

Ruling of the IUCN SSC Standards and Petitions Committee on the Listing of the Smooth Handfish, *Sympterychthys unipennis*

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Background

The Standards and Petitions Committee (SPC) received a petition on the listing of Smooth Handfish (*Sympterychthys unipennis*) on 20 May 2021. The petition argued that the Extinct (EX) listing of this species was not supported by the available information. The SPC sent additional questions to both the petitioners and the assessors as well as several independent experts. This ruling is based on the information provided in the justifications and addenda filed by the petitioners and the assessors as part of the formal petitions process, the information SPC received in response to its questions, publicly available information on this and related species, the IUCN Red List Categories and Criteria (IUCN 2001) and the guidelines for their use (IUCN SPC 2019), and relevant scientific literature on extinction.

The definition of Extinct

The IUCN Categories and Criteria define Extinct (EX) as follows:

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

A critical aspect of this definition is the meaning of "exhaustive surveys." In an attempt to standardize the interpretation of what constitutes "exhaustive surveys," the SPC has provided detailed guidance (IUCN SPC 2019; section 11), including methods for calculating the probability that a species is extinct, $P(E)$, based on records of the taxon, and the timing, comprehensiveness and adequacy of any targeted surveys designed to detect the taxon after the last known record.

A listing of EX does not mean that the species is extinct beyond all doubt. There are costs associated with listing an extinct species as extant; the assessors allude to this omission error. There are also costs of making the reverse error (see Akçakaya et al. 2017 for a review of the costs of both types of errors). Considering the relative costs of omission and commission errors, the SPC has suggested that assessors can consider a 90% probability of being extinct sufficient for listing a species as EX (IUCN SPC 2019, section 11.3.3). This does mean that a few species listed as EX in the IUCN Red List may be later rediscovered. The suggested threshold implies that at least nine out ten species assessed will be truly extinct, while up to one out of ten will be extant, and may eventually be rediscovered. If such a happy event ever happens, the initial misclassification would have been a risk worth taking in order for the Red List to reflect the level of biodiversity loss most accurately.

The uncertain nature of inferring extinctions also means that some species listed as threatened or as DD may already be extinct. This is acknowledged to some extent by the "Possibly Extinct" tag, which is currently applied only to species listed as CR and that are strongly suspected of being extinct. The SPC has suggested that assessors can consider a 50%-90% probability of being extinct sufficient for tagging a species as Possibly Extinct (IUCN SPC 2019, section 11.3.3).

Of course, the point of the quantitative and qualitative methods recommended in the guidelines for calculating the risk that a species is extinct is to reduce both types of errors, in addition to providing a more consistent evaluation of the evidence for and against extinction.

What is an exhaustive survey?

The adequacy of the surveys to detect a taxon that has not been recorded recently depends on several factors, which are encapsulated in the following three values:

1. The proportion of the taxon's habitat within its likely entire range that was surveyed (or covered by passive surveillance); and
2. The probability that the taxon, or recent evidence of it, would have been recorded in the area that was surveyed, if it were present. This depends on aspects of detectability, including body size, behaviour (e.g., activity and movement patterns, shyness, tendency to skulk, phenology, vocalization, sociality), degree of crypsis, local abundance, and accessibility to or searchability of its habitat and microhabitat; and
3. The probability that the taxon, or recent evidence of it, could have been reliably identified in the survey if it had been recorded. This depends on the verifiability of the record; that is, the likelihood that the recorded taxon could be distinguished from a similar taxon (e.g., a congener) given its distinctiveness (e.g., in appearance, morphology, vocalizations, behavior), and the identification skill of the observers

It is important to note that, in most cases, these values are uncertain and often specified as wide ranges of values rather than precise estimates.

In response to SPC's request for information that may shed light on these aspects of survey adequacy for the Smooth Handfish, both the assessors and the petitioners claimed that the first of these values was unknown, even unknowable. If this claim is true, if the proportion of this species range that has been surveyed cannot be known with any more precision than 0% to 100%, then there is no way to claim that the surveys have been exhaustive. In such a situation, claiming expert knowledge that surveys have been exhaustive would not be convincing. And, an EX listing cannot be justified without exhaustive surveys. This would suggest that the correct listing for this species should be DD.

However, the SPC is not convinced by the claim that this information is unknowable. Indeed, one of the independent experts contacted by SPC was able to provide ranges of values for the three quantities listed above. Using these values with the method recommended in the Red List Guidelines, the SPC calculated that the probability that the species is extinct, $P(E)$, is in the range 20% to 100%. This wide range, covering the values suggested for extant, Possibly Extinct, and Extinct, would also suggest that the correct listing for this species should be DD. However, based on the sensitivity of $P(E)$ to the range of values provided by the independent expert, the SPC believes that with additional expert input and analysis, it may be possible to reduce the uncertainty ranges of these three quantities, and to reassess based on quantitative estimates in accordance with the current guidance.

