Reintroduction of the Morelos minnow (*Notropis boucardi*) in the "Barranca de Chapultepec" protected area, Cuernavaca, Morelos, Mexico.

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Introduction

The "Carpita de Morelos" *Notropis boucardi*, is restricted to a small system of streams located to the west of Cuernavaca, as well as in an endoreic spring (Hueyapan) of the neighboring municipality of Jiutepec, within a state protected area called "El Texcal". Three main threats to *N. boucardi* have been identified, water pollution, water management/use and invasive species. In the first case as the consequence of the growth of the city of Cuernavaca in the last 50 years, and the lack of appropriate wastewater treatment, most of the streams within the urban area of the city are polluted to a degree that *N. boucardi* can't survive (Contreras-MacBeath & Rivas 2007). A distribution study (Preciado 2012) demonstrated that in a period of about 50 years, the species has lost 49% of its original distribution.

The species to be listed as threatened by the Mexican environmental authority (SEMARNAT 2010), consequently, the State of Morelos, with the aid of the Biological Research Center of the Universidad Autónoma del Estado de Morelos, have put forwards a conservation strategy that involves protection of remaining wild populations and reintroduction of the species in areas where it once existed, such as the Parque Ecológico Chapultepec.

Goals

Goal 1: Establish a viable population of *Notropis boucardi* in the "Parque Ecológico Chapultepec".

Goal 2: Eradicate invasive fish species (*Oncorhynchus mykiss* and *Cyprinus carpio*) from the stream.

Goal 3: Implement a monitoring program for the introduced population.

Goal 4: Develop a communication strategy in order to gain support for the species.

Success Indicators

Indicator 1: Reintroduced fish spawn naturally in the stream.

Indicator 2: Alien *Oncorhynchus mykiss* and *Cyprinus carpio* are eradicated from the "Parque Ecológico Chapultepec" stream.

Indicator 3: Monitoring program in place

Indicator 4: Agencies and stakeholders support and are involved in the conservation project.

Feasibility:

The Project followed the guidelines for reintroductions and other conservation translocations developed by the Reintroduction and Invasive Species Specialist Groups' Task Force (IUCN/SSC 2013), so biological feasibility was taken into account, thus prior knowledge of the species life history was included (Contreras-MacBeath & Rivas 2007), and a study describing the genetic variations of each known population was conducted, in order to define the founding population (Rosas 2013).

Because of the low number of individuals in the remaining populations of the species (Peciado 2012), a decision was made to collect specimens for translocation only after the reproductive season, and to take small number of specimens from different sites.

The reintroduction site "Barranca de Chapultepec" is within the natural distribution of the species, and there are unconfirmed records of the species being historically present. Nevertheless an analysis of water conditions in the stream, as well as in the sites where the founding populations would be obtained was carried out, and as was expected, these match.

With regards to social feasibility and regulatory compliance, the reintroduction site is a State Protected Area managed by the Ministry of Sustainable Development of the State of Morelos, which is a partner in the project. The Ministry provided the required permits and funds for this project. As will be described in the next section a communication strategy was put in place to gain support from different stakeholders.

Implementation:

In order to gain support for the conservation of *N. boucardi* from Federal and local authorities, as well as from the general public a communication strategy was developed. It included the publication of information related to this species in journals, books, magazines, and Web Pages as well as by articles in newspapers, radio and TV interviews, and in public and community meetings. The strategy included billboard signs describing the importance of *N. boucardi* as an indicator species for water quality that were displayed in different public spaces of the city. Due to this effort, *N. boucardi* is now recognized as a focal species in the State of Morelos, due to the fact that it represents the only endemic vertebrate of the State.

The first face of on-site implementation consisted in the eradication of invasive fish species (*Oncorhynchus mykiss* and *Cyprinus carpio*) from the stream, due to the fact that these predate and/or compete with *N. boucardi*. This was successfully carried out by means of a combination of electrofishing, and the use of nets with the aid of the workers of the Park.

For this first reintroduction event, founders were obtained from "Barranca La Primavera" stream, which is about 2 miles from the Park. Most of this stream has been heavily impacted by polluted effluents from surrounding urban area, but there is a residual population of *N. boucardi*, that is highly threatened. Due to small population size, only 72 specimens were captured and transported for their immediate release in "Barranca de Chapultepec" stream.

Post-release monitoring:

A post-release monitoring program was established in order to follow the introduced specimens. Preliminary data shows that a population has not yet been established. In this respect, multiple release events must be implemented in order to increase the chances of success. Monitoring revealed predation of introduced specimens by Muscovy duck (*Cairina moschata*) which is exótic to the Park. This was not anticipated.

Major difficulties

a) Unforseen threat posed by and established population of Muscovy duck (*Cairina moschata*) which is exotic to the park. This has complicated our invasive eradication strategy, because even though there is now general support for elimination of exotic fishes. There is a local environmental group protecting Muscovy ducks.
b) Due to the small size of natural populations, availability of founders is related to the reproductive cycle of the species, so it is a small window of opportunity of a couple of months following the rainy season.

Major lessons learned

a) A good communication strategy is fundamental in order to gain support from different stakeholders.
b) Taxonomical and population genetics information was crucial for a successful site selection strategy.
c) The reintroduction program is at a relatively early stage and ongoing. Preliminary results make it evident that multiple reintroductions are needed in order to establish a viable population.

d) In any reintroduction program such as this, it is necessary to look for the unexpected, such as what occurred with the invasive Muscovy duck that were found to predate on *N. boucardi*.

Success or Failure	**Place "x" below in only one of the 4 rankings.**
Highly Successful	
Successful	
Partially Successful	x
Failure	

Reason(s) for success/failure:

Several of the goals such as gaining public support, eradicating invasive species and establishing a monitoring program were met, but our main goal, which is establishing a viable population has not been accomplished, so we rank it as partially successful. This is due to the fact that there were not enough organisms introduced, and that there is a need to establish a strategy to eradicate Muscovy ducks at least from the introduction sites, in order to minimize predation. On the other hand, multiple reintroductions have to be carried out through a longer period of time in order to reach the goal of establishing a viable population.

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