A process for assessing and prioritizing species conservation needs: going beyond the red list

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SUPPLEMENTARY MATERIAL 1 Assessment Questions and Answer Scores.

Assessment questions are designed to serve two purposes: to identify the needed conservation actions for each species and for quantitative prioritization of species for each action. Numeric scores from questions are used to develop the overall prioritization score, with the scores for the selected responses added to give a total. A higher total score represents a species of higher priority. Questions without scores are used as triggers for conservation actions, or to provide additional information to support subsequent action-planning, but are not used in the prioritization (scoring) process. Assessors select the most appropriate response to each question for the species being assessed.

Section One – Review of external data

1. **Extinction risk:** What is the current IUCN Red List category for the taxon?

   The Red List category can be modified accordingly (for the purposes of this assessment only) if new/additional information is available, or if country-level Red List assessments exist. If the assessors consider that the Red List category of threat would change if the species was re-assessed using more current data than that which was used previously, or if a more recent national Red List assessment exists, a revised estimate of the new category can be chosen, and this will be used to calculate priorities and conservation actions.

   If a national Red List assessment exists, the national category of threat is used rather than the global category.

Extinct	20
Extinct in the wild	20
Critically Endangered	16
Endangered	12
Vulnerable	8
Near Threatened	4
Data Deficient	8
Least Concern	0
Not Evaluated	0

   If there is a proposal to modify the Red List category, a note must be added explaining the rationale for the proposed change.

2. **Possibly extinct:** Is there a strong possibility that this species might be extinct in the wild?
   If there is a strong possibility that the species might have already gone extinct in the wild, this should be indicated, as it is also likely that the species will be included as a high priority for conservation actions, however, the likelihood of some of these actions (e.g. collection for *ex situ* rescue or research) is highly unlikely.

   Yes
   No

Note: If the answer is Yes, a note should be added to justify this reasoning.

3. **Phylogenetic significance**: The taxon's Evolutionary Distinctiveness (ED) score, as generated by the ZSL EDGE program. (These data are added by AArk staff, and are not editable by Assessors).

   Using a scientific framework to identify the world's most Evolutionarily Distinct and Globally Endangered (EDGE) species, the EDGE of Existence program highlights and protects some of the weirdest and most wonderful species on the planet. EDGE species have few close relatives on the tree of life and are often extremely unusual in the way they look, live and behave, as well as in their genetic make-up. They represent a unique and irreplaceable part of the world's natural heritage, yet an alarmingly large proportion are currently sliding silently towards extinction unnoticed. A higher ED score indicates a more unique species.

   Additional information about the EDGE scoring process can be found at www.edgeofexistence.org/about/edge_science.php.

ED value > 100	10
ED value 50-100	7
ED value 20 - 50	3
ED value <20	0

4. **Protected habitat:** Is a population of at least 50% of the individuals of the taxon included within a reliably protected area or areas?

   Protected habitat is defined as a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Protected habitat might be within a national system of protected areas or privately-owned land which is actively managed to protect natural biodiversity.

   Initial data were extracted from the IUCN Red List of Threatened Species (2008), www.iucnredlist.org and the Alliance for Zero Extinction (2010), www.zeroextinction.org.

   Yes
   No
   Unknown

   Note: If the answer is Yes, a note should be added, providing details of the protected habitat(s).

Section Two – Status in the wild

5. **Habitat for reintroduction:** Does enough suitable habitat exist, either within or outside of currently protected areas that is suitable for reintroduction or translocation?

   This question provides information on particular areas of existing habitat that are suitable for reintroduction of captive-bred animals. When prioritizing species for possible *ex situ* conservation and reintroduction programs, priority should be given to those species that are known to have suitable release habitat available.

Yes	10
No	0
Unknown	0

   Note: If the answer is Yes, a note should be added to provide details of the suitable reintroduction areas.

6. **Previous reintroductions:** Have reintroduction or translocation attempts been made in the past for this species?

This question does not affect the conservation action(s) assigned to the species, and nor does it affect the scoring. It is included purely to help guide, and to indicate the potential for demonstrable success with future reintroduction or translocation attempts.

Yes, successfully
Reintroduction or translocation attempts have been made for this species in the past, and post relocation monitoring has shown that the reintroduction or translocation was successful, with animals persisting in the wild.

