

COLLABORATION FOR ENVIRONMENTAL EVIDENCE

SYSTEMATIC REVIEW No. 69



**WORKING TITLE: ARE THREATENED AMPHIBIAN RE-INTRODUCTIONS
SUCCESSFUL?**

DRAFT REVIEW PROTOCOL

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COVER SHEET

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1. BACKGROUND

Amphibian populations have suffered dramatic reductions and extinctions on a global scale since the eighties (Stuart et al. 2004). This situation encouraged the evaluation of the present status quo situation of all species of this vertebrate class known as the "Global Amphibian Assessment" (GAA) which shed a number of alarming results.

Of the 5,743 globally known species of amphibians (including frogs and toads, salamanders and caecilians) assessed by the GAA, at least 32% are found in IUCN threat criteria, being the vertebrate group with the greatest number of threatened species compared to 12% of the birds and 23% of the mammals. From the total number of threatened amphibians, 427 species are categorised as *critically endangered*, 761 are endangered and 668 are vulnerable. It is considered that only 27% of amphibian species populations are stable and less than 1% of amphibian populations are rising. To date, from most species there isn't sufficient information to determine their actual conservation status (Young et al. 2004, IUCN et al. 2006).

This same evaluation indicated that habitat degradation is one of the greater threats faced by amphibians globally, and affects more intensely to the specific richness that contamination of the environment (IUCN et al. 2006). Even when diseases seem to have a lower impact on amphibian diversity loss, there is more evidence everyday that suggests that the more drastic reductions and recent extinctions are associated with the presence of the chytrid fungus *Batrachochytrium dendrobatidis*, which causes cutaneous chytridiomycosis (Berger et al. 1998, Skerratt 2007).

This reductions and extinctions requires actions of a different nature, whose objective is the recovery of populations and their habitat. Due to the fact that many of these population reductions and species disappearances have taken place in protected areas, and that habitat protection is not considered to be sufficient as a conservation strategy an alternative can be establish captive breeding programs to reintroduce¹ the species to their original habitat where the species has disappeared, or the direct reintroduction to maintain viable populations in the wild.

The aim of any reintroduction must be the establishment of a species in the wild that is locally or globally extinct in order to increase the long term survival of the species (IUCN 1998). However in conservation terms, the reintroduction of animals has three main objectives: 1) survival of the samples once released in the wild, 2) establishment of the animals in the release site, and 3) successful reproduction in the release site. Many of the reintroduction programs have failed, in the short term, due to the death of released animals at the beginning of the program due to stress (Texeira et al. 2007), lost the

¹ **Re-introduction**": an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct (IUCN 1998).

ability to detect and respond to natural predators (Kraaijeveld-Smit et al. 2006). In the medium and long term, by loss of genetic variability (Favé et al. 2008, Kraaijeveld-Smit et al. 2006) or if the habitat at the release site cannot support the species (Armstrong and Seddon 2007).

On a global scale many vertebrate reintroductions have been carried out, but few have been successful (IUCN 1998). Very little has been learned from these reintroductions (Armstrong and Seddon 2007), for they are based on the requirements of the species, and on the factors that limit their distribution and abundance (IUCN 1987). It hasn't been considered either the way in which way a reintroduced species is affected by group size and composition, as well as what are the necessary habitat conditions for the persistence of a population once it has been reintroduced (Armstrong and Seddon 2007). From there, the reintroduction needs to be planned out assessing the feasibility, followed by a carefully controlled test that may precede the reintroduction extensively with a post-reintroduction monitoring (IUCN 1998).

Globally, few amphibian reintroductions have been carried out, *Alytes muletensis* (Mallorcan Midwife Toad), *Bufo baxteri* (Wyoming Toad), *Bufo calamita* (Natterjack Toad), *Leiopelma hamiltoni* (Maud Island Frog), *Peltophryne lemur* (Puerto Rican Crested Toad), *Philautus romeri* (Romer's Tree Frog), *Polypedates cruciger* (Common Hourglass Tree Frog) y *Rana dalmatina* (Agile Frog) (Soorae and Seddon, 1998). However in South America, and particularly in Venezuela, amphibian reintroductions have not been considered as a conservation strategy. On the contrary, the projects have been more aimed at habitat protection by the creation of protected areas.

In this context, this review intends to analyse all of the available studies related to amphibian reintroductions (threats, successful events or no), with the objective of evaluating the appropriateness of this type of action for the effective conservation of this taxonomic group.

