively (Goodale, 2003). In Canada, a quota of 2 500 tonnes was instituted in 2001, but this was overrun in one year to 3 500 tonnes (Hanson, 2003). Recent landings have been consistent with the TAC (Table 5). Total landings (US commercial, US recreational, and non-US.) have been of the order of 5 000–7 000 tonnes from the population in recent years (NMFS, 2006, Figure B4), while recent discard mortality is estimated at about 4 000–5 000 tonnes/yr (NMFS, 2006). Thus, the Canadian and US fishery management plans have succeeded in substantially reducing removals; while it is not yet known whether the reductions are sufficient to enable rebuilding, projections in the US assessment indicate that biomass should remain stable at recent fishing mortality levels and rebuild with a decrease in fishing mortality.

Restrictive management measures are not in place in the northeast Pacific. In Alaska (Gulf of Alaska and Bering Sea/Aleutian fishery management plans), spiny dogfish are lumped with "other species" for which a grouped TAC is in place (NPFMC, 1997, 2001). In Canada's Pacific Region, a TAC of 15 000 tonnes is in place (DFO, 2006, p 16) and catches against the TAC have been around 5 000–6 000 tonnes/year in 2003–2005 (Table 5). For the Washington-Oregon-California region, trip limits are in place but there appear to be no TACs or other management measures for spiny dogfish (PFMC, 2006).

No fishery management measures are in place in the northwest Pacific (proposal). A TAC is in place in New Zealand but does not appear to be restrictive on catches; for 2004–5 total catches were 7 300 tonnes against a TAC of 12 660 tonnes (New Zealand Ministry of Fisheries, 2006).

Trade considerations

Spiny dogfish meat has a high value in markets and substantial amounts have been traded internationally over the past decade (proposal). Available trade and production data show that the European Union is a significant importer of spiny dogfish (proposal Tables 5, 6), and consumed 65 percent of world production in 2001 (Fowler *et al.*, 2004).

Available trade data indicate that a total of 13 exporting countries accounted for 98 percent of imports to the EU between 1995 and 2005 (Lack, 2006). The remaining two percent was supplied by 14 countries/entities (Lack, 2006). Imports and exports have been influenced by changes in landings since 1990; as landings in the EU have declined, landings in the USA increased substantially in the 1990s, then declined (proposal; NMFS, 2006; Table 5). Canadian landings increased six-fold in the period 1997 to 2001 as US regulations on catch went into effect. With the decline in landings in countries which formerly supplied the EU, imports from "new" areas such as Morocco and New Zealand are reported to be increasing (proposal Table 5).

The Panel noted that a significant proportion of the EU market (60 percent in 2004) was supplied by catches from EU vessels and that internal trade within the EU was not subject to the provisions of CITES. With respect to the northeast Atlantic population the Panel noted that around 30 percent of the EU supplies originated from non-EU vessels, equivalent to imports. Overall, the Panel agreed that international trade was an important factor affecting catches of spiny dogfish globally and that sustained demand for the meat for the EU market was likely to continue.

Implementation issues

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. In many cases, waters under national jurisdiction extend only 12 nm offshore, increasing the possibility that spiny dogfish could be taken outside those waters. Should this occur, the State of introduction would be required to make non-detriment findings in respect of the catch. The relevant regional fisheries body in the Mediterranean Sea is the General Fisheries Commission for the Meditteranean (GFCM) and it is possible that that body could facilitate the development of agreed criteria for making non-detriment findings.

Split-listings

Given that the Panel agreed that the Northeastern Atlantic population of spiny dogfish met the criteria for listing in Appendix II, the possibility of a split listing was considered, whereby the Northeastern Atlantic population would be listed in Appendix II and other populations would not be listed. The Panel noted the advice of the FAO Expert Panel on Implementation Issues Associated with Listing Commercially-Exploited Aquatic Species on CITES Appendices (FAO,

2004b) that inflexible adherence to the CITES invocation to avoid split-listings could result in stocks that would not otherwise qualify for listing being placed in Appendix II. However, the Panel considered that, in addition to the implementation difficulties under CITES, such a split listing could facilitate IUU fishing for spiny dogfish on the Northeastern Atlantic, with catches laundered as taken from non-listed 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.

Basis for findings: legally-obtained, not detrimental

Non-detriment findings

Non-detriment findings (NDFs) 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. Quality of NDFs can be assured by review in the Scientific Committees of CITES (Animals and Plants Committees) and in individual Parties. FAO (2004b, paras 28–29) provides some guidance on NDFs in a fisheries context.

Scientific capacity and management measures are in place with respect to the two populations of spiny dogfish in the northern Atlantic. However, where they are to be relied upon as the basis for non-detriment findings, 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 some areas where exploitation rates appear to be relatively low (e.g. the northeast Pacific and southern hemisphere).

Findings that specimens were legally obtained

The majority of targeted fishing for spiny dogfish currently occurs under the auspices of a national management plan. Exports of spiny dogfish products taken in compliance with such management plans would provide a basis for a finding that it had been legally obtained. Where spiny dogfish is exported from waters with no specific management measures for the species a finding that is had been legally obtained would be relatively straightforward, though in the longer-term, the absence of such measures may make non-detriment findings increasingly difficult.

Identification of products in trade

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 (proposal). 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, however the latter 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. 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.

"Look-alike" issues
Listing for "look-alike" reasons (i.e., listing on Appendix II under Article II, para 2b 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. 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 species on the basis that their products resemble those of spiny dogfish in trade.

Potential socio-economic impacts of the proposed listing
Socio-economic impacts will depend on whether existing trade is brought under regulation (the intent of an Appendix II listing) or is restricted (as would be the case if, for example, adequate non-detriment findings could not be developed). Spiny dogfish populations in the north Atlantic are already subject to restrictions on catch though an Appendix II listing could result in further reductions in catch levels. With respect to other waters, regulation of trade is unlikely to result in any reductions in current catch levels therefore the socio-economic impacts would be minimal. Costs are likely to arise from additional paperwork for exporters.

The imposition of an Appendix II listing may require tightening of management measures in order to secure non-detriment findings for export. In the short-term this may impose costs and restrictions on fishing and processing opportunities however, experience suggests that in the absence of strong management, target fisheries for spiny dogfish are relatively short-lived.

Likely effectiveness of a CITES Appendix II listing for species conservation
An Appendix II listing, imposing global regulation on a species which may only be unsustainably harvested in some parts of its global range, would be an inefficient management measure. A listing of spiny dogfish in Appendix II could impose unnecessary regulations on trade from a number of populations where available information indicates that directed fishing mortality is low.

With respect to the spiny dogfish populations of primary conservation concern, restrictions on catch are already in place for the northwest Atlantic population although improved coordination between federal and state fishery management measures in the USA, and between the USA and Canada, is required if rebuilding efforts are to succeed.

In regard to the northeast Atlantic spiny dogfish population, the Panel noted that while the majority of catch from this stock was consumed domestically within the EU a requirement for non-detriment findings for that part of the catch taken by non-EU members may assist in securing a closer alignment between scientific advice and management measures for the stock in its

entirety. However, it is imperative that EU members prohibit target fisheries for spiny dogfish and severely curtail bycatch.

The Panel noted that market demand for high-value spiny dogfish products had the potential to drive increased exploitation of currently under-exploited stocks.

Key implementation issues identified by the Panel included the need for a coordinated approach to facilitate non-detriment finding for catches taken in high seas areas of the Mediterranean; difficulties in differentiating products from spiny dogfish and other sharks in trade; and a closer alignment between management measures and scientific advice to underpin non-detriment findings.

Fisheries management considerations

Apart from New Zealand's non-restrictive quota and Argentina's closed areas (for hake) that may also protect spiny dogfish, the Panel was not aware of management measures in any other part of the southern hemisphere; however, it is also believed that most of these populations are only lightly to moderately exploited.

In the northeast Pacific, Canada has implemented a non-restrictive TAC and the US Pacific Fishery Management Council has implemented trip limits. No fishery management measures are in place in the northwest Pacific.

In the northwest Atlantic, fishery management plans are in place in both Canada and the USA. These have succeeded in substantially reducing catches in recent years. However, there is discord between federal and state TACs in the USA, with the latter needing to be reduced to federally-recommended levels. There is also a need for improved coordination between the USA and Canada in managing the northwest population.

In the northeast Atlantic, ICES has recommended a TAC of zero for the stock, but landings continue to be substantial. Management is largely ineffective, and a CITES listing by itself will do little to resolve the problem as the majority of the trade is between EU members. It is imperative that meaningful management measures be developed and implemented.

The lack of effective management in the northeast Atlantic, the paucity of mature females in the northwest Atlantic and the potential for exploitation to increase substantially in other areas due to high market demand means that the global status of the species should continue to be monitored.

The fisheries management record for *Squalus acanthias* is poor to extremely poor throughout the world. The Panel noted agreement of states to implement effective management of the International Program of Action for sharks and further noted that sustainable management would require that, where they had not done so, range States develop and implement National Plans of Action for Sharks to ensure that catches of spiny dogfish (and other sharks) from both directed and non-directed fisheries are sustainable.

Overall conclusions

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence does not support the proposal to include *Squalus acanthias* under CITES Appendix II. Globally, the species does not meet the biological decline criteria for listing under CITES Appendix II. The northeast Atlantic population meets the decline criterion for listing on Appendix II. The northwest Atlantic population does not meet the criterion if the entire population is taken into account, although it may if mature females alone are considered. The northeast Pacific has not shown declines consistent with the Appendix II criterion, while in the northwest Pacific a decline to Appendix II level was evident only in areas believed to be at the margins of the distributional range. In the southern hemisphere, surveys in the southwest Atlantic and southwest Pacific indicate stable or increasing abundance.

The listing proposal states that North Atlantic, Mediterranean, Black Sea and North Pacific *Squalus acanthias* stocks qualify under criterion 2a, A (that the species can be inferred or projected to become eligible for inclusion in Appendix I in the near future). However, the Expert Panel concluded that this statement was not supported by the available information, except for the northeast Atlantic population.

The global population size of *Squalus acanthias* is estimated to be one billion or more.

International trade of *Squalus acanthias* is the key driver of exploitation in all areas, except the northeast Atlantic where most of the catch is traded internally within EU markets. The catch imported into the EU from harvests by non-EU members from the northeast Atlantic stock is, however, appreciable.

There are serious fisheries management failures for some individual populations. Catches from the northeast Atlantic stock, both internally traded in the EU and imported, need to be curtailed. Federal and state US fishery management plans exist for the northwest Atlantic stock and have succeeded in reducing catches, but they are not well coordinated. 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 had 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, and the need for a closer alignment between management measures and scientific advice to underpin non-detriment findings.

The Expert Panel considered the option of a split listing for *Squalus acanthias*, with the northeast Atlantic population alone being listed on Appendix II. However, given that EU members are both the main harvesters and consumers of northeast Atlantic spiny dogfish, it was concluded that the development and implementation of effective management measures would have a far greater positive impact on the sustainability of the population. Moreover, the Panel considered that, in addition to the implementation difficulties under CITES, such a split listing could facilitate IUU fishing for spiny dogfish on the Northeastern Atlantic, with catches laundered as taken from non-listed stocks.

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TABLES AND FIGURES

Table 1. Information for assessing the productivity level for spiny dogfish. Productivity levels refer to FAO (2001).

Parameter	Information	Productivity	Source
Intrinsic rate of increase	a. NE Atlantic: 4–7% b. NW Atlantic: 3.4–4.7% from MSY c. NE Pacific: 1.7–2.3% from MSY	Low (<0.14)	a. Proposal b. Smith *et al.*, 1998 c. Smith *et al.*, 1998
Natural mortality	a. NE Atlantic 0.1 (most ages) b. NW Atlantic 0.1 c. NE Pacific 0.065	Low (<0.2)	a. ICES, 2006a, proposal b. NMFS, 2006 c. Smith *et al.*, 1998
Age at maturity	a. NE Atlantic, 50%: female 11 yr b. NW Atlantic, 50%: female 12 yr, male 6.5 yr c. NE Pacific, 50%: female 36 yr	Low (>8 yr)	a. ICES, 2006a b. Nammack *et al.*, 1985, proposal c. Saunders/ MacFarlane 1993
Maximum age	a. NW Atlantic 50 yr (assumed) b. N Pacific 60 yr	Low (>25 yr)	a. NMFS, 2006, proposal b. Proposal
von Bertalanffy K	a. NE Atlantic: female 0.09. male 0.17 b. NW Atlantic: female 0.1057, male 0.1481	Low for females (<0.15)	a. ICES, 2006a b. Nammack *et al.*, 1985
Length at maturity	a. NE Atlantic: female 80 cm, male 64 cm b. NW Atlantic: female 78 cm, male 60 cm		a. ICES, 2006a b. Nammack *et al.*, 1985

Table 2. Decline indices for spiny dogfish. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
Northeast Atlantic	Model estimate of biomass	Recent total biomass is appr. 5% that in 1905	Analytical assessment	Northeast Atlantic stock, 1905–2005	Population model with multiple inputs (5)	ICES 2006a, proposal
	Model estimate of biomass	Recent total biomass is appr. 7% of that in 1955	Analytical assessment	Northeast Atlantic stock, 1905–2005	Population model with multiple inputs (5)	ICES, 2006a, proposal
	CPUE	Recent values appr. 40% of historic	Mean values of "year effect" 1985–1989 are 39% of 2001–2005	Scottish trawlers 1985–2005	Standardized CPUE (4)	ICES, 2006a Table 2.4, Fig. 2.8
	Landings	Recent values appr. 15% of historic highs	Mean values 2000–2004 are 15% of values 1950–1954	Northeast Atlantic 1947–2005	Landings (2)	ICES 2006a, Table 2.1
Black Sea	Population biomass	Increased 1972 (80 000t) to 1982 (220 000t), declined to 1992 (80 000t)	Virtual population analysis	Black Sea, 1972–1992	Population model, no details (1)	FAO, 1997, proposal
Mediterranean	Biomass?	No trend	Unknown	Eastern basin, 1994–2004	Unknown (0)	Serena *et al.*, 2005 in proposal
	"Occurrence"	No trend	Unknown	Adriatic Sea, 1948–1998	Unknown (0)	Jukic-Peladic *et al*., 2001 in proposal
Northwest Atlantic	Swept area biomass, females	Recent values appr. 20% of those in late 1980s/early 1990s	Smoothed values 2001–2005 ca 50,000t, 1987–1991 ca. 250 000t	US waters 1980–2006	Survey CPUE (5)	NMFS, 2006; Fig. 1 this report
	Swept area biomass, females	Recent values appr. 35% of those in early 1980s	Smoothed values 2001–2005 ca 50 000t, 1980–1984 ca 150 000t	US waters 1980–2006	Survey CPUE (5)	NMFS, 2006; Fig. 1 this report
	Swept area biomass, females	Recent rate of decline 4% per year	Linear regression 1996–2005	US waters 1996–2005	Survey CPUE (5)	Figures from NMFS, 2006
	Swept area biomass, total	Recent values appr. 67% of those in late 1980s	Smoothed values 2001–2005 ca 400 000t, 1986–1993 ca 600 000t	US waters 1980–2006	Survey CPUE (5)	NMFS, 2006; Fig. 1 this report
Northwest Atlantic (continued)	Swept area biomass, total	Recent values appr. 200% of those in late 1960s	Smoothed values 2001–2005 ca 400 000t, 1968–1972 ca 200 000t	US waters1980–2006	Survey CPUE (5)	NMFS, 2006; Fig. 1 this report
	Landings	Recent values ca 40% of historical	Average 2000–2004 is 43% of 1990–1994; similar in relation to 1970–1975	US waters 1962–2005	Landings (2)	NMFS, 2006
	Trawl survey numbers	Stable/increasing 1970–1997	Inspection of graph	Scotian Shelf (Canada)	Trawl survey (5)	Fig. 5 this report
Northeast Pacific	Trawl survey biomass	Increasing 1984–2003	Inspection of graph	Gulf of Alaska	Survey biomass (5)	Courtney *et al.*, 2004, Fig. 9 this report
	Longline CPUE	Increases 1985–1999	Inspection of graphs	Gulf of Alaska	IPHC Longline	Wright and Hulbert, 2000

Area	Index	Trend	Basis	Coverage	Reliability	Source
					survey CPUE (5)	
	Trawl survey CPUE kg/set	No overall trend 1984–2003	Inspection of graph	Hecate Strait, continental shelf of Canada	Trawl survey CPUE (5)	Fig. 6 this report
	Longline survey CPUE	No overall trend 1993–2004	Inspection of graph	Continental shelf, Canada	Longline survey CPUE (5)	Fig. 7 this report
	Landings	Declined by 85% to late 1990s	Unknown	Puget Sound	Landings (2)	Camhi, 1999 in proposal
	Trawl survey biomass and numbers	No overall trend 1980–2001	Inspection of graph	Vancouver Region	Survey biomass (5)	Fig 8 this report
Northwest Pacific	Landings	Decrease to 1.7% of historical	From 60 000 t/yr in 1952 to 1 000 t/yr after 1993	Observation	Catches (2)	Fisheries Agency of Japan, 2004
	Landings	Decrease to 34% of historical	From average 938t/yr 1971–1975 to average 320 t/yr 1999–2003	Landings, Japan, 1971–2003	Catches (2)	Fisheries Agency of Japan, 2004
	CPUE	Decrease 80–90% 1970s to 1995–2001	From 8–28 units in 1970s to 1–5 in 1995–2001	Sea of Japan	CPUE – method unknown (3)	Fisheries Agency of Japan, 2003 in proposal
	CPUE Danish seine and bull trawl	Decrease 90% mid 1970s to late 1990s	From 100–200 kg/trawl in 1970s to 10–20 kg/trawl 1990s	Sea of Japan	CPUE – method unknown (3)	Fisheries Agency of Japan, 2003 in proposal
	CPUE trawl	Decrease to 26% of historical	Average 42.6 kg/haul 1971–1975, average 11.2 kg/haul 1999–2003	Sea of Japan	CPUE (3)	Fisheries Agency of Japan, 2004
Southwest Pacific	Trawl survey CPUE	No trend early 1990s to recent	Description of results in assessment document	New Zealand waters	Survey CPUE (5)	NZ Ministry of Fisheries 2006
Southwest Atlantic	Trawl survey biomass	Decrease to 20% of historical	From 5 000 t 1994 to appr. 1 000t 1999–2005	Argentina – Bonaerense region	Survey biomass (5)	Massa *et al.*, 2007; Fig. 10 this report
	Trawl survey biomass	Decrease to 50% of historical	From ca. 80 000 t 1997–1999 to appr. 40 000 t 2003–2005	Argentina – Central region	Survey biomass (5)	Massa *et al.*, 2007; Fig. 11 this report
	Trawl survey biomass	No trend	Fluctuating ca 40 000–appr. 100 000 t 1992–2006	Argentina – southern region	Survey biomass (5)	Massa *et al.*, 2007; Fig 12 this report

Table 3. Approximate global population estimate for spiny dogfish.

Area	Population assessment (million)	FAO Landings (tonnes, average 2003–2004)	Source/method	Estimated population (million)
Northeast Atlantic	50	9 065	Population assessment: 100 000t biomass, individual average weight 2 kg	50
Northwest Atlantic - USA	195	2 777	390 000t biomass, average weight 2 kg;	195
Northwest Atlantic – Canada	200		Trawl survey numbers	200
Mediterranean and Black Sea		205	By ratio of landings to NW Atlantic: 205/2 777 x 395m	29
Northeast Pacific		6 121	At least as large as Northwest Atlantic (see note1)	395
Southwest Pacific	50 for New Zealand	3 237	Note 2	100
Southwest Atlantic	50 for Argentina shelf		100 000t survey biomass, 2 kg individual average weight per	50
Approximate global population				1 019

Note 1. Northeast Pacific landings 6 121 tonnes, northwest Atlantic 2 777 t; northeast Pacific less heavily exploited than northwest Atlantic; therefore northeast Pacific population must be at least as large as northwest Atlantic

Note 2. New Zealand trawl survey biomass 100 000 t; individual average weight 2 kg; therefore NZ numbers about 50 m. This being a small part of the distribution area in southwest Pacific, total population estimated at twice NZ.

Table 4. Decline indices (extent of decline and recent rate of decline) for spiny dogfish populations examined by the Panel in relation to Appendix II criteria. Indices are represented in the maps shown in figures 9 and 10. No catch information was included in the table, only indices which might track population abundance.

Population	Index	Extent of decline	Recent trend	Baseline	Application	Reliability	Source
Northeast Atlantic	Model: total biomass	Qualifies (to 5%)	Stable?	"Unexploited" early 1900s	Entire population	5	ICES 2006
	Model: total biomass	Qualifies (to 7%)	Stable?	Lightly exploited, 1950s	Entire population	5	ICES 2006
Mediterranean and Black Sea	Med: unknown. BS: population biomass (model) and landings.	No trend: not qualified?	Unknown	Unknown	Black Sea and part of the Mediterranean	1 (not verified)	Proposal
Northwest Atlantic	Trawl survey biomass	Mature females: qualifies (to 20%)	Stable or increasing	Moderate exploitation, late 1980s	US waters	5	NMFS 2006
	Trawl survey biomass	Mature females: not qualified (to 35%)	Stable or increasing	1970s, recovering from exploitation	US waters	5	NMFS, 2006
	Trawl survey biomass	Total population: not qualified (to 67%)	Stable or increasing	Late 1980s, following reduced exploitation	US waters	5	NMFS, 2006
	Trawl survey biomass	Total population: not qualified (higher than baseline)	Stable or increasing	Early 1970s, following unknown exploitation	US waters	5	NMFS, 2006
	Trawl survey numbers	Total population, adults: not qualified (increasing)	Increasing	Early 1970s, following unknown exploitation	Canadian waters (Scotian Shelf)	5	Figure 5, this report
Northeast Pacific	Longline CPUE	N/A (period too short)	Increasing (1985–99)	N/A	Gulf of Alaska	3 (method not certain)	Wright and Hulbert,2000
	Trawl survey biomass	Not qualified (increasing)	Increasing (1984–2003)	Early 1980s (exploitation not known)	Gulf of Alaska	5	Courtney *et al.*, 2004

Population	Index	Extent of decline	Recent trend	Baseline	Application	Reliability	Source
	Trawl survey CPUE	Not qualified (no trend)	Decline but NSD	Mid-1980s	Hecate Strait, BC, Canada	5	S. Campana (pers. comm.)
	Longline survey CPUE	Not qualified (no trend 1993–2004)	Decline 1997–2004	Early 1990s	Continental shelf, BC, Canada	5	S. Campana (pers. comm.)
	Trawl survey biomass and numbers	Not qualified (no trend 1980–2001)	Stable	Early 1980s	Continental shelf NW USA and SW Canada	5	S. Campana (pers. comm.)
	Landings	Qualifies? (“85% decline to late 1990s”)	Unknown	Unknown	Puget Sound	1 (not verified)	Camhi, 1999 in proposal
Northwest Pacific	Trawl CPUE	Qualifies (to 26%)	Stable	Early 1970s, following intensive exploitation in 1950s	Sea of Japan	3	Fisheries Agency of Japan, 2004
	CPUE, gear not stated	Qualifies (to 10–20%	Unknown	1970s	Sea of Japan	1 (unvalidated statement)	Proposal citing Fisheries Agency of Japan 2003
	CPUE, Danish seine and bull trawl	Qualifies (to 10%)	Unknown	1970s	Sea of Japan	1 (unvalidated statement)	Proposal citing Fisheries Agency of Japan, 2003
Southwest Atlantic	Argentina trawl survey	Qualifies (to 20%)	Stable	1994	Bonaerense Region (small coastal region)	5	Massa *et al.*, 2007
	Argentina trawl survey	Not qualified (to 50%)	Stable	Late 1990s	Central region (large shelf area)	5	Massa *et al.*, 2007
	Argentina trawl survey	Not qualified (no trend)	Stable	1992–2006	Southern region (large shelf area)	5	Massa *et al.*, 2007
Southwest Pacific	NZ trawl survey CPUE	Not qualified (no trend)	Stable	Early 1990s to recent	New Zealand shelf	4	NZ Ministry of Fisheries, 2006

Table 5. Trade vs. production for selected dogfish producers and consumers.