Yes, but unsuccessfully
Reintroduction or translocation attempts have been made for this species in the past, and post relocation monitoring has shown that the reintroduction or translocation attempts were not successful - the relocated animals did not survive in the wild.

Yes, but outcome is unknown
Reintroduction or translocation attempts have been made for this species in the past, insufficient monitoring has been undertaken to indicate whether the relocated animals survived in the wild.

No
No known attempts have been made to reintroduce or translocate this species in the past.

Note: If the answer is Yes, a note should be added to provide details.

Section Three – Threats and recovery

7. **Threat mitigation:** Are the threats facing the taxon, including any new and emerging threats not considered in the IUCN Red List, potentially reversible?

It is often helpful to turn each of the answers into questions, and ask each question in turn until the correct answer is obtained, e.g.

- Does the species require conservation action at this time? If not, select answer (a).
- Is the species effectively protected? If it is, select answer (b).
- Are the threats this species is facing known? If not, select answer (c).
- Are the current threats being actively managed? If they are, select answer (d).
- Are the threats this species is facing potentially reversible before the species becomes extinct? If they can, select answer (e).
- Can the threats be reversed in time to prevent the species becoming extinct? If not, select answer (f).

(a) Species does not require conservation action at this time 0
This species is not currently facing any major threats in the wild, and no conservation action is currently required to safeguard this species in the wild.

(b) Species is effectively protected 0
All, or the majority of the population of the species in the wild is sufficiently protected to prevent further decline in numbers (e.g. the bulk of the population occurs in protected areas).

(c) Threats unknown 8
Either no knowledge about the threats to this species exists, or there is so little information known about the distribution of the species in the wild, that the threats cannot be determined.

(d) Threats are being managed - conservation dependant 10
Without the current management of the threat, the species would disappear in the wild. Examples of this sort of management include actions such as filling temporary ponds each year for breeding, diverting a dam to create a torrent, or harvesting predatory species.

(e) Threats are potentially reversible in a timeframe that will prevent further decline/extinction 2
The threats to the species can, or will likely be removed or reversed, in a timeframe that will prevent further decline of the species in the wild.

(f) Threats cannot/will not be reversed in time to prevent likely species extinction 20
The species will very likely go extinct in the wild before anything can or will be done to save it, but in principle the threats to the species could be reversed and the animals in *ex situ* colonies could be used to re-stock the wild if/when the threats are reversed.

8 **Over-collection from the wild:** Is the taxon suffering from unsustainable collection within its natural range, either for food, for the pet trade or for any other reason, which threatens the species' continued persistence in the wild?

Yes	10
No	0
Unknown	0

Note: If the species is suffering from over-collection, the reason (pet trade, food, etc.) should be included in a note.

9. **Population recovery:** Is the known population of this species in the wild large enough to recover naturally, without *ex situ* intervention if threats are mitigated?

Yes
No
Unknown

Section Four – Significance

10. **Biological distinctiveness:** Does the taxon exhibit, for example, a distinctive reproductive mode, behaviour, aspect of morphology or physiology, *within the Class* Amphibia?

Aspect of biology identified that is unique to species	10
Aspect of biology shared with <6 other species	5
No aspect of biology known to be exceptional	0

Note: If the species is identified as being biologically distinct, a note should be included to explain this.

11. **Cultural/socio-economic importance:** Does the taxon have a special human cultural value (e.g. as a national or regional symbol, in a historic context, featuring in traditional stories) or economic value (e.g. food, traditional medicine, tourism) within its natural range or in a wider global context?

Yes	10
No	0

If the species is identified as being of cultural or socio-economic importance, a note should be included to explain this.

12. **Scientific importance:** Is the species vital to current or planned research other than species-specific ecology/biology/conservation? (e.g. human medicine, climate change, environmental pollutants and conservation science), *within the Class* Amphibia.

Research dependent upon species	5
Research dependent upon <6 species (including this taxon)	3
No research dependent on this species	0

Note: If the species is identified as being of scientific importance, a note should be included to explain this.

Section Five* – Ex situ *activity

13. ***Ex situ* research:** Does conserving this species (or closely related species) *in situ* depend upon research that can be most easily carried out *ex situ*?

Yes
No

14. **Husbandry analog:** Do the biological and ecological attributes of this species make it suitable for developing husbandry regimes for more threatened related species? i.e. could this species be used in captivity to help to develop husbandry and breeding protocols which could be used for a similar, but more endangered species at a later stage?

