

DAPTF SEED GRANT – FINAL REPORT – March 2006

Project Title: Development of a Database on Reintroductions, Translocations, and Associated Captive Breeding of Amphibians.

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Background

Historically, species translocations and reintroductions¹ have been used as efforts of last resort in the recovery of endangered species. However, because of the accelerating rate of population decline of many species, reintroductions have become an increasingly important component of conservation strategies. Reintroductions have failed more often than they have succeeded, especially for threatened and endangered vertebrates (e.g. Griffith et al. 1989), calling into question the approaches, assumptions, and methods used. Recent reviews of reintroduction programs have suggested a better grounding in ecological theory is needed (May 1991, Sarrazin and Barbault 1996). Specifically, reviewers have recommended that habitat suitability, demographic factors, and genetic structure and variation of the focal species be understood prior to the initiation of a reintroduction (Griffith, et al. 1989, Sarrazin and Barbault 1996). These same reviews have stressed the need for long-term monitoring of reintroduced populations so that successes and failures can be documented allowing one to learn from both outcomes.

Amphibian translocations and reintroductions are currently occurring throughout North America, Europe, and Australia with limited coordination among practitioners and no internationally endorsed taxa-specific guidelines. While some reintroductions have been successful (Denton et. al. 1997), others have failed or have unknown outcomes (Dodd 2005). These failures as well as other ecological and genetic concerns have led to cautionary articles regarding amphibian reintroductions (Dodd and Siegel 1991, Reinert 1991, Seigel and Dodd 2002, Dodd 2005). Amphibians present distinctive challenges as reintroduction subjects due to several unique ecological, genetic, and demographic characteristics and the interplay among them. For example, they often exhibit strong site fidelity and have low dispersal rates which can lead to local adaptations that strongly influence genetic structure (Storfer 1999). In addition, their biphasic life cycles may result in different habitat requirements for eggs, larvae or juveniles, and adults.

An important step in understanding past successes and failures of amphibian reintroductions is a critical evaluation of past and current programs using standardized metrics for species characteristics and measures of success. A database with detailed information on attempted amphibian reintroductions would allow that sort of analysis. Such a database also could be used by both restoration practitioners searching for current information and contacts, and by scientists interested in evaluating programs with regard to species, geographic regions, and other factors.

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.

Translocation - deliberate and mediated movement of wild individuals or populations from one part of their range to another. (IUCN 1995).

In the winter of 2003, in collaboration with Tim Halliday of DAPTF, I used email and phone surveys of herpetological colleagues to collect preliminary information on recent (1980-present) reintroduction projects for amphibians throughout the world. As of March 2003, we had received what I believe to be a fairly complete list of programs in North and Central America. This included 46 reintroduction or translocation programs and associated captive breeding efforts involving 25 species. Information on these programs was compiled in tabular form and included the following categories: focal species, species' legal status, geographic location, individual or group in charge, years in operation, whether it was considered a translocation or reintroduction, whether captive breeding was part of the program, whether it included monitoring, reports or publications on the project, and detailed contact information for the project coordinator. This information is summarized in Table 1 below and details for each program are available at the DAPTF web site - <http://www.open.ac.uk/daptf/about/about7.htm>.

This collated information was used as a starting point for and documentation of existing amphibian reintroductions for an amphibian reintroduction database. Though the majority of amphibian reintroductions to date have occurred in North America, Europe, and Australia, the amphibian database described here will ultimately be international in scope to facilitate communication of best practices to and from all regions. It is also designed to distinguish between *in situ* and *ex situ* captive breeding programs associated with either translocations or reintroductions.

Methods

I began the process of developing a database for amphibians using an Avian Reintroduction Database (ARD) as a model (Earnhardt 2003). The ARD (Microsoft Access format) provides a searchable, updateable medium for storing information on reintroductions of birds. It contains 80 variables relating to demography, genetic, behavioral, and ecological aspects of focal species and their reintroduction sites. Currently it contains data on 54 species and 350 field releases from around the world (Earnhardt 2003). Further updates will include information on translocations and a possible expansion of the database to mammals (J. Earnhardt, pers. comm.)

