

# Lower Colorado River Multi-Species Conservation Program



*Balancing Resource Use and Conservation*

## Relict Leopard Frog Monitoring and Management

### 2011 Annual Report



December 2011

# Lower Colorado River Multi-Species Conservation Program Steering Committee Members

## **Federal Participant Group**

Bureau of Reclamation  
U.S. Fish and Wildlife Service  
National Park Service  
Bureau of Land Management  
Bureau of Indian Affairs  
Western Area Power Administration

## **Arizona Participant Group**

Arizona Department of Water Resources  
Arizona Electric Power Cooperative, Inc.  
Arizona Game and Fish Department  
Arizona Power Authority  
Central Arizona Water Conservation District  
Cibola Valley Irrigation and Drainage District  
City of Bullhead City  
City of Lake Havasu City  
City of Mesa  
City of Somerton  
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Mohave County Water Authority  
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Mohave Water Conservation District  
North Gila Valley Irrigation and Drainage District  
Town of Fredonia  
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Salt River Project Agricultural Improvement and Power District  
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Yuma Irrigation District  
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Desert Wildlife Unlimited

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Coachella Valley Water District  
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Bard Water District  
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Palo Verde Irrigation District  
San Diego County Water Authority  
Southern California Edison Company  
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## **Nevada Participant Group**

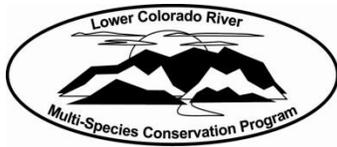
Colorado River Commission of Nevada  
Nevada Department of Wildlife  
Southern Nevada Water Authority  
Colorado River Commission Power Users  
Basic Water Company

## **Native American Participant Group**

Hualapai Tribe  
Colorado River Indian Tribes  
Chemehuevi Indian Tribe

## **Conservation Participant Group**

Ducks Unlimited  
Lower Colorado River RC&D Area, Inc.  
The Nature Conservancy



# Lower Colorado River Multi-Species Conservation Program

## Relict Leopard Frog Monitoring and Management

### 2011 Activity Report

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Lower Colorado River  
Multi-Species Conservation Program  
Bureau of Reclamation  
Lower Colorado Region  
Boulder City, Nevada  
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# ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
CAS	conservation agreement and strategy
EPMT	Exotic Plant Management Team
m	meter(s)
NPS	National Park Service
Reclamation	Bureau of Reclamation
T <sup>A</sup>	ambient air temperature
UNLV	University of Nevada, Las Vegas
USFWS	U.S. Fish and Wildlife Service

## **Symbols**

°C	degrees Celsius
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## EXECUTIVE SUMMARY

- Spring and fall surveys were completed at all natural and active experimental sites.
- High counts of adult and juvenile frogs at sites were similar to counts last year, with maximums of 585 frogs tallied in spring and 450 tallied in fall (table ES-1).
- The number of frogs at natural sites remains relatively low, and almost 80 percent of frogs counted were at the experimental sites.
- Low counts and limited apparent recruitment continues to be of concern at Rogers and Lower Blue Point, and the frogs observed at Upper Blue Point were mostly marked animals released at this site over the last few years.
- No relict leopard frogs were observed during spring surveys at Perkins Pond (following observations of adult frogs last year from the initial releases), and only two frogs were observed during the fall survey following this year's releases.
- Partial egg masses and some newly hatched tadpoles were collected for headstarting from three sites in Black Canyon as well as from Lower Blue Point.
- Union Pass Spring was permitted for experimental translocation and received its first translocated frogs.
- A total of 347 frogs from Black Canyon sites were released at Quail and Union Pass Springs, and a total of 990 frogs from Lower Blue Point were released at Perkins Pond, Rogers Spring, and back into Lower Blue Point.
- Sampling for *Batrachochytrium dendrobatidis* (*Bd*), the causal agent of chytridiomycosis, was conducted at Black Canyon Side Spring, Tassi Spring, and Upper and Lower Blue Point. *Bd* was detected on frogs at Lower Blue Point. *Bd* was also detected in samples of bullfrogs from the Muddy River near Perkins Pond.
- Habitat efforts were focused at Lower Blue Point, Bighorn Sheep Spring, and at Pupfish Refuge Spring.
- Assistance was provided to the Bureau of Land Management and the U.S. Fish and Wildlife Service on surveys to assess three potential translocation sites in the Gold Butte area.

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Table ES-1.—Summary of the maximum number of adult and juvenile frogs of *Rana onca* seen during visual encounter surveys in 2011, with results from 2010 presented for reference (The count totals presented are high counts mostly from nocturnal surveys. The seasonal totals represent minimum counts for the entire population.)

