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APPLICATION OF CITES LISTING CRITERIA TO
COMMERCIALY EXPLOITED MARINE SPECIES

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APPLICATION OF CITES LISTING CRITERIA TO COMMERCIALY EXPLOITED MARINE SPECIES

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Executive summary

1. In document CoP 15 Doc. 63 submitted to the 15th Conference of the Parties, the CITES Secretariat identified a number of issues surrounding the application of the criteria for inclusion of commercially exploited aquatic species on Appendix II of the Convention, specifically the application of criterion B in Annex 2a of Resolution Conf. 9.24 (Rev. CoP 15) to commercially exploited aquatic species. Differences of interpretation had arisen between the parties proposing listings, the CITES Secretariat and the FAO Expert Advisory Panel for the assessment of proposals relating to CITES listings of commercially exploited aquatic species. CoP 15 decided on a process involving the Standing, Animals and Plants Committees to resolve this issue.
2. The revision of criterion B of Annex 2a that was adopted at CoP13 changed the emphasis of the criterion. Application of the new version requires a determination of whether management arrangements are in place that are adequate to ensure that trade is not reducing a population to dangerous levels. The emphasis of criterion A of Annex 2a, and of the previous version of criterion B, was on the determination of whether a potentially dangerous population trend has occurred.
3. The CITES Standing Committee requested that Parties submitting proposals to CoP 15 explain how they have applied the criteria. Although this information was not always supplied explicitly, the application of the criteria can be inferred from the information presented. A review of the proposals for listing terrestrial species on Appendix II that were submitted to CoPs 13-15 shows that criterion A of Annex 2a has usually been applied in contexts where the global decline can be evaluated against the guidelines specified in CoP 9.24 Annex 5, while criterion B of Annex 2a has usually been applied when there is evidence for unsustainable exploitation for trade in the areas for which data are available, but an estimate of global decline is not possible due to lack of data.
4. Because the criteria relating to small population sizes and restricted areas of distribution rarely play a role for commercially exploited marine species, the main issues in the CITES context relate to the assessment of past or projected rates or extents of decline in the population, and the extent to which trade controls are required to prevent further declines.
5. The guidelines contained in Annex 5 of Conf. 9.24, adopted at CoP 13, for the interpretation of the CITES decline criteria to commercially exploited aquatic species, contain a number of ambiguities relating to the definition and criteria for a decline that probably cannot be resolved from the wording of the criteria and guidelines alone. Analysis of the substantive practical and theoretical issues that have arisen in the context of the recent application of the criteria to commercially exploited marine species is more likely to result in progress.
6. The population levels of commercially exploited marine fish populations at which “the survival of the species might be threatened by continued harvesting” are probably not determined primarily by biological factors such as depensation, but by operational factors: beyond a certain degree of depletion, the species no longer supports a directed fishery; the main threat becomes by-catch and other hard-to-manage threats; reliable monitoring data become scarce; and remedial action becomes progressively harder to implement. While the quantitative thresholds in the

guidelines for applying the decline criteria to commercially exploited aquatic species are above population levels of concern, the decline of populations to the thresholds under harvesting will often have been the result of fishing mortality rates that, if continued, will lead to the extirpation of the population over time.

7. An examination of some statistical aspects of applying the criteria and guidelines to exploited marine fish populations suggests that the criteria are not too conservative: populations which are fully exploited, but not over-exploited, are unlikely to trigger the criteria for either Appendix I or Appendix II, when using the thresholds in the Annex 5 guidelines. Conversely, most populations which have declined sufficiently to satisfy the criteria, will have been subject to harvest rates, that, if continued indefinitely, will eventually lead to extinction. Populations that are continuously monitored will likely trigger the listing criteria before they have declined to dangerously low levels. However, in the case of low productivity species, the recovery of the population back to target levels may take over 30 years even if harvesting is completely suspended on listing.

8. In order to give effect to the management-oriented component of criterion B of Annex 2a, the data quality index developed by FAO could usefully be supplemented with additional indexes to reflect the level of fishery management that is in place with respect to the species and the degree of compliance with management measures.

9. The current guidelines for applying the criteria to commercially exploited aquatic species appear to have been drafted in the context of classical models for fish populations, and may not be suitable for cases that do not conform to these, such as sedentary species or species occurring in very small local populations with very small ranges. In such cases, sustainable harvest rates can be much lower than would be predicted based on classical models of growth and recruitment.

10. A review of the issues raised at the various points in the consultation and review process with respect to proposals submitted to CoPs 13, 14 and 15 to list commercially exploited marine species on Appendix II, show that the main questions related to the assessment of decline in cases of incomplete information, such as indices of abundance being available only for part of the range of the species. The cases which are particularly difficult to resolve are those where there is evidence of decline in some areas, but where data for the world as a whole are insufficient to estimate a global rate or extent of decline. Management issues were also frequently raised, especially with regard to the role of CITES vis à vis the responsibilities of Regional Fishery Management Organisations (RFMOs).

11. It is recommended that when a species gives rise to concern, as evidenced by one or more regional populations having experienced declines that meet the criteria for Appendix I or criterion A of Annex 2a, the decision to include the species on Appendix II under criterion B of Annex 2a be based on the adequacy or otherwise of the management arrangements that are in effect for the remainder of the populations, and the degree of compliance with these. Inclusion on Appendix II under Annex 2aB is indicated when most major populations of the species are not subject to management and compliance arrangements that meet specified standards. Guidelines for making non-detriment findings in such cases could be structured accordingly. The steps required to assess a species under the proposed interpretation of the criteria are outlined using flowcharts.

1 Introduction

In a document (CoP 15 Doc. 63) submitted to the 15th Conference of the Parties, the CITES Secretariat identified a number of issues surrounding the application of the criteria for the inclusion of **commercially exploited aquatic species** on Appendix II of the Convention. The specific questions related to the application of the criterion B in Annex 2 a of Resolution Conf. 9.24 (Rev. CoP 15) and the introductory text of Annex 2a to commercially exploited aquatic species. The CoP 15 agreed (in Decisions 15.28 through 15.30) on a process for resolving these issues and developing guidance for the application of this criterion to commercially exploited aquatic species for inclusion on Appendix II.

This paper, which considers only **commercially exploited marine species** proposed for listing on Appendix II, aims to contribute to this process by examining:

- issues and ambiguities in the wording of the current guidelines for application of the criteria
- the listing criteria and application guidelines from the perspective of fishery science and management
- relevant issues arising in the course of review and discussion of the commercially exploited marine species proposed for listing on Appendix II at CoPs 13, 14 and 15
- comparable issues arising from the application of the criteria to terrestrial species

Based on these analyses, a suggestion is made for additional guidelines for the application of criterion B in Annex 2a to commercially exploited marine species.

A total of 14 proposals to list commercially exploited marine species on Appendix II have been considered by the last three Conferences of the Parties (Table 1). The list does not include two proposals to list species on Appendix I and one proposal for a transfer from Appendix I to Appendix II.

Table 1. Proposals to list commercially exploited marine species on Appendix II, submitted to CoPs 13-15

CoP	Proposal	Species	common name	FAO Panel assessment	Secretariat recomm.	CoP decision
13	32	<i>Carcharodon carcharias</i>	great white shark	undecided	adopt*	adopted
13	33	<i>Cheilinus undulatus</i>	humphead wrasse	yes	adopt	adopted
13	35	<i>Lithophaga lithophaga</i>	date mussel	no	reject	adopted
14	15	<i>Lamna nasus</i>	porbeagle shark	no	adopt	rejected
14	16	<i>Squalus acanthias</i>	spiny dogfish	no	adopt	rejected
14	18	<i>Anguilla anguilla</i>	European eel	yes	adopt	adopted
14	19	<i>Pterapogon kauderni</i>	Banggai cardinal fish	no	adopt	withdrawn
14	20	<i>Panilurius argus, P. laevicauda</i>	spiny lobster	no	reject**	withdrawn
14	21	<i>Corallium</i> spp. & <i>Paracorallium</i> spp.	red & pink corals	no	adopt	rejected
15	15	<i>Sphyrna lewini</i> ***	scalloped hammerhead shark	yes*	adopt	rejected
15	16	<i>Carcharhinus longimanus</i>	oceanic white-tipped shark	yes	adopt	rejected
15	17	<i>Lamna nasus</i>	porbeagle shark	yes	adopt	rejected
15	18	<i>Squalus acanthias</i>	spiny dogfish	no	adopt	rejected
15	21	<i>Corallium</i> spp. & <i>Paracorallium</i> spp.	red & pink corals	no	adopt	rejected

*subject to amendments

**Appendix III listing suggested

***additional species included in proposal on look-alike basis (Annex 2b criterion)

2 Background to commercially exploited marine species and the CITES listing criteria

2.1 Commercially exploited marine species and CITES: legal background

The CITES Convention contains a number of provisions that are specific to marine species.

In addition to regulating trade in the usual sense of imports and exports, CITES regulates “introduction from the sea”, defined as transportation into a State of specimens of any species which were taken in the marine environment not under the jurisdiction of any State (Article I(e)). For species listed on Appendix I or II, permits from the State of introduction are required (Article IV.6(a)). The details are still the subject of consultation between Parties. There is consensus that “introduction from the sea” refers to takes of specimens on the High Seas (in the sense of the UN Convention on the Law of the Sea) (Resolution Conf. 14.6 (Rev. CoP15)), but the definition of “State of introduction” remains to be clarified (Decision 14.48 (Rev. CoP15)).

Regardless of how the remaining issues relating to Introduction from the Sea are resolved, CITES controls apply in principle to specimens of listed marine species that have been taken on the High Seas, and to specimens of listed marine species when they are exported or re-exported, regardless of whether they were originally taken on the High Seas or not. Specimens taken within waters under national jurisdiction (including the territorial sea and Exclusive Economic Zone) and consumed within the State of first landing, are not “traded” in the sense of CITES and are not subject to CITES controls. These issues can be relevant to the application of listing criteria to the extent that they can affect whether a species is determined to be affected by trade.

2.2 Co-ordination with other organisations

For Appendix II species, issuance of a permit for introduction from the sea should normally be contingent on a non-detriment finding (Article IV.6(a)), except that if the species is covered by a pre-existing convention (Article XIV), it is sufficient that the flag state certify that the take was in accordance with that convention. Examples of pre-existing conventions include the conventions establishing the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the International Whaling Commission (IWC).

Article XV.2(b) obliges the CITES Secretariat to consult inter-governmental bodies having a function in relation to species proposed for inclusion in (or deletion from) Appendix I or II, especially with a view to obtaining scientific data these bodies may be able to provide and to ensuring co-ordination with any conservation measures enforced by such bodies. This provision applies regardless of whether the body pre-date CITES or not.

Because it has a generic function for commercially exploited marine species, the CITES Secretariat has signed a Memorandum of Understanding (SC54 Doc. 10A) with the Food and Agriculture Organisation of the United Nations (FAO). FAO has participated in the process of developing listing criteria for commercially exploited marine species, and has established an Expert Advisory Panel for the Assessment of Proposals to amend Appendices I and II of CITES concerning Commercially

Exploited Aquatic Species. The “FAO Panel” (its shorthand name for the purpose of this paper) has reported three times, in 2004, 2007 and 2009 to consider proposals submitted to the 13th, 14th and 15th Conferences of the Parties respectively (CITES documents CoP 13 Doc. 60 Annex 3, CoP 14 Doc. 68 Annex 3, CoP 15 Doc. 68 Annex 3; FAO 2004, 2005, 2010). The views of the FAO Panel on the listing criteria and on specific listing proposals are discussed below. They have played a significant role in the CoP’s considerations of these matters.

In addition, Regional Fishery Management Organisations (RFMOs), such as ICCAT, are consulted on proposals relating to specific taxa for they have a function. It is not always clear whether an RFMO “has a function” in relation to a given taxon. The statutes of some RFMOs are flexible with respect to which taxa they cover, such that the organisation is not actively involved in the management of all taxa that it could in principle take action on. As discussed later in this paper, the question of whether an RFMO is active in the management of a species can be a significant question for some listing decisions.

Many of the commercially exploited marine species of interest in the CITES context have populations that straddle or migrate between waters under national jurisdiction and the high seas, or between the waters of different states, such that the provisions of the 1995 UN Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks apply with respect to states party to that agreement and to RFMOs. In particular, parties are committed to the precautionary approach under Article 6 of the Agreement:

Article 6. Application of the precautionary approach

1. States shall apply the precautionary approach widely to conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks in order to protect the living marine resources and preserve the marine environment.
2. States shall be more cautious when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures.

2.3 The listing criteria and interpretation guidelines for commercially exploited aquatic species

Quantitative criteria for the listing of species on the CITES Appendices were first adopted by CoP 9 (1994) in Resolution Conf. 9.24. CoP 11 agreed (Decision 11.2) a process for review of these criteria which involved the Plants and Animals Committees, an independent Criteria Working Group, and the Standing Committee. This resulted in a draft revision of 9.24 prepared for CoP 12 by the CITES Secretariat (CoP12 Doc. 58). CoP 12 noted some outstanding issues and agreed (Decision 12.97) to use CoP12 Doc. 58 as the basis for further consultations, with the aim of adopting a revised version at CoP13. Although the draft in CoP12 Doc. 58 does not appear to have been adopted as a revision of 9.24, it is referred to in some subsequent documents as Conf. 9.24 (Rev. CoP 12). A revised version (CoP 13 Doc. 57 Annex 3, with the amendments suggested in paragraph B of the document) was adopted by CoP 13 as Conf. 9.24 (rev. CoP 13).

Some minor additional amendments to 9.24 were adopted by CoP 14 and by CoP 15, but these do not materially impact the issues addressed in this paper. The version currently in effect is Conf. 9.24 (Rev. CoP15).

For the purpose of this paper, the most significant changes adopted by CoP 13 were the revision to the criteria for listing species in accordance with Article II.2(a) of the Convention:

Conf. 9.24 Annex 2a (original version)

The following criteria must be read in conjunction with the definitions, notes and guidelines listed in Annex 5.

A species should be included in Appendix II when either of the following criteria is met.

- A. It is known, inferred or projected that unless trade in the species is subject to strict regulation, it will meet at least one of the criteria listed in Annex 1 in the near future.
- B. It is known, inferred or projected that the harvesting of specimens from the wild for international trade has, or may have, a detrimental impact on the species by either:
 - i. exceeding, over an extended period, the level that can be continued in perpetuity; or
 - ii. reducing it to a population level at which its survival would be threatened by other influences.

