

CITES

Proposed revision of Resolution Conf. 9.24 (CoP12 Com. I. 3)

Criteria for listing on Appendix I and Appendix II

Test of the applicability of the criteria

This document has been prepared to facilitate the assessment of the proposed revision of Resolution Conf. 9.24 (CoP12 Com. I. 3) using an individual plant or animal taxon.

Notice to reviewers: This review should focus on whether the criteria in Table 1, Table 2 and the accompanying definitions, explanations, and guidelines in Annex 5, are biologically sound and applicable for the taxon under review. The purpose of this

review is not to determine whether the current listing status of the taxon under review is appropriate.

Registration Form and Contact Details

Please fill in the details below and send the completed document, as appropriate, to the Chairman of the Animals Committee or the Chairman of the Plants Committee.

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Taxon reviewed (including common and taxonomic names):

Gray whale, *Eschrichtius robustus*

Eastern North Pacific Stock

Please return your completed paper or electronic document to one of the below:

<p>Margarita A. Clemente Muñoz Presidenta del Comité de Flora CITES Universidad de Córdoba / Jardín Botánico Avenida de Linneo s/n E-14004 CÓRDOBA Spain / España / Espagne email cr1clmum@uco.es</p>	<p>Thomas Althaus Chair of the CITES Animals Committee Federal Veterinary Office Schwarzenburgstrasse 161 CH-3097 LIEBEFELD Switzerland / Suiza / Suisse email: thomas.althaus@bvet.admin.ch</p>
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Instructions on conducting the criteria review

- Tables 1 and 2 outline the proposed draft criteria for listing species on Appendix I and Appendix II of CITES, respectively. These should be read in conjunction with the definitions, explanations, and guidelines included in the proposed amendment of Annex 5.
- Please test the criteria for Appendix I and II using the information you have for the taxon selected i.e. fill out Table 1 and Table 2. This allows a more complete test of the criteria in the short time allowed to us.
- If you fill in this form electronically then these definitions and explanations can be accessed by clicking on the Hyperlink within the table (or 'Ctrl' and click). To get back to the text after clicking a Hyperlink you click on the 'Back' arrow in the Web toolbar (if this is not set up in your version of Word then go to 'View' in the Word menu, then 'Toolbars' and click on 'Web').
- We have provided a copy of the definitions and explanations (Annex 5) at the end of this document for those who wish to fill in the tables as a hard copy.
- Using the data available to you for your chosen taxon please indicate the key data that you used to make your decision, and any problems you had in interpreting or applying the criteria for your chosen taxon.
- Once completed, please send electronic copies and/or hard copies of the review, as appropriate, to the Chair of the Plants Committee or Animals Committee.
- Thank you for taking part in this process.

The Completed forms must be returned by 31 October 2003

Table 1 – Comments from reviewer on applicability of criteria for listing on Appendix I

<p style="text-align: center;">CRITERON</p> <p>For your information for a species to fulfill the draft criteria for Appendix I it must meet the trade criteria and at least one of the criteria A-D.</p>	<p style="text-align: center;">NOTES</p> <p>Whenever appropriate, indicate ways in which this criterion and definitions, explanations and guidelines could be improved and/or quantified to better suit this taxon and its relatives (If you need additional space, please use a separate sheet of paper).</p> <p>For the following specific questions, if a point estimate is not available, please provide a likely range of values (e.g., “about 6,000 – 10,000 individuals”) or some kind of rough estimate or inference (e.g., “likely to be less than 500 square kilometres”). Please try to make a numerical guess or give a verbal description and only use DNW (Do Not Know) if there is truly no information available on the quantity in question.</p>
<p>Trade Criterion Is or may the <u>species</u> be <u>affected by trade</u>?</p>	<p>No because there is no market for gray whale products. About 140-170 animals from this population are taken annually for aboriginal subsistence purpose under IWC regulation, and the products are limitedly used by locals. Any future take for commercial purpose in the future will be under control by the IWC using the conservative RMP so that, the level of harvest and trade in that case will not affect the population</p>
<p>A) The <u>wild population is small</u>, and is characterized by at least one of the following (see definitions below):</p>	<p>What was/is the estimated size of the <u>population</u>? Please include units of measurement.</p> <p>Does not meet this listing criterion. The wild population is not small. The IWC has recognized a population size of 26,300 animals (data from 1997/98) (IWC web site), and it is generally believed the population is reaching to the carrying capacity</p>