Site type	Site	Spring 2010	Fall 2010	Spring 2011	Fall 2011
Natural	Bighorn Sheep Spring	25	5	18	16
	Boy Scout Canyon Spring	23	20	23	46
	Dawn's Canyon Spring	4	3	8	5
	Black Canyon Springs	25	16	24	20
	Salt Cedar Canyon Spring	21	26	11	14
	Upper Blue Point <sup>1</sup>	30	26	31	22
	Lower Blue Point	10	3	6	6
	Rogers Spring	1	2	6	3
	Experimental	Goldstrike Canyon	18	27	15
Grapevine Spring		132	101	148	72
Pupfish Refuge Spring		42	38	31	25
Perkins Pond		Intro.	17	0	2
Quail Spring		169	191	164	96
Red Rock Spring		15	10	19	16
Tassi Spring		50	5	81	95
Union Pass Spring		–	–	Intro.	0
Totals		565	491	585	450

<sup>1</sup> In this table, the counts at Upper Blue Point are the highest totals from multiple mark-recapture surveys.

## Activities

This report summarizes efforts under a project intended to implement monitoring, headstarting, and translocation actions described in the voluntary conservation agreement and strategy (CAS) for the relict leopard frog (*Rana onca*). The intent is to manage these frogs through a cooperative interagency program designed to increase both overall numbers as well as number of populations in a defined area of southern Nevada and northern Arizona. The methods implemented in this project are specified in a protocol and techniques manual included in the CAS. In general, visual encounter surveys were conducted at all natural and experimental sites known to contain *R. onca*. To establish new populations and augment existing ones, egg masses and some young tadpoles were collected from native populations and reared in captive settings through development to advanced stage tadpoles or young frogs. These animals were then released at

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suitable sites following objectives determined by the Relict Leopard Frog Conservation Team. The following information summarizes observations made during monitoring surveys and results from the headstarting and translocation actions. Headstarting consists of individuals who were raised from egg to juvenile frog in a captive setting and then released back into the same spring from which they were collected. Translocation consists of frogs raised in a captive setting and released into a different spring from which they were originally collected. Other conservation actions are also discussed when appropriate.



# MONITORING OF NATURAL SITES IN BLACK CANYON

## Black Canyon Sites

### Bighorn Sheep Spring, Nevada

The low numbers of frogs seen this spring and fall (table 1) are consistent with observations over the last couple years. Four pools were created in the stream using sandbags and rock on July 25 and 29, 2011, by crews under the guidance of personnel from National Park Service (NPS) resource management. Frogs and tadpoles (mostly young) were later observed in these pools during the fall survey. Overall, habitat seems to be improving with vegetation returning and growing dense; hopefully, this vegetation will stabilize gravel within the stream. Large tadpoles were observed at this site, and juveniles were observed in the fall.

During the spring, 256 newly hatched tadpoles were collected from an isolated pool in the stream channel for the translocation program (see table 15). Habitat conditions for the tadpoles were limited, and it was assumed that survivorship of these tadpoles would have been minimal if left in the pool.

Table 1.—Summary of *Rana onca* observed at Bighorn Sheep Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	01/21/2011	14.1	0	0	600+	2
Nocturnal	04/14/2011	19.4	18	0	2	0
Nocturnal	10/12/2011	23.0	10	6	200+	0

### Boy Scout Canyon Spring, Nevada

Observations this spring (table 2) were similar to previous survey results, although during the fall, a record number of frogs were counted. Large tadpoles observed in a side channel low in the drainage near the river in the spring had turned into frogs by fall, which likely resulted in the high count. Many of the frogs counted in the fall were small adults, likely young of the year.

During the spring, a dead frog was observed in a thermal side pool where the water temperature was 56.6 degrees Celsius (°C). Although speculation, it appears that the animal leaped into the hot water and was overcome. Then, during the spring nocturnal survey, an injured individual was observed who appeared to have had its head previously crushed, possibly by being stepped on by a tourist visiting the nearby hot springs. The animal appeared blind, weak, and sickly in appearance.

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Table 2.—Summary of *Rana onca* observed at Boy Scout Canyon Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	01/21/2011	16.8	3	0	100	2
Nocturnal	04/19/2011	27.0	23	0	150+	0
Nocturnal	10/12/2011	26.7	40	6	0	0

From the upper breeding pools at this site, part of an egg mass was collected in spring for the translocation program (see table 15). As conducted in previous years, some minor habitat maintenance was performed at the upper pools to reduce emergent and overhanging vegetation and to maintain pool depth.