Conf. 9.24 Annex 2a (as revised by CoP 13, unchanged by CoP 14 and CoP 15):

The following criteria must be read in conjunction with the definitions, explanations and guidelines listed in Annex 5, including the footnote with respect to application of the definition of “decline” for commercially exploited aquatic species.

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.

These criteria are referred to in this paper as criteria 2aA and 2aB respectively. In some cases commercially exploited marine species have been proposed or listed under the “look-alike” criterion of Annex 2b of the Resolution (“criterion 2bA”):

- A. The specimens of the species in the form in which they are traded resemble specimens of a species included in Appendix II under the provisions of Article II, paragraph 2 (a), or in Appendix I, such that enforcement officers who encounter specimens of CITES-listed species, are unlikely to be able to distinguish between them;

In the CITES context, “species” can mean any species, subspecies, or geographically separate population thereof (Article Ia).

The biological criteria for Appendix I (Conf. 9.24 Annex 1) play a role in the criteria for Appendix II, because criterion 2aA specifies that a species qualifies for Appendix II if it is projected to meet at least one of the Appendix I criteria in the “near future”.

Few of the commercially exploited marine species listed or proposed for listing under CITES to date could be considered to have a “small” wild population (criterion A) or a restricted area of distribution (criterion B). In practice the most relevant criterion is C (referred to in this paper as criterion 1C) “a marked decline in the population size in the wild”:

- C. A marked decline in the population size in the wild, which has been **either**:
 - i. observed as ongoing or as having occurred in the past (but with a potential to resume);
or
 - ii. inferred or projected on the basis of any one of the following:
 - a decrease in area of habitat; or
 - a decrease in quality of habitat; or
 - levels or patterns of exploitation; or
 - a high vulnerability to either intrinsic or extrinsic factors ; or
 - a decreasing recruitment

Annex 5 to 9.24 contains definitions, explanations and guidelines for the interpretation of the terms used in the criteria. The CoP 13 revision made substantial changes to the definition of “decline”. In addition to the changes to the generic definition of decline, a footnote specific to commercially exploited marine species was added:

The CoP 13 revision also added the following footnote to the definition of “decline”:

¹Application of decline for commercially exploited aquatic species:

In marine and large freshwater bodies, a narrower range of 5-20% is deemed 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. Low productivity is correlated with low mortality rate and high productivity with high mortality. One possible guideline for indexing productivity is the natural mortality rate, with the range 0.2–0.5 per year indicating medium productivity.

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.

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). There should rarely be a need for concern for populations that have exhibited an historical extent of decline of less than 50%, unless the recent rate of decline has been extremely high.

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 5% and 10% above the relevant extent-of-decline might be considered as a definition of ‘near’, taking due account of the productivity of the species.

A recent rate-of-decline is important only if it is still occurring, or may resume, and is projected to lead to the species reaching the applicable point for that species in the Appendix I extent-of-decline guidelines within approximately a 10-year period.

Otherwise the overall extent-of-decline is what is important. When sufficient data are available, the recent rate-of-decline should be calculated over approximately a 10-year period. If fewer data are available, annual rates over a shorter period could be used. If there is evidence of a change in the trend, greater weight should be given to the more recent consistent trend. In most cases, listing would only be considered if the decline is projected to continue.

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. Depending on the biology, patterns of exploitation and area of distribution of the taxon, vulnerability factors (as listed in this annex) may increase this risk, whereas mitigating factors (e.g. large absolute numbers or refugia) may reduce it.

This footnote is based partly on the recommendations of the 2nd FAO Technical Consultation on the Suitability of the CITES Criteria for listing Commercially Exploited Aquatic Species (CoP 12 Inf. 5 FAO, 2001). The range specified in paragraph 5 of the footnote for extents of decline “near” the thresholds for Appendix I, in which a species could be considered for Appendix II, has been termed the “buffer zone” by the FAO Panel (FAO, 2004)

The following principle has sometimes been invoked to resolve doubtful cases when applying the criteria to commercially exploited marine species:

Conf. 9.24 Annex 4 (CoP 13 revisions underlined) :

When considering proposals to amend Appendix I or II, the Parties shall, by virtue of the precautionary approach and in case of uncertainty either as regards the status of a species or the impact of trade on the conservation of a species, act in the best interest of the conservation of the species concerned and adopt measures that are proportionate to the anticipated risks to the species.

2.4 Current issues relating to the listing criteria and their interpretation

2.4.1 Differing interpretations by FAO and the CITES Secretariat

A difference of interpretation has arisen over how the quantitative decline guidelines in Footnote 1 relate to criteria A and B of Annex 2a. This has resulted in the CITES Secretariat and the FAO Panel making different recommendations on proposals 14.15, 14.16, 14.19, 14.21, 15.18 and 15.21 (see Table 1).

Document CoP14 Inf. 64 submitted by FAO explains how the FAO Panel in its 2nd Report (FAO, 2007) has interpreted Annex 5 for the evaluation of proposals relative to the Appendix II criteria. The 3rd Report of the FAO Panel (FAO, 2010) also notes that its interpretation of the Appendix II criteria was in accordance with document COP14 Inf. 64.

The authors of CoP14 Inf. 64 take the view that there is no qualitative difference in the application of criteria A and B of Annex 2a, and that the only difference is the use of the “buffer zone” specified in Footnote 1 to Annex 5. Their conclusion is:

Further, as elaborated above and stated in the FAO ad hoc Advisory Panel Report², it is clear that for commercially exploited aquatic species, application of Paragraph B requires demonstration of either a reduction that will lead to the species reaching the Appendix-I extent-of-decline guidelines within approximately a 10-year period, or that the species falls within the ‘buffer zone’ extent-of-decline (abundance) guidelines for Appendix II.

In CoP15 Doc. 63 the CITES Secretariat presents a different point of view, arguing that the word “reducing” in criterion 2aB is not synonymous with “decline” used in criterion 1C, to which criterion 2aA indirectly refers, and is not subject to the quantitative guidelines contained in Annex 5. The Secretariat justify their view by the way proposals for listing species under criterion 2aB (2aBi and 2aBii in the version prior to CoP 13) have been justified, evaluated and decided. Their conclusion is:

... Rather than fixed thresholds or percentages or strict biological standards, the application of paragraph B relies on direct or indirect evidence, or inference through projection models, that wild harvest is reducing a wild population and that its inclusion in Appendix II is needed to ensure that continued harvest (for international trade) is regulated and does not cause the wild population to become threatened with extinction. The Secretariat considers that this

demonstrates that the intention of the Parties was to take pre-emptive action, such as inclusion in Appendix II, in order to avoid a species becoming threatened with extinction through international trade, i.e. before reduction engenders a decline. In contrast, the word 'decline' as applied in the criteria for Appendix I, indicates that the species has already suffered a significant impact from international trade and that serious measures are now required to address this impact.

Similar considerations to those underlying the Secretariat's view are discussed in document CoP 14 Inf. 48 in relation to two proposals (14.15 and 14.16) for including commercially exploited marine species on Appendix II where the recommendations of the FAO Panel's and those of the Secretariat diverged. Cop 14 Inf. 48 notes that only some of the populations of each of these species clearly satisfy criterion 2aA, but that for most of the other populations existing management arrangements are insufficient to prevent a similar extent of decline in the face of continuing high demand for international trade. Only for those few populations for which adequate management measures are in place have stable or increasing trends been observed. The authors concluded that under these circumstances, for those populations which may not yet satisfy criterion 2aA, but where management measures to prevent continued declines are not yet in place, control of trade is required to ensure that the harvest of specimens is not reducing the wild population to levels at which its survival might be threatened, and that these populations therefore qualified for Appendix II under criterion 2aB.

CoP 15 agreed on a process, involving the Plants, Animals and Standing Committees, aimed at resolving the differences over interpretation of the criteria (Decisions 15.28, 15.29, 15.30).

2.4.2 Some ambiguities in the current specification the interpretation guidelines listing criteria for commercially exploited marine species

As noted by the CITES Secretariat in CoP15 Doc. 63, Footnote 1 is attached to part of the explanation for the term "decline" for use in interpreting the biological criterion 1C for Appendix I. The definition of decline has a direct effect on the interpretation of criterion 2aA for Appendix II, because this criterion requires a projection that the species will meet the Appendix I criteria in the near future.

However, Footnote 1 also contains some points specific to Appendix II, and it is not entirely clear which parts of Footnote 1 relate to Appendix I only, to Appendix II only, or to both. Nor is it clear which of the points in Footnote 1 that refer to Appendix II relate to criterion 2aA only, to criterion 2aB only, or to both.

Annex 5 specifies that a "decline" (as used in criterion 1C) can be expressed either in terms of an extent of decline from an historic baseline, or as a recent rate of decline. The footnote proposes, as a quantitative guideline for "recent rate of decline", the rate of decline that would result in the historical-extent-of-decline criteria being reached in approximately 10 years. This makes the decline criterion 1C (when using the recent rate of decline as the measure) very similar in structure to criterion 2aA, which involves the notion of projected decline that will result in the species qualifying for Appendix I in the "near future".

The term "near future" used in criterion 2aA is specified in Annex 5 to be between 5 and 10 years. It is not clear whether the words "in approximately a 10-year period" in Footnote 1 are supposed to refer to the term "near future" as used in criterion 2aA. If one assumes that the "near future" is 10

years, then the population decline condition for criterion 2aA for Appendix II becomes quantitatively identical to that for triggering criterion 1C for Appendix I (when using “recent rate of decline” as the basis for estimating decline). This situation tends to encourage confusion between the two notions (a recent rate of decline, for applying criterion 1C, versus a projected decline, for applying criterion 2aA).

As currently formulated, the decline guidelines in Footnote 1 imply that an aquatic species satisfies Appendix I criterion 1C when the recent rate of decline is such that the population is projected to reach the relevant extent-of-decline criterion within 10 years. Furthermore, the species satisfies criterion 2aA for Appendix II when it is projected to qualify for Appendix I in the near future (5-10 years). Taken together, these provisions imply that the species qualifies for Appendix I when it is projected to reach the extent-of-decline threshold within 5-10 years, and for Appendix II when it is projected to reach the extent-of-decline threshold within 15-20 years. However, it does not appear that the guidelines have been interpreted this way.

The interpretation of the guidelines advocated in CoP14 Inf. 64 leaves little distinction between criterion 2aA and criterion 2aB, despite the fact 2aA refers to the “near future” while 2aB does not. The only difference between the two criteria apparent in the interpretation promoted in CoP14 Inf. 64 is that the “buffer zone”, specified in Annex 5 Footnote 1, of 5-10% above the extent-of-decline guideline for Appendix I can be used to justify a listing under criterion 2aB, even if the species is not declining appreciably. However, the buffer zone of Footnote 1 is not explicitly linked to criterion 2aB, and it is unclear how this buffer zone relates to the concept embodied in criterion 2aB.

Furthermore, the position taken in CoP14 Inf. 64 (passage cited in section 2.4 above) would be problematic if the word “demonstration” is taken to imply a burden of proof, because that would run counter to the principle laid down in the UN Fish Stocks Convention that “absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures” (if one assumes that a CITES listing counts as a “conservation or management measure”).

A generic problem with criteria that are developed through a consultative process is the necessity, when applying the criteria, to place an exact interpretation on criteria that were developed through a process that was by its nature not especially rigorous or exact. There is a risk that debate over the interpretation of the criteria takes on a legalistic character, analogous to the way lawyers debate the exact interpretation of statutes. Because of inconsistencies in the drafting of the criteria, resulting in part from a failure to make necessary consequential changes when amendments are made, it is unlikely that the differences of opinion can be resolved at the purely legalistic level. It is probably more fruitful to develop a working interpretation based on addressing the practical and theoretical issues that have been encountered or need to be faced when applying the criteria. Some of these are addressed in the remainder of this paper.

2.5 Comparison with terrestrial species

The CITES Secretariat raised the issue of interpretation of the criteria at the 58th meeting of the Standing Committee in July 2009 (SC58 Doc. 43). The Committee agreed to ask Parties, as they prepared for CoP15, to clearly define in their listing proposals how they interpreted and applied Resolution Conf. 9.24 (Rev. CoP14) using sound and relevant scientific information, and recognizing flexibility and data-poor cases (SC 58 Summary Record, item 43).

With regard to the proposals for including species on Appendix II, only the proposers of commercially exploited marine species (Proposals 15, 16, 17, 18 and 21 to CoP 15) explicitly provided the requested information, which is summarized in section 4. However, the way the criteria have been applied to terrestrial species can to some extent be inferred from the data provided in support of the proposals.

Table 2 lists the proposals for inclusion of terrestrial species on Appendix II under criterion 2a that were submitted to CoPs 14 and 15, at which the current version of the criteria were in effect, along with the recommendations of the CITES Secretariat and the decisions of the CoP.

In each case where the proposal explicitly invoked criterion 2aB, the supporting document provided evidence that the species had declined throughout the range, or in each area for which data are available, and that trade has contributed to the decline. In each case, the information presented suggested that the decline is expected to continue if no remedial action is taken. In none of these cases did the proposal provide a quantitative estimate of the global extent of decline.

Thus, criterion 2aB appears to have been invoked by proposers in cases where they are unable to make an assessment of whether the species meets the criteria for Appendix I globally, or will in the near future, but where the population is being reduced by trade (usually in combination with other factors) such that the criteria for Appendix I will, absent effective control of trade, be satisfied at some unspecified time in the future, if not already.

In three cases (Proposals 14.31, 14.33 and 15.13) where the proposal invoked criterion 2aB, the CITES Secretariat considered that the information presented was already sufficient to satisfy criterion 2aA. However, the Secretariat did not supply its own estimate of the global rate or extent of decline.

In one case (Proposal 14.32) the proposal invoked criterion 2aB, but the Secretariat considered that there was insufficient evidence of international trade in sufficient quantities to count as a significant contributory factor in the decline of the species.

In two cases (Proposals 15.29 and 15.42) where the proposal invoked criterion 2aA, the Secretariat did not consider that the information presented demonstrated that the guidelines for criterion 2aA had been met, but did consider that the species qualified for Appendix II under criterion 2aB, because sufficient qualitative evidence of decline, with unsustainable trade as a contributory factor, was presented.