<p>A)(i) an observed, inferred or projected <u>decline</u> in the number of individuals or the area and quality of habitat; or</p>	<p>Does not meet this listing criterion. The historical distribution of this population is assumed to be similar to the present distribution. There is no evidence of decline in quality of habitat. On the contrary, according to the IWC reference, and assuming a constant rate of increase, this stock was increasing at a rate of 3.2% over the period 1967/68-1987/88 even under an average annual catch of 174 whales (IWC web site)</p>
<p>A)(ii) each <u>sub-population being very small</u>; or</p>	<p>What were/are the estimated sizes of the <u>subpopulation(s)</u>? Please include units of measurement.</p> <p>Does not meet this listing criterion. There are genetic differences between western and eastern North Pacific gray whale populations. However, there is no evidence of sub-population structure within the eastern North Pacific population. Whales breed promiscuously and mix in their winter assembly making population structure within the nuclear genome highly unlikely. Photo-id studies suggest possible site fidelity to feeding grounds but these data are scarce and not conclusive (report presented to the IWC/SC, SC/52/SD3)</p>
<p>A)(iii) a majority of individuals, during one or more life-history phases, being concentrated in one <u>sub-population</u>; or</p>	<p>See above</p>
<p>A)(iv) large short-term <u>fluctuations</u> in the number of individuals appropriate to measuring population size for the species concerned;</p>	<p>If the population was/is characterized by large short-term <u>fluctuations</u> in the numbers of individuals, what was/is the average magnitude in orders of magnitude? What was/is the average period of fluctuation in years?</p> <p>Does not meet this listing criterion. Estimates in 2000/01 (18,246) and 2001/02 (16,848) (presented to the IWC/SC meeting in 2003) are considerably lower than that made in 1997/98 (26,300). However such fluctuation is within the level of CV of each estimate and another possible reason might be due to an effect after the population reached or exceeded its carrying capacity.</p>
<p>A)(v) a high <u>vulnerability</u> due to the species' biology or behaviour (including migration).</p>	<p>Does not meet this listing criterion. In a part of the feeding habitat whales have been taken by aboriginal whaling but this activity is strictly regulated by the IWC (see Cii). On the breeding habitat whale watching activities are conducted but such activities are regulated and they do not affect the population. An unusual high number of stranding was observed in 1999 and 2000. However this can be interpreted as an effect after the population reached or exceeded its carrying capacity.</p>

<p>B) The wild population has a restricted <u>area of distribution</u> and is characterized by at least one of the following (see definitions below):</p>	<p>What was/is the estimated <u>area of distribution</u>? If listing on the basis of one or more <u>sub-populations</u>, what were/are the estimated areas of distribution of the subpopulation(s)? Please include units of measurement?</p>
	<p>Does not meet this listing criterion. The population has not a restricted area of distribution. The eastern North Pacific population distributes widely from summer feeding grounds in the Bering, Chukchi and western Beaufort Seas to its wintering and calving areas off the coast of Baja California</p>
<p>B)(i) <u>fragmentation</u> or occurrence at very few locations; or</p>	<p>Does not meet this listing criterion. There are no evidence on sub-populations</p>
<p>B)(ii) large fluctuations in the <u>area of distribution</u> or the number of <u>sub-populations</u>; or</p>	<p>Does not meet this listing criterion. As a migratory species, gray whales from the eastern North Pacific seasonally move between feeding (summer) and breeding area (winter) along the North America western coast. The historical distribution of this population is assumed to be similar to the present distribution. There is no evidence of sub-populations</p>
<p>B)(iii) a high <u>vulnerability</u> due to the species' biology or behaviour (including migration); or</p>	<p>Does not meet this listing criterion (see A)(v)).</p>
<p>B)(iv) an observed, inferred or projected decrease in any one of the following:</p>	
<ul style="list-style-type: none"> • the <u>area of distribution</u>; or 	<p>Does not meet this listing criterion (see B) and B) (ii))</p>
<ul style="list-style-type: none"> • the area of habitat; or 	<p>Does not meet this listing criterion</p>
<ul style="list-style-type: none"> • the number of <u>sub-populations</u>; or 	<p>Does not meet this listing criterion (see A) (ii))</p>
<ul style="list-style-type: none"> • the number of individuals; or 	<p>Does not meet this listing criterion (see A) (i))</p>