Because the ARD database exists as a model, my project involved two steps: (1) evaluate the structure and variables in the ARD in terms of their appropriateness for amphibians, and (2) begin to fill in the revised database with information on amphibian reintroductions. The general structure of the ARD is depicted in Figure 1 and a detailed list of data fields for the avian database is available upon request. For step 1, I first made minor modifications to a template of the existing ARD data fields so that field names, terminology, and associated definitions were more appropriate for amphibians. I then solicited courtesy reviews of the proposed template from 11 herpetological colleagues by telephone and email. Step 2 involved collecting more detailed information for a subset of the 46 North and Central American programs described above; including acquisition of unpublished reports and relevant publications and email exchanges with practitioners. For this step, I focused on projects in the western United States and Canada because all of these were active programs involving species at risk and substantial literature was available for them.

Results

Of the 11 herpetological colleagues I queried, 6 provided comments on the proposed database structure. Comments ranged from very detailed to very general, but all were focused on

individual data fields rather than on the overall structure of the database. All comments were incorporated into the database template and the Access database structure is currently being revised. The overall structure of the database remains the same as the ARD and the revised data fields are described in Table 2. Published and unpublished reports were gathered through contacts listed in the table of amphibian reintroduction projects described above (available on the web at: <http://www.open.ac.uk/daptf/about/about7.htm>). These sources along with information gleaned from general natural history and field guides will provide the initial data for the revised amphibian reintroduction database. Not all sources listed are currently in hand; e.g., acquisition of some unpublished reports and Master's theses will require additional inquiries and costs (e.g., photocopying) (Table 3). In addition to the above accomplishments, conceptual advances were made through reviewing the amphibian reintroduction literature and via discussions with herpetological colleagues. Some of these concepts were incorporated into Lind (2005) and others are currently being developed in a manuscript.

Future Work

I continue to seek additional funding to complete work on the amphibian database project. A collaborator (JoAnn Earnhardt, Lincoln Park Zoo, Chicago, IL) and I applied unsuccessfully for a Lindberg Foundation Grant in 2004. I am currently writing a grant proposal to the Chicago Zoological Society Board of Trade, Endangered Species Fund, and will work with Pritpal Soorae (IUCN/SSC Re-introduction Specialist Group) to garner a letter of support for that proposal. I am also developing a manuscript covering both conceptual and practical aspects of amphibian reintroductions with a reintroduction practitioner from Oregon (Christopher Pearl, USGS Forest and Rangeland Ecosystem Science Center).

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Table 1. Summary¹ of recent (1980-present) and planned reintroduction/ translocation programs for amphibians in North and Central America (compiled via email and telephone inquiries, February – March 2003).

Region	Number of Active Programs	% of Programs with Species State or Federally Listed	% of Programs With Captive Breeding or Rearing	Species
Eastern U.S. ²	24	8.3	5.9	<i>Bufo fowleri</i> , <i>B. houstonensis</i> , <i>Hyla versicolor</i> , <i>Pseudacris crucifer</i> , <i>Rana clamitans</i> , <i>R. sylvatica</i> , <i>Scaphiopus holbrooki</i> , <i>Ambystoma annulatum</i> , <i>A. maculatum</i> , <i>Notophthalmus viridescens</i> , <i>Plethodon cinereus</i>
Western U.S.	17	100.0	23.5	<i>Bufo baxteri</i> , <i>B. boreas</i> , <i>Rana boylei</i> , <i>R. chiricahuensis</i> , <i>R. draytonii</i> , <i>R. lutriventris</i> , <i>R. muscosa</i> , <i>R. onca</i> , <i>R. pipiens</i> , <i>R. pretiosa</i> , <i>R. subaquavocalis</i> , <i>R. tarahumara</i>
Eastern Canada	0			
Western Canada	2	100.0	100.0	<i>R. pipiens</i>
Mexico	0			
Caribbean	2	100.0	100.0	<i>Bufo lemur</i> , <i>Leptodactylus fallax</i>
Central America	1	100.0	100.0	<i>Atelopus zeteki</i>

¹ Details on each program are available at the Declining Amphibians Populations Task Force web site – <http://www.open.ac.uk/daptf/about/abou7.htm>.