2. OBJECTIVE OF THE REVIEW

Primary question

Are threatened amphibian reintroductions successful? Understanding successful as a population reaching at least one reproductive event.

Table 1. Definitions of the components of the primary question

Subject	Intervention	Outcome measures	Comparators	Design
Threatened Amphibians	Reintroduction	Survival	Studies that report survival data of amphibians that have been reintroduced to the wild	Quantitative and qualitative studies that present data that will facilitate the evaluation of the project from defined comparators
		Capacity to reproduce effectively	Studies that report the number of events reproductive (clutches and metamorphosis) after the reintroduction	

Secondary question

The origin of animals (captive breeding or relict wild populations) can influence the successful of the populations to be reintroduced?

3. METHODS

Search strategy

General search

The following electronic data bases will be used which will be consulted in the Faculty of Science of the Universidad Central de Venezuela and the Instituto Venezolano de Investigaciones Científicas (IVIC).

- Agricola (<http://agricola.nal.usda.gov>)
- BIOSIS (<http://www.biosis.org>)
- CAB Abstracts (<http://www.cabi.org>)
- Ebsco (<http://web.ebscohost.com>)
- Directory of Open Access Journals (<http://www.doaj.org>)
- HighWire (<http://highwire.stanford.edu>)
- ISI Web of Knowledge: ISI Web of Science: Science Citation Index Expanded (<http://apps.isiknowledge.com>)
- Index to Theses Online (<http://www.theses.com>)

- JSTOR (<http://www.jstor.org>)
- Science Direct (<http://www.sciencedirect.com>)
- Science.gov (<http://www.science.gov>)
- Scientific Electronic Library Online (<http://www.scielo.org>)
- Scirus (<http://www.scirus.com>)
- Scopus (<http://www.scopus.com>)
- SpringerLink (<http://springerlink.metapress.com>)
- IUCN / SSC Re-introduction Specialist Group (<http://www.iucnsscrg.org>)
- Zoological Record (<http://scientific.thomson.com>)

Additionally, the results of the Internet searchers with the following search engines will be consulted and the first 200 results will be used:

- Google (<http://www.google.com>)
- Google Scholar (www.scholar.google.com)
- Intute (www.intute.ac.uk).
- www.allnet.co.uk
- www.alltheweb.com
- www.dogpile.com

The indices of the following specialised journals will also be consulted:

- Copeia
- Journal of Herpetology
- Herpetologica
- Conservation Biology

To carry out the searchers, the following keywords will be employed:

- Introduction
- Re-introduction
- Re-establishment
- Amphibian AND Re-introduction
- Anuran AND Re-introduction
- Salamander AND Re-introduction
- Gymnophiona AND Re-introduction
- Salienta AND Re-introduction
- Frog AND Re-introduction
- Toad AND Re-introduction

The searchers in the data bases, catalogues and search engines will be carried out by a single reviewer both in Spanish and English.

Specialied search

With the aim of assessing grey literature (reports, theses and non-published research Works), specialists will be consulted in order to be able to find and have access to this type of information.

Study inclusion criteria

- **Relevant subject:** Threatened amphibians
- **Type of intervention:** Reintroduction to the wild
- **Types of comparators:** Survival rate of amphibians that have been reintroduced to the wild and the number of events reproductive (clutches and metamorphosis) after the reintroduction
- **Types of results:** Only those qualitative and/or quantitative results on the survival and effective reproductive capacity of demo populations that have been reintroduced to the wild.
- **Types of study:** All studies that present information associated with the relevant subject, intervention and selected indicators will be considered to assess the effectiveness of the intervention. Studies about conceptual subjects will not be included. Even though quantitative studies are more relevant, studies where qualitative data are available will not be discarded. If the abstracts do not provide sufficient data to decide the inclusion of an article in the review, the whole article will be revised to determine its relevance.
- **Potential reasons for heterogeneity:** It is reasonable to think that we will find different sources of heterogeneity:
 - Access to data bases
 - Information availability
 - Taxonomy of the species to be reintroduced
 - Origin of animals to be reintroduced (captive breeding or relict wild populations)
 - Geography and frequency of endangered amphibian reintroductions
 - Methods of reintroduction
 - Single or multiple reintroduction
 - Number of animals to reintroducing
 - Type of animal (tadpoles, juveniles or adults)
 - Habitat conservation status
 - Type and duration of monitoring activities post-reintroduction
 - Methods of evaluating the success of the reintroductions.