<ul style="list-style-type: none"> the quality of habitat; or 	Does not meet this listing criterion
<ul style="list-style-type: none"> the recruitment. 	Low recruitment was observed in 1999, 2000 and 2001 but this is interpreted as an effect after the stock reached or exceeded the carrying capacity. The calf production has recently improved to approximately the mid-range of pre- 1999 levels (IWC/SC report of the 2003 meeting)
<p>C) A marked <u>decline in population size in the wild, which has been either</u> (see definitions below):</p>	<p>Historical extent of <u>decline</u> - To what extent has the <u>population</u> or the <u>area of distribution</u> (please specify which) declined since historical times (i.e., going back 100 years or more if known; else based on whatever information is available)? (Ex. The ___ has declined down to ___% of the historical levels of ___ years ago.)</p> <p>Recent rate of <u>decline</u> - Characterize the recent (10-20 year) trends in population size or area of distribution (please specify which).</p>
	Does not meet this listing criterion (see A) (i))
<p>C)(i) observed as ongoing or as having occurred in the past (but with a potential to resume); or</p>	Does not meet this listing criterion (see A) (i))
<p>C)(ii) inferred or projected on the basis of any one of the following:</p>	
<ul style="list-style-type: none"> a decrease in area of habitat; or 	Does not meet this listing criterion
<ul style="list-style-type: none"> a decrease in quality of habitat; or 	Does not meet this listing criterion
<ul style="list-style-type: none"> levels or pattern of exploitation; or 	Does not meet this listing criterion. The IWC agreed that a take of up to 463 whales per year is sustainable for at least the medium term (30 years) and is likely to allow the population to remain above MSYL.

<ul style="list-style-type: none"> • threats from extrinsic human-induced factors such as competition/predation by introduced species or the effects of hybridization, toxins and pollutants; or 	Does not meet this listing criterion
<ul style="list-style-type: none"> • a decreasing recruitment 	Low recruitment was observed in 1999, 2000 and 2001 but this is interpreted as an effect after the stock reached or exceeded the carrying capacity. The calf production has recently improved to approximately the mid-range of pre- 1999 levels
D) If not included in Appendix I, is likely to satisfy one or more of criteria A-C within 5 years?	Unlikely

For criteria **A)(v)** and **B)(iii)**, please check which if any of the vulnerability factors listed below apply:

- | | | |
|--|---|---|
| <input type="checkbox"/> low fecundity
<input type="checkbox"/> slow growth rate
<input type="checkbox"/> high age at first maturity
<input type="checkbox"/> distorted age, size or sex ratio
<input type="checkbox"/> complex social structure
<input type="checkbox"/> extensive migratory behaviour
<input type="checkbox"/> strong aggregating behaviour (e.g., schooling)
<input type="checkbox"/> low population density (for sessile or semi-sessile species) | <input type="checkbox"/> specialized niche requirements (e.g. diet and habitat)
<input type="checkbox"/> species associations such as symbiosis and other forms of co-dependency
<input type="checkbox"/> fragmentation and habitat loss
<input type="checkbox"/> reduced genetic diversity
<input type="checkbox"/> depensation (prone to continuing decline, even in the absence of exploitation)
<input type="checkbox"/> high degree of endemism | <input type="checkbox"/> threats from disease
<input type="checkbox"/> threats from invasive species
<input type="checkbox"/> threats from rapid environmental change (e.g. climate regime shifts)
<input type="checkbox"/> selectivity of removals (that may compromise recruitment)
<input type="checkbox"/> Other (please specify) |
|--|---|---|