**Dawn’s Canyon Spring, Nevada**

Over the last few years, all life stages of *R. onca* have been observed within this small canyon site, and juvenile frogs are commonly seen, indicating successful reproduction and recruitment. Although no evidence of reproduction was observed this spring, the number of frogs counted during the nocturnal survey (table 3) matched the highest count recorded at this site, and in fall, one juvenile frog was observed. During the spring nocturnal survey, one dead, partly decomposed adult frog was observed in the upper plunge pool.

Table 3.—Summary of *Rana onca* observed at Dawn’s Canyon Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	02/07/2011	16.9	2	0	0	0
Nocturnal	04/14/2011	20.1	8	0	0	0
Nocturnal	10/12/2011	25.3	4	1	0	0

**Black Canyon Spring and Black Canyon Side Spring, Nevada**

These two areas represent components of the same system, although treated as separate sites for reporting. In general, the main stream segment does not represent good habitat for *R. onca*, and the few side patches where frogs have mostly been seen in the past have become overgrown. The lack of observations during the nocturnal survey along the main stream (table 4) was not surprising, and very few frogs have been observed along this stretch over the years. In contrast, all life stages were again observed in the cool waters of Black Canyon Side Spring (table 4), and the counts of frogs at this site remain relatively high.

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Table 4.—Summary of *Rana onca* observed at Black Canyon Spring and Black Canyon Side Spring during visual encounter surveys conducted in 2011  
(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
<b>Black Canyon Spring (main)</b>						
Diurnal	02/07/2011	18.8	0	0	0	0
Nocturnal	03/31/2011	21.8	0	0	0	0
Nocturnal	10/17/2011	25.5	0	0	0	0
<b>Black Canyon Side Spring</b>						
Diurnal	01/28/2011	14.0	6	0	12*	2
Nocturnal	03/31/2011	25.0	20	4	2	0
Nocturnal	10/17/2011	24.8	17	3	0	0

\* Identification of these small tadpoles was not certain.

Calling by *R. onca* was noted during nocturnal surveys in both spring and fall. Portions of two egg masses were collected at this site in the spring for the translocation program (see table 15).

### **Salt Cedar Canyon Spring, Nevada**

Vegetation has been rebounding from the scouring of this site in 2006, and some areas of the stream have again become quite choked. Water flow at this site seems diminished, possibly because of the increased vegetation. During the spring, some minor cutting of vegetation was conducted along the stream to keep a survey path open.

The number of frogs observed has declined from highs in 2009 (as many as 47 frogs) to only 11 frogs this spring and 14 this fall (table 5). The lower counts may relate somewhat to decreasing visibility as vegetation increases; however, even in some of the more open pools, few frogs were seen. Large tadpoles seen in the spring and a few juveniles (including a metamorph) indicate reproduction and recruitment this year. During the spring, a skeleton of an adult frog was observed, and raccoon prints were evident. There is concern regarding adult frog survivorship. Only three of the frogs seen in the fall were large adults (hence, likely older individuals).

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Table 5.—Summary of *Rana onca* observed at Salt Cedar Canyon Spring during visual encounter surveys conducted in 2011  
(Temperature [<sup>o</sup>C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	01/28/2011	20.7	5	0	50+*	0
Nocturnal	04/19/2011	27.0	8	3	70	0
Nocturnal	10/17/2011	25.2	12	2	0	0

\* Identification on these small tadpoles was not certain.

## Northshore Springs Complex

### Upper and Lower Blue Point Spring, Nevada

In recent years, surveys at Blue Point Spring have been split into upper and lower portions of the stream. Seasonal mark-recapture estimates have been made at Upper Blue Point as part of a long-term study; similar efforts have occurred this year. The observations from these nocturnal surveys are reported herein as visual encounter surveys (table 6). Most of the frogs observed were individuals released to the site as part of augmentation efforts in 2008 and 2010. As is typical at Upper Blue Point, no egg masses or tadpoles were observed; although, calling was heard during the spring surveys. Observation of a young, unmarked frog this year provides evidence of at least some minimal recruitment, but natural recruitment at this site has been very limited over the last several years.