Year	**EU**			**US**			**Canada**				
	Prodn	**Imports**	**EU imports % total**	**Prodn (Atl)**	**Exports**	**Exports % prodn**	**Atlantic Prod**	**Pacific Prod**	**Total Prod**	**Exports**	**Exports % prod**
1999	11 200	8 697	44	14 900	6 200	42	2 468	3 365	5 833	1 895	32
2000	15 533	7 281	32	9 300	5 439	58	2 828	4 655	7 483	3 143	42
2001	16 015	5 900	27	2 300	2 702	117	3 807	4 532	8 339	4 436	53
2002	9 301	5 841	39	2 200	2 029	92	3 596	4 701	8 297	4 653	56
2003	10 426	4 774	31	1 200	1 554	130	1 324	5 769	7 093	4 196	59
2004	6 047	4 534	43	1 000	1 331	133	2 371	5 488	7 859	4 140	53
2005	5 636	4 605	45	1 200	1 392	116	2 270	5 432	7 702	3 220	42
Sources	ICES 2006A Table 2.1	Proposal Table 6		NMFS, 2006 Table p. 13	Proposal Table 7		DFO website (National)	DFO website (Pacific)		DFO website (National)	

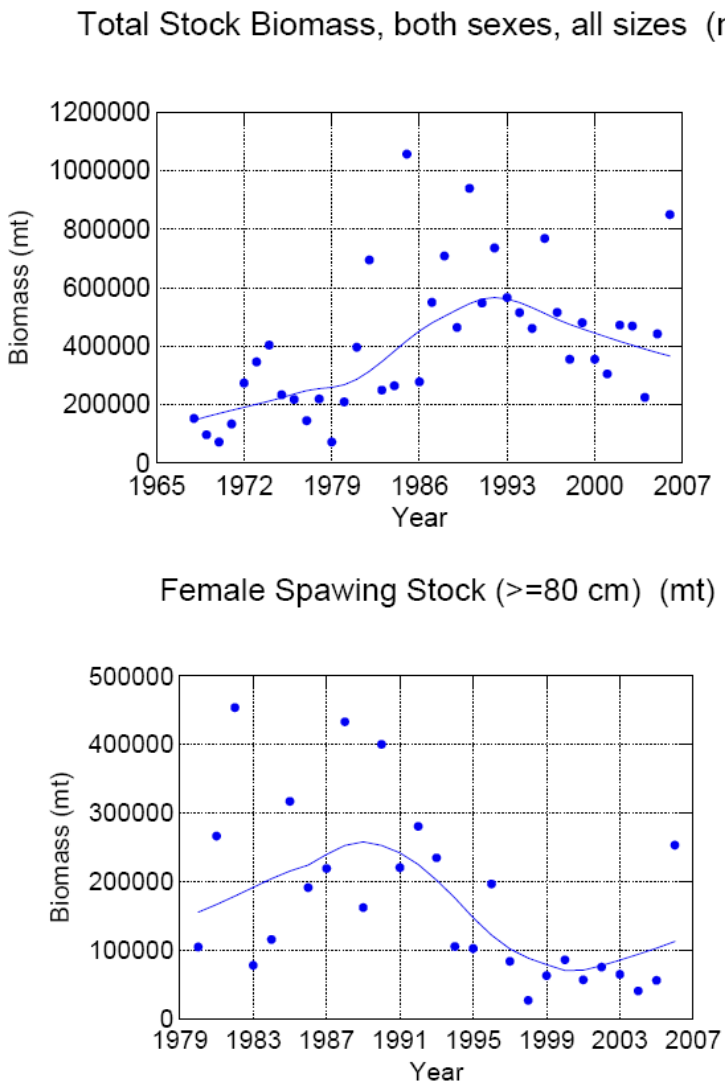

Figure 1. Swept area estimates of total dogfish biomass (tonnes), 1968–2006 (top), and for mature females only (bottom), 1980–2006, NEFSC spring R/V trawl surveys. Line represents Lowess smooth with tension factor 0.5 (source: NMFS, 2006).

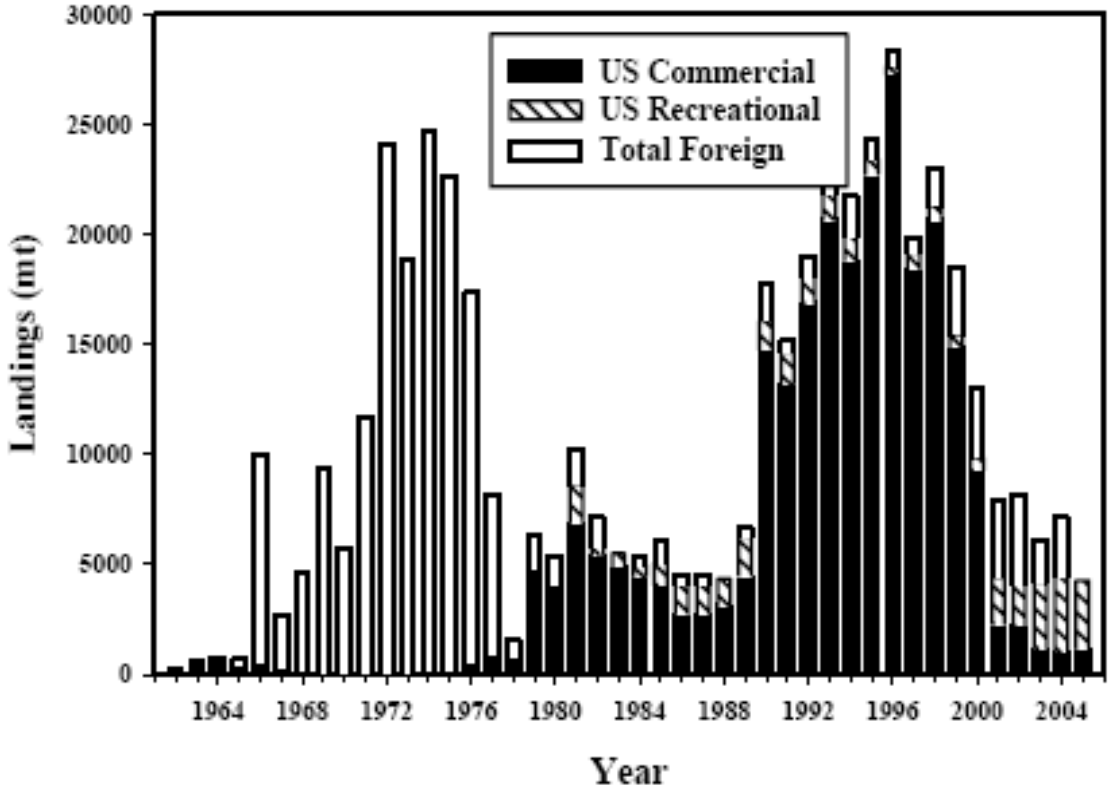

Figure 2. Spiny dogfish landings from the northwest Atlantic (Source: NMFS, 2006).

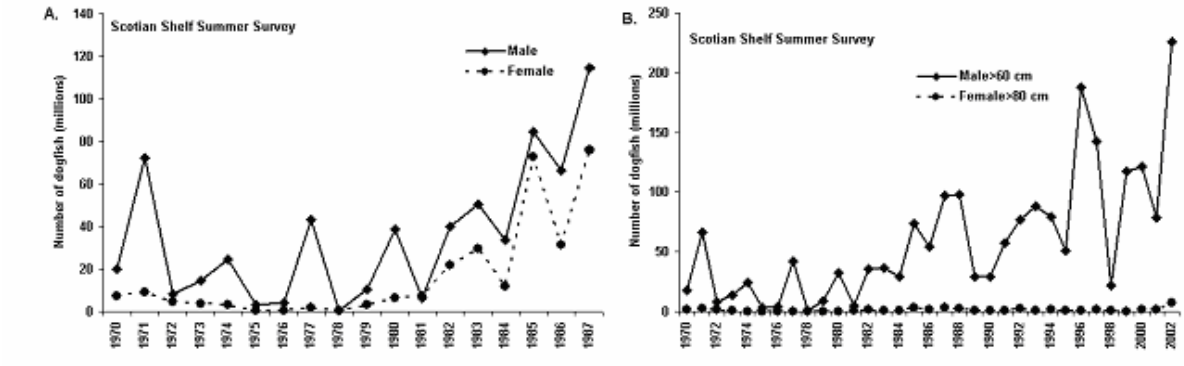

Figure 3. Estimated total number of spiny dogfish by sex and maturity from the Scotian Shelf. (From Bundy, 2003, Figure 10).

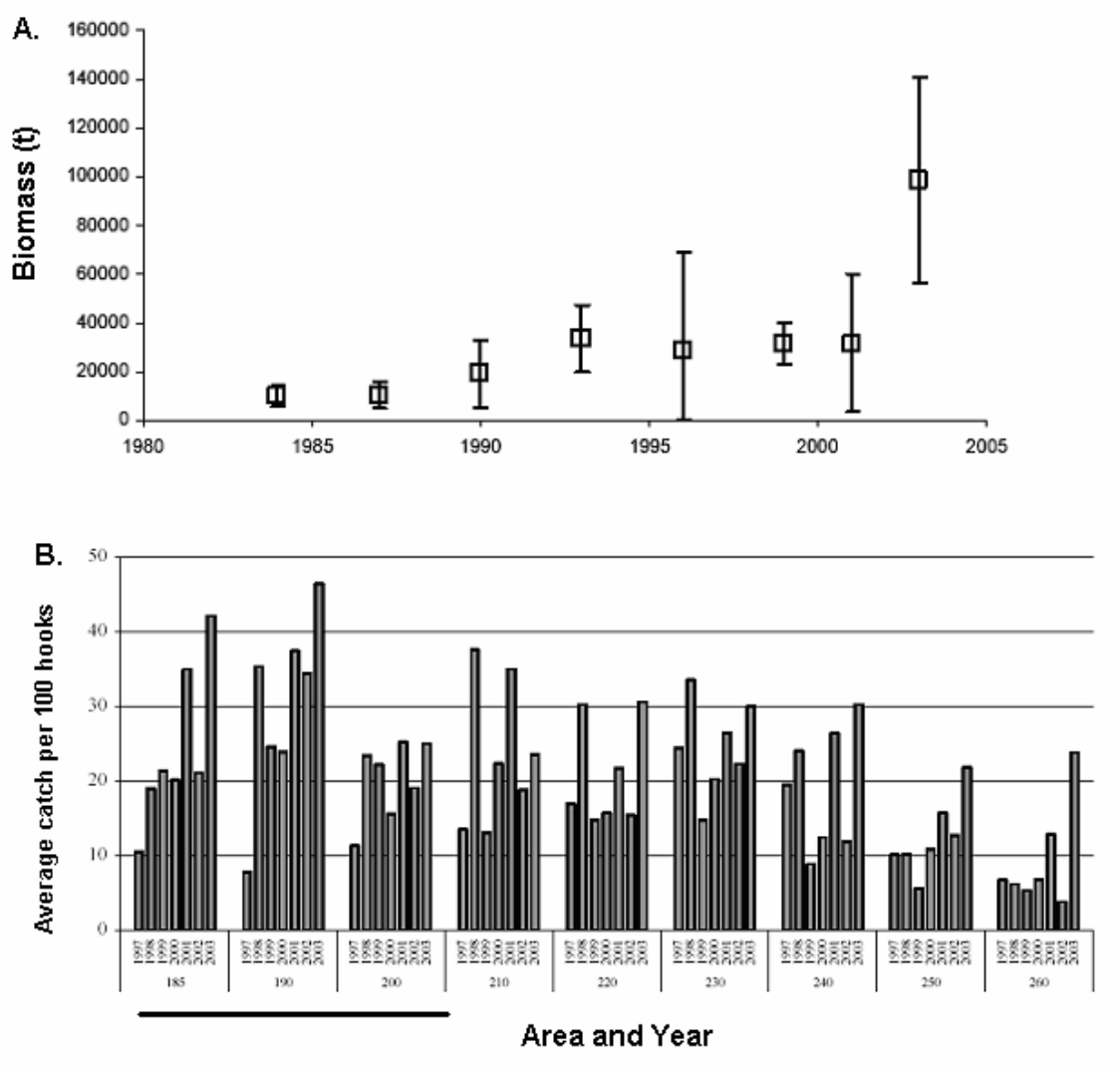

Figure 4. Trends in the abundance of spiny dogfish in Gulf of Alaska from (A.) biomass estimates (t) derived from the AFSC bottom trawl survey (error bars represent 95% confidence intervals); and (B.) catch rates in the IPHC set survey. Waters adjacent to Canada off southeast Alaska are represented by IPHC areas 185, 190, and 200. Figure modified from Courtney *et al.* (2004).

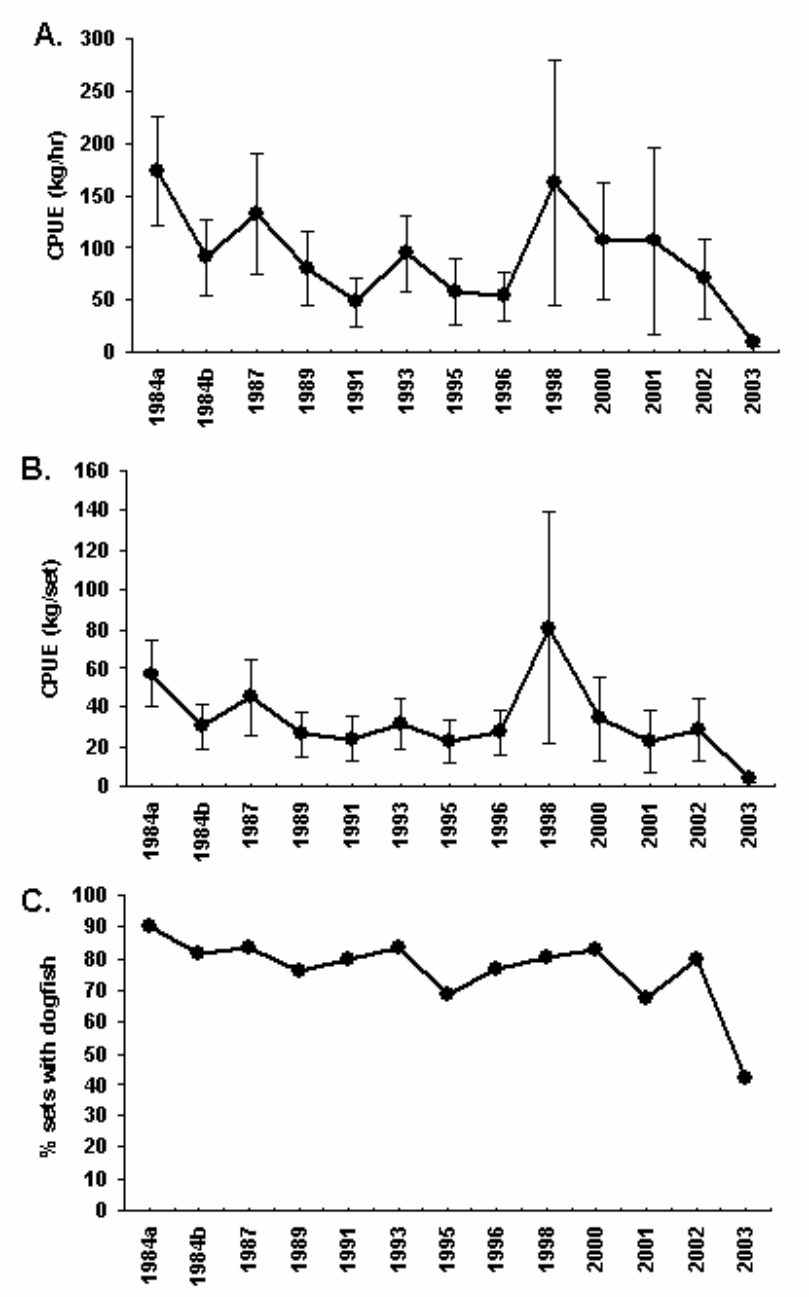

Figure 5. Trends in the abundance of spiny dogfish from Hecate Strait trawl surveys between 1984–2003 using (A) mean CPUE (kg/hour); and (B) mean CPUE (kg/set); and (C) percentage of sets with spiny dogfish. Error bars represent 95% confidence intervals around the mean. Source: information provided by S. Campana.

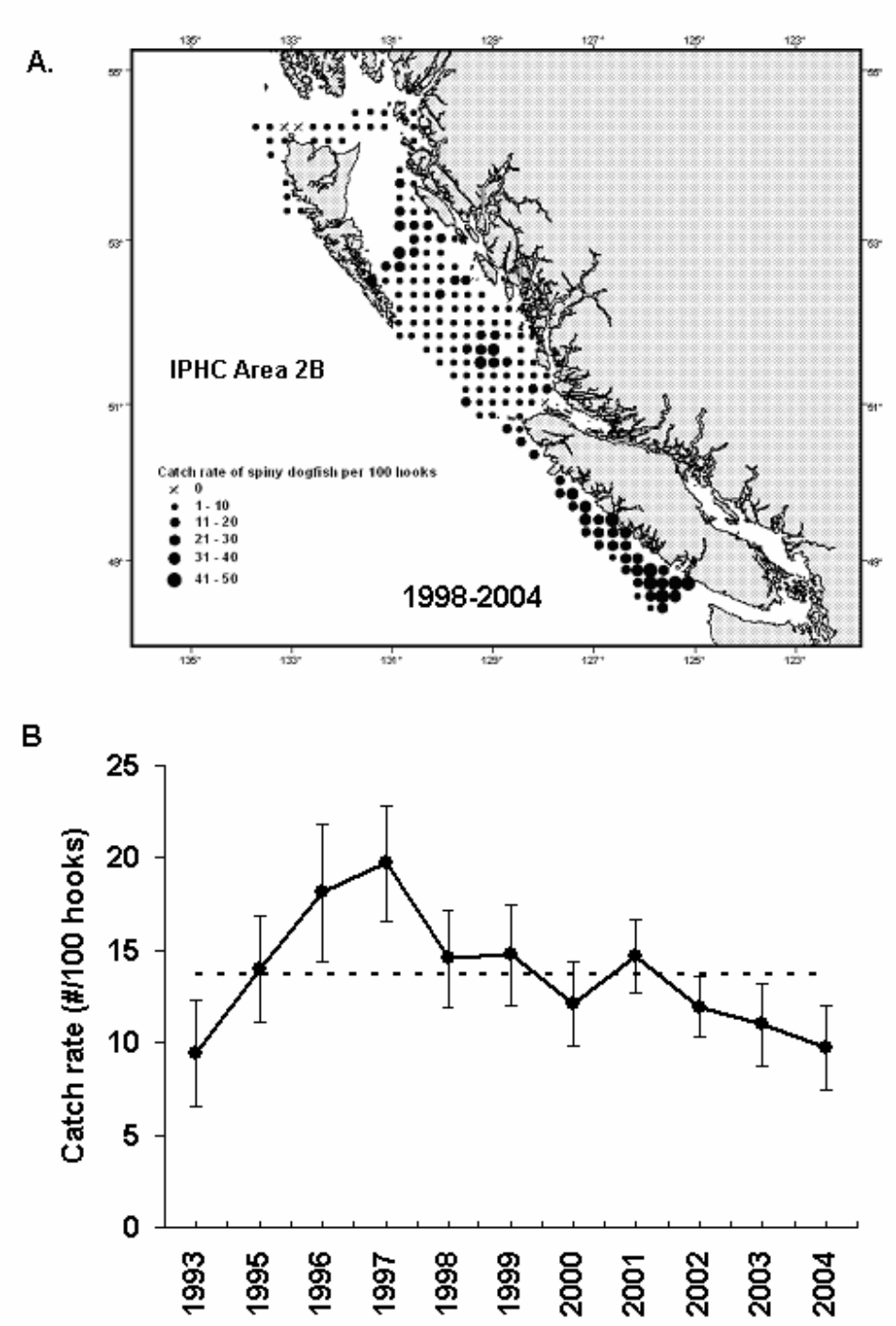

Figure 6. (A) Distribution of spiny dogfish in IPHC Area 2B shown by relative catch rates from 1998–2004 at IPHC survey stations; and (B) mean catch rate by year (error bars represent 95% confidence intervals around the mean). Dashed lined represents the series average. Data provided from the International Pacific Halibut Commission standardized stock assessment survey 1993–2004. Note: no survey in 1994. Source: information provided by S. Campana.