Clearly there is scope for debate in individual cases as to whether the available information is complete enough to judge that criterion 2aA is satisfied. However, there seems to be consensus that where trade has been shown to be a contributory factor in the decline, evidence of decline and unsustainable trade throughout the parts of the range for which data are available, is a sufficient

basis to apply criterion 2aB, even when no estimate of the global rate or extent of decline has or can be made.

Table 2. Proposals to CoP 14 and 15 to list terrestrial species on Appendix II ¹

CoP	Proposal	Proposer's assessment ²	Secretariat assessment ²	CoP decision
14	31	2aB	2aA	rejected
14	32	2aB	insuff. evidence of trade	rejected
14	33	2aB	2aA	rejected
15	11	2a	Appendix III	adopted
15	12	2aA	Appendix III	adopted
15	13	2aB	2aA+2bA	adopted
15	20	2aA	2aA	adopted
15	22	-	insufficient information	rejected
15	23	-	insufficient information	adopted
15	24	-	insufficient information	adopted
15	26	-	insufficient information	adopted
15	27	-	insufficient information	adopted
15	29	2aA	2aB	adopted
15	30	-	insufficient information	rejected
15	34	-	insufficient information	rejected
15	35	-	insufficient information	adopted
15	36	-	insufficient information	rejected
15	39	-	insufficient information	adopted
15	40	-	insufficient information	rejected
15	41	-	insufficient information	adopted
15	42	2aA	2aB	adopted

¹ excluding commercially exploited marine species

² excluding species included on lookalike basis (criterion 2b)

2.6 Synthesis

The specific changes made to criterion B of Annex 2a with the CoP 13 revision help to clarify its intent. One of the key differences between the new version of criterion B of Annex 2a adopted at CoP 13 and the previous version is the greater emphasis in the new version on the requirements for management, in addition to mere assessment of the population status.

The former version requires an assessment of the effects of trade, with a species to be listed if trade is judged to be having a detrimental effect. The new version specifies that a species should be listed if trade control is required to ensure that trade is not having a detriment effect.

The emphasis in the new version implies that evaluation of a species against the criterion involves not merely an assessment of its population status and the effects of trade, but also a consideration of the current management arrangements that are in place, and an assessment of whether they are adequate to ensure that the species does not decline to dangerous levels. The quantitative

guidelines in Annex 5 remain relevant as a guide to the extents of decline that would give rise to concern.

The new version of criterion 2aB also provides a clearer distinction between the kinds of information that are required to apply criteria 2aA and 2aB. The application of criterion A requires merely a population projection for the recent past or the near future, without explicit consideration of the management context, while the application of criterion B involves a consideration of the adequacy or otherwise of current management arrangements. A suggested approach for applying criterion B in this manner is provided at the end of this document.

3 The listing criteria from a fishery science and management perspective

3.1 Background to the theory of fishing

The theory of fishing which is summarised in this section is described in a number of textbooks, ranging from the classic Beverton and Holt (1957) through Gulland (1977) to more modern treatments such as Haddon (2011).

The theory focusses on the exploitation of a typical “fish” species (mainly teleosts but also elasmobranchs and other kinds) which may be demersal (bottom-dwelling) or pelagic, but are presumed to be mobile. The population of a fish species is normally assumed to consist of a number of distinct unit “stocks”, which are assessed separately on the assumption of minimal interchange between them.

Fishing intensity is measured as the fishing mortality rate, F , which corresponds to the proportion of the stock removed by fishing per unit time. The natural mortality rate, M , is assumed (in elementary models) to be constant and to be unaffected by fishing. Each fish population is assumed to have a characteristic somatic growth curve, which can be expressed as mean size at age or mean weight at age, which generally approaches a maximum size or weight asymptotically with increasing age.

When discussing population size, it is important to specify a minimum age or size above which individuals are to be counted in the total. Many teleost species are highly fecund, with each gravid female releasing thousands or millions of eggs, some of which develop into larvae, of which most only survive a few days. The early life history stages are not included in estimates of population size. The most commonly employed index of population size is the spawning stock biomass (SSB), being the total weight of fish of spawning age. Because it is assumed (in the more elementary models) that the fecundity of fish is proportional to their weight once the fish is mature, the SSB is proportional to the reproductive potential of the population. In some cases the sexes are treated separately, such that SSB refers to the female spawning biomass only. For species which do not spawn, such as viviparous elasmobranchs, the term mature biomass is preferred.

When the SSB is reduced to low levels, the recruitment (production) of young fish will also be low; it tends to zero as the SSB tends to zero. However, above a certain stock level, the level of recruitment

may be only weakly dependent on the SSB, due to various ecological compensatory mechanisms. These are still not very well understood, partly because of the difficulty of identifying relatively modest density-dependent influences against a background of typically quite large density-independent fluctuations in recruitment.

“Growth overfishing” means that the fish are caught before they have had a chance to become full grown, such that even if recruitment is not impacted, the total yield of the fishery is lower than it would be with a lower fishing intensity.

“Recruitment overfishing” also implies that the yield is lower than it would be with lower fishing intensity, but in this case recruitment is also reduced; recruitment overfishing can occur even if catches of juveniles are avoided.

In practice, the two types of overfishing occur together and are implicitly combined in the models of fish population dynamics used in fish stock assessments.

Assuming a constant intensity of fishing (a constant rate of fishing mortality), the equilibrium biomass of a fish population will be a decreasing function of F , for example as shown in Fig. 1. The equilibrium yield (average annual catch) will be a maximum for intermediate values of F . At low values of F , few fish are caught because there is not much fishing; at high values of F , few fish are caught because there are not many fish left in the sea. The peak of the yield-versus- F curve corresponds to the maximum sustainable yield; the corresponding fishing mortality rate is denoted F_{MSY} . The desirable range of F from a fishery management perspective is generally near or below F_{MSY} . The equilibrium level of spawning stock that corresponds to fishing at F_{MSY} is labeled SSB_{MSY} or simply B_{MSY} . The equilibrium biomass level in the absence of fishing (the unexploited level) is usually denoted B_0 . In some assessment models it is identified with the historic, pre-exploitation stock level.

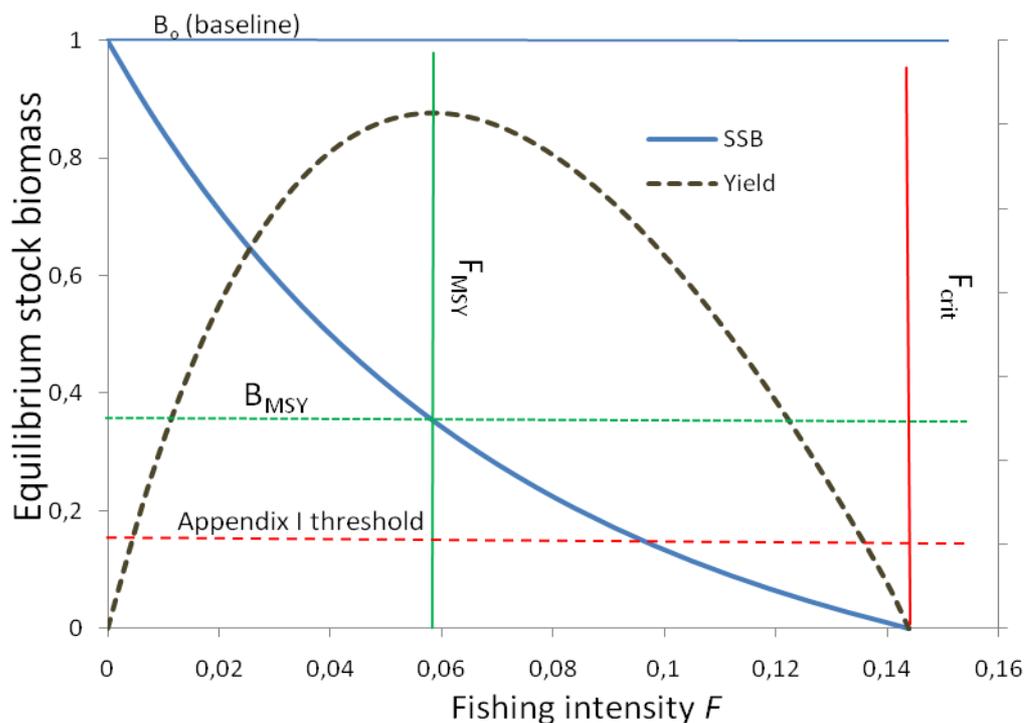


Fig. 1. Basics of equilibrium fishing theory. The greatest equilibrium yield is obtained when $F = F_{MSY}$. When $F > F_{crit}$ the population is predicted to decline to extinction. Fish stocks in the lower right quadrant ($F > F_{MSY}$, $B < B_{MSY}$) are considered overfished. Fish stocks in the upper left quadrant are considered lightly exploited. Stocks with $F = F_{MSY}$ and $B = B_{MSY}$ are fully exploited. Stocks can enter the upper right and lower left quadrants, but only transiently (no equilibrium).

The UN Convention on the Law of the Sea (UNCLOS) and related agreements oblige states and RFMOs to take measures which are designed, on the best scientific evidence available, to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield, as qualified by relevant environmental and economic factors. A stock fished at an F level near to F_{MSY} is considered “fully exploited”. A stock fished at an intensity such that F exceeds F_{MSY} is considered overexploited. In practice the situation is somewhat more complex, because of natural fluctuations in fish stock and recruitment levels, and because it is not possible to set or determine the F level with high precision. Broadly speaking, when the spawning stock biomass is appreciably below B_{MSY} , the stock is regarded as overfished, and management measures should be aimed at enabling its recovery.

The fishing level above which the equilibrium stock level becomes zero is usually called F_{crit} . When $F > F_{crit}$, the population will decline inexorably towards extinction. Other F -based reference points commonly used in fisheries assessment and management, such as F_{max} and $F_{0.1}$ refer to yield-per-recruit rather than total yield, and are not directly relevant here.

At the simplest level, a species is in danger of extinction when the fishing intensity is such that $F > F_{crit}$. However, even when $F > F_{crit}$, the decline towards extinction can take time. Most species that have been considered for CITES listings to date are low-productivity stocks (see below) for which the value of F_{crit} can be quite low; if F exceeds F_{crit} by a moderate amount, it can take many years for the stock to disappear completely. Fig. 2 shows the predicted trend in spawning stock biomass for a low/medium productivity stock (with parameters as given in Table 7) under fishing at F_{MSY} and under fishing at F_{crit} .

Whether the species will actually become extinct depends on whether the situation $F > F_{crit}$ is likely to persist even after the species has become rare. This depends on whether it continues to be vulnerable to by-catches or opportunistic catches after directed fisheries for the species have “run out of fish”.

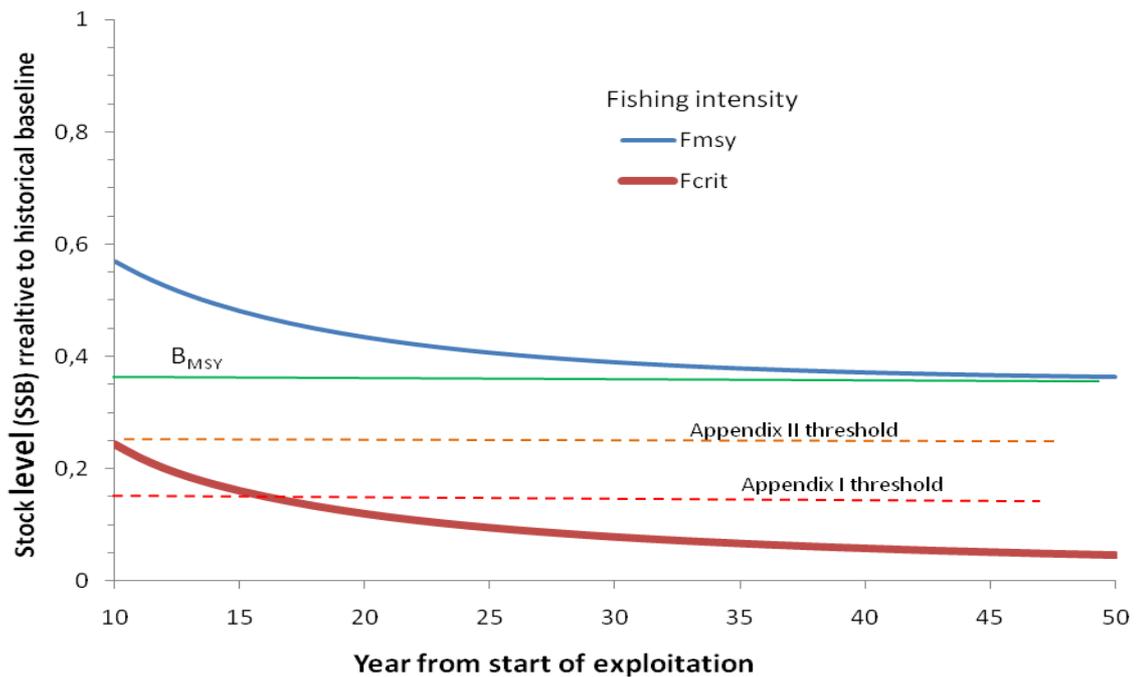


Fig. 2. Transient dynamics over time of initially unexploited fish stock subject to: (a) fishing at intensity F_{MSY} ; (b) fishing at intensity F_{crit} . Under fishing at F_{MSY} the stock will stabilise at B_{MSY} while under fishing at F_{crit} the stock will decline gradually towards extinction.

3.2 Application to the listing criteria

3.2.1 Population thresholds for Appendix I and Appendix II criterion 2aA

The guidelines for applying the listing criteria to commercially exploited marine species distinguish between high, medium and low productivity species. Productivity is a measure of the intensity of fishing pressure that a species can sustain in the long term, or equivalently it is a measure of how quickly a species can recover if fishing pressure is relaxed.

The determination of productivity is not entirely straightforward, and is still the subject of some debate for some species. A multi-factor indicator of productivity developed for the American Fisheries Society (Musick, 1999) has been adapted by FAO for CITES use (FAO, 2001). Fecundity (e.g. number of eggs produced per female) is only one factor affecting productivity: a highly fecund species where gravid females produce millions of eggs each year can have low productivity if very few of these eggs grow into adult fish. Table 3 shows the parameter ranges and the range of criterion thresholds for low, medium and high productivity species as proposed by FAO.