Table 2 – Comments from reviewer on applicability of criteria for listing on Appendix II

<p style="text-align: center;">Criterion</p> <p>For your information for a species to fulfill the draft criteria for Appendix II it must meet at least one of the criteria A-D.</p>	<p style="text-align: center;">NOTES</p> <p>Whenever appropriate, indicate ways in which this criterion and definitions, explanations and guidelines could be improved and/or quantified to better suit this taxon and its relatives (If you need additional space, please use a separate sheet of paper).</p>
<p>Trade Criterion Is or may the <u>species</u> be <u>affected by trade</u>?</p>	<p>No because there is no market for gray whale products. About 140-160 animals from this population are taken annually for aboriginal subsistence purpose under IWC regulation, and the products are limitedly used by locals. Any future take for commercial purpose in the future will be under control by the IWC using the conservative RMP so that, the level of harvest and trade in that case will not affect the population</p>
<p>A) It is known, or can be inferred, that the regulation of trade in the species is necessary to avoid it becoming eligible for inclusion in Appendix I in the near future.</p>	<p>Does meet this listing criterion.</p>
<p>B) It is known, or can be inferred or projected, that harvesting of specimens from the wild for international trade has, or may have, a detrimental impact on the species by either:</p>	
<p>B)(i) Exceeding, over an extended period, the level that can be continued to perpetuity.</p>	<p>Does not meet this listing criterion. There is no international trade for gray whale meat products. Any future take from this population for commercial purposes will be in the context of the IWC-adopted RMP, which is conservative. Catch quotas derived from the RMP will not affect the population.</p>
<p>B)(ii) Reducing it to a population level at which its survival would be threatened by other</p>	<p>Does not meet this listing criteria (see above)</p>

influences.	
C) 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 a non-expert, with reasonable effort, is unlikely to be able to distinguish between them.	<p>This criterion is not applicable since gray whale meat will not enter into international trade. There is no commercial market and a demand for gray whale meat. Even if there were international trade and even though ‘a non-expert, with reasonable effort, is unlikely to distinguish between them’ (gray whale meat and meat from other species of whale) such problem could easily be resolved by requiring trade be accompanied by certificates showing genetic profiles.</p>
D) There are compelling reasons, other than those given in C to ensure that effective control of trade in currently listed species is achieved.	<p>Does meet this listing criterion. Effective control of trade will be assured by an effective DNA registry and routine DNA surveys in the market.</p>

For criteria A) and B), please check which if any of the vulnerability factors listed below apply:

- | | |
|--|---|
| <input type="checkbox"/> low fecundity | <input type="checkbox"/> fragmentation and habitat loss |
| <input type="checkbox"/> slow growth rate | |
| <input type="checkbox"/> high age at first maturity | <input type="checkbox"/> reduced genetic diversity |
| <input type="checkbox"/> distorted age, size or sex ratio | <input type="checkbox"/> depensation (prone to continuing decline, even in the absence of exploitation) |
| <input type="checkbox"/> complex social structure | <input type="checkbox"/> high degree of endemism |
| <input type="checkbox"/> extensive migratory behaviour | <input type="checkbox"/> threats from disease |
| <input type="checkbox"/> strong aggregating behaviour (e.g., schooling) | <input type="checkbox"/> threats from invasive species |
| <input type="checkbox"/> low population density (for sessile or semi-sessile species) | <input type="checkbox"/> threats from rapid environmental change (e.g. climate regime shifts) |
| <input type="checkbox"/> specialized niche requirements (e.g. diet and habitat) | <input type="checkbox"/> selectivity of removals (that may compromise recruitment) |
| <input type="checkbox"/> species associations such as symbiosis and other forms of co-dependency | <input type="checkbox"/> Other (please specify) |

Definitions, explanations and guidelines

Species

In Article I of the Convention the term species is defined as "any species, subspecies or geographically separate population thereof".