² Eastern U.S. is east of the Rocky Mountains. The high number of programs in this region are largely a result of a multi-year effort to translocate several relatively common species into unoccupied areas of the Gateway National Recreation Area in New York, U.S.A. (Cook 2002).

Table 2. Data fields and descriptions from Microsoft Access database (see Figure 1) of amphibian reintroductions. Database table names are highlighted. Data fields are grouped here for efficiency but each is a unique field within the database.

DATA FIELD	DESCRIPTION
Species Information	
Species ID, Order, Genus, Species, Subspecies, Common name	Taxonomic status
ESA status, CITES status, IUCN Red List category, Recovery Plan, PVA,	Risk status for each and information on analyses that have been done
Diet, Migratory, Aquatic/terrestrial, Ecotype Breeding Habitat Type, Adult Habitat Type,	Basic ecological data
Lifespan Min, Lifespan Max, Clutch size, Clutches/yr, Age at first mating (female), Age at first mating (male), Breeding season,	Life history information
Surrogate species, Surrogate for which species	Was this species used as a surrogate for another, if so, what was the other species?
Pre-Release, Release Site, Post-Release	
Site ID, Species ID	Site ID assigned automatically, Species ID from the Species Information table
Release site, State/region, Country, Latitude/longitude	Location of release
Reason for decline, Habitat loss, Over-exploitation, Invasives, Disease, Climatic effects, Contaminants/toxin, Synergies (combination of above), Problem addressed, Reason for reintroduction	Information on the causes of decline, indication of to what degree this problem has been addressed, and reason for the reintroduction.
Source facility, Type of facility/source, Source animals geographic origin, AZA, Captive pop (pre), Captive pop status, Head-starting, Bred for reintro	Information about the source population and source facility.
Size of release area, Total habitat area, Habitat type, Habitat protected, Within known range	Information about the release site.
Habitat alterations, Breeding/Oviposition, Feeding, Predator, Competitor, Fencing, Habitat enhancement/restoration, Invasive species removed, Predators, Competitors	Status of release site relative to restoration or protection/control of predators/competitors.
Wild pop present, Wild pop size, Program status and date, Continually Supplemented, Population status and date, Current Pop size and date	Status of released and wild population.
Release Event Log	
Event ID, Species ID, Site ID, Day, Month, Year, Reintroduction event date	Release date information.
Captive/wild hatching, Captive/wild reared, Head-started	Captive or wild rearing.
Medical screening, Vaccinations / preventative treatment, Genetic screening	Information on screening of released amphibians.
Selection criteria, Medical, Genetic, Behavior, C/W reared	Criteria used to determine which individuals were released.
Conditioning, Acclimatization, Acclim duration, Climate	Conditioning and acclimatization of released individuals and conditions of release site.
Into wild population, Release group type, Supplemental feedings, Feeding duration, IUCN guidelines, Surrogate procedure, Similar procedure	Information on release setting, feeding, guidelines and procedures followed.
#Animals released, #Male, #Female, #Unknown, # by Lifestage, Age Min, Age Max	Number of individuals released by gender and age/life stage.
Marked with, Monitored by, Monitoring duration	Monitoring and marking information.

DATA FIELD	DESCRIPTION
<u>Release Event Log, cont.</u> Survived 1 week, Survived 1 month, Survived 1 year, Breeding attempted, Breeding successful, Main cause of death	Survival and breeding status or released individuals.
<u>Sources</u> Source ID, Species ID, Authors, Year, Title, Publisher, Volume, Pages, Location, Type	Literature and other source information.
<u>Contacts</u> Species ID, Site ID, Contact name, Contact institution, Contact address, Contact email, Contact phone	Contact information.
<u>Agencies</u> Site ID, Agency ID, Agency Name	Agency information.

Table 3. Reports and publications on species reintroduction/translocation projects in the western United States and Canada (Rocky Mountains and west). **Highlighted** items are currently in hand. Information gleaned from these references in combination with general natural history and field guides (included in “Reports and Publications” at the bottom of the table) will provide the initial data for the amphibian reintroduction database. (Changes post-submission to T. Halliday [i.e. after 3/22/06] are in green text.)