Table 3. Productivity ranges for use with the CITES listing criteria

Parameter	Symbol	Productivity range		
		Low	Medium	High
Natural mortality	M	< 0.2	0.20 – 0.50	> 0.50
Somatic growth rate	K	< 0.15	0.15 – 0.33	> 0.33
Age at maturity	t_{mat}	> 8.0	3.3 – 8.0	< 3.3
Intrinsic rate of increase	r	< 0.14	0.14 – 0.35	> 0.35
Appx I extent of decline		15 – 20 %	10 – 15 %	5 – 10 %
Appx II "buffer zone"		10%	5 – 10 %	5%

(Adapted from FAO, 2001)

The thresholds in the quantitative guidelines for the decline of a population from an historical baseline (Footnote 1 to Annex 5 of Conf. 9.24) are generally below the stock level corresponding to the MSY level, such that a stock that has declined to the level at which it qualifies for Appendix I is already considered to be overfished. Fig. 1 (which is based on the parameters of a population that is borderline low/medium productivity) shows a typical relationship between the Appendix I threshold and the MSY level.

Depletion of a population to below the Appendix I threshold implies that the fishing mortality has been higher than F_{MSY} , and may exceed F_{crit} such that the stock is overfished, and will go extinct in the longer term if fishing intensity is not reduced. Because the data available for the species likely to be of interest in the CITES context do not usually enable estimation of the true F level with much precision, the difference between F_{MSY} and F_{crit} is not necessarily large compared with the uncertainty in F . Consequently, it is fair to say an overexploited stock ($F > F_{MSY}$) is potentially at a long-term risk of extinction ($F > F_{crit}$), depending on the nature of the fishing pressure and how it responds to declining abundance.

3.2.2 2aB criterion for Appendix II

The Appendix II criterion 2aB refers to the:

level at which its survival might be threatened by continued harvesting or other influences.

Doc. CoP 14 Inf. 64 suggests that this level corresponds to the level at which compensatory effects (also known as Allee effects) might occur. Depensation means that the usual ecological compensatory mechanisms are reversed at low population levels such that the stock could decline towards extinction even if fishing pressure were lifted. However, there is little evidence that compensatory effects actually occur in "classical" fish stocks, at least not at stock levels high enough to

assess (Liermann and Hilborn, 1997), although local depensation due to group-size effects has been suggested in the case of the Banggai cardinal fish (Proposal 14.19, see section 4.3).

The level at which survival might be threatened by continued harvesting or other influences can depend not only on ecological factors, but also on fishery-related factors.

When a species has become too rare to support a targeted fishery, it may still be caught opportunistically (as a supplementary target) in fisheries where other species are the main target. If it is a desirable fish, the F level may remain high even after catches have become low. Even after it has become too rare to be a supplementary target, it may still be caught incidentally as a by-catch. If the overall level of fishing intensity across its range is high, and the species is of lower productivity than the main target species, it may still experience $F > F_{crit}$ even as a by-catch (Myers and Worm 2005). If it is a valuable species, such as a shark with valuable fins, there may still be a market for the product: either a specific market for the species, or a generic market, such that there will be an economic disincentive to release by-caught specimens alive.

Once catches of the species have become very infrequent, it will be hard to detect trends in the species abundance, and hard to enforce or verify measures to reduce by-catch rates. Even if the species is not yet at the level at which biological factors threaten its survival, it may have declined below the point at which remedial measures are practicable. It would not be practicable, for example, to limit fishing effort across a large area, merely to reduce the by-catch of a species that is seldom encountered. Even if such a measure were politically feasible, it would be almost impossible to demonstrate (other than by theoretical methods) that the measure had had a beneficial effect in terms of recovery of the endangered species.

In such cases the concept of “commercial extinction” (too rare to target) may not be applicable. Before a species is commercially extinct it may already have reached “management extinction” (too rare to manage) or “scientific extinction” (too rare to monitor).

These considerations suggest that the key to saving a species from extinction is to take remedial action while the species is still “abundant enough to manage”, and that the requirement in criterion 2aB 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.

should be interpreted in terms of the sufficiency of the management arrangements for the species and the scope for remedial measures.

3.2.3 Measures of population size

The guidelines in Conf. 9.24 Annex 5 suggest some scope for choosing the most appropriate measure of population size:

When providing details on the size of a population or subpopulation, it should be made clear whether the information presented relates to an estimate of the total number of individuals or to the effective population size (i.e. individuals

capable of reproduction, excluding individuals that are environmentally and behaviourally or otherwise reproductively suppressed in the wild) or to another appropriate measure, index or component of the population.

As noted above, the spawning stock biomass or mature biomass is usually an appropriate measure of population size for fish stocks; this should be specified when it is used as the measure of population trends. Analogous measures should be considered for non-fish species (see section 3.5).

3.3 Data quality and management issues

Fishery management authorities can be involved in the management of an exploited species to varying degrees, ranging from the collection of only the most basic catch data to the implementation of robust, state-of-the-art management procedures designed to ensure that management objectives are met.

The first level is the collection of species-level catch data. This cannot be taken for granted, because species of interest in the CITES context are usually not among the most abundant species in the catch. Fishery management authorities, whether national or international, may not bother to collect separate catch data for these species. Where species level catch data are collected, further subdivision by size class of fish enhances their value.

The next level is the compilation and analysis of suitable indices of fishing effort for the species of interest, so that trends in catch rates, corrected for effort levels, can be analysed to determine whether a species appears to be in decline. In response to apparent declines, regulations can be adopted with the aim of limiting the catch of the affected species, although not necessarily tuned towards a particular goal or target.

The next level up is to conduct regular stock assessments, which use the available data, including catch and effort data, and, where available, fishery-independent indices of abundance, such as results of egg and larval surveys or acoustic surveys, together with other biological data, to estimate the current size and structure of the fish population, and to determine its status in relation to reference points such as F_{MSY} or SSB_{MSY} . This enables goal-oriented management measures to be implemented, such as catch or effort limits designed to restore the population biomass to SSB_{MSY} .

Even using modern approaches to stock assessment, and with relatively good data, there usually remains considerable uncertainty about the status of the stock and its relationship to management targets. There is no guarantee that regular implementation of management measures based on the results of the stock assessments will ensure good management performance in the long run, such as stable, sustainable catches and a low risk of unintended depletion of the stock. This deficit can be overcome by the management procedure approach (Smith *et al.* 1999; Cooke 1999; Butterworth 2007; Punt and Donovan 2007), which is currently gaining ground amongst fishery scientists and managers. This approach involves defining explicitly the rules that link management measures to the results of stock assessments, so that the entire process can be tuned to ensure good performance in the face of uncertainty. The tuning is performed using a process called Management Strategy Evaluation (MSE) which typically makes extensive use of simulation testing of the assessment/management cycle. The risks associated with any given management strategy, and the

trade-offs between competing objectives, such as current catch levels versus long-term conservation of the stock, can be explicitly computed, and used to guide policy decisions.

For the CITES context, the FAO Panel (FAO, 2001) has developed a 5-point scale for characterising the quality of data used for assessing species against the CITES listing criteria (Table 4). If the management-related aspects of the conservation status of species and populations are also to play a role in the application of listing criteria, it may be helpful to define an analogous scale for the quality of management of the populations, such as that shown in Table 5.

Currently, most national and international fishery management authorities operate at level 4 for the species of greatest economic importance, and at lower levels for other species. However, there is an emerging trend towards level 5 approaches, such that in the future level 5 may become the standard for good practice, at least for “important” species (Holland, 2010).

The effectiveness of the best-designed fishery management procedure will be compromised if there is insufficient compliance. Lack of compliance with fishery regulations remains a widespread problem (FAO, 2005). Table 6 presents a crude index for difference levels of compliance.

Data reliability scores (Source: FAO, 2004)

Table 4.

Score	Source of data or information
5	Statistically designed, fishery-independent survey of abundance
4	Consistent and/or standardised catch-per-unit effort data from the fishery
3	Unstandardised catch-per-unit effort data from the fishery
3	Scientifically designed, structured interviews
3	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
0	Flawed analysis or interpretation of trends

Table 5. Fishery management quality scores

Score	Level of management
5	Goal-oriented management procedure validated using MSE approach
4	Goal-oriented management based on stock assessments
3	Species-level management measures, but not goal-oriented
2	Species-level catch data collected
1	Management agency (eg RFMO) exists, but not yet active on this species
0	No responsible management agency

Table 6. Fishery management compliance scores

Score	Level of compliance
3	Full or good compliance: effectiveness of management measures not materially impacted by non-compliance
2	Fair compliance: non compliance impacts the effectiveness of management measures, but can be roughly quantified and taken into account in stock assessments
1	Poor compliance: ability to manage stocks and/or conduct meaningful stock assessments is severely compromised
0	No compliance or no information on compliance

3.4 Statistical aspects of the criteria guidelines in the context of typical fisheries data

An important question is to what extent the decline guidelines specified in Footnote 1 to Annex 5 can be applied quantitatively using typical fisheries data. This is examined here under a number of scenarios.

3.4.1 Scenarios

Three levels of productivity are considered: (i) low productivity; (ii) borderline low/medium productivity; (iii) borderline medium/high productivity. The parameters for each level are shown in Table 7. The parameters for levels (ii) and (iii) have been selected by setting each parameter at the value corresponding to the boundaries between the low, medium and high productivity ranges defined by FAO (2001). The parameters for case (i) – low productivity – were chosen to provide approximately half the productivity of the low/medium border. In each case, a Beverton-Holt stock-recruitment relationship (Beverton and Holt, 1957) was assumed, with parameters chosen to give the specified intrinsic rate of increase r .

Three levels of fishing intensity are considered: (i) full exploitation ($F = F_{MSY}$); (ii) overexploitation ($F = F_{crit}$); and (iii) severe overexploitation ($F = 2 \times F_{crit}$). In case (i) the stock is not in danger of extinction; in case (ii) the stock will decline towards extinction, but at an ever-decreasing rate; in case (iii) the stock will decline more rapidly towards extinction. The fishing mortality rate is assumed to be independent of fish age, so that $F_{crit} = r$. While the assumption of size-unselective fishing usually does not hold in real cases, it is a fairly straightforward matter to adjust the calculations for the actual or assumed non-uniform selectivity pattern.

The values for F_{MSY} and B_{MSY} (as a fraction of the unexploited level) that result from the assumed parameter values are shown in Table 7.

Table 7. Stock dynamic parameters in the test scenarios

Parameter	Symbol	Productivity case		
		Low	Low/Medium	Medium/High
Natural mortality	M	0.10	0.20	0.50
Somatic growth rate	K	0.075	0.15	0.33
Age at maturity	t_{mat}	12	8.0	3.3
Intrinsic rate of increase	r	0.07	0.14	0.35
Relative biomass at MSY	B_{MSY}/B_0	0.406	0.407	0.418
MSY fishing mortality	F_{MSY}	0.026	0.050	0.124

It is assumed that an index of abundance is available with which the trends in the fish stock can be assessed, such as standardised catch per unit effort or a fishery-independent index of abundance. Broadly speaking, fishery indices of annual abundance rarely have a coefficient of variation (CV) much less than 0.2, a typical value is of the order of 0.3 while in some cases the CVs is 0.5 or more. Taking CVs of 0.2, 0.3 and 0.5 to represent ‘good’, ‘fair’ and ‘poor’ data, the probability that the population has declined to various extents can be estimated as a function of the observed rate of decline for these three cases.

The status of a fish population can be most accurately assessed if it is monitored from the start of exploitation. This is the ideal case, but is only realised for stocks on which fishing started relatively recently. Two alternative scenarios were considered: (i) fish stock unexploited at the start of monitoring; (ii) fish stock already fully exploited ($B = B_{\text{MSY}}$) at that start of monitoring.

The factors considered and the levels for each one are summarised in Table 8. There are a total of 54 different combinations (3 levels of productivity \times 3 levels of fishing intensity \times 3 levels of data precision \times 2 options for stock status at the start of monitoring).

For each of the 54 scenarios, the following statistics were computed for each year of the scenario:

- stock biomass level, relative to the unexploited level
- probability that the CITES listing criteria are satisfied
- time required for recovery of the stock to B_{MSY} if fishing stops

The latter is an index of how quickly easily an overfished situation could be remedied by management action.

Three listing criteria are considered:

(i) the Appendix I extent-of-decline criterion (stock decline to 10-20% of baseline, depending on productivity)

(ii) the Appendix II criterion Annex 2aA based on a projection that the stock will reach the Appendix I criteria within 10 years

(iii) the Appendix II criterion Annex 2a based on the stock being in the “buffer zone” (5-10% above the Appendix I extent-of-decline level: specified Conf. 9.24 Annex 5 footnote 1 paragraph 5).

In each case the decline was estimated by fitting a linear trend to the log abundance index assuming that the data points are log-normally distributed. In the case of criterion (ii) the fitted trend was projected for 10 years into the future. In each case a criterion was considered triggered when the data indicated this with 95% confidence.

It should be emphasised that these highly simplified scenarios are aimed at determining only the very broad features of the properties of the listing criteria as applied to exploited fish stocks. More realistic simulations, such as those of Beddington and Cooke (1983), take account of additional factors including recruitment variability.