Species and subspecies refer to the biological concept of a species, and do not require any further definition.

The two terms also cover varieties.

"Geographically separate population" refers to parts of a species or a subspecies within particular geographical boundaries. This can also refer to populations or subpopulations, or, for the sake of convenience in certain cases, to 'stocks' as the term is understood in fisheries management.

Until now, the Conference of the Parties has interpreted 'geographically separate populations' as populations delimited by geopolitical boundaries, whereas they have rarely used the other option of geographical boundaries.

Affected by trade

A species "is or may be affected by trade" if:

1. it is known to be in trade, and that trade has or may have a detrimental impact on the status of the species; or
2. it is suspected to be in trade, or there is potential international demand for the species, that may be detrimental to its survival in the wild.

Area of distribution

Area of distribution of a species is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of occurrence, excluding cases of vagrancy and introductions outside its natural range (though inferring and projecting area of occurrence should be undertaken carefully, and in a precautionary manner). The area within the imaginary boundary should, however, exclude significant areas where the species does not occur, and so in defining an area of distribution, account should be taken of discontinuities or disjunctions in the spatial distribution of species. For migratory species, the area of distribution is the smallest area essential at any stage for the survival of that species (e.g., colonial nesting sites, feeding sites for migratory taxa, etc.). For some species for which data were available to make an estimate, a figure of less than 10,000 km² has been found to be an appropriate guideline (not a threshold) of what constitutes a restricted area of distribution. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Decline

A decline is a reduction in the abundance, or area of distribution, of a species. Decline can be expressed in two different ways: (i) the overall long-term extent of decline or (ii) the recent rate of decline. The long-term extent of decline is the total estimated or inferred percentage reduction from a baseline level of abundance or area of distribution. The recent rate of decline is the percentage change in abundance or area of distribution over a recent time period. The data used to estimate or infer a baseline for extent of decline should extend as far back into the past as possible.

A general guideline for a marked historical extent of decline is a percentage decline to 5%-30% of the baseline, depending on the reproductive biology of the species. The extremes of 5% and 30% will be applicable to only a relatively small number of species, but some species may even fall outside of these extremes. However, both these figures are presented only as examples, since it is impossible to give numerical values that are applicable to all taxa because of differences in their biology (*see footnote with respect to application of decline to commercially exploited aquatic species).

A general guideline for a marked recent rate of decline is a percentage decline of 50% or more in the last 10 years or three generations, whichever is the longer. If the population is small, a percentage decline of 20% or more in the last 5 years or 2 generations (whichever is the longer) may be more appropriate. However, these figures are presented only as examples, since it is impossible to give numerical values that are applicable to all taxa because of differences in their biology.

The historical extent of decline and the recent rate of decline should be considered in conjunction with one another. In general, the higher the historical extent of decline, and

* Application 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.

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'.

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.

the lower the productivity of the species, the more important a given recent rate of decline is.

In estimating or inferring the historical extent of decline or the recent rate of decline, all relevant data should be taken into account. A decline need not necessarily be ongoing. If data are available only for a short period and the extent or rate of decline based on these data are cause for concern, the guidelines above (extrapolated as necessary or relevant) should still apply. However, natural fluctuations should not normally count as part of a decline, but an observed decline should not necessarily be considered part of a natural fluctuation unless there is evidence for this. A decline that is the result of legal activities carried out pursuant to a harvesting programme that reduces the population to a planned level, not detrimental to the survival of the species, is not covered by the term "decline".

Extended period

The meaning of the term extended period will vary according to the biological characteristics of the species. Selection of the period will depend upon the observed pattern of natural fluctuations in the abundance of the species and on whether the number of specimens removed from the wild is consistent with a sustainable harvesting programme that is based on these natural fluctuations.