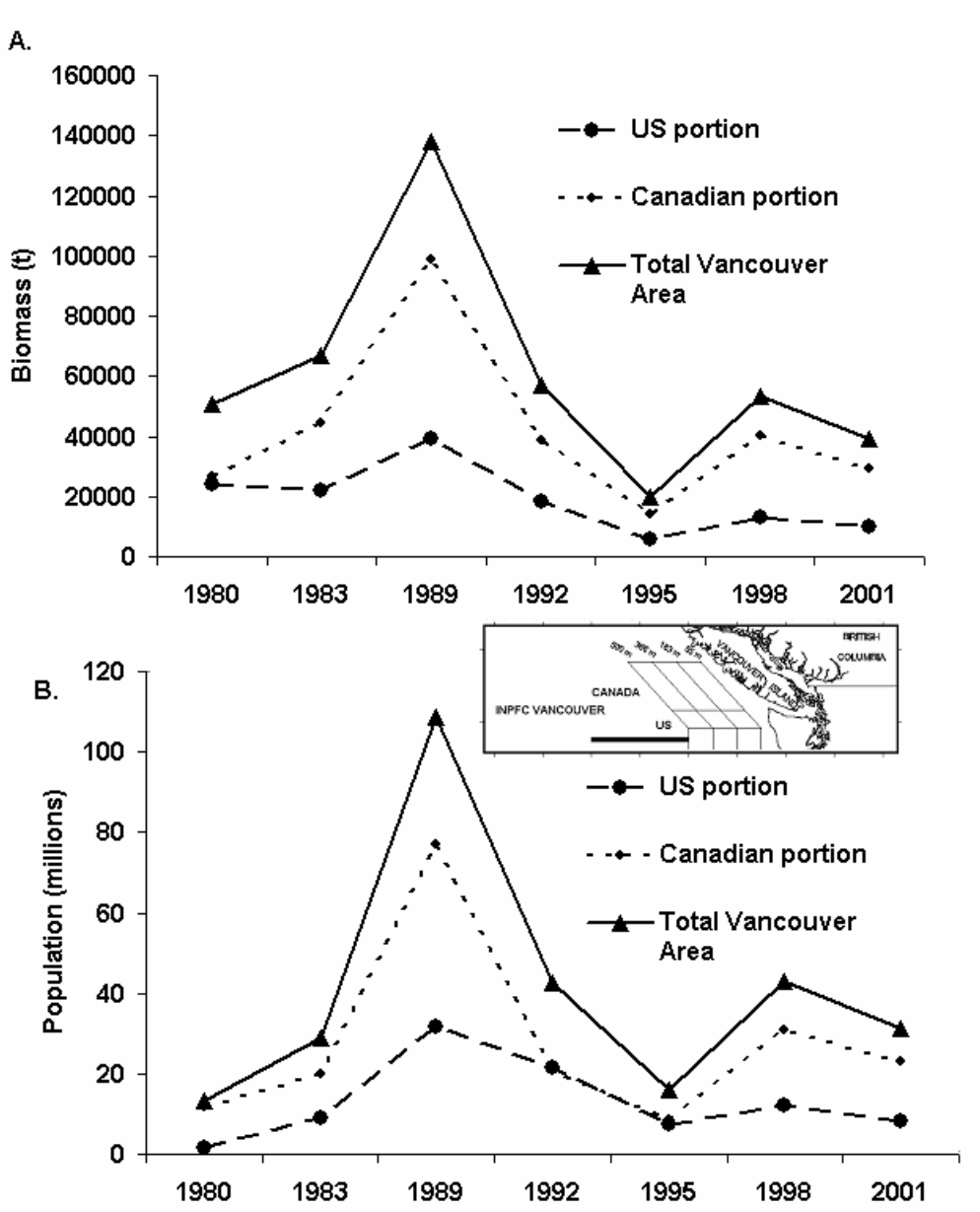

Figure 7. Swept area abundance estimates expressed as (A) biomass; and (B) population in both the Canadian and U.S. portions of the *INPFC Vancouver* region. Data from the National Marine Fisheries Service triennial trawl survey database. Source: information provided by S. Campana.

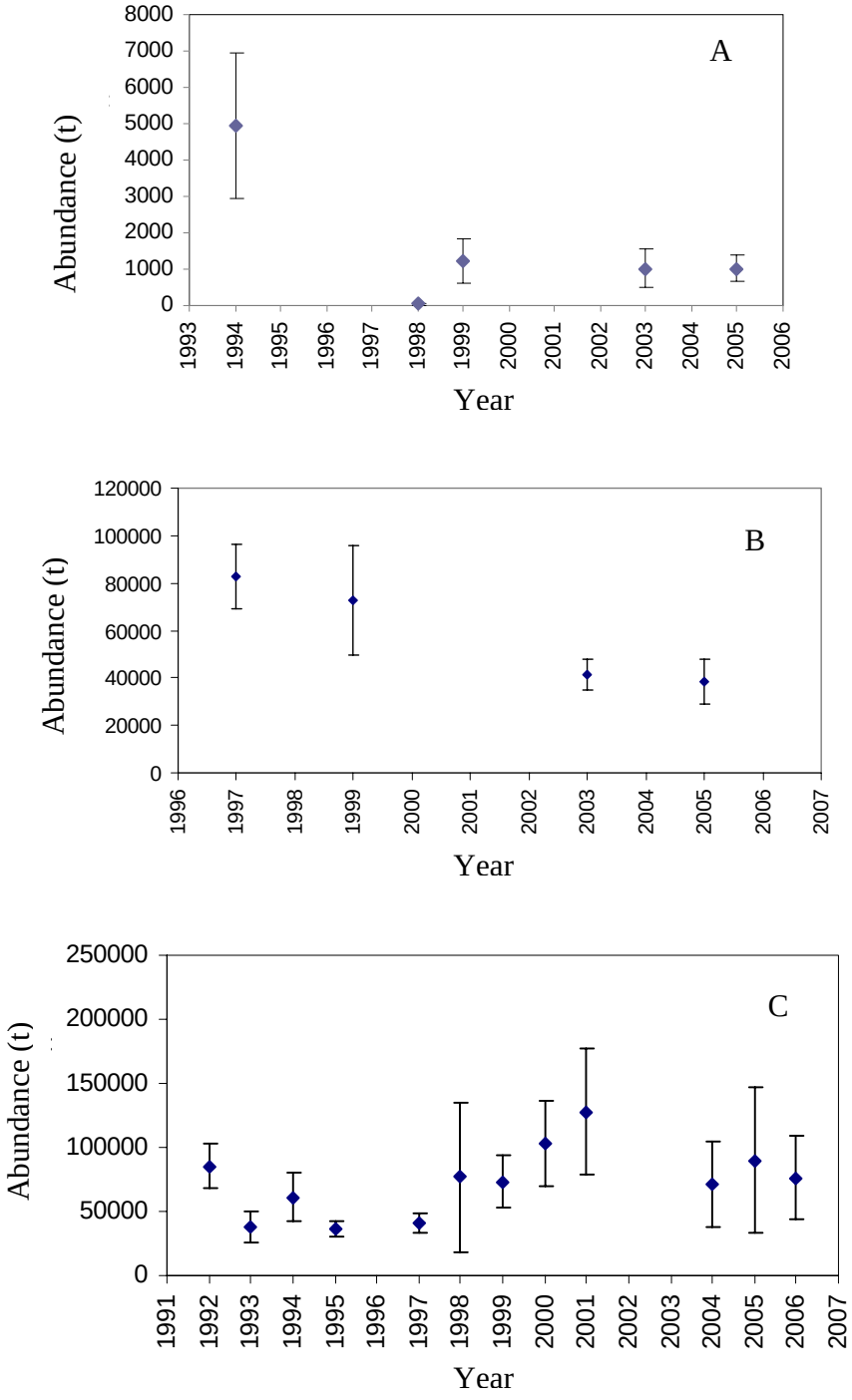

Figure 8. Swept area estimates of total *Squalus acanthias* biomass (tonnes) on the Argentinean shelf: (A) Bonaersense region; (B) central region; (C) southern Patagonian shelf (source: Massa *et al.*, 2007).

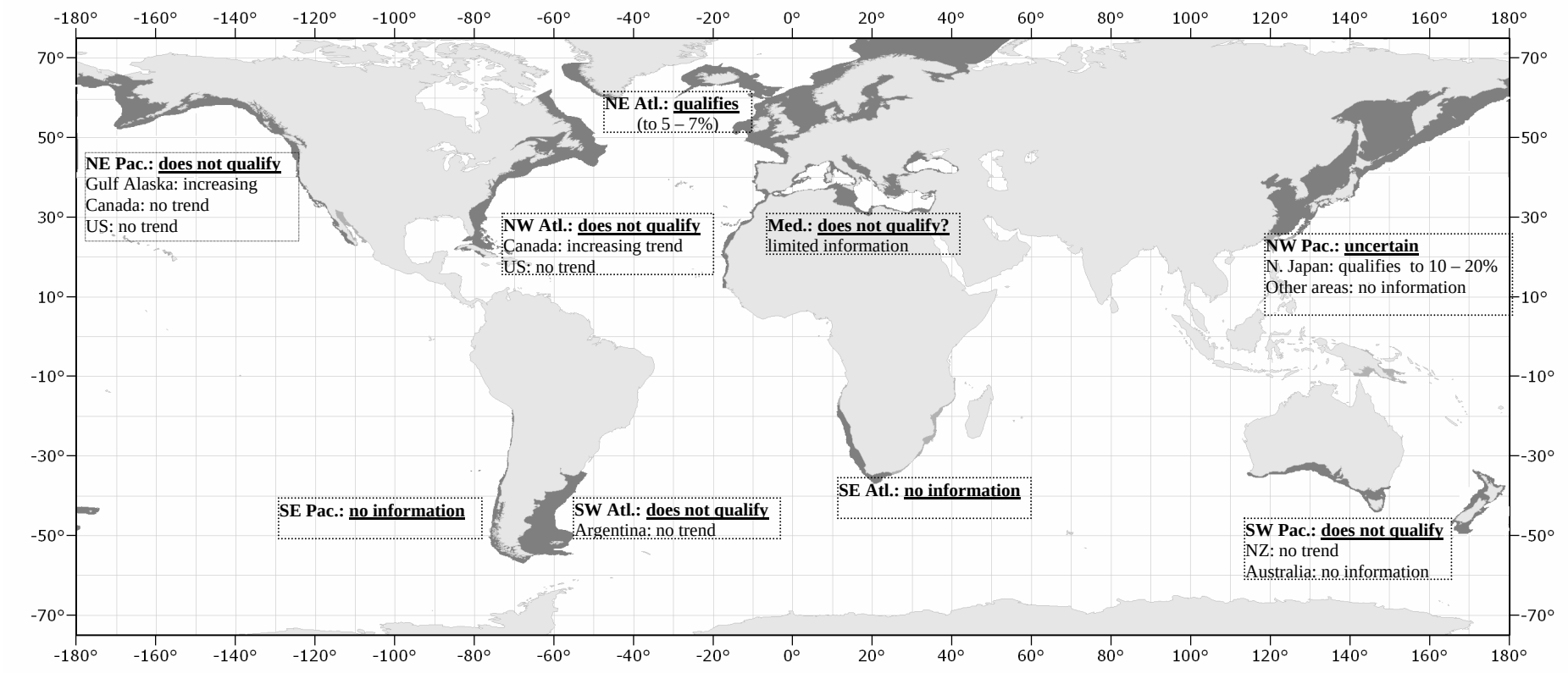

Figure 9. Area of distribution (FAO) and the Panel evaluation of the extent of decline of stocks of *Squalus acanthias* according to Appendix II criteria (see Table 4 for sources and other details).

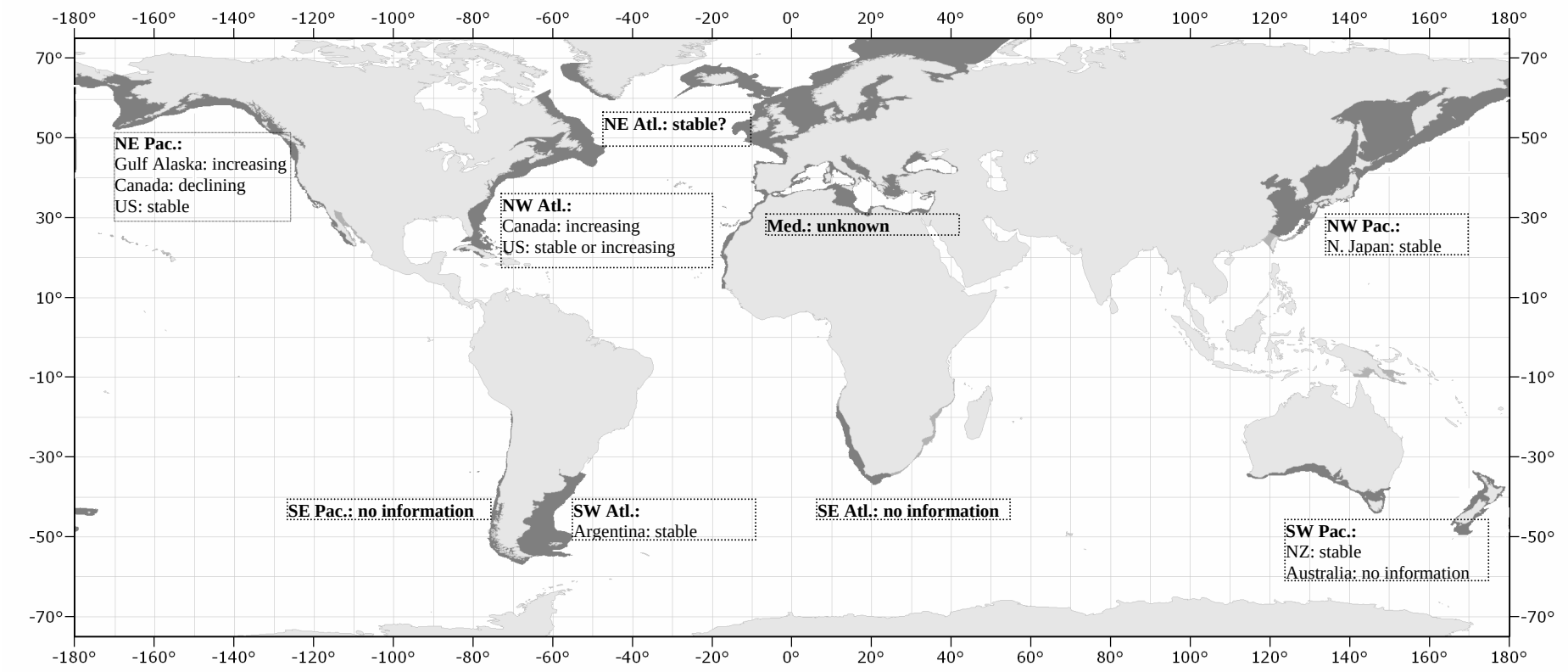

Figure 10. Area of distribution (FAO) and the Panel evaluation of the recent rate of decline of stocks of *Squalus acanthias* according to Appendix II criteria (see Table 4 for sources and other details).

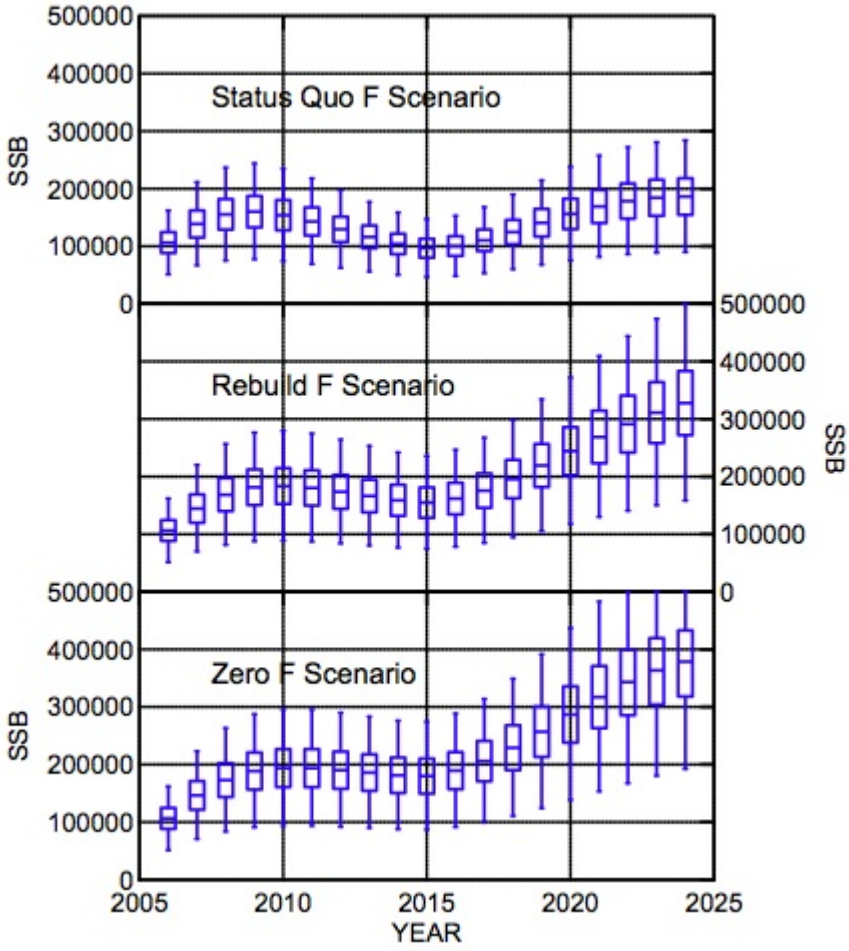

Figure 11. Spawning stock biomass (tonnes) projections for the northwest Atlantic stock, 2006–2024, for three scenarios: status quo (full F=0.128), rebuild F (F=0.03) and no fishing (F=0). Boxes represent interquartile ranges. From NMFS (2006).

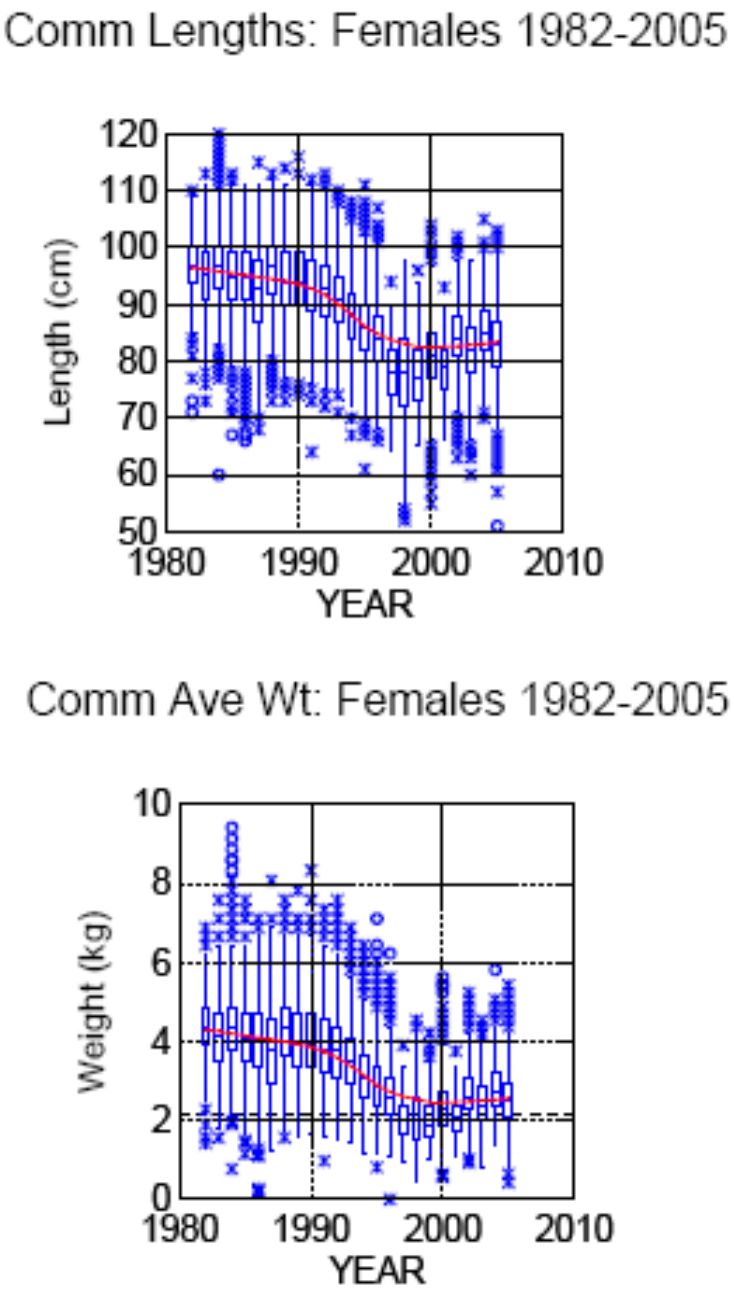

Figure 12. Length and weight of females in commercial fishery samples (Source NMFS 2006).

APPENDIX G

FAO Ad Hoc Expert Advisory Panel assessment report: sawfishes

PROPOSAL No. 17

SPECIES: All species of sawfishes, family Pristidae

PROPOSAL: Inclusion of all species of the family Pristidae on CITES Appendix I in accordance with Article II, paragraph 1.

Basis for proposal: The proposal states that all known species in the family Pristidae have severely declined (by more than 90 percent at global levels), and that wild populations would benefit through such a listing preventing international trade.

ASSESSMENT SUMMARY

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence did support the proposal to include all species of Pristidae in Appendix I of CITES in accordance with Article II, paragraph 1 of the Convention.

Although quantitative information on decline is sparse, declines to less than 15–20 percent of historical baseline, as specified in the Annex 5 definition of "Decline" for a commercially-exploited aquatic species with low productivity, were evident for a few areas, and there are widespread indications throughout the global range of severe declines in abundance and distribution and of local extirpations, which indicate that this group meets the criterion. The proposal states that Appendix I criteria for small population and restricted distribution are also met, but based on the available information the Panel could not support this conclusion.

The panel concluded that international trade probably is an important driver of sawfish exploitation. There is some evidence of directed harvest for trade but international trade may be driving retention of specimens taken as bycatch to a greater extent than it is driving directed harvest.

An Appendix I listing would likely contribute to conservation of this group of species, and the negative effects of such a listing would be relatively low. A CITES Appendix I listing would only be effective in combination with strengthened national management, which is generally not effective over the entire range of the group, and which generally does not address all sources of mortality. Mortality due to habitat degradation and incidental catch would not be affected by a CITES listing. Strengthening management measures where these are in force, and implementing management in other areas, would be essential to ensure conservation of this group.

PANEL COMMENTS

Biological considerations

Population assessed
The family Pristidae (sawfishes) includes seven species (taxonomy currently under review) which were formerly widely distributed in coastal and freshwater habitats in tropical and subtropical areas (proposal p. 2).

Productivity level
Based on available information, sawfishes would fit into the "low" productivity category (Table 1).

Demographic information is not available for most species, though it seems reasonable to apply estimates for any one species to the family as a whole. Most information is from *Pristis perotteti* (Simpfendorfer, 2000). Age at maturity estimates (10–33 yr) are from field observations (Thorson, 1986 in Simpfendorfer, 2000). Natural mortality was estimated using several indirect methods giving values from 0.07 to about. 0.15 per year.

Population status and trends

Decline
Few quantitative estimates of decline are available, but there are many observations of greatly reduced abundance relative to historical levels and of extirpations from substantial parts of historical ranges (Table 2).