Table 8. Summary of test scenarios

Factor	Levels	Definitions
Productivity	Low Low/Medium Medium/High	see table 7
Fishing intensity	Sustainable Overfished Severly overfished	$F = F_{MSY}$ $F = F_{crit}$ $F = 2 \times F_{crit}$
Data precision	Good Fair Poor	CV = 0.2 CV = 0.3 CV = 0.5
Initial status	Unexploited Fully exploited	$B = B_0$ $B = B_{MSY}$

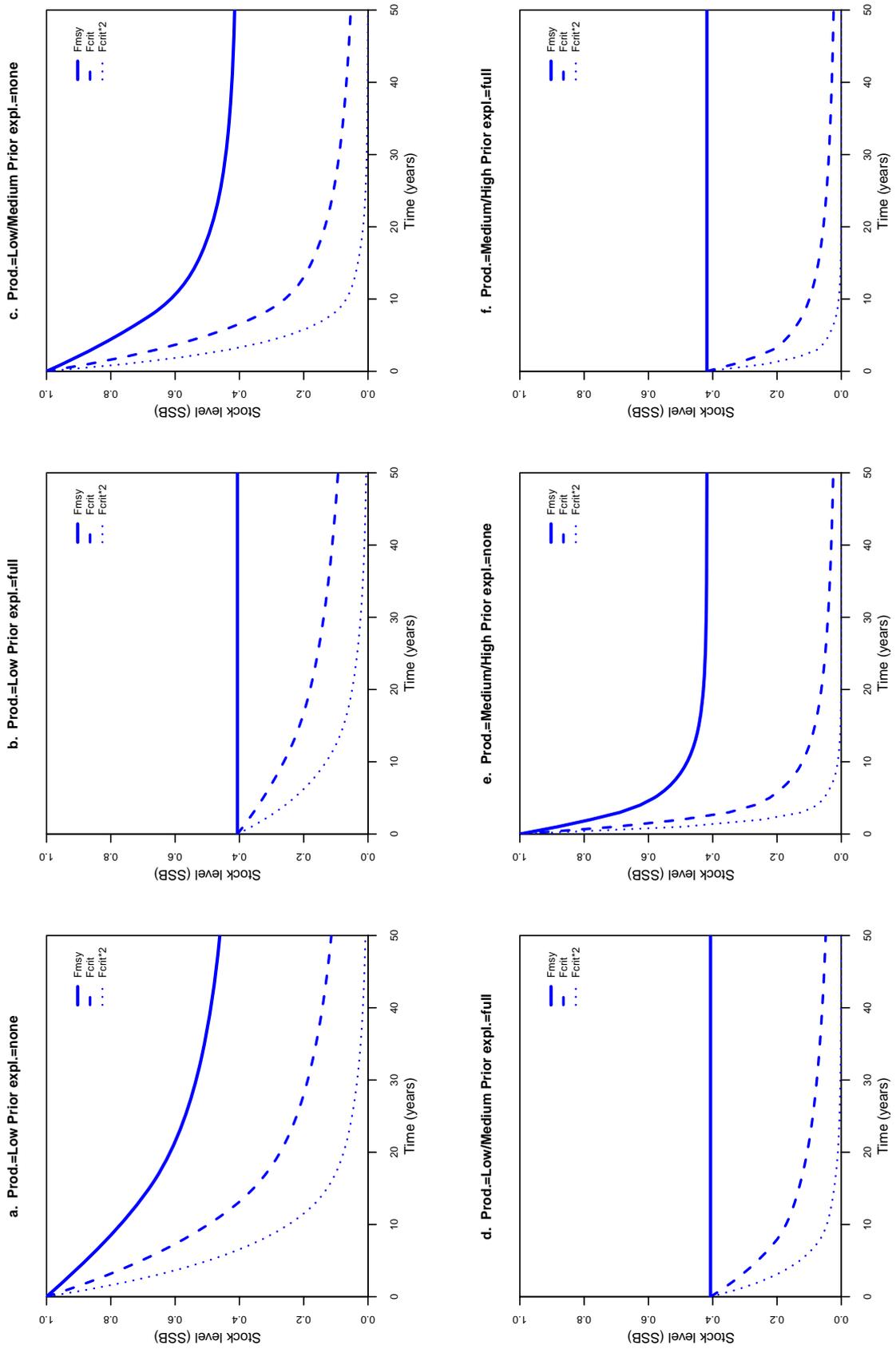


Fig. 3. Trends in population size (SSB) over time for the different scenarios.

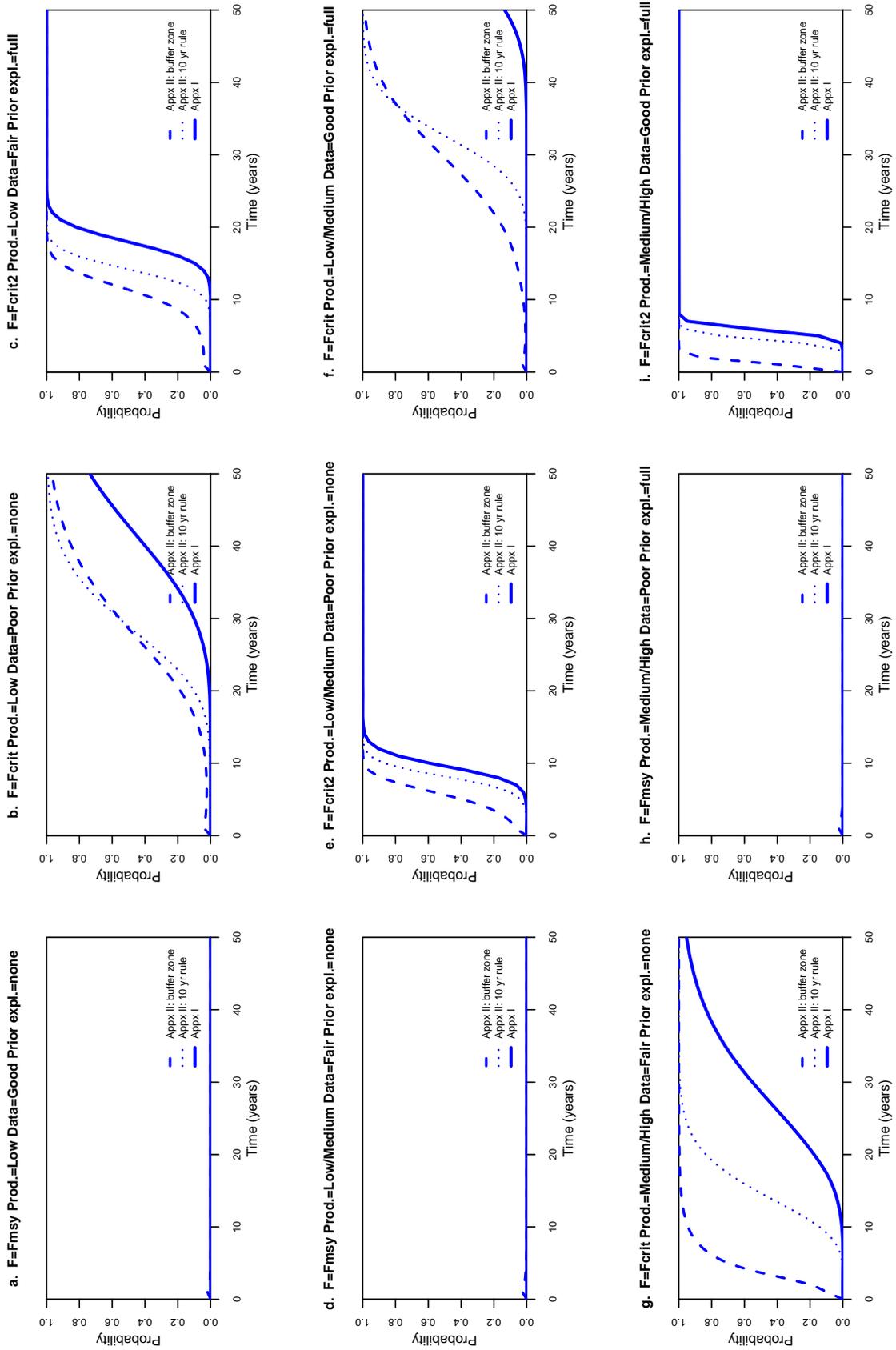


Fig. 4. Probability of triggering the listing criteria for the different scenarios (see text).

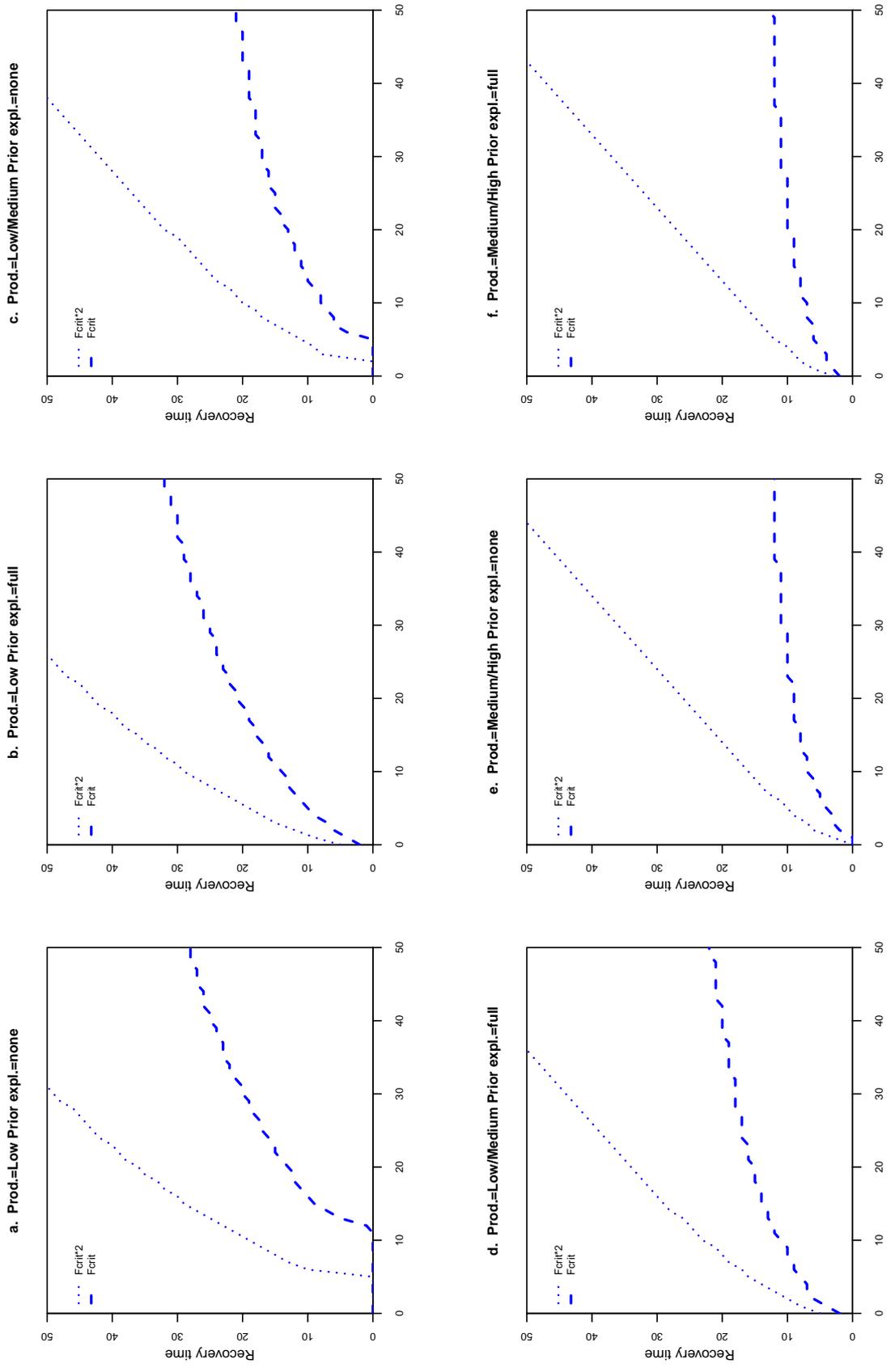


Fig. 5. Recovery time to MSY level on suspension of fishing, for each scenario (see text).

3.4.2 Results

Figs 3a-f show the stock biomass trajectories corresponding to each scenario. There are only six plots for the 54 scenarios, because the trajectories do not depend on data precision, and three levels of exploitation are shown on each plot.

Figs 4a-i show the probabilities of triggering each of the three sets of listing criteria as a function of time: results for 9 of the 54 scenarios are shown, selected on the basis of a partial factorial design.

In cases 4a, 4d, 4h, where the stock is fully exploited ($F = F_{MSY}$) but not overexploited, there is a negligible probability of any of the listing criteria being triggered (the curves barely rise above the x-axis). This shows that the probability of “unnecessarily” triggering the listing criteria for a population that is not overexploited is negligible.

Figs 4b, 4f, 4g are for the case of moderate overexploitation where the stock is at risk of extinction in the long term ($F = F_{crit}$). Depending on the scenario, the “buffer zone” criterion for Appendix II is triggered either before, or at about the same time, as the projection criterion. Generally there is a high probability of triggering an Appendix II criterion within the time horizon examined, but it can require over 40 years of data (see Figs 4b, 4f). By this time, the recovery time to B_{MSY} , even if fishing were stopped completely, is nearly 30 years in low productivity cases (Figs 5a, 5b). Under these circumstances, the Appendix II listing would need to be maintained on a zero-quota basis for a considerable period after coming into effect, for the population in question.

Figs 4c, 4e, 4i are for the case of severe overexploitation ($F = 2 \times F_{crit}$). The listing criteria are triggered sooner than with moderate overexploitation, but at a similar or greater degree of stock depletion, such that in low productivity cases, the recovery time even without fishing can exceed 30 years (Figs 5a-b).

3.4.3 Discussion

The results show that the decline guidelines specified in Footnote 1 to Annex 5 are not too conservative for a single population, in that populations which are fully exploited, but not overexploited, are very unlikely to satisfy the guidelines for a decline and qualify for listing.

The converse conclusion is that once a population species meets the guidelines for a decline, and hence satisfies criterion 2aA, then it is likely that $F \geq F_{crit}$ and that the population will decline gradually towards extinction if remedial management action is not taken.

Whether the guidelines are sufficiently conservative cannot be ascertained on the basis of these scenarios alone, because even for the case of “poor” precision of data they represent relatively favourable circumstances, to the extent that an annual index of abundance is assumed to be available. However, the results shown here suggest that, for population subject to continuous monitoring, the guidelines are sufficient to ensure that a species qualifies for listing before it is in imminent danger of extinction. In the absence of continuous monitoring, a more precautionary approach may be needed to ensure that lack of data does not result in lack of needed management action.

With respect to the objective of ensuring that exploitation is sustainable, the situation is less satisfactory. The results show that low productivity populations, once they meet the guidelines for a listing, are likely depleted to the point that several decades of protection will be required for them to recover, even under a complete cessation of fishing. To the extent that the purpose of an Appendix II listing is to allow trade to be regulated (rather than prohibited, as in the case of an Appendix I listing), it would be appropriate for species to be able to qualify for Appendix II when a decline towards the Appendix I thresholds is known or inferred to be occurring, but over a longer time horizon than the 10-year threshold for listing under criterion 2aA.

If individual populations of a species could be listed separately without problems, these results would apply directly to the case where there are multiple populations of a species that are subjected to potentially to different levels of fishing pressure and degrees of depletion. However, split-listing is generally discouraged because of the enforcement problems it creates (Conf 9.24 Annex 3). The issues surrounding cases where different populations of a species are differentially depleted, or where data are available only for some populations, are considered in section 5.

3.5 “Non-classical” fisheries

In the classical theory of fishing, the fish are assumed to be mobile, and the nature of the harvesting process is assumed to be unimportant, except for the issue of size selectivity of the catch, which is adequately handled by standard age-structured fish population models.