Species	Location	Reports & Publications (detailed citations at bottom of table)
<i>Bufo baxteri</i> Wyoming toad	Mortenson Lake National Wildlife Refuge and Hutton Lake National Wildlife Refuge, Wyoming,	Baxter 1946, Baxter, 1952, Baxter 1985, Baxter and Meyer 1982, Baxter et al. 1982 , Baxter and Stone 1985, Blair 1957, Corn 1992, Freda et al., 1988, Garber and Patten 1990, Jennings and Anderson 1997 , Lewis 1984, Lewis et al. 1985, Odum and Spencer 1996, Packard 1971, Parker 2000, Parker et al. 2000, Porter 1968, Smith et al. 1998, Spencer 1999, Stone 1991, Taylor et al. 1999a, b, c, d, e, Withers 1992
<i>Bufo boreas</i> Boreal toad	Rocky Mountain National Park, Larimer County, Colorado	Muths et al. 2001, Scherff-Norris et al. 2002
<i>Rana boylei</i> Foothill yellow-legged frog	Pinnacles National Monument, California	Johnson 2004, Johnson and Saulino 2006
<i>Rana chiricahuensis</i> Chiricahua leopard frog	Pleasant Valley Ranger District, Tonto National Forest, Gila County, Arizona	Sredl and Healy 1999
<i>Rana draytonii</i> California red-legged frog	Guadalupe Restoration Project, Guadalupe-Nipomo Dunes Complex, San Luis Obispo Co., California	Rathbun and Schneider 2001
<i>Rana draytonii</i> California red-legged frog	San Francisco Bay Area, California	None known.
<i>Rana draytonii</i> California red-legged frog	Pinnacles National Monument, California	Fesnock and Johnson 2002
<i>Rana lutiventris</i> Columbia spotted frog	Heber Valley, Wasatch County, Utah	Ammon and Wilson 2000, Ammon and Wilson 2001
<i>Rana muscosa</i> Mountain yellow-legged frog	Sequoia – Kings Canyon National Park, California	Fellers, pers. com., Matthews 2003 , USDI National Park Service 2001
<i>Rana muscosa</i> Mountain yellow-legged frog	John Muir Wilderness, Sierra National Forest, Fresno County, California	Knapp 2001, Matthews 2003
<i>Rana muscosa</i> Mountain yellow-legged frog	Gable lakes, Inyo National Forest, Inyo County, California	None at present.
<i>Rana onca</i> Relict leopard frog	Boulder City, Nevada (artificial wetlands)	Bradford et al. 2004 , Malfatti circa 1999 , Relict Leopard Frog Conservation Team 2003
<i>Rana onca</i> Relict leopard frog	Lake Mead National Recreation Area, Arizona and Nevada	Bradford et al. 2004 , Malfatti circa 1999 , Relict Leopard Frog Conservation Team 2003