Yes
No

Notes: Resources for *ex situ* programs are scarce, and analog species should only be specified for target species that are threatened, and have not previously been successfully kept in captivity. A note should be included which lists the target species for this analog.

15. **Captive breeding:** Has this species been successfully maintained and bred in captivity?

Yes, bred to F2
In this instance, successful captive breeding to F2 refers to animals which were bred and raised to adulthood in captivity, and they have then subsequently reproduced, with these second generation offspring also reaching adulthood. This second generation breeding and rearing to adulthood should be a repeatable event.

Yes, bred to F1
In this instance, captive bred to F1 refers to animals which were both bred and raised to adulthood in captivity. This first generation breeding and rearing to adulthood should be a repeatable event.

Maintained but no successful breeding
Animals have been successfully maintained in captivity for a long enough period of time to show that their husbandry and dietary needs are being met effectively, although the species is yet to regularly reproduce offspring that have reached adulthood.

Not held in captivity to date
Attempts to maintain this species in captivity have not yet been made.

Note: If the species has previously been maintained or bred in captivity, a note should be included providing details of institutions, zoo associations and contact person(s), if known.

Section Six – Education

16. **Educational potential:** Is the species especially diurnal/active/colourful and therefore suited to be an educational ambassador for amphibian conservation?

Yes
No

Section Seven* – Ex situ *Program Authorization/Availability of animals

17. **Mandate:** Is there an existing conservation mandate recommending the *ex situ* conservation of this taxon?

Yes
No

The decision about which species should be protected in *ex situ* conservation programmes should not be made by the *ex situ* community alone because such programs must be part of broader plans for species conservation. The *ex situ* community needs to respond to needs identified by appropriate conservation authorities, especially since the decision to safeguard species in *ex situ* programs needs to follow from a careful assessment of which species cannot currently be assured of adequate protection *in situ*. A recommendation for an *ex situ* population of a threatened species can come from a number of recognised sources, such as:

- An IUCN SSC taxonomic specialist group (e.g. the Amphibian Specialist Group (ASG)).
- The IUCN - the IUCN Guidelines on the Use of *Ex situ* Management for Species Conservation recommends *ex situ* populations for all Critically Endangered species.
- An IUCN SSC Conservation Breeding Specialist Group (CBSG) Population and Habitat Viability Assessment (PHVA) workshop process. (www.cbsg.org/document-repository).
- An IUCN SSC Conservation Breeding Specialist Group (CBSG) Conservation Assessment and Management Plan (CAMP) process. (www.cbsg.org/document-repository).
- A published Species Action Plan.
- A local, regional or national government request.

Notes: If the answer is No, there is insufficient authorisation for an *ex situ* initiative at this time. Seek mandate from the appropriate IUCN taxonomic specialist group or other authority. If the answer is Yes, identify the source of the recommendation.

18. **Range State approval:** Would a proposed *ex situ* initiative for this species be supported (and approved) by the range State (either within the range State or out-of-country *ex situ*)?

Yes
No

Notes: If the answer is No, there is insufficient authorisation for an *ex situ* initiative at this time. Seek approval from range country (with help from the appropriate IUCN SSC taxonomic specialist group as required) before proceeding.

19. **Founder specimens:** Are sufficient animals of the taxon available or potentially available (from wild or captive sources) to initiate the specified *ex situ* program? It is recommended that a minimum of twenty active breeding pairs of animals be used as founder animals, ideally including several different locations or populations.

Yes
No
Unknown

Notes: If the answer is No, there are insufficient potential founder specimens to initiate the ex situ program. Evaluate options for alternative conservation strategy including gamete biobanking.

20. **Taxonomic status:** Has a complete taxonomic analysis of the species in the wild been carried out, to fully understand the functional unit you wish to conserve (i.e. have species limits been determined)?

Typically this unit is a species; however, because species are continuously changing units evolving through time, there are often distinct but not yet unique subunits (evolutionary significant unit or ESU) in the process of divergence within the species and which might warrant independent consideration.

Yes
No
Unknown

Notes: Typically this unit is a species; however, because species are continuously changing units evolving through time, there are often distinct but not yet unique subunits (evolutionary significant unit or ESU) in the process of divergence within the species and which might warrant independent consideration.