The guidelines contained in footnote 1 to Annex 5 appear to have been drafted with the classic fish model in mind: they may be less suitable for other cases, such as sessile species, or species whose distribution consists of multiple very small populations with very small ranges.

Almost all of the current harvest of the date mussel *Lithophaga lithophaga* (Proposal 13.35, adopted at CoP 13) involves destruction of the habitat in the course of the harvesting process. The operation is essentially a mining process, such that no non-zero level of harvest is sustainable. The value of F_{crit} for the harvest of this species in the wild is effectively zero. Non-detriment findings (NDFs) should in such cases be made contingent upon evidence that the specimens have not been harvested using destructive methods. Sustainable use of this species in the long term will probably need to be based primarily on farmed mussels.

In the case of the Banggai cardinalfish *Pterapogon kauderni* (Proposal 14.19, withdrawn) evidence was presented that some of the fishing involved successive extirpation of very local populations, such that the effective value of F_{crit} may be only a small fraction of that estimated from growth rates and classical stock recruitment relationships. In this case, strong management at the local level is required, and NDFs should be contingent on the specimen coming from a well-managed local population. This would likely require some form of certification scheme for local management arrangements.

Corals, such as *Corallium* spp. and *Paracorallium* spp. (Proposal 15.21) are often assessed by using the number of colonies per unit area as a measure of abundance for the purpose of estimating extents of decline. However, each colony consists of numerous individuals (polyps), and it is the number of

these, rather than the number of colonies, which determines the reproductive potential. Harvesting of a coral bed generally involves removal of most or all large colonies such that the average size of remaining and new colonies is much less than in the unharvested bed. The total weight, or total weight adjusted by appropriate conversion factors for living weight or biomass, will be a better measure of population size, analogous to the spawning stock biomass for fish. While it is not feasible or desirable to weigh living corals directly, sizes can be estimated, and an approximate size/biomass relationship used to provide an index of biomass for the assessment of trends.

For most *Corallium* species, beds have been depleted successively, starting with the most accessible ones (Bruckner and Roberts, 2009). Because the successful dispersal of larvae tends to be limited to relatively short ranges, sustainable harvest rates can be much lower than would be predicted from growth and recruitment rates. The low growth and recruitment rates of corals mean that the value of F_{crit} , calculated in the classical manner, will already be rather low. In the context of sequential depletion of beds, the effective value of F_{crit} can be much lower still. This implies that even relatively light exploitation can be unsustainable in the longer term, and could be deemed to be reducing the population to levels at which its survival would be threatened, albeit over a relatively long time horizon, unless there exists refuges or reserves that are known to be secure, and large enough to support self-sustaining populations.

4 Review of issues raised with respect to recent proposals to list commercially exploited marine species on Appendix II

4.1 Introduction

The proposals submitted to the last three Conferences of the Parties (CoPs 13, 14 and 15) to include commercially exploited marine species on Appendix II are listed in Table 1. Proposals to list species on Appendix I, or to transfer from Appendix I to II are not included.

Proposals to amend the Appendices with respect to commercially exploited marine species are subject to a series of consultations and evaluations:

- Range States: to be contacted by the proposer directly or through the CITES Secretariat, as specified in Annex 6 of Conf. 9.24. Their comments are to be appended to or included in a revised version the proposal if received in time.
- all Parties to CITES are invited to comment after receiving the proposal with an initial evaluation by the Secretariat
- the Regional Fishery Management Organisation having a function with respect to the species, if there is one.
- the FAO Panel meets and provides comments and recommendations in its report

- IUCN/Traffic provide an analysis of the proposal, focussing mainly on factual points.
- the CITES Secretariat provides its own revised evaluation and recommendations.
- CoP debate (in Committee I and sometimes also in plenary)

In the following sections, points raised with respect to each proposal during the above consultations are noted in so far as they may be relevant to the interpretation and application of listing criteria. This is not a comprehensive summary of points raised in relation to the proposals.

The focus of this analysis is on the identification of *issues* that may be relevant to the interpretation of the criteria. Therefore, the factual validity of assertions made with respect to individual species is not examined here. In most cases, no distinction is made between issues raised in support of or in opposition to a proposal. Where the same issue is raised by more than one evaluator, it is usually mentioned here only once.

4.2 Proposals to CoP 13

Proposals to CoP 13 were to be evaluated against the then current version of the criteria contained in 9.24 (original). However the FAO Panel (FAO, 2004), applied the draft version of the guidelines (CoP 13 Doc. 57) that were adopted at CoP 13. Some proposers may have worked from the intermediate draft of the criteria and guidelines that was posted as Conf. 9.24 (Rev. CoP12).

Proposal 13.32: *Carcharodon carcharias* (great white shark)

Basis: criteria 2aA and 2aB i,ii,

Justification:

- substantial declines in all areas for which data series are available.
- some international trade (takes on high seas, plus some exports of products such as teeth).

Range states:

- declines observed in some areas only, there is no global assessment, hence does not meet decline criterion
- very few catches, so hard to monitor

Other parties: main threat is catches in coastal waters; unclear whether international trade is a significant factor

FAO Panel: not possible to estimate the global decline and therefore not possible to judge whether the listing criteria are met.

CITES Secretariat:

- may meet Appendix II criteria overall
- the limited international trade may be detrimental to the survival of some populations.

CoP debate:

- management of the species is the responsibility of FAO and RFMOs
- insufficient evidence to determine that criteria are met
- international trade is not the primary threat

Proposal 13.33: *Cheilinus undulatus* (humphead wrasse)

Basis: criterion 2aB

Justification:

- substantial serial declines in the few areas for which data are available
- all catches are within EEZs but international trade in live fish is a significant threat factor in addition to catches for local consumption.

FAO Panel: meets criterion 2aB and possibly 2aA. The factors which have caused the declines in the areas with data are operative throughout the range.

IUCN/Traffic:

- high value and direct capture of individual fish means commercial extinction may not precede biological extinction
- readily recognisable in live trade, thus CITES implementation is practicable
- not subject to management by any other international body

CITES Secretariat: meets Appendix II criteria based on serial declines in all areas with data, and there is significant international trade.

CoP debate:

- data not available for all areas
- could set precedent
- management of the species responsibility of FAO

Proposal 13.35: *Lithophaga lithophaga* (date mussel)

Basis: Article I.2(a), criteria unspecified.

Justification: evidence for decline in area of occupied habitat due to harvesting, some of which is for international trade.

FAO Panel:

- species not at risk of extinction in near future because substantial areas of unexploited or lightly exploited habitat remain
- because the harvesting method involves destruction of habitat, the harvest is not sustainable (because the destroyed habitat cannot be recolonised) and the species is at risk in the long term
- CITES controls would not add much to existing controls; emphasis should be on enforcing existing controls

IUCN/Traffic:

- CITES listing would help to enforce existing protective regulations
- unclear whether harvest exceeds levels that can be sustained in perpetuity

CITES Secretariat:

- probably not overexploited for international trade in a significant portion of its range
- enforcing existing controls would be better than an Appendix II listing

4.3 Proposals to CoP 14

Proposals submitted to CoP 14 were the first to be evaluated exclusively against the revised version of the criteria in Conf. 9.24 (rev. CoP13).

Proposal 14.15: *Lamna nasus* (porbeagle shark)

Basis: criteria 2aA and 2aB

Justification: Historic declines meeting the quantitative decline criteria have been documented in all areas for which data are available. In the remaining areas, management measures are not in place to prevent similar declines. It is a valuable secondary target, and a primary target in some areas and on an opportunistic basis. International trade is not documented to the species level, but probably occurs because of the high value.

FAO Panel:

- global population probably does not meet decline criterion because southern hemisphere populations are believed to be relatively lightly exploited, but data are sparse
- some of the evidence for decline in NE Atlantic is questioned; decline in NW Atlantic is not questioned but management measures are now in place
- most catches, including all directed catches, are within EEZs and would not be subject to Introduction from the Sea controls under CITES; high seas catches consist only of by-catches from long-lining
- management measures are lacking in most areas and should be implemented at national level

IUCN/Traffic:

- species is specifically managed only in USA, Canada and New Zealand
- some international trade is known to occur, and probably is a driver for some catches, but is hard to quantify due to lack of species-level data

CITES Secretariat:

- species has declined to the extent of the 2aA guideline in the northern hemisphere
- lack of effective management in most areas and value of meat and fins indicates that regulation of trade may be required to avoid continuing declines, and therefore listing under 2aB would be justified

CoP debate:

- measures taken by NEAFC (an RFMO) are not mentioned in proposal
- main threat for the most depleted population (NE Atlantic) is domestic (EU) trade

Proposal 14.16: *Squalus acanthias* (spiny dogfish)

Basis: criteria 2aA and 2aB

Justification: Historic declines meeting the quantitative decline criteria have been documented in all areas for which data are available. In most of the remaining areas, management measures are not in place to prevent similar declines, or apply only to a small part of the migratory range. It is a high value fish with a tendency to aggregate and the aggregations are targeted by fisheries. There is substantial documented international trade, although global trade data are incomplete.

FAO Panel:

- although the population in the NE Atlantic meets the decline criteria, the global population does not, because in other areas the data show no declines, or lesser declines, or are considered unrepresentative
- effective management lacking in most of the world
- most catches, including all directed catches, are within EEZs and would not be subject to Introduction from the Sea controls under CITES; high seas catches consist only of by-catches from long-lining
- management measures are lacking in most areas and should be implemented at national level

IUCN/Traffic:

- catches of the species are driven in large part by its high value for international trade, and serial depletion of populations around the world appears to be occurring

CITES Secretariat:

- some populations have declined to the extent of the 2aA guidelines
- lack of effective management in most areas and demand for meat and fins in international trade suggests that regulation of trade may be required to avoid continuing declines, and therefore listing under 2aB would be justified

CoP debate:

- species is globally abundant ($> 10^9$ individuals)
- main threat for the most depleted population (NE Atlantic) is domestic (EU) trade
- management is satisfactory in some areas

Proposal 14.18: *Anguilla anguilla* (European eel)

Basis: criteria 2aA and 2aB

Justification:

- historic declines (1980-present) of glass (juvenile) eels exceed the 2aA guidelines
- capture and export of glass eels for eel aquaculture is a significant factor in the decline

FAO Panel:

- species clearly meets the decline criteria
- a substantial fraction enter international trade
- implementation of CITES controls would be relatively unproblematic

IUCN/Traffic: evidence for decline of adult eel populations more mixed, but declining in most surveyed locations

CoP debate:

- could result in proposals for similar species under look-alike criteria
- could be some implementation problems

Proposal 14.19: *Pterapogon kauderni* (Banggai cardinalfish)

Basis: criterion 2aB

Justification:

- declines of >90% observed in two populations, plus evidence that other populations are at a low fraction of baseline by comparison with an unexploited population;
- main threat is capture for the international aquarium trade.

FAO Panel:

- species has probably not declined below the guideline thresholds for criterion 2aA
- current exploitation may be sustainable
- risk of sequential extirpation of local populations
- local management initiatives show conservation promise

IUCN/Traffic:

- some evidence of serial depletion of local stocks
- apparent failure to rebuild depleted or extirpated populations
- possibility for compensatory effects related to group size

CITES Secretariat: satisfies criterion 2aB due to limited, fragmented distribution with small, isolated subpopulations vulnerable to extinction by collection for international trade

CoP debate: priority should be given to local management measures

Proposal 14.20: Brazilian populations of *Panulirus argus*, *P. laeviscauda* (spiny lobster)

Basis: criterion 2aB

Justification:

- apparent decline of ~90% in index of abundance over 50 years
- fishing mainly for international trade

FAO Panel:

- formal stock assessment shows no declining trend for *P. argus* over last 30 years
- exported catch could be diverted to domestic markets
- listing would be difficult to implement
- problem is lack of enforcement of existing national management measures

CITES Secretariat:

- listing of Brazilian populations only (split-listing II/-) is contrary to listing criteria

- an Appendix III listing would be more appropriate

CoP debate: (withdrawn)

Proposal 14.21: *Corallium* spp. (red, pink corals)

Basis: criterion 2aB

Justification:

- no quantitative assessment of decline, but history of serial overexploitation of new coral beds as they are found
- main threat is harvesting for trade, mainly international.

FAO Panel:

- no reliable data on population trends and no evidence that decline has been as much as 2aA guidelines
- genus not adequately managed in most of range
- listing would generate an administrative overhead: resources would be better expended on local management

CITES Secretariat: the species may not have declined as much as the 2aA guidelines, but the history of overharvesting in one area after another may justify listing under 2aB.

CoP debate:

The proposal was first debated in Committee I, where arguments against included:

- the FAO panel recommendation
- management measures already in place in some countries' waters
- there exist beds in deeper waters that are currently inaccessible to the harvest
- implementation issues, including uncertainty over treatment of personal effects

The Committee established a drafting group to draft a Decision (CoP 14 Com. I. 15) relating to implementation issues, including:

- identification of parts and derivatives in trade
- taxonomy and nomenclature
- discrimination of pre-Convention material from material harvested post-listing
- discrimination of fossil from non-fossil specimens
- management of harvests and making of non-detriment findings

Committee I accepted the proposal by the required 2/3 majority and referred the draft decision to the Plenary. The Plenary voted on the proposal again, where it failed to achieve a 2/3 majority. The draft Decision was not considered further.

4.4 Proposals submitted to CoP 15

Proposal 15.15: *Sphyrna lewini* (scalloped hammerhead shark)

Basis: criterion 2aA

Note: *S. mokarran*, *S. zygaena*, *Carcharhinus plumbeus*, *C. obscurus* were included in the proposal for Appendix II based on criterion 2bA (look-alike species), but *C. plumbeus* and *C. obscurus* were later withdrawn from the proposal, following advice that they are distinguished in trade.

Justification: Severe declines in almost all areas for which data exist. Species subject to both by-catch and targeted catch throughout its range: fins are a high-value product in international trade, hence declines suspected in areas for which data are lacking.

Range States:

- trend data not available for all areas
- some of the trend data is not disaggregated to species level, but represents the entire genus *Sphyrna* spp. and possibly other shark species caught together with them

FAO Panel: concurs with proposers' assessment for *S. lewini* but considers that *Carcharhinus* spp. are distinguished from *Sphyrna* spp. in trade and need not be listed under 2b.