Species	Location	Reports & Publications (detailed citations at bottom of table)
<i>Rana pipiens</i> Northern leopard frog	Release sites are located in west central Alberta (Caroline and Rocky Mountain House area) and central Alberta (Red Deer area). Rearing facility is located near Caroline, Alberta	Fisher 1999, Kendell 2001, Kendell 2002, Kendell 2003a, Kendell 2003b, Kendell 2004, Romanchuk 2003, Wendlandt and Takats 1999.
<i>Rana pipiens</i> Northern leopard frog (southern mountain population)	Creston Valley, British Columbia	Adama et al. 2002, Adama et al. 2003, Wind 2002
<i>Rana pipiens</i> Northern leopard frog	Flathead Indian Reservation, Montana	None known.
<i>Rana pretiosa</i> Oregon spotted frog	Wickiup Reservoir, Oregon	In prep.
<i>Rana subaquavocalis</i> Ramsey Canyon leopard frog	Huachuca Mtns, Cochise County, Arizona	Demlong 1997, Ramsey Canyon Leopard Frog Conservation Team 2000, Sredl, et al. 2002
<i>Rana tarahumarae</i> Tarahumara frog	Proposed for Big Casa Blanca (Santa Rita Mtns) & Sycamore Canyons (Atascosa Mtns) , Nogales Ranger District, Coronado National Forest, Santa Cruz County, southern Arizona	Field et al. 2002, Hale and May, 1983, Hale and Jarchow 1988, Rorabaugh and Humphrey 2002, Sredl et al. 2004
Reports and Publications		
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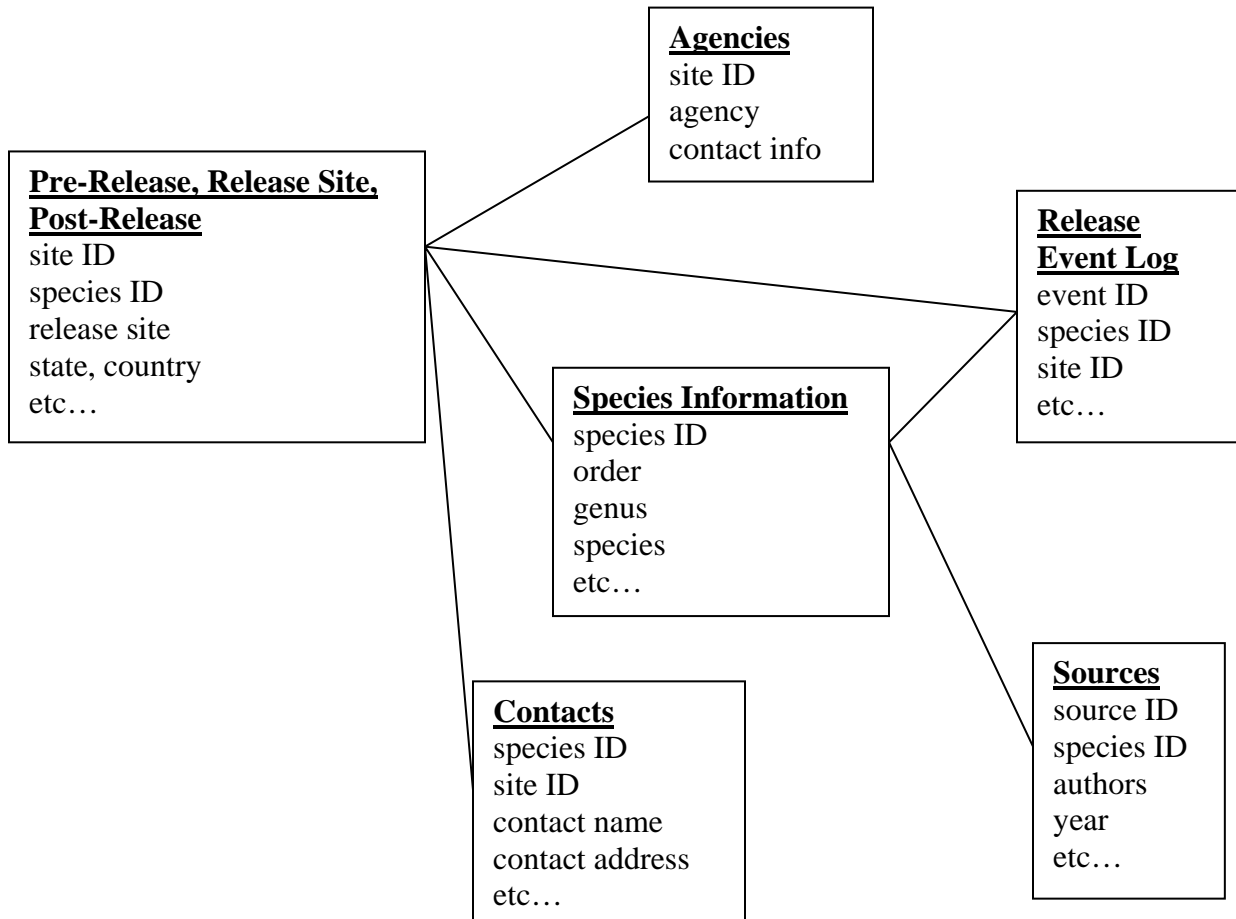


Figure 1. Structure of the amphibian reintroduction database, based on Microsoft Access “relationships” report. Boxes represent individual tables and lines represent linked data fields among tables. Table titles are underlined within each box and example data fields are listed below titles.