The number of *R. onca* observed at Lower Blue Point remains low (table 6), and all the animals observed were in areas where vegetation was cut earlier in the year as part of an effort to rehabilitate the fish-free pond at this site. Calling was heard in the spring at the disturbed sites, and egg masses were found in the pool again this year along with some tadpoles. Partial egg masses were collected for the translocation program (see table 15). Although the eggs left in the pond should have produced numerous tadpoles, none were seen during a search of the pond at the end of March. Because of the lack of observed tadpoles, some animals were returned to the site. By July 16, the intake to the pond had become overgrown again, and the fish-free pond was drying out. By the fall survey, the pond consisted of only moist soil and cattails. In general, habitat along the entire stream is overgrown, and very little open habitat exists.

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Table 6.—Summary of *Rana onca* observed at Upper and Lower Blue Point Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
<b>Upper Blue Point</b>						
Diurnal	02/08/2011	15.0	0	0	0	0
Nocturnal	03/29/2011	18.2	13	0	0	0
Nocturnal	04/04/2011	19.5	19	0	0	0
Nocturnal	05/02/2011	19.3	30	1	0	0
Nocturnal	05/21/2011	28.4	26	0	0	0
Nocturnal	06/06/2011	26.4	25	1	0	0
Nocturnal	09/28/2011	27.8	22	0	0	0
Nocturnal	10/09/2011	19.3	12	1*	0	0
Nocturnal	10/15/2011	26.7	20	0	0	0
Nocturnal	10/27/2011	17.0	22	0	0	0
Nocturnal	11/10/2011	13.2	21	0	0	0
<b>Lower Blue Point</b>						
Diurnal	02/08/2011	17.8	1	0	20	4
Diurnal	02/11/2011	22.1	0	0	20+	3
Nocturnal	03/29/2011	13.9	6	0	0	0
Nocturnal	7/16/2011	22.9	6	12	0	0
Nocturnal	10/18/2011	24.3	4	2	0	0

\* Identification of the juvenile frog was not certain.

### **Rogers Spring, Nevada**

Habitat conditions for *R. onca* at this site remain relatively poor, with dense vegetation covering most of the stream system. Most frogs observed at this site (table 7) occur along the powerline road where some open habitat remains and where headstarted frogs were released in the past. Again this spring, a few headstarted animals were released at this area (see table 16). This area also includes a site just upstream from the powerline road where frogs occupy a slow, side flow of water that runs through a dense patch of compressed, short vegetation.

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Table 7.—Summary of *Rana onca* observed at Rogers Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	03/12/2011	28.0	3	0	0	0
Nocturnal	04/12/2011	15.1	6	0	0	0
Nocturnal	10/11/2011	22.9	3	0	0	0

## MONITORING OF EXPERIMENTAL TRANSLOCATION SITES

### Goldstrike Canyon, Nevada

Translocations to this site ended in 2009, and the numbers of adult frogs seen during the nocturnal surveys is somewhat lower than counts in recent years. Throughout this year, we observed egg masses and larvae (including a late-stage tadpole in the fall), but no juvenile frogs (table 8), so we cannot confirm natural recruitment at this site. During the fall survey, an egg mass was found in a very small side pool off the main channel. This site contained only a trickle of water, and efforts were made to increase the flow to support tadpoles. The fall surveys were both conducted upstream past the “Grotto” where surveys have normally ended, but no *R. onca* were observed above the traditional ending point.

Table 8.—Summary of *Rana onca* observed at Goldstrike Canyon during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	01/28/2011	15.8	3	0	300+	3
Nocturnal	04/14/2011	21.4	15	0	50+	0
Nocturnal	10/23/2011	27.9	9	0	17	0
Nocturnal	11/09/2011	20.8	12	0	12	1

### Grapevine Spring (Meadview, Arizona)

Translocations to this site ended in 2009, but evidence of reproduction has consistently been seen at this site. Frogs were observed calling, in amplexus, and laying eggs this spring (table 9). Large tadpoles were noted in the spring and fall,

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Table 9.—Summary of *Rana onca* observed at Grapevine Spring (Meadview, Arizona) during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	03/05/2011	19.3	98	0	6	0
Nocturnal	04/22/2011	20.2	146	2	325+	11
Nocturnal	10/19/2011	22.0	71	1	7	0

and the juveniles observed this year confirm natural recruitment. In recent years, the number of adults counted has been high, and the result from the spring, nocturnal survey this year represents the highest count to date. This site was substantially impacted by flood water during a storm in October 2010. Habitat conditions appear good this year, but vegetation (particularly cattails and monkey flowers) has quickly grown back. Dense vegetation certainly impacted visibility during the fall survey.

## Pupfish Refuge Spring, Nevada

Augmentation at this site ended in 2008, but the number of adult frogs seen this year (table 10) remains consistent with numbers counted in recent years. Juvenile frogs, along with a few late-stage tadpoles were observed this year, indicating active natural recruitment. Speckled rattlesnakes (*Crotalus mitchelli*) were observed within areas occupied by frogs during both fall surveys.