CoP debate:

- lack of management action to date by RFMOs
- management at national level and by RFMOs is preferable to a CITES listing

Proposal 15.16: *Carcharhinus longimanus* (oceanic whitetip shark)

Basis: criterion 2aA

Basis:

- declines consistent with 2aA guidelines observed in all areas for which there are data.
- species is an oceanic bycatch, but fins have high value for international trade, thus discouraging live discards.

FAO Panel:

- probably meets Annex 2aA criteria, based on observed declines in all areas with data and probable similar vulnerability in other areas
- listing could encourage collection of species-level catch data

Range States:

- trend data not available for all areas
- listing could reduce provision of data

CoP debate: similar issues as for proposal 15.15.

Proposal 15.17: *Lamna nasus* (porbeagle shark)

Basis:

- criterion 2aA (North Atlantic, Mediterranean, and Southwest Atlantic stocks)
- criterion 2aB (other southern hemisphere stocks)
- criterion 2bA (remainder)

Justification:

- declines consistent with 2aA guidelines observed in the specified regions
- risk of similar declines in other regions
- listing of remaining populations on look-alike grounds

FAO Panel:

- populations representing most of the historical abundance globally meet the decline criteria for 2aA
- noting Conf. 9.24 Annex 4 requirement that measures be proportionate to the anticipated risks, listing the remaining populations based on criterion 2bA/B is justified
- additional information since proposal 14.15 warrants change in recommendation from rejecting to accepting proposal

IUCN/Traffic: most RFMOs do not require shark catch data to be submitted

Range States:

- trend data not available for all areas
- listing could reduce provision of data

CoP debate:

- lack of management action to date by RFMOs
- listing would improve supply of species-level catch and trade data
- management at national level and by RFMOs would be preferable to a CITES listing

Proposal 15.18: *Squalus acanthius* (spiny dogfish)

Basis:

- criterion 2aA (all northern hemisphere stocks, except possibly NE Pacific)
- criterion 2aB (stocks in several other regions (unspecified))
- criterion 2bA (remainder)

Justification:

- severe declines meeting 2aA criterion in most areas for which data exist
- demand for international trade is probable driving force behind most fisheries
- few species-level trade data

Range states:

- not overfished in some range states
- evidence of decline only for some areas
- CITES controls would be difficult to implement

FAO Panel:

- minority of populations meet the 2aA decline criteria
- listing species under a combination of 2a/2b when most populations do not meet 2a criteria would not be “proportionate to the anticipated risks to the species” (Conf. 9.24 Annex 4)

IUCN/Traffic: globally, the species is crudely estimated to have declined to about one-third of historic abundance, close to the guideline threshold for Appendix II in Annex 5 Footnote 1, assuming no decline in areas without trend data

CITES Secretariat:

- given the demand for meat in international trade, reasonable to consider that populations close to meeting 2aA guideline,
- can be deemed to satisfy the requirements of criterion 2aB, while the remainder satisfy 2bA
- interpretation of criterion 2aB different from FAO’s

CoP debate:

- national measures sufficient in some range states
- listing will help importing countries to identify products from sustainable sources

Proposal 15.21 Family *Corallidae* (*Corallum* spp. and *Paracorallum* spp.)

Basis:

- *C. rubrum*, *C. secundum*, *C. lauense* (= *C. regale*), *P. japonicum*, *C. elatius*, *C. konoji* and *C. sp. nov.* under criterion 2aB
- remainder under 2bA

Justification:

- no global estimate of decline, but history of serial overexploitation, driven by demand for international trade, as new beds are discovered
- management measures exist only in some areas, and are not sufficient for the slower-growing species

FAO Panel:

- no evidence of decline to 2aA thresholds for populations representing a large proportion of the abundance of the seven species
- catch declines not necessarily due to stock declines
- see also comments on Proposal 14.21

IUCN/Traffic:

- guidelines in Footnote 1 are based on conventional fisheries biology and management practice; they are not suitable for sessile, colonial organisms
- biomass may be a better measure of population size than number of colonies
- insufficient data to estimate global trend
- some populations likely to remain inaccessible to harvesting
- implementation problems due to large stockpiles

CITES Secretariat:

- accept Proposers' justification (interpretation of criterion 2aB different from FAO's)

CoP debate:

Arguments against the proposal included:

- there exist conservation efforts and laws in some range states
- GCFM (an RFMO in the Mediterranean) is the more appropriate management body
- declines in catches do not reflect declines in stocks
- there exist substantial populations outside known fishing areas
- none of the species are included on the IUCN Red List
- expected negative effects of the listing on the coral trade and livelihoods
- implementation problems including pre-Convention specimens

Arguments for the proposal, in addition to those in the Supporting Document, included:

- deepwater stocks also liable to be depleted if trade not regulated
- harvesting methods constitute mining, as they do not allow for regeneration of beds

4.5 Summary of issues raised in the evaluation and debate of proposals

The generic issues that were mentioned in relation to the proposals can be broadly classified into:

Substantive issues

- Major declines recorded in some areas only, but there is concern over the threat of serial overexploitation of populations, eventually resulting in global depletion
- Whether trade is a significant component of cumulative threats
- Whether a listing would be proportionate to the risks to the species

Data-related issues:

- Insufficient data on trends
- Data exist for some areas only: global status cannot be determined
- Lack of species-level data in catch and/or trade statistics

Management-related issues

- Role of RFMOs and national measures, sufficiency of existing management measures
- Practicality of CITES implementation
- Utility of CITES implementation

The different categories of issues are inter-related. For example, lack of species-level catch data is often the result of the relevant RFMO not having taken an interest in the species. The next section contains a discussion of how the above issues could be handled in the application of the listing criteria.

5 Discussion and recommendations

5.1 Data limitation and multi-population issues

The limitations of the available data will be a perennial problem for applying the criteria to commercially exploited marine species. As noted in section 2.1, the precautionary principle included in the UN Fish Stocks Agreement calls for caution when information is uncertain, unreliable or inadequate, and specifies that the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures. In the CITES context, Annex 4 (headed “Precautionary Measures”) to Conf. 9.24 specifies that in cases of uncertainty Parties shall act in the best interest of the conservation of the species concerned, and adopt measures that are proportionate to the anticipated risks to the species. This can be read as providing scope for steering a pragmatic course between the two extremes of taking no action in the absence of conclusive evidence, versus the basing of all decision on “worst case” assumptions.

The analysis in section 4 of recent proposals for listing commercially exploited marine species on Appendix II shows that the situation where data to support a listing are available in some regions only, but not globally, is a common one for marine species, but there are several distinct sub-cases, including:

- a) data for some areas show declines; no data for other areas, but fishing intensity suspected to be high even in areas without data
- b) data for some areas show declines; no data for other areas, but fishing intensity believed to be low in the areas without data
- c) data for some areas show declines; data for some other areas show stable or increasing trends; no data for the remaining areas

The lack of data from a region can be due to a variety of factors, such as:

- a) the species is rare in the region
- b) the species is common, but rarely caught in the gear employed to date

- c) the species regularly caught, but species-level catch data are not collected
- d) species-level catch data are collected, but no stock assessment or standardised trend analysis has yet been performed

The debates on the recent listing proposals for marine species have revealed that the most controversial cases tend to be those where a species shows severe declines in some areas, but is believed to be in a satisfactory situation in other areas.

In some cases where populations have shown severe declines in the more heavily fished areas, there is concern that serial depletion of populations occurring around the globe could ultimately threaten the species as a whole in the future. Here it is useful to distinguish between the following cases with regard to the situation in the areas for which there are no trend estimates:

- (a) fishing pressure may be high (i.e. comparable to that which has caused declines in other areas) due wholly or partly to demand for international trade.
- (b) fishing pressure is believed to be light (i.e. probably sustainable) , but is liable to rise in the face of unmet demand for international trade; pre-emptive management measures (at national or RFMO level) are not in place.
- (c) fishing pressure is believed to be light (i.e. probably sustainable) , and either:
 - (i) adequate management arrangements are in place; or
 - (ii) fishing pressure is not expected to increase.

A workable approach to applying the listing criteria needs to be capable of handling each of the above cases in an appropriate manner. For example a listing would appear warranted in cases where situation (a) or (b) is diagnosed, but not in case (c). There seems to be broad agreement that split-listing is not normally the best solution, because of the enforcement problems it creates. Conf. 9.24 Annex 3 specifies in particular that the listing of some populations of a species on Append II, while others remain unlisted, should be avoided.

The approach used in Proposals 15.17 and 15.18 (see section 4.4) was to base an Appendix II listing proposal for the species on the Annex 2aA criterion for those populations that meet this criterion, on the Annex 2aB criterion for those populations that meet that criterion, and on the Annex 2bA (look-alike) criterion for the remainder. The comments received on the proposals at the various stages in the process show that that this approach is most likely to find favour in those cases (such as 15.17) where the data indicate that the bulk of the world population meets the 2aA criterion, such that the listing decision is not driven by the status of the species in a small part of its range.

5.2 Management issues

The debates on recent listing proposals for commercially exploited marine species, summarized in section 4, reveal general agreement that in normal circumstances, RFMOs should be the primary

international management bodies for the species under discussion. However, for most of the species considered in the CITES context to date, the following situation has pertained in some or all regions:

- no RFMO responsible for the species
- no action by the RFMO nominally responsible for the species
- measures recommended or adopted by the RFMO are not enforced.

Absence of effective RFMO action was frequently cited as a contributory reason for seeking a listing.

A number of the comments have emphasised that it is not the task of CITES to usurp the role of RFMOs, but to complement it, for example by:

- (i) providing safeguards for species which are not yet subject to effective RFMO management; and/or
- (ii) helping to enforce RFMO measures where these are being undermined by international trade.

In the latter case, RFMO measures relating to Appendix II species can be supported by CITES Parties by a policy of issuing non-detriment findings only for exports (or introductions from the sea) which have documentation to prove that they were obtained in compliance with all applicable regulations of the RFMO (FAO, 2004b).

With regard to the incorporation of management-related considerations into the interpretation of listing criteria, the CITES Secretariat has, as discussed in section 2, already pointed the way in document CoP 15 Doc. 63 (cited in section 2.4), by noting that while criterion 2aA focuses on observed population trends, criterion 2aB has a more management-oriented emphasis. In particular the new wording of Annex criterion 2aB adopted at CoP 13 places a greater emphasis on management requirements than the previous version. Whether a species meets the new criterion 2aB depends on what is required to ensure that trade is not reducing the population to dangerous levels. The key is to identify those populations where management measures are already in place that will ensure that the population will not be depleted to dangerously low levels.

5.3 Recommendations

5.3.1 Proposal for an interpretation of criterion 2aB for commercially exploited marine species

In order to focus attention, at least initially, on those species which have been shown by the experience to date to be vulnerable to overfishing, there may be merit in combining both trend-related and management-related considerations in applying criterion 2aB.

The following is a suggestion for an additional guideline to the interpretation of criterion 2aB, which is designed to address the management-related and multi-population issues discussed in the above sections.

“Commercially exploited aquatic species whose global population does not satisfy criterion A of Annex 2a should be considered for inclusion in Appendix II under criterion B of Annex 2a

when one or more major populations satisfy criterion A, unless most of the remaining populations are subject to effective conservation or management arrangements (other than CITES trade controls) that are deemed sufficient to ensure that these populations will not be reduced by the effects of trade to levels that would satisfy criterion A or qualify the population for inclusion in Appendix I. “

The guidelines in Conf. 9.24 Annex 5, including the footnote relating to declines in commercially exploited aquatic species, would continue to be applied for the purpose of assessing whether specific populations meet the criteria for inclusion in Appendix I, or criterion 2aA for inclusion in Appendix II.

5.3.2 Explanation

The above proposal is designed to ensure that listing decisions remain “proportionate to the anticipated risks to the species” as specified in Conf.9.24 Annex 4, and do not result in a species becoming listed as a result of inadequate management in only a small part of its range.

The definition of “effective conservation or management arrangements” for the purpose of applying this guideline could be oriented towards current “best standard practice” in the field of fishery management. Currently, management at level 4 or higher on the scale proposed in Table 5 (section 3.3 of this paper) coupled with a compliance score of 2 or higher on the scale proposed in Table 6, could count as effective management, but the thresholds could be raised to scores of 5 and 3 respectively in the future when these become “industry standard”.

When a species is listed on Appendix II based on the above interpretation of criterion 2aB, a reasonable condition for issuing a non-detriment finding would be that both of the following requirements be satisfied:

(i) the specimens or products derive from a population that is:

(a) not overfished; and

(b) subject to management and compliance arrangements that meet the above standards;

and:

(ii) the specimens were harvested in accordance with the regulations of the competent national and international fishery management agencies.

5.3.3 Implementation of the proposal

If the above proposal is accepted as a basis for interpreting criterion 2aB for commercially exploited marine species, it will need to be applied by both the drafters of listing proposals and by the various agencies responsible for evaluating listing proposals (see section 4.1.). Fig. 6a shows, in the form of a flowchart, the steps that would be required to assess a species against the Appendix II listing criteria.

In the first instance, the data are reviewed to ascertain whether the entire species can be assessed against the decline criteria of Annex 5 at the global level. In some cases this is possible, even if trend data are not available for all regions. If approximate estimates of the absolute size of each

population are available, then a conservative estimate of the global extent of decline can be made by summing trend and abundance data across regions, on the assumption of no trend in those regions without data. An example of such a calculation is found in document CoP 15 Inf. 18 with respect to proposal 15.18.

If the species satisfies criterion 2aA at the global level, then no assessment relative to criterion 2aB is required. If there are insufficient data to estimate the global extent of decline, or if the global extent of decline does not satisfy criterion 2aA, but there is significant international trade in the species, then separate assessments of each regional population should be conducted, not with a view to listing regional populations, but in order that the results be fed into an evaluation of the species against criterion 2aB.

If none of the regional populations satisfy criterion 2aA, then the species is not considered a candidate for Appendix II (unless it is a look-alike candidate under criterion 2b due to similarity with other species in its genus).

If at least one regional population is found to satisfy criterion 2aA, this constitutes concrete evidence that the species, if not protected by appropriate management regulations, is potentially vulnerable to levels of overfishing that can endanger its survival in the longer term, for the reasons explained in section 3. In that case, the management status of each of the remaining regional populations should be assessed.