If the answer is No, there is insufficient knowledge of the species, and a taxonomic study, including phylogenetic analyses of DNA, should be undertaken before considering an *ex situ* program for the species.

Undertake appropriate research in conjunction with local field biologists (with help from the appropriate IUCN taxonomic specialist group as required) in order to confirm that the specific program encompasses only ONE evolutionary distinct unit (ESU) before proceeding.

SUPPLEMENTARY MATERIAL 2 Conservation Actions.

One or more conservation actions can be recommended for each species, and these are calculated for each species, based on the data provided during the assessment workshop (Appendix 1). The triggers described for each conservation action are compared to the responses to the assessment questions to determine which actions are relevant for each species.

Ark
A species that is extinct in the wild (locally or globally) and which would become completely extinct without *ex situ* management.

Triggers for Ark species are:

- IUCN Red List category = Extinct in the Wild (EW)

Rescue
A species that is in imminent danger of extinction (locally or globally) and requires *ex situ* management, as part of an integrated program, to ensure its survival.

Triggers for Rescue species are:

- IUCN Red List category is not Extinct in the Wild (EW) **and**
- Threat Mitigation = Threats cannot/will not be reversed in time to prevent likely species extinction.

  Note: Threats that constitute imminent danger of extinction include:
  - Threats for which we currently have no remedy:
    - *Bd*, including any species known or suspected to be susceptible
    - Climate change, including any species documented to be drastically contracting its range, e.g., mountaintop salamanders in Central America (per Wake et al.) and mountaintop frogs in Madagascar (per Raxworthy et al.)
  - Threats for which we have a remedy but not the resources or will to intervene
    - Imminent destruction of more than 50% of habitat, e.g., dam construction, mining/pollution
    - Species collected to brink of extinction
  - All other threats are considered to be “reversible in time frame”.

***In Situ* Conservation**
A species for which mitigation of threats in the wild may still bring about its’ successful conservation.

Triggers for *In Situ* Conservation species are:

- Threat Mitigation = Threats are reversible in time frame that will prevent further decline/extinction **or**
- Threat Mitigation = Threats cannot/will not be reversed in time to prevent likely species extinction (species is in Rescue role) **and** Protected Habitat = No (species will need a secure place to go back to).

***In Situ* Research**
A species that for one or more reasons requires further *in situ* research to be carried out as part of the conservation action for the species. One or more critical pieces of information is not known at this time.

Triggers for *In Situ* Research species are:

- IUCN Red List category = Data Deficient (DD) **or**
- Threat Mitigation = Unknown **or**
- Habitat for Reintroduction is Unknown **or**
- Protected Habitat = Unknown **or**
- Population Recovery = Unknown **or**

- Over-collection status = Unknown **or**
- Taxonomic Status = No **or**
- Founder Specimens = Unknown **or**
- Conservation role = Rescue.

***Ex Situ* Research**
A species currently undergoing, or proposed for specific applied research that directly contributes to the conservation of that species, or a related species, in the wild (this includes clearly defined 'model' or 'surrogate' species).

Triggers for *Ex Situ* Research species are:

- The species has been identified as a husbandry analogue for a more threatened species **or**
- IUCN Red List category = Critically Endangered (CR) **or** Endangered (EN) **or** Vulnerable (VU) **or** Near Threatened (NT) **or** Data Deficient, **and** conserving this species depends on *ex situ* research **and** Threat Mitigation = Threats unknown or Threats are reversible in time frame **or**
- IUCN Red List category = Extinct in the Wild (EW) **or** Critically Endangered (CR) **or** Endangered (EN) **or** Vulnerable (VU) **or** Near Threatened (NT) **or** Data Deficient, **and** the species has not been successfully maintained and bred in captivity **and** the species is biologically or evolutionarily distinct.

Mass production in captivity
A species threatened through wild collection (e.g. as a food resource), which could be or is currently being bred in captivity – normally in-country, *ex situ* - to replace a demand for specimens collected from the wild. *This category generally excludes the captive-breeding of pet and hobbyist species, except in exceptional circumstances where coordinated, managed breeding programs can demonstrably reduce wild collection of a threatened species.*

Triggers for Mass Production in Captivity species are:

- IUCN Red List category = Critically Endangered (CR) **or** Endangered (EN) **or** Vulnerable (VU) **and**
- Species is suffering from over-collection from the wild.