Fluctuations

Fluctuations in population size or area of distribution are considered large when the population size or area in question varies widely, rapidly or frequently. Where data exist to make an estimate, one order of magnitude has been found to be an appropriate guideline (not a threshold) for population size. Similarly, fluctuations can be considered 'short term' if the period of fluctuation is about two years. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Fragmentation

Fragmentation refers to the case where most individuals within a taxon are found in small and relatively isolated sub-populations, which increases the probability that these small sub-populations will become extinct and the opportunities for re-establishment are limited. For some species in trade where data exist to make an estimate, an area of distribution of 500 km² or less for each subpopulation has been found to be an appropriate guideline (not a threshold) of what constitutes fragmentation. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Generation length

Generation length is the average age of parents of the current cohort (i.e., newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural (i.e., pre-

disturbance) generation length should be used.

Near future

Refers to a time period in which it can be projected or inferred that a species would satisfy one (or more) of the criteria in Annex I unless it is included in Appendix II. Clearly this period will be taxon- and case- specific, however, 5-10 years may be considered a useful guideline. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Population issues

Population

Population refers to the total number of individuals of the species (as “species” is defined in Article 1 of the Convention and in this Annex (to be considered in light of any decision arising from consideration of Doc. 12.59)

Sub-population

Sub-populations are defined as geographically or otherwise distinct groups in the population between which there is limited genetic exchange.

Population size

When providing details on the size of a population or sub-population, 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 or component of the population.

In the case of species biologically dependent on other species for all or part of their life cycles, biologically appropriate values for the host or co-dependent species should be chosen.

Small wild population

For some species where data exist to make an estimate, a figure of less than 5,000 individuals has been found to be an appropriate guideline (not a threshold) of what constitutes a small wild population. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Very small wild sub-population

For some species where data exist to make an estimate, a figure of less than 500 individuals has been found to be an appropriate guideline (not a threshold) of what constitutes a very small sub-population. However, this figure is presented only as an example, since it is impossible to give numerical values that are applicable to all taxa. There will be many cases where this numerical guideline does not apply.

Possibly extinct

A species is possibly extinct when exhaustive surveys in known and/or suspected habitat, and at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Before a species can be declared possibly extinct, surveys should take place over a time-frame appropriate to the species' life cycle and life form.

Recruitment

Recruitment is the total number of individuals added to any particular demographic class of a population by either sexual or asexual reproduction.

Threatened with extinction

Threatened with extinction is defined by Annex 1. The vulnerability of a species to threats of extinction depends on its population demographics, biological characteristics (such as body size, trophic level, life cycle, breeding structure or social structure requirements for successful reproduction), and vulnerability due to aggregating habits, natural fluctuations in population size, and/or residency/migratory patterns. This makes it impossible to give numerical threshold values for population size or area of distribution that are applicable to all taxa.

Vulnerability

Vulnerability can be defined as the susceptibility to intrinsic or external effects which increase the risk of extinction. There are a number of taxon- or case-specific biological and other factors that may affect the extinction risk associated with a given percentage decline, small population size or restricted area of distribution. These can be, but are not limited to, aspects of any of the following:

- Life history (e.g., low fecundity, slow growth rate, high age at first maturity, long generation time)
- Low absolute numbers or biomass or restricted area of distribution
- Population structure (age/size structure, sex ratio)
- Behavioural factors (e.g., social structure, migration, aggregating behaviour)
- Density (for sessile or semi-sessile species)
- Specialized niche requirements (e.g., diet, habitat)
- Species associations such as symbiosis and other forms of co-dependency
- Fragmentation and habitat loss
- Reduced genetic diversity
- Dependence (prone to continuing decline even in the absence of exploitation)
- Endemism
- Threats from disease or invasive species
- Rapid environmental change (e.g., climate regime shifts)
- Selectivity of removals (that may compromise recruitment)