Small population
No estimates of total population size are available.

Restricted distribution
No estimates of distribution area are available. The family was historically widely distributed in tropical and subtropical areas, in coastal and freshwater habitats, but there are observations of reduced range and extirpations for several species (Table 2).

Assessment relative to quantitative criteria

Decline
Under the CITES criteria for commercially-exploited aquatic species (Conf Res. 9.24 Rev CoP 13), a decline to 15–20% of the historical baseline for a low productivity species would justify consideration for Appendix I.

Observations from many parts of the range suggest that abundance has declined to a small fraction of historical levels, and there are no recent reports of specimens of Pristidae from substantial portions of the historical ranges (Table 2). In many cases the evidence is more or less anecdotal, but in others it is based on intensive searching of fish markets or fishery records for specimens of this group. There is no evidence of abundant populations of this group in the proposal or in sources consulted, except for small refugia in the Everglades National Park in the USA (Carlson *et al.*, 2007) for *P. pectinata* and northern Australia for *P. microdon* (Stevens *et al.*, 2005)

Although few of these estimates are quantified and most have relatively low reliability (Table 2), nevertheless it is notable that the annual world catch has dropped to 4–6% of historical levels, and that the estimates show strong consistency, clearly suggesting abundance declines of over 90%. Accordingly the Panel agreed that the family met the Appendix I decline criterion.

Small population
Probably only small numbers remain, but there is no basis to calculate them.

Restricted distribution
As above.

Were trends due to natural fluctuations?
There is no evidence that observed declines were due to natural fluctuations. They are consistent with the effects of human-caused mortality (from fishing and other causes) on a low productivity family.

Risk and mitigating factors
The long toothed rostrum characteristic of the group makes sawfishes very vulnerable to entanglement in net-based fishing gear. The group inhabits relatively shallow (normally less than 10 m depth) waters in coastal and freshwater areas where fisheries for a variety of species are conducted and as such individuals are vulnerable to directed harvest and to incidental harvest in fisheries targeting other species.

Products from sawfishes are highly valued on markets, which would increase risk to these species. While most catches are probably incidental, there are incentives for fishers to target these species and to retain individuals incidentally caught rather than returning them unharmed to the water.

Sawfishes are vulnerable to habitat degradation and loss because of their reliance on shallow coastal and freshwater habitats. Coastal development, dredging, sedimentation, pollution and freshwater diversions may impact habitat, and construction of dams and other obstructions may obstruct migratory pathways.

A few factors introduced recently that mitigate risk for this group include management and protection measures which have been put in place in 6 countries (proposal pp 10, 12): However, these measures do not mitigate risk throughout the range of this group.

Trade considerations

Products in international trade include rostra and teeth (as curios, for cockfighting spurs, for traditional medicines), fins (highly valued for soup), and live specimens for public and private display aquariums. These species are not in the ornamental fish trade.

Information on international trade is sparse because Pristidae are not coded to species or family in current commodity coding systems. A number of convincing observations are available in the proposal on the importance of trade.

Prices for sawfish products on world markets can be very high: $2 000 – $7 000 for individual rostra, up to $3 000 for individual fins, and up to $5 000 for live individuals. Rostra and teeth,

powders and fins are easily dried and transported, facilitating international trade. Web-based sales methods are being used to buy and sell products from Pristidae, further facilitating international trade.

It is essentially impossible to assess the proportion of harvest which enters trade and the extent to which trade is driving exploitation. Given the recent rarity of these species and the apparent decline in directed fisheries, specimens entering international trade may originate mainly from fish incidentally caught. The Panel concluded that demand for products from international markets could be driving directed harvest to some extent, in particular for live specimens and fins from northern Australia. There would be little incentive to discard bycaught specimens alive because of high value of all parts of sawfishes on local and international markets. International trade may be driving retention of specimens incidentally caught to a greater extent that it is driving directed harvesting.

In summary, the Panel concluded that international trade probably is a significant driver of exploitation of this group of species.

Implementation issues

Introduction from the sea
Since sawfishes are typically found in shallow coastal waters (less than 10 m depth) and in large freshwater bodies, these species would normally be caught within national jurisdiction and introduction from the sea would not be an issue.

Implementation of an Appendix I listing
An Appendix I listing means that international trade is only permitted in exceptional circumstances. Both an export and an import permit are required for any shipment. An import permit can only be issued if the import is not for primarily commercial purposes, and also requires a finding that the purpose of the import will not be detrimental. An export permit requires a non-detriment finding and a finding that the specimen was legally obtained. Exemptions are in place for personal or household effects (not for sale) in specified circumstances, and for pre-Convention specimens.

The determination that the import of a shipment is not for primarily commercial purposes would essentially eliminate most of the existing international trade in sawfish products. Examples of trade that may be considered non-commercial might include international movements for non-commercial exhibitions or for scientific purposes.

Issuing non-detriment findings would raise several challenges. Scientific capacity in range states for sawfishes is variable and might not be adequate to support assessments of species status in some parts of the range. Information on status in much of the range is mainly anecdotal and qualitative (with some exceptions), and demographic information is very limited, which would complicate issuing findings that exports were not detrimental to species status.
Issuing findings that specimens were legally obtained would be relatively straightforward in the many states where there are no restrictions on sawfish fisheries, however the absence of management may make a non-detriment finding difficult. In those states where management measures are in place, a determination that export was based on specimens obtained in accordance with those measures would be required.

The exemption for personal and household effects (curios) applies only in specific circumstances. In practice, it is difficult to take advantage of this exemption, particularly for specimens listed in Appendix I, because Customs authorities frequently require official proof that it applies. The pre-Convention exemption requires proof that the specimen was obtained prior to entry into force of the listing; some Parties treat this provision as applying to specimens obtained prior to entry into force of the Convention for that individual Party (1975 or later). Methods exist to date specimens of Pristidae but these are expensive to use.

Identification of products in trade

Some sawfish products in trade would be easily identifiable, in particular rostra and live specimens. Rostra of a similar group, the sawsharks, are easily distinguishable from those of sawfishes with an appropriate identification guide.

Rostral teeth compete in international markets with a variety of similar products for use as cockfighting spurs: deer antler, bones, sting ray spines, sea turtle shell, sea lion teeth. If sawfishes were listed on Appendix I, an identification guide would probably be required to ensure that sawfish rostral teeth were not entering trade under the guise of other similar products.

Sawfish fins are highly valued in international markets and are traded in the Hong Kong shark fin market. Experienced traders in dried shark fins can identify them to the family level, but this would probably be impossible for a non-specialist. Powder derived from dried sawfish rostra and teeth would be very difficult to distinguish from other powders used in traditional medicines. A forensic DNA test would probably be required to ensure identification to the family level.

"Look-alike" issues

Listing for "look-alike" reasons (i.e., listing on Appendix II under Article II, para 2b of the Convention) is justified 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 sawfish listing, and tools such as identification guides and DNA tests were not adequate to bring the illegal trade under control, there would be potential justification for listing other species on the basis that their products resemble those of sawfish in trade.

Potential socio-economic impacts of the proposed listing

An Appendix I listing would essentially eliminate legal commercial international trade in sawfish products. Sawfishes have become rare throughout their range, and there appear to be few or no directed legal fisheries for these species, so economic losses from further restrictions would probably not be large. Incidental captures are probably unpredictable and relatively uncommon, but might generate relatively large occasional benefits given the high value of products in trade. For harvesters, sawfish captures probably represent an occasional, welcome addition to incomes, which could be important in the low-income areas found in parts of the range of sawfishes. For those involved in the trade, sales of sawfish products are probably a complement to sales of other species more predictably available.

If international trade is indeed a significant factor increasing pressure on sawfish harvesting, an Appendix I listing might have the effect of lowering prices for sawfish products on markets throughout their range.

Likely effectiveness of a CITES Appendix I listing for species conservation

Costs and negative effects of a CITES Appendix I listing would be minimal and a listing might contribute to conservation. A CITES Appendix I listing would not in itself ensure that sawfish species were protected, but might complement strengthened national management measures.

Sawfishes are subject to mortality from sources other than harvesting for trade. Reducing bycatch mortality would require outreach activities to encourage fishers to discard specimens in good condition. Habitat degradation is also an important source of mortality, and conservation would require measures to deal with this since it would not be affected by a CITES Appendix I listing.

A reduction in prices for sawfish products might result from an effective Appendix I listing, potentially reducing pressure on wild populations.

Conservation effectiveness of an Appendix I listing might be reduced by illegal international trade, which would be relatively easy to conduct since dried products can be easily transported by mail or by tourists. DNA identification of products is probably feasible and could be the basis for prosecutions. Enforcement of an Appendix I listing would be facilitated by the fact that any specimen in trade would probably be illegal.

Harvesting of sawfishes in IUU fisheries has been reported in remote areas of northern Australia. An Appendix I listing might provide additional tools to bring this illegal harvest under control.

Fisheries management considerations

Few management measures are in place for sawfishes in most of their range. Strengthening measures where these are in force, and implementing management in other areas, would be essential to ensure conservation of this group.

Overall conclusions

Quantitative information on decline is sparse, but declines to less than 15–20% of historical baseline (corresponding to the CITES Appendix I threshold for commercially-exploited aquatic species with low productivity) were evident for a few areas, and there are widespread indications throughout the global range of severe declines in abundance and distribution and of local extirpations. The Panel was unable to draw clear conclusions on current total abundance and on distribution area, in considering the CITES Appendix I criteria on small population size and restricted area of distribution.

International trade is probably an important driver of sawfish exploitation. There is some evidence of directed harvest for trade but international trade may be driving retention of specimens taken as bycatch to a greater extent than it is driving directed harvest.

An Appendix I listing would likely contribute to conservation of this group of species, and the negative effects of such a listing would be relatively low. A CITES Appendix I listing would only be effective in combination with strengthened national management, which is generally

not effective over the entire range of the group, and which generally does not address all sources of mortality. Mortality due to habitat degradation and incidental catch would not be affected by a CITES listing. Strengthening management measures where these are in force, and implementing management in other areas, would be essential to ensure conservation of this group.

References supporting the Panel evaluation

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TABLES AND FIGURES

Table 1. Information for assessing productivity for sawfishes. Productivity levels refer to FAO (2001).

Parameter	Information	Productivity	Source
Natural mortality	a. 0.07–0.14 per year *(P. pectinata*, *P. perotteti*)	Low (<0.2)	a. Simpfendorfer 2000 in proposal
Age at maturity	a. 10–33 yr depending on sex b. 10 yr *(P. perotteti)*	Low (>8 yr)	a. Simpfendorfer 2000, Clark *et a.,l* 2004 in proposal b. Thorson 1986 in Simpfendorfer 2000

Table 2. Decline indices for sawfishes. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
World	Reported catches	Decline to 4–6% of historical	Mean 1998–2004 ca 50 t/yr; mean 1976–1979 ca 1400 t/yr (maxima); mean 1965–1969 approx. 900 t/yr (earliest in series)	World landings (FAO)	Catches (2)	Proposal Figure 1, based on FAO records
Multiple	Observations, *P. zijsron*	Apparently extirpated from parts of range	Not recently found in South Africa, Sri Lanka, Malaysia	Areas mentioned	Observations (1)	Compagno *et al.*, 2006
USA	Observations, *P. perotteti*	Extirpated	Disappeared from USA	USA	Observations (1)	Shark Specialist Group 2000 in proposal p. 7
Southeast USA	Observations, *P. pectinata*	Currently rare, formerly common and widespread	Once common from Texas to N. Carolina; current population estimate 2 000 individuals in USA	Southeast USA	Observations (1)	Proposal p. 5
Southeast USA	Observations, *P. pectinata*	Possibly extirpated from large part of range	No longer found from Florida to New York	Southeast USA	Observations (1)	Simpfendorfer 2000 in Proposal p. 5 (2002?)
Southeast USA	CPUE, all species	Declined to near zero	10–40 specimens per vessel 1951–58, near zero 1970–1979	Louisiana trawlers	CPUE unstandardized (3)	Simpfendorfer 2002 in proposal Fig 2, p. 6
Nicaragua	Catches, all species	Currently rare, historically abundant	60–100 000 individuals removed in 6 years 1970–1975; currently rare; none found in 1998	Lake Nicaragua, inland waters of Nicaragua	Catches (2)	Various in proposal p 5
Nicaragua	Catches, all species	Decline to less than 1% of historical	60–100,000 individuals removed in 6 years 1970–1975; 4–6 removed per year since 1998	Lake Nicaragua and inland waters of Nicaragua	Catches (2)	Proposal Table C p. 20
Gulf of Thailand, SE Asia	Catches, all species	None found recently, historically common in fisheries	*A. cuspidata* common in commercial catches Gulf of Thailand 1959–1962; no sawfishes found in markets Thailand, Borneo, Singapore 1993–1996	Historical: Gulf of Thailand fisheries Recent: SE Asia fish markets	Catches (2), visual observations (1)	Various in proposal p. 5
Southeast Asia	Catches, observations, *P. microdon*	Greatly reduced, locally extirpated; formerly common	Common in fisheries in 1960s, currently few reported, extirpated from Fly River, New Guinea	Southeast Asia	Catches, observations (1–2)	Compagno *et al.*, 2006c in proposal Table C p 20.

Australia	Observations, *P. zijsron*	Currently rare, historically common	Few recent observations, very low trawl bycatch, formerly high catches were “a problem”	Queensland, Gulf of Carpentaria, Moreton Bay, east coast – combined	Observations (1)	Compagno *et al.*, 2006
West Africa	Observations, *P. pectinata, P. perotteti*	No recent records, historically extremely abundant	Last known records 1970 (Gambia), 1984 (Sénégal), 1993 (Guinea), 2000 (Guinea-Bissau)	Countries mentioned	Observations (1)	Proposal p. 6
Southern Africa	Catches, *P. pectinata, P. perotteti, P. zijsron*	Currently rare, formerly common in catches	Commonly caught in shark beach netting in 1960s; 0–5 per year 1978–2002; 2 caught in past decade	South Africa, Natal	Catches (1)	Proposal Table C p. 20
Med., eastern Atlantic	Observations, *P. pristis*	Extirpated from these areas	Believed extirpated	Mediterranean, E. Atlantic	Observations (1)	Cook and Compagno, 2000 in proposal p. 6
Egypt	Observations, all species	Now very rare, once widespread	Now very rare, once widespread	Egypt	Observations (1)	Proposal p. 12

APPENDIX H

FAO Ad Hoc Expert Advisory Panel assessment report: European eel

PROPOSAL No. 18

SPECIES: *Anguilla anguilla* - European eel

PROPOSAL: Inclusion of *Anguilla anguilla* (European eel) on CITES Appendix II in accordance with Article II paragraph 2a.

Basis for proposal: The proposal states that this species satisfies the qualifying criteria for Appendix II in terms of Annex 2a, both in terms of criterion A because of its long and steady decline, and criterion B because the stock is outside safe biological limits.

ASSESSMENT SUMMARY

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence did support the proposal to include *Anguilla anguilla* (European eel) in Appendix II of CITES in accordance with Article II paragraph 2(a).

The Panel considered that the trends in available data did demonstrate an historical extent of decline in *Anguilla anguilla* to less than 20–30% of baseline, as specified in the Annex 5 definition of "Decline" for a commercially-exploited aquatic species with low to medium levels of productivity.

The Panel concluded that a substantial fraction of the production of *Anguilla anguilla* is in international trade.

The Panel expressed concern about the poor history of management of this species in much of its range. It emphasized that a CITES listing could only be effective in combination with strengthened fishery management measures within the European Union.

The Panel considered that there were few implementation issues that would diminish the effectiveness of a listing. While processed European eel would be difficult to distinguish from other *Anguilla* spp., the majority of the exports of European eel from range states was in a form that was readily recognizable in a CITES sense, since they would be identifiable by their origin, and control of trade at this point was the most crucial in securing conservation benefits.

PANEL COMMENTS

Biological considerations

Population assessed
The European eel is widely distributed in marine, coastal and freshwater habitats of Europe from the Baltic Sea and Iceland south to the Mediterranean and North Africa. It is considered a panmictic species, that is, a single spawning population with no genetically distinct subpopulations within the overall distribution (proposal).

Productivity level
Productivity level is difficult to assess, as the life history is complex and atypical of aquatic species. There is considerable plasticity in some parameters.

European eel spawn in the Sargasso Sea, and leptocephalus larvae move to continental shelf waters off Europe and North Africa where they metamorphose into glass eels at age approximately 3 years. Glass eels become elvers, which move into coastal and inland waters, where they become yellow eels (the growth phase). This stage may last from 2–25 years (even more than 50 years) prior to maturation and metamorphosis to the silver eel stage. The age at maturity has a marked north-south gradient, being least in the southernmost part of the range where growth rate also is high. Silver eels migrate to the Sargasso Sea for spawning and die after spawning (Tesch, 2003).

The average age at maturity was considered to be the best basis available for assessing productivity. Based on the information in Table 1, the European eel was considered to be of low productivity in more northerly latitudes, but of medium productivity in the Mediterranean Sea region.

Population status and trends

Decline
Estimates of recruitment trends, developed by combining observations from 19 catchments in 12 countries, are provided in the EIFAC-ICES Working Group (EIFAC-ICES, 2006) (Proposal Figures 6, 7) (Table 2). Though ideally indices of total or spawning stock abundance would be preferred, reasonable inferences can still be drawn from continued downward trends in recruitment indices as these would most likely be linked to similarly or even greater declines in spawning stock size. However, because some of the recruitment series reported are based on catches in the absence of associated effort information (reliability index 2), the Panel concentrated its attention on more reliable fishery-independent series (from either research surveys or fixed traps constituting constant effort – reliability indices five and four respectively), though this did result in a geographical bias to the dataset as most commercial fisheries exist in the southern part of the range, where no survey data were available.

Figure 1 gives the resultant fishery independent glass eel recruitment series (in the year of arrival– 0+ age), each scaled to its 1979–1994 average, and the dotted line is the moving average of the geometric mean. Treating the mean index for the period 1950 to 1980 as a baseline, the mean index from 2000 to 2005 reflects a drop to 13 percent of this baseline.

Figure 2 gives the fishery independent recruitment series for all age classes, including 0+ glass eel and older age classes of yellow eel before any exploitation has occurred. These series were also scaled to their 1979–1994 averages and the dotted line is again the moving average of the geometric mean. If the mean index for the period 1950 to 1980 is again treated as a baseline, the mean over 2000 to 2005 reflects a drop to nine percent of baseline. However, the earlier part of the period used for the baseline includes only a few series; if instead the 1970–1980 period is used for the baseline, the estimated drop is to 19 percent of this alternative baseline.

While the other series provided in EIFAC-ICES (2006) were considered less reliable, it should nevertheless be noted that all show similar trends to the series in Figures 1 and 2, and furthermore the series for more southerly locations tend to show greater reductions. This is evident from Figure 3, which shows the downward trends in eel-landings from different habitat regions.

Small population
There are currently no estimates of total population size or number of mature individuals for this species (EIFAC-ICES, 2006).

Restricted distribution
The EIFAC-ICES WG on Eels indicates that 80 000 km^2 of habitat may be available in inland and coastal waters, lagoons and estuaries (EIFAC-ICES, 2006 p 52), though suitable habitat is appreciably less because of obstructions and dams without suitable fish ladders.

Assessment relative to quantitative criteria

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

Considering the evidence in Figures 1 and 2, and the associated declines ranging from 9 to 19% of baseline as reported above, the Panel considered that this was sufficient to meet the criteria for an Appendix II listing.

Small population
Information on population size is not available for consideration of this characteristic, which in any case is considered generally inappropriate for commercially exploited aquatic species.

Restricted distribution
It is clear from information quoted above that this is not a species characterized by “small distribution”, and that recent habitat loss has not alone been sufficient to threaten survival of the species, although there has been habitat loss and this is a contributing factor in historical and present reductions in abundance.

Were trends due to natural fluctuations?
A negative relationship of recruitment to the North Atlantic Oscillation (NAO) index and to an index of mid-water temperatures in the Sargasso Sea has been demonstrated (Knights, 2003) but is unable to explain the decline since 1990. However, a comprehensive analysis including multidecadal climate change is lacking. Fluctuations arising from environmental variation are thus not considered sufficient to account for most of the decline noted above.

Risk factors and mitigating factors
European eel are impacted by a wide range of threats from human activities in addition to fisheries, which increase risk to the population. Access to freshwater habitats is blocked by dams and other obstructions (road construction, urbanization) in many watersheds, the species is particularly susceptible to accumulation of lipophilic contaminants (which may affect capacity to make the long spawning migration), and turbine mortality may occur at hydroelectric facilities on the downstream spawning migration (EIFAC-ICES, 2006). In addition an introduced swim bladder parasite originating in Japan began infesting European eels in the 1980s (Ringuet *et al.*, 2002)

European eel are subject to fishing at all continental life stages from juveniles to adults, and some estimates of total fishing mortality over the life cycle are very high (e.g. [Dekker] (2000) quotes a cumulated mortality rate of 3.25, corresponding to an annual *F* of 0.54), suggesting a high level of risk to the population. Eel products have traditionally had high value on markets and recently prices for elvers to support aquaculture have been very high (proposal). Fishery management to date has apparently not been restrictive (EIFAC-ICES, 2006).

Ringuet *et al.* (2002) provide a summary of technical regulations used by European Union members who focus primarily on controlling inputs (minimum size, season, gear type). Work is ongoing regarding an EC regulation establishing measures for the recovery of the stock (13139/05 PECHE 203 – COM (2005) 472 final), but as of March 2007 these had not yet been adopted by EC Ministers. Accordingly it does not appear that fisheries management measures represent a factor mitigating risk to this species at present.

Trade considerations

Although adult eel products are imported into the European Union (proposal), the primary product in trade in the European Union for the past decade has been exports of live young eels for aquaculture (proposal; Ringuet *et al.*, 2002). Value of live young eels has greatly increased on European markets in response to demand from Asian aquaculture producers (proposal Figure 16) and is high enough to support smuggling of live young eels. Illegal fishing of elvers and glass eels is documented in Portugal (Ringuet *et al.*, 2002; p. 9). A police investigation of illegal trade in France over 2004–2005 has shown that approximately 16% of the total glass eel production came from illegal sources (Cedric Briand, pers. comm.).

Imports by Japan from the European Union of young eels for culture varied from 0.7 to 4.2 t/yr in 1989–1997, but quantities imported declined subsequently up to 2001 (Ringuet *et al.*, 2002; Table 5). China and China, Hong Kong (SAR) became the primary importing countries of live young eels from the European Union from 1993/4 (Ringuet *et al.*, 2002, p 14). Information in the proposal (proposal Tables 6 and 7) indicates that substantial quantities of young eels were

exported from the European Union, primarily to Asian countries, from 1995 to 2005. The proposal (Figure 11) provides an estimate that some 43 percent of glass eel landings were exported to Asia in the mid-1990s. Despite considerable uncertainty about some of the figures, it seems clear from the information available that substantial quantities of young European eels originating in the European Union are in international trade, and may represent around one-third of production in recent years. Given also the recent very high values for live young eels on international markets stemming from a general decline in availability, it is reasonable to conclude that international trade is a significant factor in driving fisheries for young European eels.