Table 10.—Summary of *Rana onca* observed at Pupfish Refuge Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	02/15/2011	20.0	2	0	1050+	1
Nocturnal	04/21/2011	27.9	31	0	56	2
Nocturnal	10/03/2011	29.6	16	2	0	0
Nocturnal	10/13/2011	29.5	25	0	0	0

As part of a Bureau of Reclamation (Reclamation) project, tamarisk was removed from the lower portion of the stream (below Portal Road) by the NPS Exotic Plant Management Team (EPMT) during the week of November 28–December 2. This was the culmination of 3 years of efforts to remove tamarisk at this site. Herbicide was again used on the newly cut stumps and for retreatment of

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regrowth in other areas of the system. As part of efforts to improve habitat this year, approximately 250 willow cuttings were planted by crews under the direction of Reclamation personnel. Some rock work was also conducted to create pooling in the stream.

During this time, personnel from the University of Nevada, Las Vegas (UNLV) and NPS spent 2 days working along the Portal Road drainage ditch to remove cattails and grasses that choke the drainage and to create several small pools; this area appears to be the main source of recruitment for *R. onca* at this site. The main pool at the base of the road was choked with vegetation and did not appear to contain tadpoles as in previous years. These cattails were dug out by the roots to recreate a large pool (12.5 meters [m] x 2 m x 0.30 m). Several large tadpoles were rescued from the ditch as work progressed and placed into less disturbed pools.

## **Quail Spring, Nevada**

Translocation to this small spring site began in 2008, and as part of this continuing effort, 75 tadpoles were released this spring (see table 16). The spring surveys were again quite high this year, with the diurnal count being the highest recorded at this site for daylight surveys. The nocturnal spring survey, however, was conducted a bit late in the season and may have been impacted by young animals emerging from the earlier release (table 11). The frog population at this site is quite dense, but the frogs look to be in good health. Calling was heard during both surveys. The number of frogs observed in the fall was conspicuously low, but the frogs were mostly sitting amongst the dense vegetation in the center of the pond and were difficult to see (the observer noted that there were definitely more frogs than officially counted).

Table 11.—Summary of *Rana onca* observed at Quail Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [ $T^A$ ] during the survey.)

<b>Survey type</b>	<b>Date</b>	<b><math>T^A</math></b>	<b>Adult</b>	<b>Juvenile</b>	<b>Larvae</b>	<b>Egg masses</b>
Diurnal	03/11/2011	25.0	81	0	3	7
Nocturnal	05/14/2011	25.2	161	3	15	0
Nocturnal	10/23/2011	20.0	96	0	16	0

Before the May survey, some cattails along the bank of the main pond and grasses growing in the smaller pond were pulled. At that time, there was some concern that vegetation would overrun the ponds if cattle did not return over the summer; however, by the fall survey, cattle and burros had devoured and disturbed

vegetation surrounding both ponds. Interestingly, in the fall, the lower artificial pond was full of dragonfly nymphs (> 100 individuals), and no tadpoles were observed.

## **Red Rock Spring, Nevada**

Translocations to this site ended in 2010. The number of adults counted this year (table 12) remained relatively similar to the numbers observed over the years. Evidence of reproduction has been observed on numerous occasions, and one large tadpole was observed in a pool this fall, but natural recruitment has not yet been confirmed at this site. Surface water, however, often dries down during summer months and appears to greatly limit the ability of tadpoles to mature. A summer survey was conducted along with Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service (USFWS) personnel to assess the potential for habitat restoration that could help with surface water retention. Even following the summer rains just previous to the visit, water flow was intermittent. Of note this year, during the first fall survey, three great horned owls (*Bubo virginianus*), known predators of frogs, were observed at the site.

Table 12.—Summary of *Rana onca* observed at Red Rock Spring during visual encounter surveys conducted in 2011  
(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

<b>Survey type</b>	<b>Date</b>	<b>T<sup>A</sup></b>	<b>Adult</b>	<b>Juvenile</b>	<b>Larvae</b>	<b>Egg masses</b>
Diurnal	03/03/2011	25.3	7	0	0	0
Nocturnal	04/26/2011	20.2	19	0	0	1
Diurnal	7/13/2011	37.4	13	0	4	0
Nocturnal	10/14/2011	22.2	14	0	0	0
Nocturnal	10/21/2011	16.5	16	0	0	0
Nocturnal	10/28/2011	12.4	12	0	1	0

Mark-recapture surveys, as part of efforts funded by the USFWS, were also conducted at this site in order to better quantify the status of the population; counts from this effort are reported herein as visual encounter surveys (see table 12). From the estimate, only around 20 adult frogs currently occupy the site.