Proportion of habitat surveyed

Both the assessors and the petitioners stressed that the proportion of the range of the species surveyed cannot be known, because the range is not known. However, an inability to quantify the first does not necessarily follow from the range being unknown (i.e., the proportion can be known

with a higher certainty than the range itself), and the range is not a complete unknown, as discussed next.

Although the range of a species that has been recorded only once cannot be known with the same level of certainty as for species recorded multiple times, it is not necessarily completely unknown. Often, as in this case, the location of the type specimen, the morphology of the species, and the biology of related species give clues about the areas where the focal species might be/have been found. These types of information suggest that Smooth Handfish habitat likely included shallow waters. However, given the occurrence of some handfish species in waters deeper than 100 m (e.g. *S. moultoni*), the possibility that Smooth Handfish habitat can extend to deeper waters should also be considered. Where there are steep benthic gradients, even species with limited dispersal can occur in a wide range of depths.

Even if the range of a species is very uncertain, it may be possible to estimate the proportion of habitat surveyed. If, for instance, the northern and southern range limits are unknown, but the survey intensity is similar regardless of latitude, it would be possible to estimate the proportion of habitat surveyed with a higher certainty than the range itself. In this case, the survey intensity depends on depth, so uncertainty about plausible depth range can be more important than the uncertainty of the geographic range.

Other considerations

The assessors provided other arguments to support the EX listing, which were discussed by the SPC but not taken into account in the final ruling. One such argument involved the degree of expertise of the different parties. The SPC considers only the facts of the case presented. It does not evaluate the level of expertise of the petitioners or assessors. Parties in future petitions are strongly encouraged to focus only on information relevant to the criteria and taxon being assessed.

The assessors have also compared the level information provided in their assessment of Smooth Handfish to that for other species listed as EX. Consistency of the application of the criteria is important for maintaining the same standard for extinction risk benchmarks through years and decades (so that trends in the status of biodiversity can be followed over time). However, this does not mean that all assessments provide the same level of detail and information as previous assessments. If this were the case, there would be no improvement in the quality of assessments since the 1990s. The IUCN Red List aims to have increased rigor. Therefore, providing a level of information and data similar to previous assessments is neither a necessary condition for an assessment to be valid, nor necessarily a desirable characteristic.

Assessors and the petitioners discuss various other species, including Thylacine, Blue Grey Mouse and Passenger Pigeon. The SPC did not find these discussions useful for the decision on the present case.

The assessors claim that the information required for the recommended method of calculating $P(E)$ is unknowable for species currently listed as EX. This is not correct, as demonstrated by Butchart et al. (2018) as well as by testing conducted by SPC prior to including these recommendations in the guidelines.

The assessors claim that the passenger pigeon (*Ectopistes migratorius*) was excluded from the Butchart et al. (2018) study, "presumably because probabilities could not be calculated." This is also incorrect; Butchart et al. describe how they selected species (including only 10 randomly

selected species that had been listed as EX). More generally, for many species listed as EX, the recommended protocol will be easy to apply to, and will result in $P(E)$ close to 1.0. This is especially true for Passenger Pigeon, with a well-documented range, and intense birding activity within that range since the documented death of the last known individual. The recommended quantitative method is much more informative for cases where there are far fewer surveys and records, which are the species that Butchart et al. focused on.

The assessors calculate the proportion of species that have not been sighted since 1802 that are listed as EX, and provide this as a proxy for $P(E)$. This is not a satisfactory proxy for $P(E)$, because it does not consider the specifics of the particular species being assessed, such as how exhaustive the surveys for it had been, as required by the IUCN definition of EX.

The petitioners claim that the case fits the IUCN definition of "unknown provenance" ("The taxon is known only from one or more specimens with no or extremely uncertain locality information, so that it is not possible to make any further inference about its status"), stating that the provenance of the Smooth Handfish's original collection location cannot be ascertained. However, the route of the French expedition on which the species was collected is known in general terms from journals. Consequently, the suggestion that the provenance is unknown is unconvincing because a plausible envelope of potential distribution could be identified using general information about the route.

Conclusion

Both the assessors and the petitioners provided much information on the life history of handfish species. This gave the SPC an important context for its deliberations. However, neither the assessors, nor the petitioners placed sufficient focus on a quantitative evaluation of the extent to which surveys are exhaustive, which is key to the assessment of Extinct listing. Because this is the most critical consideration, the SPC concludes that the information provided in the original assessment does not support the EX listing, and rules that listing of Smooth Handfish now be changed to DD. However, as discussed above, the SPC suspects that there is actually sufficient information and expert knowledge to quantify the extent to which surveys have been exhaustive, and strongly recommends that a revised assessment is undertaken.

References

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