Implementation issues

Introduction from the sea
Since all landings of European eel are from coastal and inland waters, introduction from the sea would not be an issue for this species.

Basis for findings: legally-obtained, not detrimental

Non-detriment findings
Scientific capacity exists in European Union member countries to develop the information and analyses necessary to support non-detriment findings.

Findings that specimens were legally obtained
Trade in illegally harvested European eel, particularly live young eels, is a potential issue given the very high recent prices for this product on world markets, and illegal harvesting has been documented (Ringuet *et al.,* 2002). Requiring certification that specimens were legally acquired could contribute to improved regulation of trade and harvest.

Identification of products in trade
European eel are marketed in two very different forms: live young eels, and large eels live, fresh, frozen or smoked. Products from other *Anguilla* species are also in international trade. Fourteen of the 15–17 *Anguilla* species support commercial fisheries (FishBase in proposal, p. 18), while *A. anguilla* (European eel), *A. rostrata* (American eel) and *A. japonica* (Japanese eel) are the three species most important in international trade (Ringuet *et al.*, 2002). Both for live young eels and for product from large eels, it would probably be very difficult to distinguish species in trade. Species of *Anguilla* eels resemble each other closely as young and as adults. Live young eels cannot be identified by quick examination, and counts of vertebrae of sampled individuals would probably be required for species-level identification. Live or whole adult eels could be identified accurately by specialists, but products using parts of eels or in processed form would probably be difficult to identify even for experts.

The Panel considered that the majority of exports of European eels from range states was in a form that was readily recognizable in a CITES sense, since they would be identifiable by their origin. After processing for re-export, robust product labelling schemes would probably be required to differentiate European eels from other eels, with DNA tests as a backup for product labelling since DNA tests are not feasible for routine inspections (CITES, 2006). The Panel recognized that labelling could prove inadequate where species are mixed, but considered that

control of primary export from range states was feasible and of importance from a species conservation standpoint.

Potential socio-economic impacts of the proposed listing

Potential difficulties in developing non-detriment findings covering both young eels and products from aquaculture based on those young eels, would render restrictions on trade both of wild-caught and aquaculture-based product quite possible. More than 25 000 people in Europe acquired a substantial income from eel fisheries in the mid-1990s (Moriarty and Dekker, 1997), suggesting that socio-economic impacts of restrictions on eel fisheries following an Appendix II listing might be widespread and substantial. The number of fishermen targeting glass-eel is of the order of 1000 and this group is the one which primarily will be affected, as catches of adult eels essentially are marketed locally.

Impact on aquaculture, particularly in Asia, could well be appreciable, given the volume of production and the probable proportion of this which enters trade, although the extent of socio-economic impact is impossible to estimate with information available.

Likely effectiveness of a CITES Appendix II listing for species conservation

The export of glass-eels to Asia is the problem emphasised in the proposal, and this would be ameliorated by an Appendix II listing. International trade of wild caught adult European eels outside the European Union is small, and a listing on Appendix II is not likely to contribute to conservation of this component to any measurable extent.

For the catch of glass-eels obtained legally, use for stocking within the European Union will not be hindered by an Appendix II listing. In the European Union-regulation under consideration one measure is to set aside a certain proportion of the catch for this purpose. The main contribution to conservation from a listing would be indirect, arising if the illegal glass-eel catches are large and compete with the legal fishery. A reduction of illegal fishing would in that case increase the availability of glass-eel for stocking. However Appendix II regulation or restriction of trade in cultured European eels in Asia would have little conservation benefit.

A CITES Appendix II listing for European eel might lead to restrictions on trade, at least initially, due to difficulties in establishing an adequate basis for NDFs. Putting such measures in place would positively affect species status, as would any restrictions on trade arising from the inability to issue NDFs. In this sense a CITES Appendix II listing could have benefits for species status.

The Panel noted that the species likely satisfied the decline criterion for listing under Appendix I. Further an Appendix III listing limited to whole specimens (either alive or dead) might be more appropriate to promote restocking of the population without imposing CITES controls on re-exports within Asia.

Fisheries management considerations

Only a combination of several measures can be expected to see the eel population recover from its current critical state. Such measures have been identified and are well known, and include control of exploitation, restocking of recruits, and restoration of habitats. Present management

efforts are fragmented and poor. With a panmictic species such as *Anguilla anguilla*, management has to be applied to the whole area of distribution to be effective, so adoption of an efficient common scheme by the European Union is urgent.

Thus in order to ensure long term sustainability, there is an urgent need for effective control of harvesting of this species, including reduction of illegal takes and in conjunction with other measures to reduce anthropogenic impacts.

Overall conclusions

For an Appendix II listing of a low/medium productivity species (as in this case) a decline to less than 20–30%/15–25% of an historical baseline level is required (see CITES Conf. 9.24 (Rev. CoP13)), Annex 5, footnote 1). The most reliable recruitment series for the European eel population indicate declines in the range of 9–19% - figures compatible with information provided by other series.

Accordingly the Panel concluded that the European eel population meets the decline criterion for listing in Appendix II, and further considered that such listing held potential benefits for the conservation of the species. Accordingly the Panel considered such a listing appropriate, but emphasized that this could be effective only in combination with strengthened fishery management measures within the European Union.

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TABLES AND FIGURES

Table 1: Mean age at maturity (range in brackets); data reviewed in Poole, 1994; Poole *et al*., 1996a; Rosell *et al*., 2005 and Vollestad 1992. Ages exclude the 3 year larval phase. FAO (2001) indicates that ages at maturity greater than eight years indicate low productivity, while values between 3.3 and 8 years indicate medium productivity.

Latitude	Location	Female	Male
55 ^{o}	Denmark	13	9
54 ^{o}	N. Ireland	17 (14–28)	12 (8–16)
53 ^{o}	Ireland	31 (8–57)	21 (10–33)
52 ^{o}	Ireland	16	11
42 ^{o}	Spain/Portugal	4	2
39 ^{o}	Portugal	6	5
43 ^{o}	Adriatic Lagoon	5	5
43 ^{o}	Adriatic Lagoon	7	5

Table 2. Decline indices for European eel. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
Europe	CPUE glass eels	Recent levels ≤10% levels prior to 1980	Inspection figure 6 proposal	16 rivers from Denmark to Italy	Consistent CPUE, combined commercial and survey indices (4)	EIFAC- ICES, 2006, proposal
	CPUE yellow eels	Recent levels ca 10% levels prior to 1960	Inspection figure 7 proposal	4 rivers in Norway, Sweden	Consistent CPUE, combined commercial and survey indices (4)	EIFAC- ICES, 2006, proposal
	Catches	Recent years at about 40% of historical highs	Maxima ca 50 000 in 1910s and 1930s vs ca 20 000 late 1990s	Landings throughout Europe	Landings, reconstituted from multiple sources (2)	Dekker, 2003a
	Catches	Recent catches 42% (glass eels) – 54% (large eels) of 1994 levels	Glass eels: 197.6 t, 2004, 474.5t, 1994; large eels 7136 t, 2004, 13211 1994	Landings compiled by country	Landings (2)	Proposal T3 citing Moriarty and Dekker, 2003

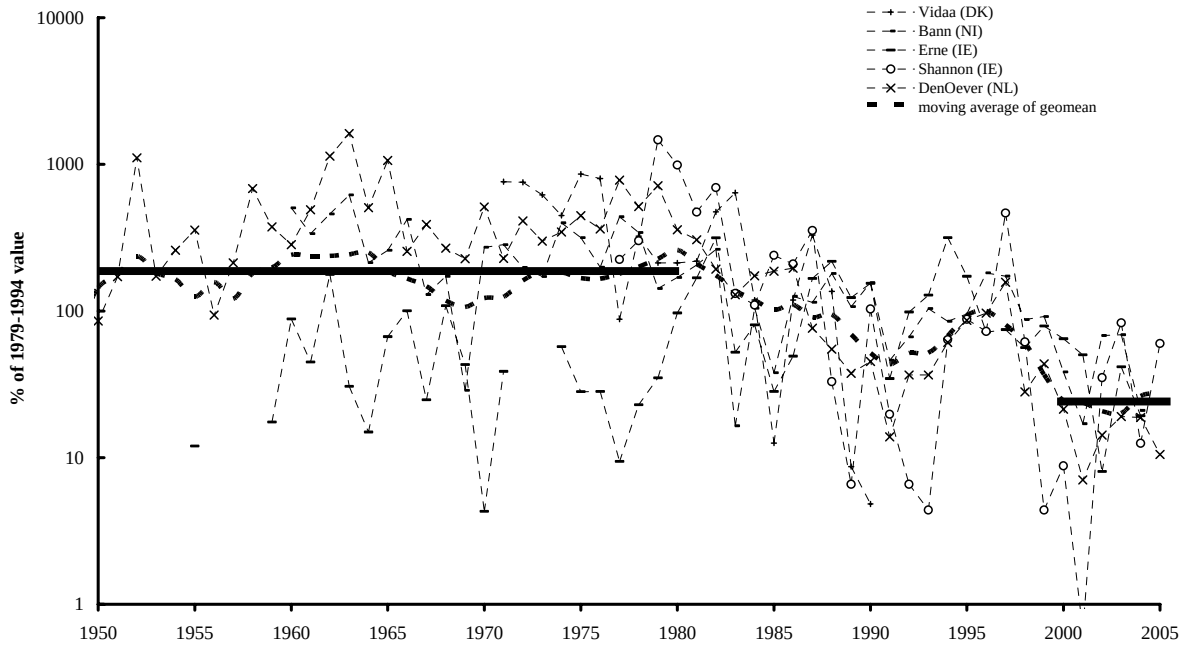

Figure 1. Time series of glass eel recruitment in European rivers for fisheries independent datasets. Each series has been scaled to its 1979–1994 average and the dotted line is the moving average of the geometric mean. The thick lines indicate the mean for the 1950–1980 and 2000–2005 periods. (Source: ICES/EIFAC WGEEL).

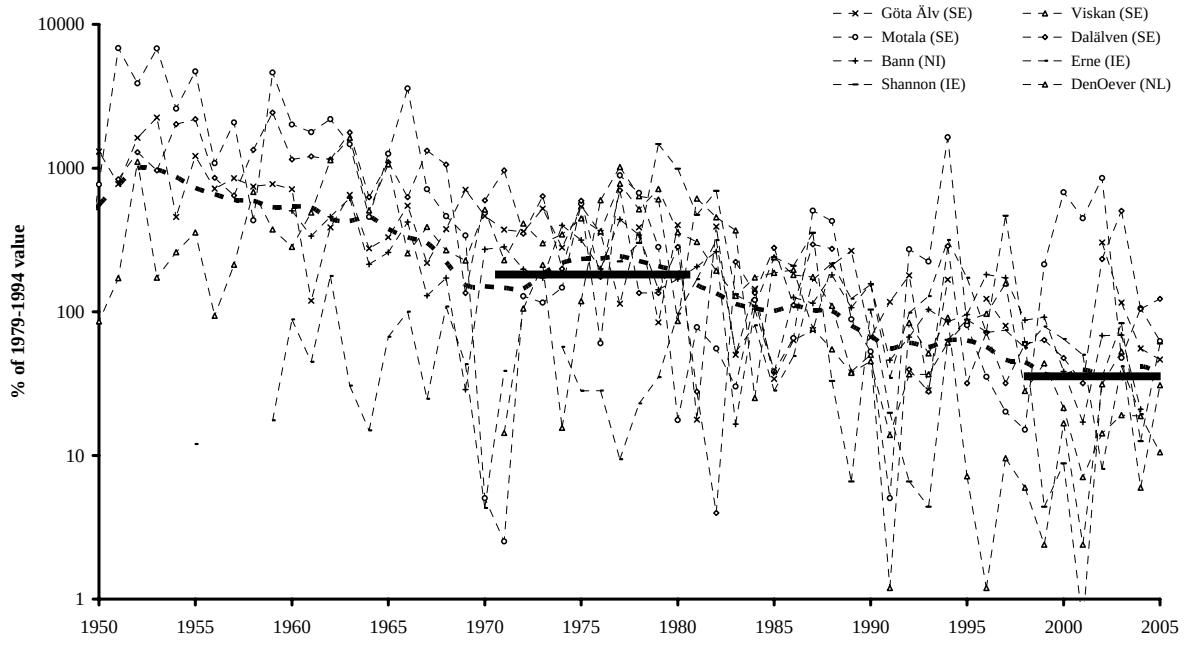

Figure 2. Time series of all ages recruitment in European rivers for fisheries independent datasets. Each series has been scaled to its 1979–1994 average and the dotted line is the moving average of the geometric mean. The thick lines indicate the mean for the 1970–1980 and 2000–2005 periods. (Source: ICES/EIFAC WGEEL).

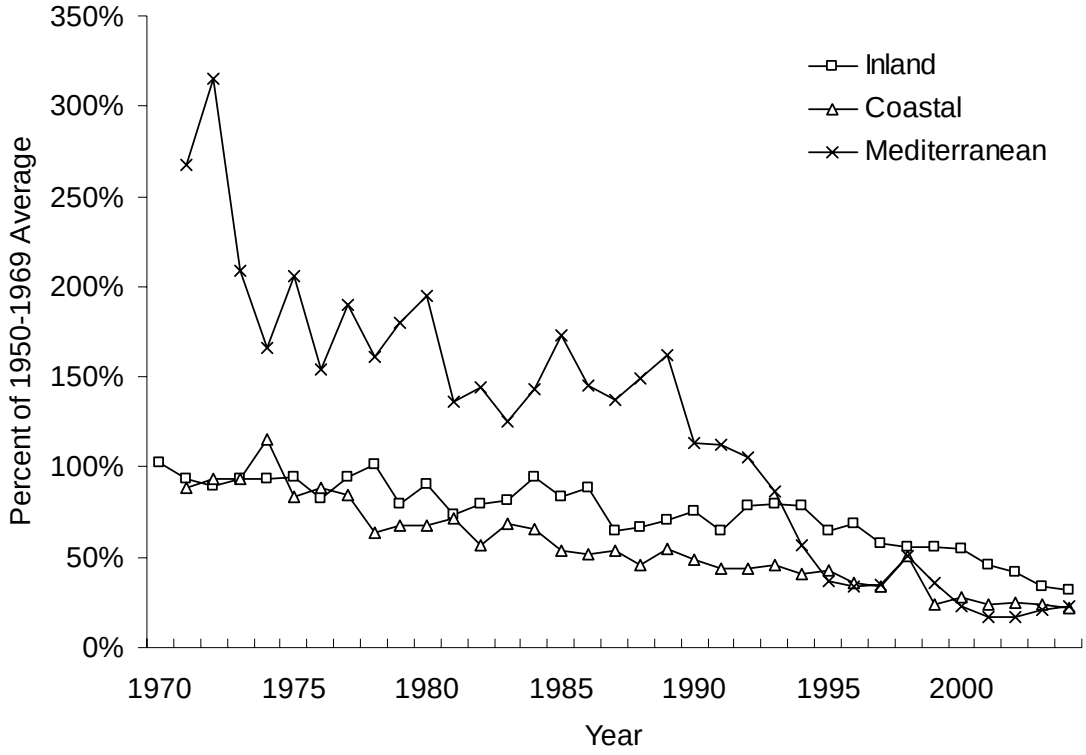

Figure 3. Trend in eel-landings from different habitat regions, based on FAO statistics for 13 selected countries having a continuous time series from 1950. The baseline is the 1950–1969 average for each region. Marine catches have declined to 20% of the baseline, inland waters to 31%. The inland catch has probably been boosted by stockings.

APPENDIX I

FAO Ad Hoc Expert Advisory Panel assessment report: Banggai cardinalfish

PROPOSAL No. 19

SPECIES: *Pterapogon kauderni* - Banggai cardinalfish

PROPOSAL: Inclusion of *Pterapogon kauderni* (Banggai cardinalfish) on CITES Appendix II in accordance with Article II paragraph 2(a).

Basis for proposal: The proposal indicates that "current status of *Pterapogon kauderni* conforms with Article II, Paragraph 2(a) of CITES and satisfies Criterion B in Annex 2a of Resolution Conf. 9.24 (Rev. CoP13). It is projected that regulation of trade in *Pterapogon kauderni* 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".

ASSESSMENT SUMMARY

The Panel concluded that Banggai cardinalfish did not meet the biological criteria for Appendix II listing.

The information provided in the proposal to support inclusion did not demonstrate a decline to criterion levels for population size. Although one subpopulation has been extirpated there was no evidence of decline in area of occurrence or number of subpopulations to criterion levels. Recent harvest levels are compatible with productivity although there are risk factors.

International trade is the major factor driving exploitation of this species. There would appear to be few complications associated with implementing an Appendix II listing, other than certification required for specimens coming from captive breeding. Short-term socioeconomic impacts of listing could however be significant for local communities.

The Panel is concerned that Appendix II listing will hinder national management efforts for this species. The Panel emphasized that existing efforts to strengthen management should be pursued urgently to ensure that rates of exploitation do not exceed sustainable levels. The Panel noted that the Government of Indonesia and concerned NGOs are making efforts to pursue management and captive breeding in cooperation with local communities.

The Panel concluded that Banggai cardinalfish should not be listed on CITES Appendix II.

PANEL COMMENTS

Biological considerations

Population assessed

The species is endemic to Indonesia and is found in isolated populations in shallow waters of the Banggai archipelago of eastern Indonesia.

The intentional release by collectors of rejected fish of this species into the sea near their facilities, and outside their geographical range, has created small groups of populations in Palu (LP3M STPL-Palu, 2006), Lembeh (Erdmann and Vagelli, 2001), Gorontalo, Manado, and North-west Bali (Reksodihardjo-Lilley, pers. comm.). In the small group of subpopulations in Palu density is higher than in the locations in Banggai district. This shows that this species can establish subpopulations outside its area of origin.

Productivity level

This species fits into the "high" productivity category based on age at maturity (8–9 months and 11 months for females and males respectively) and lifespan (2 years in the wild) (Table 1).

Abundance can apparently increase relatively rapidly when harvesting pressure is reduced. A doubling of population density over three years was observed in response to a collecting ban imposed by a local population (2001–2004, Masoni area). In an area colonized by accidental release in September 2001, the stock had increased from 49 individuals to 662 individuals in June 2002. These two examples suggest annual production levels of at least 30 percent of abundance.

Population status and trends

Decline

Only limited observations are available to assess potential decline in abundance, since the total distribution and abundance of the species have only recently been completely assessed (Table 2). Extirpation of one subpopulation formerly numbering 50 000 individuals occurred between 2001 and 2004. In another subpopulation abundance declined to less than one percent of the original level. The most recent population survey conducted in six locations in 2006 showed that the population ratio between juveniles and adults at the collection sites is higher than at the unfished control site, ranging between 106– 418 percent (Moore and Ndobe, 2006). It can be assumed that the populations are recovering, therefore not indicating a population decline over that period.

The estimated mean density of 0.07 fish m^{-2} for 7 sites (proposal Table 2, Vagelli, 2005) was compared to an estimated density of 0.63 fish m^{-2} from an unexploited site. These figures might suggest that the mean population density over the entire population was about 11 percent of unexploited density; however the two surveys on which these figures are based were conducted by different teams, and the "unexploited" level comes from a single area making up a small fraction of the total distribution, which may not be typical of "unexploited" conditions throughout the distribution.

This decline estimate also relies on the assumption that the seven sites sampled are representative of the full range of the species. This assumption implies that all areas of occurrence of the species

are heavily fished (i.e. to mean density of 0.07 fish m^2). Lunn and Moreau (2004) however, based on a 2001 study, reported that only 16 out of 47 villages visited collected the species (no indication is provided as to whether the species occurred in waters adjacent to the other villages) and that fishing took place close to fishing villages (with a few exceptions) (p346). Further, they reported then that fishing pressure was likely to grow and expand into unexploited areas. This indicates that, at least at that time, not all areas of occurrence were being exploited and therefore that the mean density of 0.07 used by Vagelli (2005) could be an under-estimate for the population as a whole. This would mean that the population depletion may not have been to as low as 11% and that the population abundance was under-estimated.

Reports of annual catches of Banggai cardinalfish also suggest that the putative decline to 11 percent is likely to be an overestimate. Vagelli (2005) estimated total annual capture for 2001–2004 at between 700 000 and 900 000 animals per year (p. 238). Lunn and Moreau (2004) estimated trade during March and April 2001 at least 118 000 fish per month but drew attention to high intra-annual variability, including a fall-off during the northern hemisphere summer (p. 349). They suggested that, taking this into account, their estimates were not incompatible with those of Vagelli and Erdmann (2002) of 600 000–700 000/year. Unconfirmed information (Reksodihardjo-Lilley, pers comm., 2007) from the ornamental fish trade industry suggests current global demand at about 500 000 fish per year. Given estimates of post harvest mortality in the order of 10% between capture and export together with recent reductions in price per fish on the international market, it appears that harvest levels may have dropped in recent years. Therefore, overall, Vagelli's (2005) estimates seem to be generally supported.

The suggestion that the current cardinalfish population of 2.4 million in 2004, reflects depletion to 11 percent of the pre-exploitation level (which would satisfy the decline criterion for listing in Appendix II under Annex 2a A) implies a baseline level of some 21.6 million fish. Considering the worst possible scenario of a population without a density dependent response to exploitation it can be estimated that a minimum cumulative catch of 21.6 – 2.4 = 19.2 million fish were taken from the overall population. This is inconsistent with estimates quoted in the proposal of an annual harvest of some 700 000 fish: assuming this to be constant since removals started in 1992 yields an estimate of the cumulative catch until 2004 of only 9.1 million fish (likely an overestimate because removals were certainly much lower in the 1992–1995 years). This unrealistically conservative zero productivity approach still suggests a minimum estimate for the current proportion of baseline for population to be above 20 percent which would not satisfy the Appendix II extent of decline criterion for a high productivity species.

The Panel considered the possibility that current rates of exploitation might be causing or in future cause the population to decline to levels that would merit its inclusion in Appendix II. Relative to the 2004 population estimate of 2.4 m individuals, annual removals of 700 000 and 900 000 animals would be an exploitation rate of at least 29–38 percent (instantaneous fishing mortality rate 0.34–0.48). More recent estimates of removals indicate that they may be lower than historical high values in the early 2000s, reported in the proposal and Vagelli (2005), as indicated above. The high productivity, of the order of 30 percent annually, indicates that past removal levels may well have been sustainable when viewed in terms of the resource as a whole. Thus, the current proportion of baseline abundance is almost certain to be appreciably higher than the 20 percent figure indicated above.