## **Tassi Spring, Arizona**

Translocations to this site ended in 2010. High numbers of frogs seen during the spring surveys this year (table 13) alleviated fears expressed last year following

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Table 13.—Summary of *Rana onca* observed at Red Rock Spring during visual encounter surveys conducted in 2011

(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Diurnal	03/03/2011	25.7	52	0	800+	6
Nocturnal	03/16/2011	25.9	77	4	100+	2
Diurnal	10/15/2011	22.2	85	10	50+*	2

\* Identification on larvae was not certain.

very low counts during the fall surveys. Many of the frogs observed this spring were clearly not young of the year, and the large swings in seasonal observability of frogs at this site are a mystery. The number of frogs observed during the fall survey this year remained high. One adult *R. onca* was found dead in the horse trough in the fall, but in general, frogs appeared healthy.

Evidence of reproduction at this site has been observed on numerous occasions, including egg masses and tadpoles observed this year during the spring and fall. Overwintering tadpoles were again observed in the horse trough. Calling was heard during both spring and fall surveys, and amplexus was seen during the spring. The observation of juveniles this year may still represent recruitment from tadpoles released last year, so natural recruitment (although likely) has yet to be confirmed.

Previous to the fall survey, cattle were observed near the site, and evidence of cattle use was clear along the lower stretch of the spring; however, no tracks were seen within the fenced area around the ranch house (including the spring head). An EPMT crew was at the site on April 27 to control Scotch thistle (an invasive exotic weed) using herbicide, including areas along the upper ditch.

## **Perkins Pond, Nevada**

A total of 372 late-stage tadpoles from Lower Blue Point were first translocated to this artificial pond in spring 2010. Later in the fall of that year, 17 adult frogs were observed. During surveys this spring, however, no *R. onca* were observed (table 14). The water temperature was still quite cold during the first spring surveys (11.7 and 19.0 °C), but had warmed (23.3 °C) by the latter survey. This year, 833 late-stage tadpoles and froglets were released into the pond (see table 16), but only two small *R. onca* frogs were observed during the fall survey (table 14). The week previous to the fall survey, however, was cool (in the low teens °C) with heavy rains, and the frogs may have already hunkered down for the season.

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Table 14.—Summary of *Rana onca* observed at Perkins Pond during visual encounter surveys conducted in 2011  
(Temperature [°C] is the ambient air temperature [T<sup>A</sup>] during the survey.)

Survey type	Date	T <sup>A</sup>	Adult	Juvenile	Larvae	Egg masses
Nocturnal	02/23/2011	14.8	0	0	0	0
Nocturnal	04/05/2011	25.1	0	0	0	0
Nocturnal	05/05/2011	25.8	0	0	0	0
Nocturnal	10/10/2011	20.5	2	0	0	0

During the spring, large numbers of chorus frogs (*Pseudoacris* sp.) were actively breeding in the pond. Early this year, *Batrachochytrium dendrobatidis* (*Bd*) was documented in bullfrogs (*Rana [Litobates] catesbeiana*) from nearby areas along the Muddy River, and there are concerns regarding transmission of *Bd* by chorus frogs. The pond is also used extensively by aquatic birds which likely prey on *R. onca*. The pond water also appeared somewhat stagnant in the fall, with large numbers of small aquatic organisms within the water column.

## Union Pass Spring, Arizona

This new site in the Black Mountains of Arizona received final compliance this year, and animals were released into two areas within the system (identified herein as the “Upper Springhead” and “Pipe Pools”). Both release sites were in relatively deep shade. At the Upper Springhead, some black willow (*Salix* sp.) were cut to open habitat and allow more sunlight to reach the pools, and at the Pipe Pools, some overhanging branches of scrub oak (*Quercus* sp.) were removed along with cattails and dead branches in the drainage bottom. The translocation effort on April 29 received considerable media attention.

During the last release on May 26, one juvenile *R. onca* was seen at the Pipe Pools, but none were seen at the Upper Springhead. No *R. onca* were seen during a nocturnal survey of Pipe Pools on October 24; the Upper Springhead site was not visited. Survey conditions that evening were good (air temperature 24.4°C), but followed colder, stormy weather during the previous week.