Conservation Education
A species that is specifically selected for management – primarily in zoos and aquariums - to inspire and increase knowledge in visitors, in order to promote positive behavioural change. For example, when a species is used to raise financial or other support for field conservation projects (this would include clearly defined 'flagship' or 'ambassador' species).

Triggers for Conservation Education species are:

- The species has a high Evolutionary Distinctiveness score **or**
- The species is biologically, culturally, or scientifically significant **or**
- The species is suited to be an educational ambassador for amphibian conservation.

Supplementation
A species for which *ex situ* management benefits the wild population through breeding for release as part of the recommended conservation action.

Triggers for Supplementation species are:

- Threat Mitigation = Threats are being managed **or** Threats are reversible in time frame that will prevent further decline/extinction **or** Species is effectively protected **and**
- The (sub)population of the species in the wild is too small to recovery naturally **and**
- There is suitable habitat available for reintroduction.

Biobanking

A species for which the long-term storage of sperm or cells to perpetuate their genetic variation is urgently recommended, due the serious threat of extinction of the species.

Triggers for Biobanking species are:

- Recommended conservation role is Ark or Rescue

None
Species that do not require any conservation action at this point in time. This list may also contain species that were not evaluated during the workshop due to lack of data being available.

Triggers for these species are:

- Species does not match the criteria for any of the previous roles **or**
- Insufficient data available during the workshop to properly evaluate the species.

SUPPLEMENTARY MATERIAL 3 An example assessment.

The following assessment for *Mantella aurantiaca* in Madagascar was made by Devin Edmonds from Association Mitsinjo. It shows how each species assessment is prioritized and how conservation actions are recommended.

Subject	Question Text	Response	Score	Comments
Extinction risk	Current IUCN Red List category. [Data obtained from the IUCN Red List.]	Critically Endangered (CR)	16	
Possibly extinct	Is there a strong possibility that this species might be extinct in the wild?	No	0	
Phylogenetic significance	The taxon's Evolutionary Distinctiveness (ED) score, as generated by the ZSL EDGE program. (These data are added by AArk staff, and are not editable by Assessors).	ED value < 20	0	
Protected habitat	Is a population of at least 50% of the individuals of the taxon included within a reliably protected area or areas?	No	0	Found within Ramsar Site of Torotorofotsy, though this site is not reliably protected. New Protected Area of Mangabe supports over 50% of *Mantella aurantiaca* population and is in development, but currently is not protected or managed effectively.
Habitat for reintroduction	Does enough suitable habitat exist, either within or outside of currently protected areas that is suitable for reintroduction or translocation?	Yes	10	Torotorofotsy, Mangabe, Ambatovy Conservation Zone, etc. however habitat needs to be modified by creation of breeding ponds to support population and this technique tested and monitored long-term.
Previous reintroductions	Have reintroduction or translocation attempts been made in the past for this species?	Yes, but outcome is unknown	0	Translocations from Ambatovy mine footprint, where breeding sites have been cleared, to created ponds ("receptor sites") in Conservation Zone surrounding the mine have been carried out by NGO Madagasikara Voakajy since 2011. Their outcome is unknown. A major limitation is finding suitable breeding sites that are not already occupied by the species. Creating new breeding ponds by modifying habitat for translocations currently undertaken but outcome not yet known.
Threat mitigation	Are the threats facing the taxon, including any new and emerging threats not considered in the IUCN Red List, potentially reversible?	Threats cannot/will not be reversed in time	20	Habitat loss is the main threat, and although actions are being carried out to address this threat in some locations they do not guarantee the species survival. See Randrianavelona, R., Rakotonoely, H., Ratsimbazafy, J., Jenkins, R. K. B. 2010. Conservation assessment of the critically endangered frog *Mantella aurantiaca* in Madagascar. African Journal of Herpetology 59(1): 65 — 78 and Randrianavelona R., Randrianantoandro J. C., Rabibisoa N., Randrianasolo H., Rabesihanaka S., Randriamahaleo S., Jenkins R. K. B. 2010. Stratégie de Conservati on de l'Espèce *Mantella aurantiaca* (grenouille dorée) 2011-2015 for threats facing *M. aurantiaca* and actions being done to address them.
Over-	Is the taxon suffering	Yes	10	Not known if collection is sustainable in the long-