Information from recent surveys by the local communities (LP3M Talinti, 2006) indicates that there are high ratios of juvenile to adults in all areas surveyed. Whereas these high juvenile to adult ratios could result from targeted depletion of adults, the Panel was informed that the fishery targets both juveniles and adults. The Panel concluded that the high proportion of juveniles in several areas was an indication that there was good recruitment to support the apparent high productivity of the population.

Small population size

Total size of the population was estimated at 2.4 million individuals in 2004 based on an estimate of mean density at sites on seven islands, combined with estimates of total area occupied at each island (Table 2). Confidence intervals for the estimate are not provided in the proposal; some information on variability in density between sites is available (proposal; Vagelli, 2005). This estimate relies on the assumption that the seven sites sampled are representative of the full range of the species.

Restricted area of distribution

The species inhabits a marine area 130 km in length and 70 km in breadth which gives an area of 9 100 km^2. The maximum potentially occupied habitat, a maximal estimate of the area of occupancy, is 34 km^2 based on a length of 426 km of coastline occupied times the width of the coastal habitat occupied (Table 2).

Assessment relative to quantitative criteria

Decline

Under the CITES criteria for commercially-exploited aquatic species (Conf Res 9.24 Rev CoP 13), a decline to 5–10 percent of the historical baseline for a high productivity species might justify consideration for Appendix I. For listing on Appendix II, the conclusion that the population might reach this level in the near future might justify consideration. For a high productivity species this would be 10–20 percent of the historical level (5–10% + 5–10%).

The Panel concluded that the current population is almost certain to be appreciably higher than the 20 percent of unfished numbers. The Panel therefore concluded that Banggai cardinalfish did not meet the decline criterion for inclusion on Appendix II.

The Panel also noted that from the limited information available, current rates of exploitation appear to be high but may nevertheless be sustainable due to the apparent high productivity and resilience of the species.

The Panel observed that recent management initiatives for this species can be expected to contribute to conservation, but currently fall short of the levels that may be needed to ensure that there is not sequential extirpation of the subpopulations.

Small population size

Whereas the total population is relatively small compared to more widely distributed marine fish species, the Panel observed that small population size alone is not a valid reason for listing in Appendix II in the absence of evidence that declines in numbers, subpopulations or area of extent

were likely to take the population past the Appendix I criterion levels in the near future. As this was not the case, the Panel concluded that Banggai cardinalfish should not be listed on the basis of this criterion.

Restricted distribution

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. The Panel concluded that extirpation of a single population would not suggest a decline in area of distribution that would merit listing Banggai cardinalfish based on this criterion.

Restricted area of distribution alone is not a valid reason for listing in Appendix II in the absence of evidence that declines in numbers, subpopulations or area of extent were likely to take the population past the Appendix I criterion levels in the near future. As this was not the case, the Panel concluded that Banggai cardinalfish should not be listed on the basis of this criterion.

Were trends due to natural fluctuations?

There is no information suggesting that population size, distribution or population trends were due to natural fluctuations.

Risk and mitigating factors

Population structure can be considered a risk factor for this species. The species is found on 27 islands which are separated by deep channels with strong currents. Adults are sedentary and substrate associated. Life history does not involve a planktonic dispersal stage. Accordingly opportunities for extirpated subpopulations to be re-established by natural dispersal and for exchange of propagules over the entire distribution of the species appear limited. Extirpation of one subpopulation has occurred and seems likely for others without increased management. The Panel expressed considerable concern that this species could be susceptible to sequential depletion and even extirpation of subpopulations if effective management is not put in place.

Ease of capture combined with high value constitutes a risk factor. Banggai cardinalfish are found in shallow waters near shore and are easy to collect live. They are valued as an ornamental species, and are found in an area where income opportunities for coastal people are very limited. As a result the species is subject to intense fishing pressure, which might be quite difficult to manage.

The Panel was of the view that vulnerability to extrinsic factors may be high. There is information that habitat is being negatively impacted by destructive fishing practices and by land-based sources of pollution. Furthermore, the species is very easy to harvest and is of high market value. There is also evidence that the population is fragmented since the population is divided into a number of small subpopulations, and there is life history and geographical evidence that these are separated.

Mouth brooding and relatively low fecundity are described as risk factors in the proposal (pp 4–5), but the extent to which these would actually increase risk was not clear to the Panel. In contrast, mouth brooding could be considered a mitigating factor as it reduces early life history mortality. The species is presumably adapted to optimize survival and rate of increase, and has

shown the potential to increase rapidly in abundance when fishing pressure is reduced (proposal p. 8). Establishment of a new population by accidental release of live individuals indicates that re-establishment of lost populations by re-introduction might be possible, but this has not been widely tested although it is being tested in a monitoring program at Palu Bay (LP3M STPL-Palu, 2006)

Although there is no overall fishery management plan or strategy which might mitigate risk to the species, there are local initiatives to reduce fishing pressure which might mitigate risk. A collecting ban imposed by a local community led to a doubling in population density between 2001 and 2004 (proposal p. 8), while a bay on Banggai Island where fishing is not permitted has high densities of this species (proposal p. 8). Stakeholders in the Banggai archipelago realize that harvest of this species is unsustainable, and are seeking solutions with the assistance of non-governmental organizations (Moore *et al.*, 2006).

Captive breeding techniques have been developed for this species (Marini 1996; Vagelli, 2002) and captive-bred specimens are available from aquarium suppliers in at least one of the key markets, the USA (proposal p. 11; FishLore, 2006; Reef Protection International n.d.). It has been implemented in one location in collaboration with the community and there are plans to expand the program to other communities in the near future (LP3M STPL-Palu, 2006). Captive breeding appears to have the potential to mitigate pressure on wild populations.

Trade considerations

Live individuals for the aquarium market are the only product in trade for this species. The majority of wild-caught Banggai cardinalfish are marketed in the aquarium trade in the United States, Europe and Asia.

Harvesting for trade probably began in 1992 but only became significant after 1995. Numbers in trade were estimated at 600 000–700 000 per year in 2001 and 700 000–900 000 in 2001–2004 (proposal p. 10) and closer to 500 000 in recent years indicating that total harvest numbers may have gone down (Reksodihardjo-Lilley, pers comm.).

This is further indicated by recent price reductions on the species where export invoices show that the same European importers who paid US$2.40 per specimen in 2005 paid US$0.98–1.05 per specimen in 2007 (data from Ornamental Fish International; S. Fossa, pers. comm.).

Given that a substantial proportion of the current population is harvested for international trade, and that international trade is the principal reason for harvesting this species, there is good evidence that international trade is driving exploitation.

Implementation issues

Introduction from the sea

Since Banggai cardinalfish are harvested from nearshore environments within the Indonesian EEZ, introduction from the sea is not an issue for this species.

Basis for findings: legally-obtained, not detrimental

Non-detriment findings

Information for assessing sustainable harvesting levels for this species, which could support non-detriment findings, is available. A recent survey covering the species' distribution has provided estimates of abundance in sampled areas. It would probably be feasible to estimate a sustainable harvesting level given available information and to develop a strategy for harvesting that would provide the basis for NDFs.

Capacity of the Government of Indonesia for doing analyses to support NDFs is probably limited, but cooperative work with, for example, NGOs or visiting scientists might contribute to building this.

Findings that specimens were legally obtained

Currently there are no fishery management measures in place regulating harvest of Banggai cardinalfish, other than a requirement that harvesters be residents of the Banggai archipelago (proposal p. 11). Accordingly it should be straightforward to certify that specimens for international trade were legally-obtained. However, a lack of management may call into question adherence to those measures underpinning NDFs.

Captive breeding

It was noted that CITES has specific guidelines for the confirmation that specimens to be traded are actually "captive bred", particularly that the captive breeding operation not require frequent inputs from wild stock. Breeding F2 individuals has proved difficult to date. Meeting these requirements could affect attempts to introduce captive breeding programs should the species be listed.

Identification of products in trade

Live individuals are the only product in international trade, and these are very easy to identify to species. A simple identification guide would probably be adequate for customs officials to identify the species in trade.

Potential socio-economic impacts of the proposed listing

Reductions in harvests of this species that may result from a CITES listing would have negative short-term socio-economic impacts in the Banggai archipelago where livelihood options are limited and the revenue per harvester appears potentially significant. Impacts would be felt by, but would probably be more limited for, buyers, for exporters and for retailers in importing countries, where Banggai cardinalfish probably represent a relatively small proportion of total incomes. Medium and long-term benefits could accrue from sustainable harvesting unless the foreign market is captured by foreign captive breeding operations (see below).

No information is provided in the proposal on the proportion of incomes coming from this species. The Panel was informed that Banggai cardinalfish is the dominant species harvested for the aquarium trade in the Banggai archipelago (Reksodihardjo-Lilley, pers comm.).

Although there might be short-term costs resulting from trade and harvest restrictions, medium- and long-term benefits accruing from sustainable harvesting of this species would be significant for local communities.

Development of captive breeding and efforts to encourage buyers to purchase captive-bred rather than wild-caught specimens (RPI, 2007) might lead to reductions in demand for wild-caught specimens and reductions in incomes from harvesting this species over the coming years even in the absence of a CITES Appendix II listing. However, a CITES listing is likely to drive breeding projects to consumer countries which would lead to long-term socioeconomic impacts.

The Panel noted that given the apparent high productivity of this species that could be expected to lead to rapid rebuilding of the population in response to management, socio-economics effects were likely to be short-term, in the order of 1–2 years. It further noted that failure to manage could lead to even greater long-term socioeconomic hardship should the population decline to levels at which sustainable levels of harvest were much lower than those at present.

Likely effectiveness of a CITES Appendix II listing for species conservation

The Panel agreed that there were no significant implementation issues with respect to a listing of Banggai cardinalfish in Appendix II. However, the Panel considered that efforts underway to strengthen domestic management of the species could prove effective in ensuring sustainable harvest for trade, such that an Appendix II listing would provide limited added benefit and indeed could hinder efforts to work with local communities to that end.

Fisheries management considerations

The Panel was informed that the utilization of marine ornamental fisheries falls under various national regulations. In additional to national regulations, local regulations include:

- There is a head tax on capture in place in one fishing location (LP3M Talinti, 2006);

- Communities are being increasingly engaged in addressing the management needs for this species. Recent surveys have shown that local stakeholders recognize that depletion is a problem and that management is needed. Local stakeholders have been involved in surveys that showed depletion in some areas but that there were high juvenile/adult ratios overall. Communities are involved in an ongoing monitoring programme;

- In 2004 a seasonal closure was implemented for one population with a resulting increase in abundance;

- Captive breeding programmes are being pursued by the Fisheries Department and the Mariculture Institute using low-technology approaches that are feasible for adoption by local communities and can be expected to offset wild capture to some extent. It has been implemented in one location in collaboration with the community and there are plans to expand the program to other communities in the near future (LP3M STPL-Palu, 2006). Captive breeding is expected to provide individuals for both trade and restocking.

Overall conclusions

The Panel concluded that Banggai cardinalfish did not meet the biological criteria for Appendix II listing. The information provided in the proposal to support inclusion did not demonstrate a decline to criterion levels for population numbers. Although one subpopulation has been extirpated there was no evidence of decline in area of occurrence or number of subpopulations to criterion levels. Recent harvest levels are consistent with productivity although there are risk factors.

International trade is the major factor driving exploitation of this species. There would appear to be few complications associated with implementing an Appendix II listing, other than certification required for specimens coming from captive breeding. Short-term socioeconomic impacts of listing could however be significant for local communities. The Panel is concerned that Appendix II listing will hinder national management effort for this species

The Panel emphasized that existing efforts to strengthen management should be pursued urgently to ensure that rates of exploitation do not exceed sustainable levels. The Panel noted that the Government of Indonesia and concerned NGOs are making efforts to pursue management and captive breeding in cooperation with local communities.

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TABLES AND FIGURES

Table 1. Information for assessing productivity of Banggai cardinalfish. Values under "productivity" refer to FAO (2001).

Parameter	Information	Productivity	Source
Age at maturity	Female: minimum size at maturity in the wild 41mm, 8–9 months old Male: mean size of brooders in wild 43mm, 11–12 months old	High (<3.3 yr)	Vagelli and Volpedo, 2004 in proposal
Maximum age	Wild: 2 years Captivity: 4 years	High (<14 yr)	Vagelli, pers. comm. in proposal

Table 2. Information related to small population, small distribution, decline criteria for Banggai cardinalfish. Reliability indices are described in the introduction (paragraph 21) of this report.

Criterion	Index	Value	Basis	Coverage	Reliability	Source
Small population	Total population size, 2004	2.4m individuals	Survey: population density x area occupied	Total distribution (27 islands)	Dive survey, confidence intervals not available (5)	Vagelli, 2005; proposal p. 2
Small distribution	Extent of occurrence	a. 9 100 km^2 b. 5 500 km	a. Length (130 km) x breadth (70 km) of distribution b. Unknown	Total distribution	a. Map estimate (5) b. Unknown (0)	a. Based on length and breadth in proposal p. 2 b. Proposal p. 2
	Area of occupancy	34 km^2	Survey: linear extent of area occupied x width to 100 m depth	Total distribution	Dive survey (5)	Vagelli, 2005; proposal
Decline	Extirpation of a sub population	Extirpation	50 000 fish 2001, none in 2004	Limbo Island	Dive survey (5)	Vagelli, 2005 in proposal p 8
	Decline of a sub population	Decline to 0.3% of original baseline	6 000 fish in 2001, 17 in 2004	Bakakan Island	Dive survey (5)	Vagelli, 2005 in proposal p. 8–9
	Exploited areas vs protected area	"Decline" to 11% of original baseline	Mean 0.07 fish/m^2 in exploited areas; 0.63 fish/m^2 in protected bay	Seven populations surveyed vs bay on Banggai Island	Dive surveys (4–different teams – comparable?)	Vagelli, 2005 for low; Lunn and Moreau, 2004 for high; in proposal p 8

APPENDIX J

FAO Ad Hoc Expert Advisory Panel assessment report: Brazil spiny lobsters

PROPOSAL No. 20

SPECIES: *Panulirus argus, Panulirus laevicauda,* Brazil populations – spiny lobsters

PROPOSAL: Inclusion of Brazil populations of *Panulirus argus, Panulirus laevicauda* (spiny lobsters) on CITES Appendix II in accordance with Article II 2(a)

Basis for proposal: The proposal is for "Insertion of the species *Panulirus argus* and *P. laevicauda* of the Brazilian lobster population to Appendix II of CITES, in accordance with Article II, paragraph 2. a), of the Convention and with Resolution Conf. 9.24 (Rev. CoP13) Annex 2 a, paragraph B. 2. b)."

ASSESSMENT SUMMARY

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence does not support the proposal to include the Brazil populations of *Panulirus argus* and *P. laevicauda* in CITES Appendix II.

The information provided in the proposal to support inclusion in Appendix II did not demonstrate a decline to threshold levels. More recent data and analyses based on formal stock assessment methods suggest that the *P. argus* population in Brazil has been fluctuating without a long-term trend for at least the past 30 years, albeit at high exploitation levels. Although there is no assessment for *P. laevicauda*, it is highly probable that it is being similarly impacted by the fishery.

The Panel concluded that an appreciable proportion of catch enters international trade. However, an Appendix II listing for Brazil populations of spiny lobster would probably not strengthen conservation as this proportion of the catch could be readily absorbed into national markets or diverted to illegal exports through other range states. Additionally, such action would not impact the marketing of illegal size lobsters in the national market. This coupled with implementation difficulties due to split listing, minimum size difference between the two species and product identification suggest that the proposed listing would be difficult to implement and unlikely to achieve the desired results.

Existing fishery regulations are sufficient to ensure sustainability of this fishery, however strict enforcement of management regulations is lacking.

PANEL COMMENTS

Biological considerations

The Panel noted that there was an appreciable amount of biological and fishery information that had not been made available in the listing proposal. In the following sections additional relevant

information is summarized together with key points from the proposal. The proposal does not always state which species is the subject of analyses, and the panel noted that most of the information appears to relate to *P. argus*, making it difficult to draw conclusions about *P. laevicauda.*

Population assessed

These species are distributed from the southeastern United States to the southern coast of Brazil, including the Gulf of Mexico and Caribbean. Mitochondrial DNA analyses suggest that *P. argus* may consist of two subspecies, one off Brazil and the other in the Caribbean and Gulf of Mexico (Sarver *et al.*, 1998). However, the Brazil form of *P. argus* has also been found in the genetic samples from Florida. Although there appear to be three major centers of exploitation for *P. argus* in the western Atlantic, two in the western Caribbean and one off Brazil, evidence suggests that they are linked through recruitment and cannot be treated independently. Whereas the Brazilian stock might provide recruitment to the other two downstream areas, it does not receive any recruitment from them (Ehrhardt and Sobreira, 2003, and N. Ehrhardt oral presentation at this meeting). As a result of this last fact, the Panel concluded that for management purposes the Brazilian *P. argus* populations could be treated as separate management unit.

In the case of *P. laevicauda*, the Brazilian stock appears to be the largest in the western Atlantic with this species being of only minor importance in other areas. As *P. laevicauda* is distributed mainly south of the area where the North Equatorial Current splits into northern and southern branches, it is considered that there is little recruitment to the Caribbean region from the Brazilian stock of this species (N. Ehrhardt oral presentation at this meeting).

In the Brazilian fishery *P. argus* makes up 80 percent of landings, *P. laevicauda* 15 percent and other species the remaining five percent (FAO/WECAFC, 2006).

Productivity level

From the information available (Table 1), both species of spiny lobsters would fit into the "medium" productivity category.

Population status and trends

Sources consulted included analyses of catch per unit effort (Paiva, 1997) and the stock assessment conducted by the FAO WECAFC lobster WG in September 2006 (FAO/WECAFC, 2006), which updates earlier FAO/WECAFC assessments (2001, 2003).

Decline

Some decline indices presented in the proposal could not be verified and the panel considered these to be of low reliability (Table 2). The proposal (p. 6) states that landings declined to 64 percent of historical values between 1979 and 1993 but this appears to be based on difference between a maximal and a minimal annual value. The reported decline to ten percent of historical CPUE is probably unrealistic (proposal p. 6) as the catches at the start of the fishery were too small to have caused abundance to drop to such an extent. Catch figures in the proposal (proposal Figure 2), indicate moderate declines to 80 percent of historical or to 70 percent of maximal values (Table 2).

Analyses of catch per unit effort for each of the two species separately from the early years of the fishery (late 1960s) to the mid-1990s (Paiva, 1997) show declines in CPUE to 22 percent of historical for *P. argus* and to 15 percent for *P. laevidauda* (Figures 1, 2). Information is from the north and northeast coasts of Brazil, the area where the fishery began.

A declining trend in CPUE for *P. argus*, although for a shorter time period (1974–1993) was reported by Andrade de Pasquier *et al.* (2001) (Figure 3). The extent of decline would be consistent with Paiva (1997) for the period when the two series overlap, but only shows a decline of about 50 percent in the period covered.

The Panel concluded that the information for the early years of the CPUE time series should be given low weighting. During these years effort was very low relative to the latter part of the series (Figure 4) and could not have led to substantial declines in abundance. Furthermore, as the fishery uses traps, competition among traps can be expected to have depressed CPUE increasingly as trap fishing effort increased. Therefore, the actual declines were considered to be less extensive than indicated by these series. Recalculation of these declines omitting the first four points gives declines in CPUE to 45 percent of historical for *P. argus* and to 32 percent for *P. laevicauda* (Figures 1, 2)

Abundance assessments of *P. argus* conducted by the 2006 FAO Working Group (WG), building on earlier WG meetings (FAO/WECAFC 2001, 2003) do not show any abundance trend over the entire history of the fishery, but indicate considerable natural variability that is believed to be due to environmental effects on recruitment as shown in Figure 5 (Ehrhardt and Negreiros-Aragao MS). The trend in spawning biomass between 1989 and 2005 was interpreted as a being largely a part of a natural fluctuation (Figure 6). However, the lower abundance in the final few years (2000–2005) compared to the peak in the early 1990s in the face of large 2000–2002 high recruitment seems to be a consequence of an increasing proportion of juveniles taken by the increase in use of gillnets in shallow areas since 1999. These assessments indicate that the population is increasingly being subjected to growth over fishing, given the growing use of gillnets, a phenomenon which needs to be addressed by local management.

Small population size

The estimated total age 2+ population size varied between about 22 million and 50 million in the period 1975 to 2005 (Figure 7, FAO/WECAFC, 2006).

Restricted distribution

Spiny lobsters are harvested over extensive areas of Brazil's continental shelf (proposal Figure 3). The overall area in which lobsters are exploited in Brazil grew from 26 000 km^2 in the mid 1950s, to 80 000 km^2 at the end of the 1980s and more recently has been around 149 300 km^2 (Martins de Castro e Silva *et al*., 2003).

Assessment relative to quantitative criteria

Decline
For consideration for listing on Appendix II assessment of whether the species is near Appendix I levels or likely to become so in the near future is required. Declines for a medium productivity species would have to be to 15–25% of the historical level (10–15% + 5–10%).

The recent FAO WG analyses for the period 1974–2005 were considered by the Panel to be the most reliable index of abundance. They show a decline in female spawning stock biomass (Figure 6) (Ehrhardt and Negreiros-Aragao MS) as indicated by comparing the 1990 and 2003 peaks. It is difficult to quantify this decline given the variability of recruitment but it does not approach the 15–25 percent extent of decline level that could lead to consideration for an Appendix II listing.

The Panel also explored the possibility that recent rate of decline might make these species eligible for Appendix II listing. The most recent assessment shows a rapid decline in age 2+ biomass from 2002 to 2005, but this is well within the range of previous natural fluctuations, and so does not bring the population close to eligibility on this criterion. The Panel noted that this decline in the face of strong recent recruitment would indicate the effect of high fishing mortality on lobsters particularly those of one year in age. This is consistent with information that the fishery is increasingly targeting young lobster inshore with gill nets. Whereas the assessment is for *P. argus*, this fishing practice can also be expected to inflict high fishing mortality on *P. laevicauda*. Management actions are clearly required to reduce this mortality.

The Panel noted that information on population trends for *P. laevicauda* are very limited. The one CPUE time series available did not indicate either a long term decline or a recent decline that would support Appendix II listing.

The Panel concluded that there is no evidence to support an Appendix II listing for either species based on the decline criterion.

Small population
Estimates of total population size are over 25 m individuals 1974–2005, and the Panel concluded that the "small population size" characteristic was not applicable to either species of Brazilian lobsters in the proposal.