The inclusion criteria will be used in three stages with the objective of the filtering out the most relevant studies. The three stages are defined by the evaluation of the studies from: Firstly by revising the title and keywords, secondly the abstract and finally the completed articles of those studies which are relevant to the review.

Study quality assessment

The studies will be classified on a quality scale based on the criteria specified in Table 2 (see attached). For each of the reviewed studies, a score value will be selected (values between 0 and 1) for each of the fields. An overall score will be obtained by adding up all of score for each of the fields. A score value greater than 5 denotes that the data extracted from the study may be included in a quantitative analysis. Finally, it needs to be decided which synthesis

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method is most adequate for each of the consulted sources (i.e. marking with an X the last four columns of Table 2).

Data extraction strategy

A data matrix will be designed and used to facilitate the analysis of data of threatened amphibian species, experimental design type, study duration, presence and type of post-reintroduction monitoring, establishment and/or reproduction of the reintroduced species and other pertinent data associated with this intervention.

Data synthesis

For each of the studies, a record card will be created in which the information pertinent to each study will be synthesised in a manner more explicit and concise format. Matrix containing the data will also be created for both qualitative and quantitative data in order to carry out all of the descriptive analysis and pertinent statistics, accordingly to the type and quality of the data.

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

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5. REFERENCES

Armstrong, D. P. and Seddon, P. J. 2007. Directions in reintroduction biology. *Trends in Ecology and Evolution* 23: 20-25.

Berger, I., Speare, S., Daszak, P., Green, D. E., Cunningham, A. A., Goggin, C. L., Slocombe, R., Ragan, M. A., Dyatt, D., McDonald, K. R., Hines, H. B., Lips, K. L., Marantelli, G. y Parkes, H. 1998. Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. *Proceedings of the National Academy of Sciences, USA* 95: 9031-9036.

Favé, M., Dúchense, P., and Turgeon, J. 2008. Inbreeding dynamics in reintroduced, age-structured populations of highly fecund species. *Conservation Genetics* 9:39–48.

IUCN - Unión Mundial para La Naturaleza. 1987. *Translocation of Living Organisms*.

IUCN Position Statement. Gland, Switzerland and Cambridge, UK. 13 pp.

This is a draft protocol for consultation. Additional work is in progress. Please do not quote this document or any part therein without prior consent of the authors.

- IUCN. 1998. IUCN Guidelines for Re-introduction. Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. 10 pp.
- IUCN – Unión Mundial para La Naturaleza. 2004. IUCN Red List of Threatened Species. Recurso electrónico en internet: <http://www.redlist.org>.
- IUCN, Conservation International and NatureServe. 2006. Global Amphibian Assessment. <www.globalamphibians.org>. Downloaded on 4 May 2006.
- Kraaijeveld-Smit, F. J. L., Griffiths, R. A., Moore, R. D. and Beebee, T. J. C.. 2006. Captive breeding and the fitness of reintroduced species: a test of the responses to predators in a threatened amphibian. *Journal of Applied Ecology* 43: 360–365.
- Skerratt, L. F., Berger, L., Speare, R., Cashins, S., McDonald, K. R., Phillott, A. D., Hines, H. B. and Kenyon, N. 2007. Spread of Chytridiomycosis Has Caused the Rapid Global Decline and Extinction of Frogs. *Ecohealth* 4, 125–134.
- Soorae, P. S. and Seddon, P. J. (Eds). 1998. *Re-introduction Practitioners Directory*. Published jointly by the IUCN Species Survival Commission's Re-introduction Specialist Group, Nairobi, Kenya, and the National Commission for Wildlife Conservation and Development, Riyadh, Saudi Arabia. 97pp.
- Stuart, S. N., Chanson, J. S., Cox, N. A., Young, B. E., Rodriguez, A. S. L., Fischman, D. L. y Waller, W. 2004. Status and trends on amphibian declines and extinctions worldwide. *Science* 306: 1783-1786.
- Teixeira, C. P., Schetini, C. A., Mendl, M., Cipreste, C. F. and Young, R. J. 2006. Revisiting translocation and reintroduction programmes: the importance of considering stress. *Animal Behaviour* 73:1-13.
- Young, B. E., Stuart, S. N., Chanson, J.S., Cox, N. A. y Boucher, T. M. 2004. Joyas que están desapareciendo: el Estado de los Anfibios en el Nuevo Mundo. NatureServe, Arlington, Virginia.