Subject	Question Text	Response	Score	Comments
collection from the wild	from unsustainable collection within its natural range, either for food, for the pet trade or for any other reason, which threatens the species' continued persistence in the wild?			term, likely has been or is still unsustainable at highly targeted sites. CITES II. Collected in high numbers into the early 2000's, with at least 30,000 individuals collected in a single year in the late 1990's (see Rabemananjara, F., et al. 2008. Malagasy poison frogs in the pet trade: a survey of levels of exploitation of species in the genus Mantella. Amphibian & Reptile Conservation 5(1): 3-16); however, moratorium on exports in mid 2000's and annual CITES quota reduced in recent years to as low as 280 individuals/year. Collection supposed to occur only at a few breeding sites that are supposed be or have been monitored recently. Research into effects of trade ongoing. Mortality after collection means CITES export quotas are lower than the actual number of frogs collected.
Population recovery	Is the known population of this species in the wild large enough to recover naturally, without *ex situ* intervention if threats are mitigated?	Yes	0	If threats can be mitigated effectively then the wild population should be large enough at most sites to recover naturally.
Biological distinctiveness	Does the taxon exhibit, for example, a distinctive reproductive mode, behaviour, aspect of morphology or physiology, within the Class to which the species belongs (Amphibia, Mammalia etc.)?	No aspect of biology known to be exceptional	0	Not biologically distinct.
Cultural/socio-economic importance	Does the taxon have a special human cultural value (e.g. as a national or regional symbol, in a historic context, featuring in traditional stories) or economic value (e.g. food, traditional medicine, tourism) within its natural range or in a wider global context?	Yes	10	Socio-economic importance related to trade. Flagship species at Mangabe and Torotorfotsy Wetland.
Scientific importance	Is the species vital to current or planned research other than species-specific ecology/biology/conservation? (e.g. human medicine, climate change, environmental pollutants and conservation science), within the Class to which the species belongs (Amphibia, Mammalia etc.)?	No research dependent on this species	0	Not known to be scientifically important.
Ex situ research	Does conserving this species (or closely	Yes	0	Population ecology and dynamics for potential sustainable trade; habitat requirements for

Subject	Question Text	Response	Score	Comments
	related species) *in situ* depend upon research that can be most easily carried out *ex situ*?			breeding pond creation regarding translocations at Ambatovy sites
Husbandry analog	Do the biological and ecological attributes of this species make it suitable for developing husbandry regimes for more threatened related species? i.e. could this species be used in captivity to help to develop husbandry and breeding protocols which could be used for a similar, but more endangered species at a later stage?	No	0	Husbandry of this species and closely related species already well-understood.
Captive breeding	Has this species been successfully maintained and bred in captivity?	Yes, bred to F2	0	Genetically viable captive assurance colony maintained in range (Andasibe) and bred to F2 generation. Outside of Madagascar bred widely within cosmopolitan zoo collections and by private breeders.
Educational potential	Is the species especially diurnal/active/colourful and therefore suited to be an educational ambassador for conservation of this group of species?	Yes	0	
Mandate	Is there an existing conservation mandate recommending the *ex situ* conservation of this taxon?	Yes	0	
Range State approval	Would a proposed *ex situ* initiative for this species be supported (and approved) by the range State (either within the range State or out-of-country *ex situ*)?	Yes	0	The Sahonagasy Action Plan is ratified by the Malagasy government and states support for *ex situ* initiatives for all amphibian species in Madagascar. Already maintained in country.
Founder specimens	Are sufficient animals of the taxon available or potentially available (from wild or captive sources) to initiate the specified *ex situ* program?	Yes	0	
Taxonomic status	Has a complete taxonomic analysis of the species in the wild been carried out, to fully understand the functional unit you wish to conserve (i.e. have species limits been determined)?	Yes	0	
		Total (priority)	66	

Recommended conservation actions

Rescue - IUCN Red List category is not Extinct in the Wild (EW) **and** threats cannot/will not be reversed in time to prevent likely species extinction.

In Situ Conservation - Threats cannot/will not be reversed in time to prevent likely species extinction **and** less than 50% of the population is found in protected habitat.

In Situ Research - Conservation action is Rescue.

Mass Production in Captivity - IUCN Red List category = Critically Endangered (CR) **and** the species is suffering from over-collection from the wild.

Conservation Education - The species is culturally significant **and** the species is suited to be an educational ambassador for amphibian conservation.

Biobanking - Recommended conservation action is Rescue.