A regional population is deemed to satisfy criterion 2aB unless management measures are in place that ensure that it will not be reduced to levels that would satisfy criterion 2aA in the future. If most of the regional populations have management measures in place that are considered adequate in this sense, then the species does not qualify for listing under criterion 2aB. To be deemed adequate in this context, management arrangements should normally be at level 4 or 5 on the scale in Table 5, with associated compliance at level 2 or 3 on the scale in Table 6.

The schema for regional assessments is shown in Fig. 6b. These are structured similarly to the global assessment, but the results are fed into the global assessment instead of being used directly to guide listing decisions.

5.3.4 Final remark

The above suggestion for interpreting criterion 2aB for commercially exploited marine species is not fully precautionary or pre-emptive, because listing would only be considered for a species when at least one population of the species is already overfished. However, this is preferable to waiting until all populations are overfished. In the latter case, there would be little advantage in an Appendix II listing compared with an Appendix I listing, because there would be no cases where a non-detriment finding would be warranted.

Fig. 6a. Proposed flowchart for the global assessment of commercially exploited marine species relative to Appendix II criteria

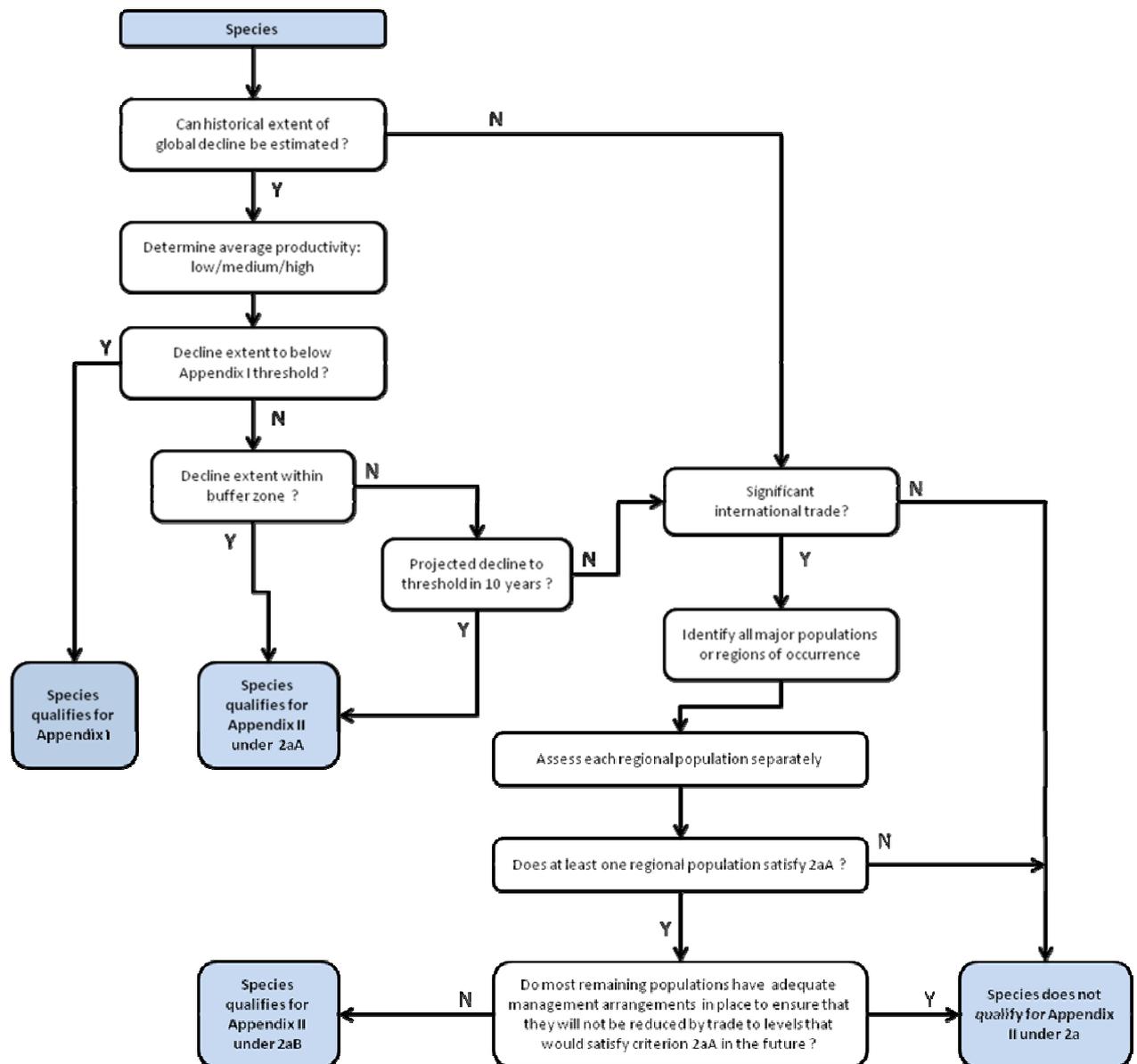
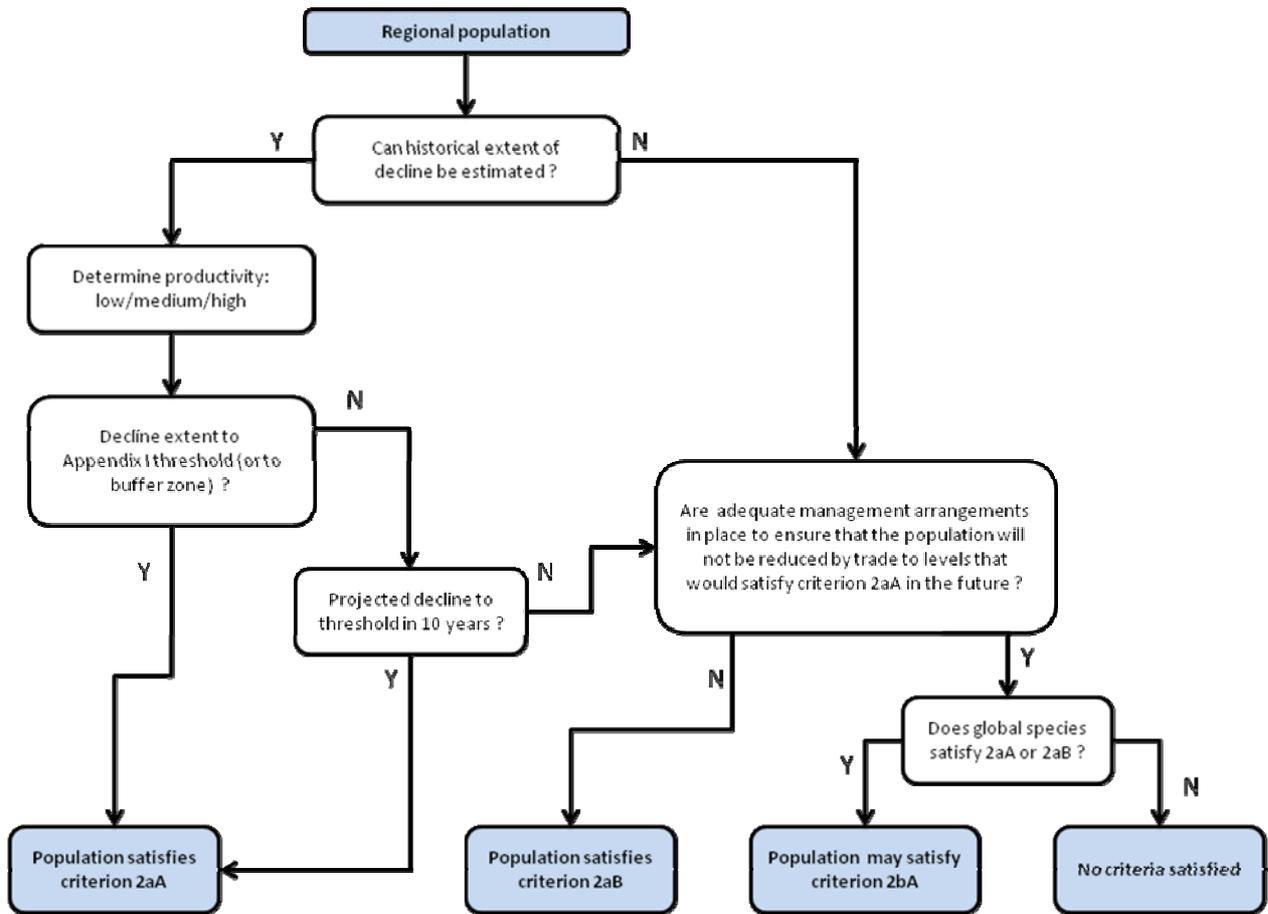


Fig. 6b. Proposed flowchart for the assessment of regional populations of commercially exploited marine species relative to Appendix II criteria



Note: the results of the regional assessment would not normally lead to a regional listing, but feed into the global assessment (see Fig. 6a).

LITERATURE CITED

I. CITES documents^{1,2}

Resolution Conf. 9.24. Criteria for amendment of Appendices I and II.

Resolution Conf. 9.24 Rev. CoP 12, Rev CoP 13, Rev CoP 15. (Subsequent revisions).

Resolution Conf. 14.6 (Rev. CoP15). Introduction from the Sea.

CoP 12 Doc. 58. Criteria for amendment of Appendices I and II (draft revision).

CoP 12 Inf. 5. Report of the Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species (FAO).

¹ available from www.cites.org

² not including submitted proposals to amend the Appendices

CoP 13 Doc. 57 Annex 3. Criteria for amendment of Appendices I and II (draft revision).

CoP 13 Doc. 60. Proposals to amend Appendices I and II.

CoP 13 Inf. 20. IUCN/TRAFFIC analyses of proposals to amend the CITES Appendices.

CoP 14 Com. I. 15. *Corallium* spp.: Draft Decisions of the Conference of the Parties.

CoP 14 Doc. 68. Proposals to amend Appendices I and II.

CoP 14 Inf. 13. IUCN/TRAFFIC Analyses of the proposals to Amend the CITES Appendices.

CoP 14 Inf. 48. Comments on the FAO assessment of the CITES amendment proposals to list the porbeagle (*Lamna nasus*) and the spiny dogfish (*Squalus acanthias*) on Appendix II of CITES.

CoP 14 Inf. 64. The interpretation of Annex 2 a (criteria for the inclusion of species in Appendix II in accordance with Article II, paragraph 2 (a), of the Convention and Annex 5 (Annex 5: Definitions, Explanations and Guidelines) of Resolution Conf. 9.24 (Rev. CoP13) in relation to commercially-exploited aquatic species (submitted by FAO).

CoP 15 Doc. 63. Criteria for the inclusion of species in Appendices I and II (draft revision).

CoP 15 Doc. 68. Proposals to amend Appendices I and II.

CoP 15 Inf. 18, 18A. Analyses of the proposals to amend the CITES Appendices (IUCN/TRAFFIC).

Decision 14.48 (Rev. CoP15). Introduction from the Sea.

Decisions 15.28, 15.29, 15.30. Criteria for the inclusion of species in Appendices I and II.

SC54 Doc. 10A. Memorandum of Understanding between the Secretariats of FAO and CITES.

SC 58 Doc. 43. Criteria for amendment of Appendices I and II.

II. Other references

Beddington J.R. and Cooke J.G. 1983. The potential yield of fish stocks. *FAO Fish. Tech. Pap.* 242 (47pp).

Beverton R.J.H. and Holt S.J. 1957. On the dynamics of exploited fish populations. *Fishery Investigations Ser. II, Vol. XIX.* HMSO, London. 532pp.

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

Butterworth D.S. 2007. Why a management procedure approach? Some positives and negatives. *ICES J. Mar. Sci.* 64(4): 613-617.

Cooke J.G. 1999. Improvement of fishery-management advice through simulation testing of harvest algorithms. *ICES. J. Mar. Sci.* 56(6):797-810.

FAO. 2001. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-Exploited Aquatic Species. Windhoek, Namibia, 22-25 October 2001. *FAO Fish. Rep.* 667.

FAO. 2004. Report of the FAO ad hoc Advisory Panel for the Assessment of Proposals to amend Appendices I and II of CITES concerning commercially exploited aquatic species. Rome, 26-30 March 2009. *FAO Fish. Rep.* 748. (51pp.)

FAO. 2004b. Report of the expert consultation on implementation issues associated with listing commercially-exploited aquatic species on CITES appendices. Rome, 25–28 May 2004. *FAO Fish. Rep.* 741. (24pp).

FAO. 2005. The 2005 Rome Declaration on Illegal, Unreported and Unregulated Fishing. <ftp://ftp.fao.org/fi/document/ministerial/2005/iuu/declaration.pdf>

FAO. 2007. Report of the 2nd FAO ad hoc Advisory Panel for the Assessment of Proposals to amend Appendices I and II of CITES concerning commercially exploited aquatic species. Rome, 26-30 March 2009. *FAO Fish. Rep.* 833. (133pp.)

FAO. 2010. Report of the 3rd FAO ad hoc Advisory Panel for the Assessment of Proposals to amend Appendices I and II of CITES concerning commercially exploited aquatic species. Rome, 7-12 December 2009. *FAO Fish. Aq. Rep.* 925. (150pp.)

Gulland J. A (ed.) 1977. *Fish Population Dynamics*. Wiley, London.372pp.

Haddon M. 2011. *Modelling and Quantitative Methods in Fisheries*. 2nd Edn. Chapman & Hall, New York. 465pp.

Holland, D. S. 2010. Management Strategy Evaluation and Management Procedures: Tools for Rebuilding and Sustaining Fisheries. *OECD Food, Agriculture and Fisheries Working Papers*, No. 25, OECD Publishing. doi: 10.1787/5kmd77jvhvkjf-en

Liermann M. and Hilborn R. 1997. Depensation in fish stocks: a hierarchic Bayesian meta-analysis. *Can. J. Fish. Aquat. Sci.* 54(9): 1976-84.

Musick J.A. 1999. Criteria to define extinction risk in marine fishes; the American Fisheries Society Initiative. *Fisheries* 24:6-14.

Myers R.A. and Worm. B. 2005. Extinction, survival or recovery of large predatory fishes. *Phil. Trans. R. Soc. B* 360:13-20

Punt A.E. and Donovan G.P. 2007. Developing management procedures that are robust to uncertainty. *ICES J. Mar. Sci.* 64(4): 603–612.

Smith A.D.M., Sainsbury K.J. and Stevens R.A. 1999. Implementing effective fisheries-management systems – management strategy evaluation and the Australian partnership approach. *ICES. J. Mar. Sci.* 56(6):967-979.