## OTHER MONITORING ACTIONS

### Sugarloaf Spring, Nevada

Located on the Arizona side of Black Canyon, this site was one of the earliest translocations. Although the spring flow was once substantial, the water dried up, and frogs disappeared. A site visit was conducted on January 29 to assess current conditions. There remains no major surface water flow, and only some small pools in the channel, likely filled by rains.

### Site Visits to Bear Paw Poppy, Horse, and Lime Springs

Three springs with potential as translocation sites for *R. onca* (Bear Paw Poppy, Horse, and Lime Springs) were targeted for additional summer visits by BLM, USFWS, and UNLV personnel on the Relict Leopard Frog Conservation Team. This followed efforts to assess springs within the Gold Butte area for *R. onca*, conducted by the U.S. Geological Survey, Western Ecological Research Center (P.I. Dr. Ken Nussear), under funding from BLM.

Bear Paw Poppy Spring (E 744065, N 4035910, Z 11) was visited on July 13. This lotic spring had a water depth of up to 0.3 m and a maximum width of about 6–10 m. The water flow at the time of the visit was quite good, with a temperature of 24.7 °C, but this followed a relatively cool and rainy spring-early summer. Some water flow, however, has been noted during site visits over several years. The site is at relatively low elevation (~ 460 m), and numerous other small springs are located nearby. The spring and stream are densely covered in aquatic vegetation, including cattails, but burro use is quite high, which has opened up the vegetation along several stretches of the stream. Red-spotted toad (*Bufo* = *Anaxyrus punctatus*) was heard calling at the site along with another potential unidentified species. Also, a small unidentified tadpole was observed (probably a toad).

Horse Spring (E 757563, N 4026539, Z 11) was also visited on July 13. This spring is also at a relatively low elevation (~ 900 m) and appears to maintain a consistent water flow (equal to that of a garden hose). The aquatic system runs for less than 100 m with a maximum width of about 6–10 m and depths less than 0.5 m. The site was heavily impacted by cattle (trampling and grazing), which produced a relatively open, muddy structure. Without cattle or burros, the site would likely become quickly overgrown by cattails and grasses. The riparian vegetation also included Gooding's willow, tamarisk, desert willow, and a *Baccharis*-like plant. The water temperature taken at the main pool with no shade was 34.2 °C at an air temperature of 34.3 °C. Predatory dragonflies, damselflies, and beetles were noted.

Lime Spring (E 763527, N 4052176, Z 11) is along the east side of the South Virgin Peak Ridge located at a relatively high elevation (> 1,430 m at the end of the diurnal survey where vegetation became too dense to easily follow the water). This site was visited on July 14, when the water temperature was cool (20.5 °C at an air temperature of 34.4 °C) and the stream had a steady flow (well more than a garden hose). Aquatically associated plant species (sedges, *Anemopsis*, etc.), however, were only associated with the very upper portions of the site. The water ran down the canyon for more than 500 m, but there was evidence that this was not always the case from the lack of aquatically dependent vegetation and the presence of historical water development that piped water to downhill troughs. The width of the spring ranged from 3–5 m with a depth of up to 0.25 m. Other vegetation included oaks, Gooding's willow, and big-tooth sage (*Artemisia*). The spring was occupied by chorus frogs and red-spotted toads, with adults and tadpoles seen throughout the system.

## Chytridiomycosis Assessment

Testing for the pathogenic fungus *Bd*, the causal agent of chytrid, was continued this year, and efforts have been expanded through a Nevada Department of Wildlife project with UNLV. A total of 84 *R. onca* frogs from Black Canyon Side Spring, Tassi Spring, and Upper and Lower Blue Point were tested, along with 20 bullfrogs from areas around the source of the Muddy River. Assessments of these samples detected *Bd* in the spring time on *R. onca* at Lower Blue Point (also detected at this site last year) and on bullfrogs from the Muddy River. Samples of Blue Point animals from both the upper and lower areas were again collected in mid-July (during hotter ambient temperatures); these samples tested negative.

## HEADSTARTING AND TRANSLOCATIONS

### Collections

Portions of three egg masses (more than one-half of each mass) and some newly hatched tadpoles representing a fourth egg mass were collected from the wild at three sites in Black Canyon during late January (table 15). In early February, portions of three egg masses were also collected from Lower Blue Point. The egg masses at Lower Blue Point were found in the created fish-free pond. Headstarted frogs had been released into this pond in 2008, and headstarted tadpoles were released into the nearby stream in 2010. Native animals have been previously observed nearby. In early January, the pond was rehabilitated with the pond cleared and flow re-established through the water pipe (the pipe had become clogged in late spring 2010). Vegetation was also cleared from the main stream channel where the intake for the pond water is located.