Restricted distribution
The estimated area of distribution of about 150 000 km^2, based on area exploited by the fishery, appears relatively large. The Panel concluded that "restricted distribution" was not applicable to either species of Brazilian lobsters in the proposal.

Were trends due to natural fluctuations?
Observed fluctuations in abundance may have at least partly been due to environmental fluctuations influencing recruitment and population abundance. A recent assessment of Brazil spiny lobsters concludes that recruitment is closely related to wind intensity, which in turn is related to ENSO events (Figure 5; Ehrhardt and Sobreira Rocha, 2003). The relationship between wind and recruitment was not re-examined with updated observations in the most recent (2006)

assessment, but a summary of the 2006 assessment states that a conspicuous peak in recruit abundance was observed in 2000–2001 and a lagged 2001–2003 peak in population biomass corresponding to this was observed (Figure 6).

The Panel concluded that the Brazilian population of *P. argus* is characterized by environmentally driven fluctuations.

Risk and mitigating factors

High value of spiny lobster products combined with ease of entry into the fishery are contributing to continuing increase in effort in this fishery. An average of US$ 25.65/kg in 2000 for exports, increasing since then, is provided in the proposal (proposal p. 8). Average landed value based on numbers for 2005 (US$ 81 million landed value for 7 700t) was US$10.50 per kg (FAO/WECAFC, 2006). Particularly in a relatively low-income area, these are attractive. There appear to be few real restrictions on entry into the fishery. Although licenses are theoretically limited, there has been a substantial increase in small motorized vessels and sailing vessels in recent years, many of them unlicensed, partly driven by increasing unemployment in the Brazilian economy and migration of labour to the fishery (Ehrhardt and Sobreira Rocha, 2003).

Gillnets are widely used, although illegal in some areas, and are considered to be damaging to lobster populations (Ehrhardt and Sobreira Rocha, 2003) because they are not size selective. A large and increasing proportion of undersized lobsters is being landed in this fishery (proposal; Ehrhardt and Sobreira Rocha, 2003; Ehrhardt and Negreiros-Aragao MS).

There appear to be few or no factors mitigating risk to these spiny lobster populations, but effective enforcement of simple existing regulations would provide a strong mitigation factor and should be urgently promoted.

Trade considerations

Products in trade were primarily frozen lobster tails until the 1990s; subsequently whole cooked frozen lobsters, live lobsters, and meat have been exported, although tails remain the principal product (proposal p. 8). Main markets for exports are the USA, Japan and France (proposal p. 8). From 1990–1994, lobster exports were valued at US$ 50–70 million (proposal p. 8).

The proposal suggests that a substantial part of the fishery is for export but does not provide details on the proportion of harvest going to trade. While the wording is not entirely clear, one statement in the proposal suggests that only five percent of harvest remains on the national market (proposal, top of p. 8; this may just refer to undersized lobsters). J. Neto (pers. comm.) indicates that 90 percent of the fishery product is exported.

Calculations based on figures in the proposal confirm that a substantial fraction of the total harvest (well over 25 percent is exported. Since the reported export weights are probably tails rather than equivalent whole weights, these would be minimal estimates.

In summary, for the Brazil populations of *P. argus* and *P. laevicauda*, trade in harvested product appears to be significant (well over 25 percent and as much as 90–95 percent of production is exported). Increasing prices for spiny lobster products on world markets are probably contributing to increasing pressure on the resource (proposal, Martins de Castro e Silva *et*

al., 2003). Trade does appear to be a significant factor in driving this fishery and the current situation of high exploitation and overcapacity for the resource. However the Panel believes that if trade restrictions were introduced the domestic markets would absorb this catch.

Implementation issues

Introduction from the sea
Since spiny lobsters are harvested from the continental shelf within the Brazilian EEZ, introduction from the sea is not an issue for this species.

Basis for findings: legally-obtained, not detrimental to species survival

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. Quality of NDFs can be assured by review in the Scientific Committees of CITES (Animals and Plants Committees) and in individual Parties. FAO (2004b, paras 28–29) provides some guidance on NDFs in a fisheries context.

Non-detriment findings could be issued if harvests for exports were being taken consistent with a demonstrably sustainable management plan (CITES, 2006). Although a management plan exists in the Brazilian fishery, which could help to ensure that exploitation was controlled, enforcement of its provisions appears to be problematical and measures in the plan are not being universally respected.

It would appear that there is scientific capacity and biological information in Brazil and in international organizations to support issuance of non-detriment findings based on an assessment of sustainable harvesting level for this resource. The most recent assessments reviewed for this report are consistent in indicating that the current level of exploitation is high but within a manageable frame that could be sustained under enforcement of the established regulations. The biology of spiny lobsters allows for assessment of population and fishery status against reference levels, and there is information from the Brazilian population to support such an assessment. The approach used by the FAO/WECAFC WG could probably be used as the basis for determining whether export shipments were detrimental to species status were the population to be listed.

Findings that specimens were legally obtained
There is a management regime in place, including specific minimum sizes that would form the basis of a finding that specimens for export had been legally obtained. However, harvesting of undersized lobster is widespread and while a legality finding might prevent export of these specimens, they are likely to be absorbed by the domestic market. There is a lack of resources for enforcement of existing measures and harvesting by unlicensed fishermen and vessels appear to be a problem.

Identification of products in trade

Spiny lobster products are widely traded on international markets. The 19 species of *Panulirus* (Holthuis n.d.) are widely harvested in tropical and subtropical waters, and markets in the USA, Japan and France are strong (proposal). FAO's FIGIS database indicates that total world exports of spiny lobster products ranged from 6 000 to 12 000 t/yr in the period 1996–2001, while imports to Europe were 5 000 to 9 000 t/year in the same period.

Although whole spiny lobsters could probably be identified to species by non-specialists with good identification guides, identification of tails would probably be difficult, and identification of meat would not be possible without forensic DNA methods.

The listing of national populations of two species of *Panulirus* on Appendix II, in the absence of listings of other populations of these species, or of other species of *Panulirus*, would raise the problem of distinguishing products originating in Brazil from products from the same or similar species originating elsewhere. The species *P. argus* is harvested in at least 19 countries of the Wider Caribbean Region and its products are exported from most of them (FAO/WECAFC, 2006) (Table 4). A robust catch documentation system would be required to ensure that products from Brazil were well identified in trade, and this might be difficult to develop. Based on mitochondrial DNA analyses, *P. argus* from Brazil can be approximately distinguished from specimens from the Caribbean (Sarver *et al.*, 1998), which might provide a basis for distinguishing products from Brazil in trade, but DNA is not a good approach for routine monitoring (CITES, 2006) and catch documentation would still have to be the primary basis for distinguishing Brazilian products. There is a size limit that differentiate *P. argus* and *P. laevicauda*, and there is a great risk of misidentification of undersize differentials for the species.

Potential socio-economic impacts of the proposed listing

Although CITES Appendix II listings are intended to foster regulation and monitoring of harvesting for trade rather than to restrict harvest, restrictions might result from a listing in this case, because of the potential difficulties in developing non-detriment findings and findings that specimens were legally obtained. The intent of the proposal is consistent with the intent of a CITES Appendix II listing proposal, in that it aims to reduce fishing pressure by limiting exports of undersize spiny lobster products.

J. Neto (pers. comm.) indicates that this is the most important fishery in Brazil. Clearly this fishery provides benefits for a large number of relatively low-income people, and short-term socio-economic impacts of restrictions on the fishery would be widespread and probably significant.

Average landed value from the lobster fishery was US$ 60million per year in 1989–2005, with a historic high of US$ 81million in 2005 (FAO/WECAFC 2006). Landings in 2005 were 7 700 t so average landed value per kg was US$ 10.50. In total 3 336 sailboats, 2 572 motorized vessels, and 5 industrial vessels were participating in the fishery in the early 2000s (FAO/WECAFC, 2006). Most vessels were less than 12 m long (Martins de Castro e Silva *et al.*, 2003).

In the late 1990s 15 800 fishers were participating in the fishery (Martins de Castro e Silva *et al.*, 2003). A survey at that time indicated that average family incomes of fishers were US$42/month. Total employment in the fishing sector was 184 000 (fishing plus services such as boat-building,

ice, stores, processing etc) (Martins de Castro e Silva *et al.,* 2003), but the proportion of total employment due to the lobster fishery is not available.

The Brazilian government has introduced an insurance scheme which supports fisher incomes during the 4-month closed season (Martins de Castro e Silva *et al.,* 2003), intended to mitigate socio-economic impacts of restrictions on the fishery, but this may be encouraging migration into the fishery.

The Panel noted that social and economic problems in Brazil are important drivers of this fishery.

Likely effectiveness of a CITES Appendix II listing for species conservation

Although the Panel does not recommend a CITES Appendix II listing, if it were to be listed and could be implemented (see below), it might lead to reductions in fishing pressure on this resource. Making findings that exports were not detrimental and were legally obtained would be challenging at least until stronger fishery management (based on sustainable harvesting strategies) and stronger enforcement were in place. Exports and fishing pressure might be reduced in the absence of these findings. If management measures adequate to support such findings were put in place, pressure on the resource would be reduced.

However, restricting exports would probably lead to a diversion of spiny lobster products into the national market in Brazil which could absorb the local production albeit at a lower price, or to illegal exports to other range states.

There are very significant implementation issues related to an Appendix II listing for these populations, mainly relating to distinguishing products from Brazil from those from other exporting countries. The CITES guideline (CITES Conf. Res. 9.24 (Rev CoP 13) Annex 3) that split-listings that place some populations of a species in the Appendices, and the rest outside the Appendices, should normally not be permitted, is probably based on a recognition of the difficulties in implementing such listings.

Consideration of Appendix III listing

The Panel considered the possibility that the Government of Brazil could list either these species or the Brazilian populations of these species in Appendix III. Appendix III includes species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the co-operation of other Parties in the control of trade (Convention Article II). Export of specimens of Appendix III species from the state to which the Appendix III listing applies requires a finding that the specimens were legally obtained.

If the species were listed in Appendix III export of specimens of the same species from other states would require a Certificate of Origin (Article V). If only the Brazilian populations of the species were listed in Appendix III, no documentation would be required from any other range state.

Implementation issues relative to identification of products in trade would still arise, as for Appendix II.

Fishery management considerations

The Panel noted with concern that the *P. argus* fishery appears to be suffering from a number of serious management and enforcement issues that should be addressed urgently at the national level. The fact that in the past few years' population numbers do not appear to be increasing to the extent expected in response to good recruitment should be of concern to managers. This is likely due to ease of access to the fishery and particularly to recent changes in fishing practices towards use of gillnets in shallow water to illegally harvest undersize lobsters. Although there is no assessment for *P. laevicauda*, it is highly probable that it is being similarly impacted by these changes in the fishery. Existing fishery regulations are sufficient to ensure sustainability of this fishery, however strict enforcement of management regulations is lacking.

Overall conclusions

The Panel concluded that neither spiny lobster species from Brazil meet the biological criteria for Appendix II listing. The information provided in the proposal to support inclusion based on the proposal was not considered to have demonstrated a decline to threshold levels. Other CPUE data (1956–1993) demonstrated some long-term decline in both species but not to criterion levels. More recent analyses based on formal stock assessment methods suggest that the *P. argus* population has been stable for at least the past 30 years, though fishing mortality on undersize lobsters has increased. Essentially the fishery is driven by incoming recruitment which is highly variable due to fluctuating environmental conditions.

An appreciable proportion of catch does enter international trade (at least 25 percent and probably closer to 90 percent. However, there are reasons to believe that measures to limit trade would lead to diversion of catch into national markets rather than improved conservation of the resource. Additionally, such action would not impact the marketing of illegal size lobsters in the national market.

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TABLES AND FIGURES

Table 1. Information for assessing productivity for Brazil spiny lobsters. Productivity levels refer to FAO (2001).

Parameter	Information	Productivity	Source
Natural mortality *P. argus*	a. 0.30 males and females	a. Medium (0.2–0.5)	a. Andrade de Pasquier *et al.*, 2001
	b. 0.35 adopted for stock assessment	b. Medium	b. Ehrhardt and Sobreira Rocha, 2003
Age at maturity	a. 4 years	a. Medium (3.3–8 yr)	a. Proposal p.4
	b. 3 years (ages 3+ used as "parent stock" in stock-recruitment relationship	b. Medium	b. Ehrhardt and Sobreira Rocha, 2003
von Bertalanffy K *P. argus*	Male: 0.236; Female 0.244	a. Medium (0.15–0.33)	a. Andrade de Pasquier *et al.*, 2001
P. laevicauda	Combined 0.171		b. Paiva (1997)
Length at maturity *P. argus*	Female 20.1cm total length, 13.0 cm tail length		a. Proposal p. 4
P. laevicauda	Female 17.0 cm total length, 11.0 cm tail length		b Paiva (1997)

Table 2. Indices for Brazil spiny lobsters. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
Brazil coast	Reported catches	Decline to 80% of values in early years	Average 1999–2002 is 81% of 1971–1974	Whole fishery 1967–2003	(2) Catches	Proposal Fig. 2
	Reported catches	Decline to 70% of maximum	Average 1999–2002 is 70% of average 1979–1982	Whole fishery 1967–2003	(2) Catches	Proposal Fig. 2
	Reported catches	Decline to 64% of maximum	1993 is 64% of 1979	Whole fishery 1967–2003	(2) Catches extremes selected	Proposal p. 6
	CPUE	Decline to 10% of maximum	Recent 0.1 kg/trap-day, historical 1.0 kg/trap-day	Whole fishery?	(3) CPUE but no details provided	Proposal p. 6
	CPUE	Decline to 53% of maximum	Recent (1989–93) average is 13.8, historical (1974–78) is 26	Whole fishery, 1974–1993	(4) Standardized CPUE	Andrade de Pasquier *et al.*, 2003, p. 43 ; Fig. 4 this report
	Mature stock biomass	"In last 7 years…has decreased considerably relative to a previous period of high recruitment"	Sequential population analyses	Whole fishery?	(5) Population assessment	FAO/WECAFC, 2006 p. 30
	P. argus. Female SSB (lb of tails)	Varied between 2 and 8 million lbs with a slight increasing trend	Sequential population analyses	Whole fishery 1974–2005	(5) Population assessment	FAO, 2006 Fig. 7 this report
	P. argus Total (males and females age 2+ Brazil spiny lobster	No trend over period, but cyclical fluctuations between 20 and 50 million individuals	Sequential population analyses	1974–2005	(5) Population assessment	FAO, 2006 Fig. 1 this report
North/north east Brazil	CPUE *P. argus*	Declined to 22% of historical	Average 1965–69 0.64kg/trap-day, 1990–94 0.14 kg/trap-day	North and northeast coasts, 1965–1994	(4) CPUE early years was given low weighting	Paiva, 1997, shown in Fig. 2 this report
	CPUE *P. laevicauda*	Declined to 15% of historical	Average 1965–69 0.28kg/trap-day, 1990–94 0.04 kg/trap-day	North and northeast coasts, 1965–1994	(4) CPUE early years was given low weighting	Paiva, 1997, shown in Fig. 3 this report

Table 3. Brazilian lobster exports in weight (probably lobster tails) and value, 1997–2001. Source: Martins de Castro e Silva *et al.*, 2003.

Year	Export	
	Weight (tonnes)	Value (million US$)
1997	2026.8	47.0
1998	1816.1	41.7
1999	1717.7	40.1
2000	2039.5	50.7
2001	2335.3	58.6

Table 4. Trade in *Panulirus* spp. products (frozen). Source: FAO FIGIS query, March 6, 2007.[1]

	Exports							**Imports**
	Africa	**North America**	**South America**	**Asia**	**Europe**	**Total**		**Europe**
1996	397	3 971	3 084	924	1 712	10 088		5 132
1997	454	2 201	2 219	899	1 823	7 596		6 808
1998	24	2 294	2 216	358	1 248	6 140		8 847
1999	65	2 547	2 310	686	3 348	8 956		9 335
2000	102	5 553	2 414	1 169	3 164	12 402		8 165
2001	117	2 417	2 802	527	3 014	8 877		7 990

[1] These figures are probably quite imprecise. Essentially negligible imports to North America or Asia are shown, which is inconsistent with plausible trade patterns, and there are probably issues with identification of products. Fresh products were not analysed but trade in these is shown as considerably lower than for frozen products on FIGIS. The available figures at least show an order of magnitude and provide support for considerable international trade in spiny lobster products.

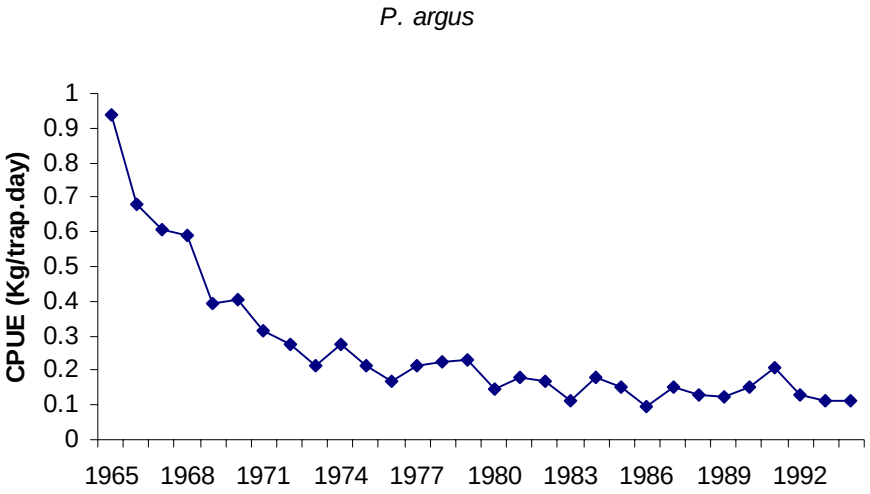

Figure 1. CPUE of *P. argus*, 1965–1994. Source: Paiva, 1997

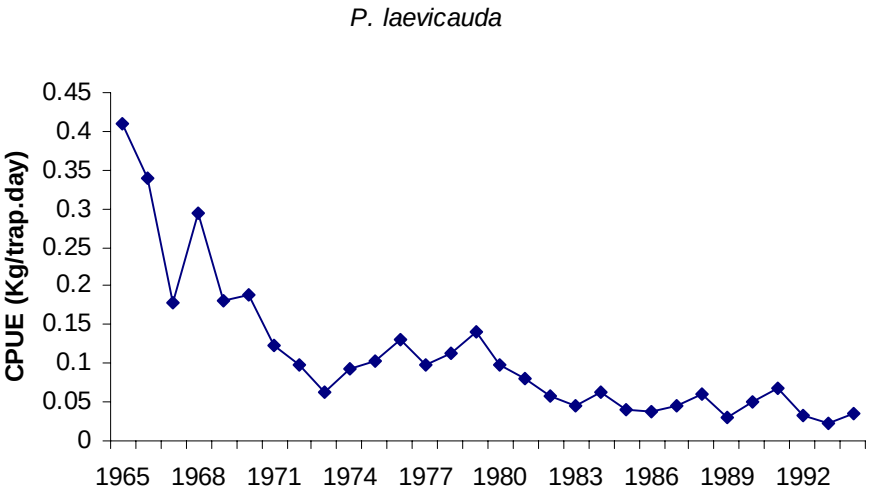

Figure 2. CPUE of *P. laevicauda*, 1965–1994. Source: Paiva, 1997

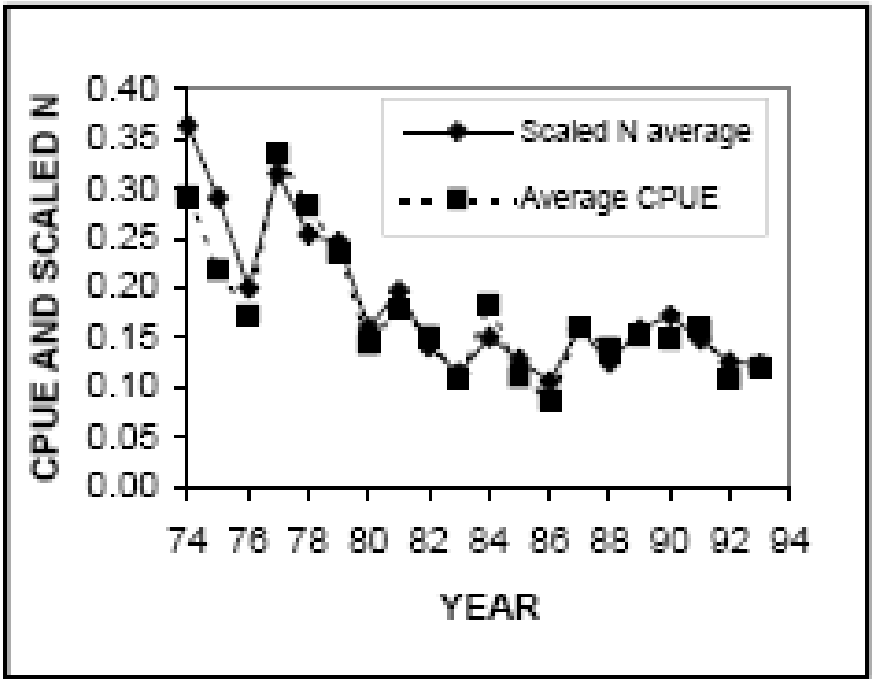

Figure 3. Catch per unit effort, Brazilian spiny lobster fishery, 1974–1993. Source: Andrade de Pasquier *et al.*, 2003

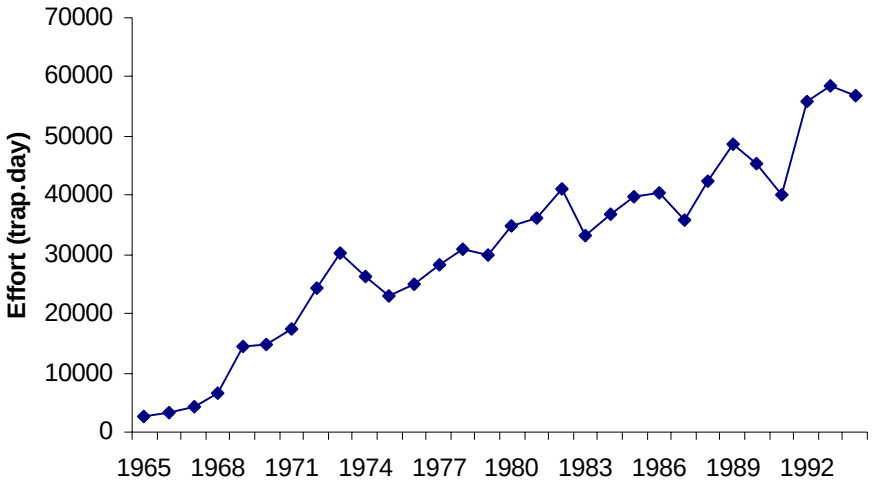

Figure 4. Fishing effort (traps days) in the Brazil spiny lobster fishery 1965 – 1994. Source : Paiva, 1997.