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Table 15.—Collection sites and dates collected of partial egg masses of *Rana onca* for headstarting and translocation in 2011

Area	Site	Date	No. of partial egg masses
<b>Black Canyon</b>			
	Bighorn Sheep Spring	01/21/2011	1 (256 tadpoles*)
	Boy Scout Canyon Spring	01/21/2011	1
	Black Canyon Side Spring	01/28/2011	2
<b>Northshore</b>			
	Lower Blue Point	02/08/2011	2
	Lower Blue Point	02/11/2011	1

\* Newly hatched from a single egg mass.

## Translocations

This year, 1,337 animals (1,049 late-stage tadpoles and 288 froglets) were translocated to three experimental sites and two natural sites (table 16). Animals from Black Canyon were released at Quail Spring and to the new site – Union Pass Spring in the Black Mountains, Arizona. Animals from Lower Blue Point were released at Perkins Pond, Rogers Spring, and back to Lower Blue Point.

Table 16.—Numbers of late-stage tadpoles and post-metamorphic frogs of *Rana onca* raised from eggs collected in Black Canyon or Lower Blue Point and released at sites in 2011

Stocks	Translocation site	Date	Tadpoles	Frogs	Site totals Grand total
<b>Black Canyon</b>					
	Quail Spring	03/11/2011	75	–	75
	Union Pass Spring	04/15/2011	60	15	–
	Union Pass Spring	04/29/2011	158	12	–
	Union Pass Spring	05/26/2011	24	3	272
Cumulative totals			317	30	347
<b>Blue Point</b>					
	Perkins Pond	04/05/2011	212	–	–
	Perkins Pond	05/05/2011	171	10	–
	Perkins Pond	05/16/2011	180	80	–
	Perkins Pond	06/03/2011	137	43	833
	Lower Blue Point	05/19/2011	0	100	–
	Lower Blue Point	05/30/2011	12	20	132
	Rogers Spring	04/25/2011	20	5	25
Cumulative totals			732	258	990
<b>Grand totals</b>			<b>1,049</b>	<b>288</b>	<b>1,337</b>

## Hatchery Issues

The Lake Mead State Fish Hatchery and Willow Beach National Fish Hatchery each provided a runway to rear tadpoles this year. The runway at the State hatchery was a new addition, instigated following the problems observed with the health of tadpoles and froglets reared at Willow Beach in recent years. Numbers of tadpoles reared at these facilities were minimized (at Willow Beach because of the previous health issues and at the State hatchery because this was an untried facility). Young tadpoles from Black Canyon sites were reared at the hatcheries, with a total of 261 tadpoles moved to the State hatchery on different days in February and March and 108 tadpoles moved to Willow Beach on March 2.

At Willow Beach, the rearing of the tadpoles was carefully controlled. The water flow in the raceway was minimized and aeration added; the water source was the aerated water from the newer well. A raceway nearer to the windows was used and artificial light added. In the past, food was supplemented with fish flakes and spirulina added by hatchery personnel. This year, only the exact same food used at the Hilltop facility was fed to the hatchery tadpoles. At the State hatchery, the same general raceway setup was used, although this facility uses unfiltered Lake Mead water, and a makeshift setup of heaters had to be added to warm the water. Water temperature in this raceway only reached 19 °C, while at Willow Beach the water temperature was 22 °C; tanks at the Hilltop facility had temperatures ranging from 22 and 27 °C. Both hatcheries were visited often to assess the development of the tadpoles, and in general, animals appeared healthy. Only one tadpole at Willow Beach was removed from the group because it was unable to stay under the surface and tended to spin in circles when attempting to reach the bottom. From late March through early April, a total of 15 healthy animals close to metamorphoses were moved from Willow Beach to Hilltop for further development. Tadpoles at the State hatchery grew at a slower rate likely because of the colder water temperature.

All animals from the hatcheries were released to Union Pass over three time periods (see table 16), but during pre-release treatments, 85 tadpoles died. Unfortunately, animals from the two hatcheries were mixed during the first treatments, but losses during the second event, which included only animals from the State hatchery, suggests that the problem was with the animals from that facility. Some tadpoles were rescued by placing them in tanks at the Hilltop facility where they revived and were later successfully released. None of the froglets treated had problems, and tadpoles reared at the Hilltop facility were treated without losses before, between, and after the events above, indicating that the problem was not caused by errors in the treatment protocol or the medicines used. One possibility is that the transfer of tadpoles from the cold water at the State hatchery to the warmer waters used in the treatments may have added an additional stress.