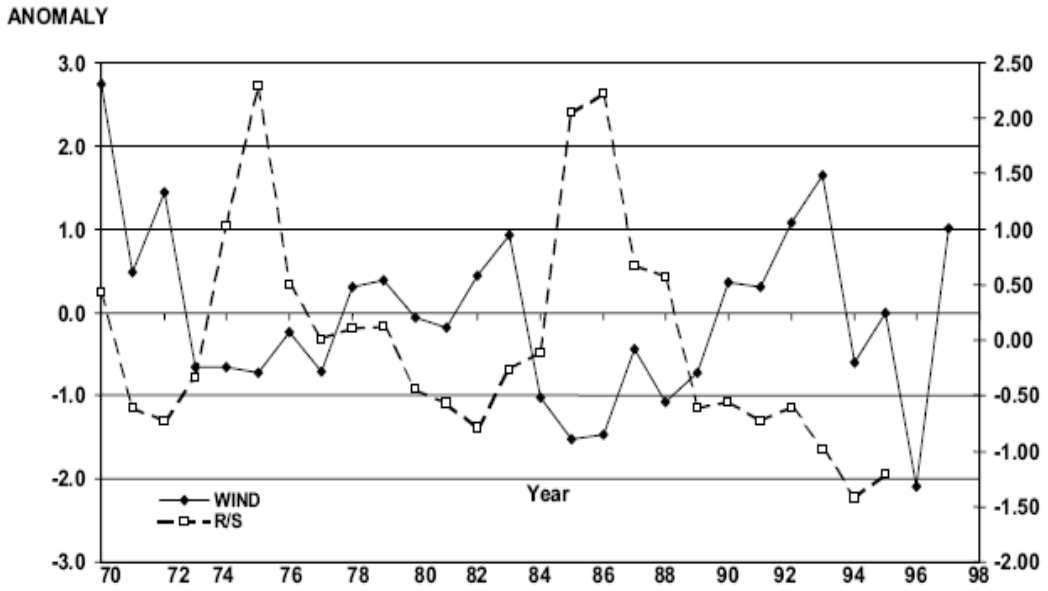

Figure 5. Wind intensity and recruitment of spiny lobster in northeastern Brazil. Source: Ehrhardt and Sobreira Rocha, 2003.

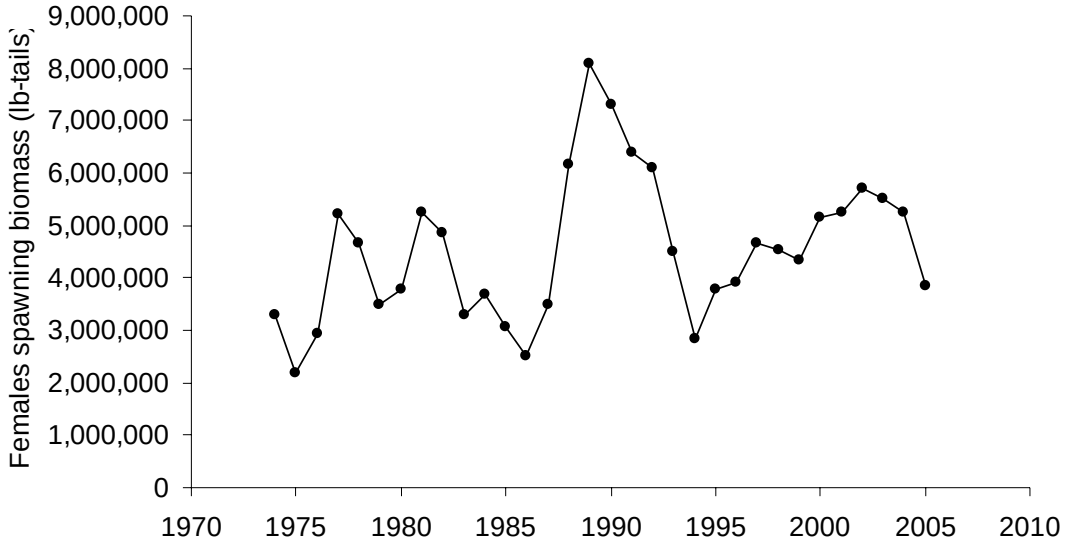

Figure 6. Brazil spiny lobster spawning stock biomass (females). Source: Ehrhardt and Negreiros-Aragao, MS

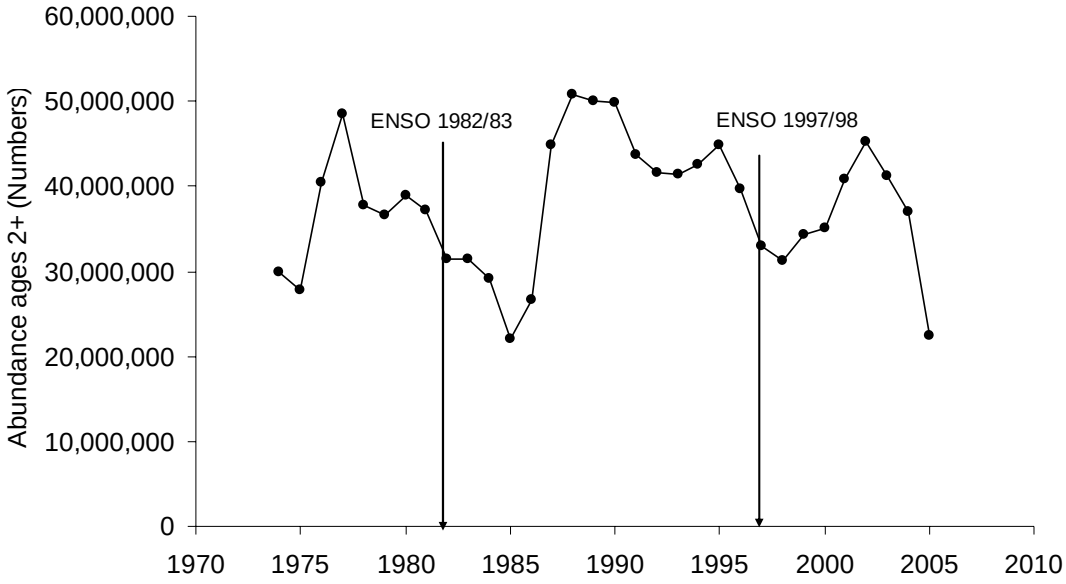

Figure 7. Total (males and females) age 2+ Brazil spiny lobster abundance in numbers. Source: Ehrhardt and Negreiros-Aragao, MS

APPENDIX K

FAO Ad Hoc Expert Advisory Panel assessment report: red/pink corals

PROPOSAL No. 21

SPECIES: *Corallium* spp.

PROPOSAL: Inclusion of all species in the genus *Corallium* (red/pink corals) in Appendix II of CITES in accordance with Article II paragraph 2(a).

Basis for proposal: According to the proposal "The current status of *Corallium* meets the conditions of Article II, paragraph 2(a) of CITES and satisfies Criterion B in Annex 2a of Resolution Conf. 9.24 (Rev. CoP13). Regulation of trade in *Corallium* is required to ensure that the harvest of specimens from the wild is not reducing wild populations to levels at which survival might be threatened by continued harvesting or other influences."

ASSESSMENT SUMMARY

The Panel concluded that the available evidence did not support the proposal to include all species in the genus *Corallium* in Appendix II of CITES in accordance with Article II paragraph 2(a).

The Panel considered that the catch declines observed did not reflect biomass declines. Taking account of available information, the Panel considered that the trends in available data did not demonstrate an historical extent of decline in *Corallium* spp. to less than 20–30 percent of baseline, as specified in the Annex 5 definition of "Decline" for a commercially-exploited aquatic species with low to medium levels of productivity. The available evidence also did not demonstrate a recent rate of decline that would require consideration for listing on Appendix II.

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

These long lived species require strong local management to prevent unsustainable harvesting. This is not currently the case across the full range of the species. Appropriate and effective management measures such as rotation of harvesting areas and protected areas, with effective enforcement, should be implemented by all range States to ensure sustainable harvesting of the species.

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

PANEL COMMENTS

Biological considerations

Population assessed
The proposal is to include all species of the genus *Corallium* in Appendix II of CITES. The genus *Corallium* includes 26 species widely distributed in tropical, subtropical and temperate oceans. Eight species are commercially harvested: *C. rubrum*, endemic to the Mediterranean and eastern Atlantic, and 7 species of the western Pacific, all found north of 19° N latitude. *Corallium* is a member of the Anthozoan Order Gorgonacea which includes the sea fans and sea pens. CITES has previously listed a number of corals on Appendix II.

Productivity level
Life history information available on *Corallium* spp suggests that this would fit into the "low-medium" productivity category (Table 1). Although the lower end of age at maturity estimates is in the "medium" productivity level, most of the range of age at maturity corresponds to "low" productivity, as do longevity and natural mortality.

Population status and trends

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.

Thus indices of decline available are based only on catches in different parts of the range of *Corallium* spp., as reported by harvesting countries and in the FAO statistics (Table 2). Japanese and Taiwan Province of China catches in the Pacific both declined to small fractions of their maximum values between 1979–81 and 1989–91 – 4% and 1% respectively. Pooled catches in the Pacific declined to 1% of historical values between 1984–6 and 2000–2. Catches of *C. rubrum* in the Mediterranean declined to 40% of the historical maximum value between 1980–84 and 2000–04.

In general the Panel considered that catch data alone are unlikely to represent abundance trends precisely since changes in fishing intensity will change catch values. More specifically doubt was cast on two of the catch series in the proposal. Kosuge (2007) records that the Japanese and Taiwan fisheries in the central Pacific near Hawaii were abandoned due to the costs of harvesting deep waters and low quality of coral in these areas and that the observed catch decline does not reflect a strong decline in abundance. Kosuge (1993) indicates that *Corallium* species (*C. japonica, C. elatius* and *C. konojoi)* were only harvested off the coast of Japan in part of their distribution area. The Panel also noted that recorded landings of coral in the Pacific were substantially lower than those in the Mediterranean. Given the wide area of distribution of *Corallium* spp. in the Pacific it was therefore questionable whether the level of harvest could have led to a decline greater than that in the Mediterranean. The Panel noted that in the Mediterranean the adopted Scuba diving collecting techniques only harvest *C. rubrum* to about 130 metres and populations exist in deeper water at least down to 250 metres. These deeper populations represent significant refugia since dredging has been banned since 1994 in EU countries In addition marine protected areas in the Mediterranean cover some of the range of

C. rubrum. It would therefore seem that the catch decline of 40 percent would represent the lower limit for the population decline in the Mediterranean.

In most of the series presented in the proposal, maximum catches followed a period of rapidly increasing catches. The observed patterns could be consistent with discovery and depletion of resources to uneconomic levels. The Panel noted that *Corallium* are widely distributed and depletion of some commercial beds may not reflect overall abundance. The proposal notes that serial depletion has occurred as beds are discovered, in the western Pacific and in the Mediterranean. *C. rubrum* was reportedly extirpated from one location east of Graham Bank (Sicily Channel) and from three banks off the coast of Sciacca (Strait of Sicily) that had been fished from the late 1800s to the early 1900s (proposal p. 6). However ASSOCORAL, 2007 (quoting Di Geronimo *et al.*, 1993) states that these were all dead or fossil coral beds. The Panel notes that despite being harvested since prehistoric times the Mediterranean population of *C. rubrum* is still widespread. Small but mature colonies have high local densities. Nevertheless mature colonies are now smaller than the minimum size for harvest and a problem is that large colonies have an important role in providing recruitment. These problems need to be addressed by implementation and enforcement of suitable local management measures.

Small population size

Colonies are presented as the unit of abundance in the proposal and in publications cited. Strictly speaking, colonies are made up of a number of individuals but it is appropriate to use colonies as the unit of abundance.

Estimates of density are available from different parts of the *Corallium* distribution (proposal), but no estimates of total population size are available.

Restricted distribution

No estimate of distribution area was available. The genus is distributed relatively widely, although in specific areas within preferred habitats (including strong currents, low slopes and low sedimentation, low light) and depth zones (varying by species).

Assessment relative to quantitative criteria

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.

Abundance indices are relatively few and imprecise, based on pooled catches over wide areas. In the Mediterranean the decline as indicated by catches has been to 40 percent which is not within the Appendix II levels. For the Pacific populations the time series of catches provided in the proposal are not considered informative indices of abundance. Based on available evidence, the Panel considered it unlikely that extent of decline in the Pacific would be to a lower level than in the Mediterranean. Catches for all areas have been stable or slightly increasing in recent years

(proposal Figures 2, 3) so no recent rate of decline can be calculated to determine whether the species might be near Appendix II in the near future. However, in the Mediterranean such stability is mainly due to the harvest of small sized colonies, as the largest ones have virtually disappeared in the harvested zones.

The Panel view is that the catch trends do not demonstrate a decline in *Corallium* consistent with listing under the CITES decline criteria.

Small population
In relation to absolute population size, there are estimates of density from different parts of the *Corallium* distribution, as provided in the proposal, but no estimates of total population size are available. The genus is widely distributed and probably occurs in relatively large numbers world-wide.

Restricted distribution
The genus is distributed relatively widely, although in specific areas within preferred habitats (including strong currents, low slopes, light and sedimentation) and depth zones, varying by species. 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.

Other indices
Maximum height of *C. rubrum* was normally 50–60 cm and basal diameter normally 3–10 mm (not cm as stated in the proposal). The Panel's Mediterranean experts confirmed that average colony sizes in exploited areas in the Mediterranean are very small. Mean height throughout the exploited zones of the Mediterranean is now stated to be 3 cm. In Hawaii size composition of *C. secundum* has increased in recent years, following catch restrictions, compared with surveys in the 1970s and 1980s (Grigg, 2002). Data made available from the Japanese Fisheries Agency indicated that *Corallium* catch per vessel from the Japanese coast had increased over the past six years.

Were trends due to natural fluctuations?
There is no evidence available that observed trends were due to environmental fluctuations or to natural population fluctuations though local die offs have been observed in the Mediterranean.

Risk and mitigating factors
The life history (long life time, low natural mortality rate) and ecological characteristics (isolated subpopulations, limiting dispersal potential) of this species contribute to risk of severe declines. Small colony size and local depletions could add to these risks.

High value of *Corallium* products would be a factor increasing risk for this species. Small coral beads can be valued at up to 300 €/kg.

Recent mass mortalities have affected populations of *C. rubrum* in the Mediterranean, especially in shallow depths. Recreational diving in the Mediterranean may be an additional threat, as may sedimentation and pollution.

The poor practice of scraping basal plates reported for the Mediterranean prevents regeneration of harvested colonies. Fisheries for other species could potentially cause incidental damage to coral colonies although there is no information on the extent of this risk.

Lack of knowledge also constitutes a risk factor. Far more information is required on genetic structures within species ranges, depth stratified long term distribution and abundance studies and studies of factors affecting growth and reproductive capacity.

Fisheries management measures which may mitigate risk to *Corallium* spp. are in place for some populations, but do not cover the entire distribution. Comprehensive fishery management is in place in Hawaii. Fishing gear restrictions are in effect in the EU, in Japan and in Hawaii. Marine protected areas and depth refugia exist in the Mediterranean, around the northwestern Hawaiian Islands and Japan. Other measures (e.g. minimum size limits, licenses and fishing seasons, rotational closed areas) are also adopted in some countries. *C. rubrum* is reproductively mature at a height of only two centimetres which is below the legal minimum size. These species, which need to grow for many years to provide optimal yield, clearly require very careful local scale management.

The Panel understands that aquaculture of young colonies for use in powdered coral products could eventually become a feasible mitigating measure for *C. rubrum*.

A consideration of the risk factors and mitigating factors did not cause the Panel to modify its view of the level of the decline criteria to be applied.

Trade considerations
Although international trade is described as a significant factor in driving fisheries for this species, relatively little information is provided in the proposal. All quantitative information deals with imports to the USA.

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

Despite a lack of global statistics it seems probable that a substantial fraction of the production of *Corallium* spp is in international trade. The US is a major market for *Corallium* products. Recently US imports might account for approximately 28 percent of world production. Principal sources of US imports in recent years include China, Taiwan Province of China, and Italy, although imports from 55 countries are reported. Italy has historically been a major centre for *Corallium* processing and has been exporting *Corallium* products for centuries. In recent years 70 percent of *Corallium* processed in Italy has originated in Japan and Taiwan Province of China. Japan imports *Corallium* from Taiwan Province of China, France, Italy, Spain and Tunisia.

Existing international trade figures do not account for re-export, although for example 70 percent of trade from Italy is re-exported. Re-export may be a significant factor for this species given the widely dispersed nature of the trade. Hence, there could potentially be some double counting in existing trade statistics.

The Panel agrees that international trade is a significant driver for the harvesting of *Corallium* spp.

Implementation issues

Introduction from the sea

Corallium spp are harvested both in waters within state jurisdiction and outside the jurisdiction of any state. Should *Corallium* spp 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. Certifying that such introductions were not detrimental to species status based on demonstrably sustainable harvesting strategies would be a challenge for this species. The CITES conference of Parties is yet to adopt an agreed interpretation of the phrase "transportation into a State". This would need to be resolved to ensure consistent application of introduction from the sea provisions by Parties.

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. Quality of NDFs can be 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.

If *Corallium* spp 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. While it might be possible to issue non-detriment findings based on the management measures in place, these might be questioned if not based on demonstrably sustainable harvesting strategies.

Findings that specimens were legally obtained

Prices for *Corallium* products are high (see "Risk Factors" above) which might encourage illegal harvest and trade. Illegal harvesting has been a problem in the past and continues in some areas. Specimens whose harvest was consistent with management measures in place could be certified as legally obtained. In waters under national jurisdiction where no restrictions on harvesting are in place, there would also be a basis for certifying that specimens were legally obtained.

A problem is that *Corallium* products may be highly processed (for example, worked into beads or based on specimens ground into powder). This may allow for legally and illegally obtained specimens to be included in the same product, and this would be difficult to detect at the time of shipment.

Identification of products in trade and "look-alike" issues
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* (proposal p. 10), identification by non-specialists 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.

Although dyed bamboo coral may be used to produce fake red or pink coral, this would not be sufficiently serious problem to justify the listing of such species for look-alike reasons.

Potential socio-economic impacts of an Appendix II listing
If including it in Appendix II resulted in harvests being more restricted than at present then socio-economic impacts might be felt by harvesters, buyers, importers and exporters, enterprises making *Corallium* products, and retailers.

Likely effectiveness of a CITES Appendix II listing for species conservation

The Panel does not recommend a CITES Appendix II listing for *Corallium* spp. 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 Governmental efforts would be better employed in enacting and enforcing appropriate local management regimes.

The Panel cautions that if *Corallium* spp were included in an Appendix II listing then aspects of the implementation of a CITES listing 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.

Fisheries management considerations

The Panel is convinced that the *Corallium spp* 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. With some exceptions current management is far from adequately restrictive.

Overall conclusions

The FAO Ad Hoc Expert Advisory Panel concluded that the available evidence did not support the proposal to include all species in the genus *Corallium* in Appendix II of CITES in accordance with Article II paragraph 2(a).

The Panel considered that the catch declines observed did not reflect biomass declines. Taking account of available information, the Panel considered that the trends in available data did not demonstrate an historical extent of decline in *Corallium* spp. to less than 20–30 percent of baseline, as specified in the Annex 5 definition of "Decline" for a commercially-exploited aquatic species with low to medium levels of productivity. The available evidence also did not demonstrate a recent rate of decline that would require consideration for listing on Appendix II.

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

These long lived species require strong local management to prevent unsustainable harvesting. This is not currently the case across the full range of the species. Appropriate and effective management measures such as rotation of harvesting areas and protected areas, with effective enforcement, should be implemented by all range States to ensure sustainable harvesting of the species.

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

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TABLES AND FIGURES

Table 1. Information for assessing productivity of *Corallium* spp. Reference levels in "Productivity" column are from FAO (2001).

Parameter	Information	Productivity	Source
Intrinsic rate of increase	0.3 – 0.5 of early stage colonies		Bramanti *et al.*, 2005
Natural mortality	0.04–0.07 (4–7% per year)	Low (<0.2)	Grigg, 1976 in Proposal p. 3
Age at maturity	7–12 years (*C. rubrum* 7–10 yr; *C. secundum* 12 yr)	Low/medium (Low >8 yr) (Med 3.3–8 yr)	References in Proposal pp. 3–4
Maximum age	75–100 years	Low (>25 yr)	Proposal p. 3

Table 2. Decline indices for *Corallium* spp. Reliability indices are described in the introduction (paragraph 21) of this report.

Area	Index	Trend	Basis	Coverage	Reliability	Source
Pacific	Catches, Japan, pooled species	Declined to 4% of historical	Average 1979–1981: 70 866 kg; 1989–1991: 2 506 kg	Japanese fisheries, 1979–1991	Catches (2)	Proposal Table 2
Pacific	Catches, Taiwan Province of China	Declined to 1% of historical	Average 1979–1981: 177 000 kg; 1989–1991: 2 467 kg	Taiwan Province of China fisheries, 1979–1991	Catches(2)	Proposal Table 2
Pacific	Catches, pooled species	Declined to 1% of historical	Average 2000–2002: 5t; average 1984–6 420t	Pacific fisheries, FAO data	Catches (2)	Proposal Figure 2
Mediterranean	Catches, *C. rubrum*	Declined to 40% of historical	Average 1980–1984 75.8 t; 2000–2004: 30.4 t	Mediterranean fisheries, FAO data	Catches(2)	Proposal Figure 3

The 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 was held at FAO headquarters from 26 to 30 March 2007. 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 ad hoc 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. Seven proposals were evaluated by the Panel: (1) CoP14 Prop. 15. Proposal to include *Lamna nasus* (porbeagle shark) on CITES Appendix II; (2) CoP14 Prop. 16. Proposal to include *Squalus acanthias* (spiny dogfish) on CITES Appendix II; (3) CoP14 Prop. 17. Proposal to include all species of the family Pristidae (sawfishes) on CITES Appendix I; (4) CoP14 Prop. 18. Proposal to include *Anguilla anguilla* (European eel) on CITES Appendix II; (5) CoP14 Prop. 19. Proposal to include *Pterapogon kauderni* (Banggai cardinalfish) on CITES Appendix II; (6) CoP14 Prop. 20. Proposal to include the species of *Panulirus argus* and *P. laevicauda* of the Brazilian lobster population on CITES Appendix II; and (7) CoP14 Prop. 21. Proposal to include all species in the genus *Corallium* (red/pink corals) on CITES Appendix II.

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