State of Utah
DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife Resources – Native Aquatic Species

Columbia Spotted Frog
(Rana luteiventris)

MONITORING SUMMARY

Central Region
2004

Erika M. DuRoss, UDWR

Publication Number 05-23
Utah Division of Wildlife Resources
1594 W. North Temple
Salt Lake City, Utah
James F. Karpowitz, Director

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1. INTRODUCTION

The Columbia spotted frog (*Rana luteiventris*) is distributed from southeastern Alaska to Oregon and western Wyoming with isolated populations existing in Utah and Nevada. Historically, spotted frog populations were common throughout the Bonneville Basin. The distribution declined following the recession of Lake Bonneville, resulting in the isolation of several remaining populations (Hovingh 1993). Today, many of these historic populations have been extirpated and the remainder are vulnerable to a variety of physical and biological impacts (Perkins and Lentsch 1998).

The Utah Division of Wildlife Resources (UDWR) monitors spotted frog populations to observe population trends, determine distribution, and identify potential habitat. Monitoring takes place annually during the spring breeding season at breeding sites documented during surveys conducted in 1992 and 1993 (Ross et al. 1993). The estimated size of a spotted frog population is based on the number of egg masses counted during the breeding season (Ross et al. 1993, Ross et al. 1994). The number of breeding adults in a population is estimated by doubling the number of observed egg masses. The estimates are then used to examine population trends based on annual fluctuations. The monitoring program also provides baseline data for development of management plans to accomplish the goals outlined in the Conservation Agreement and Strategy for spotted frog (Perkins and Lentsch 1998).

Spotted frog populations in Utah have been separated into three Geographic Management Units (GMU) (Perkins and Lentsch 1998). The GMU's were divided into subunits based on United States Geological Survey (USGS) hydrologic units; only those subunits contained within the Central Region are discussed in this report.

1.1 Wasatch Front GMU

The Wasatch Front GMU consists of six USGS hydrologic subunits, four of which are covered in this report.

1.1.1 Spanish Fork River, 16020202: Three spotted frog breeding sites occur within this subunit: Holladay Springs (south of Payson), East Hatchery Pond in Springville, and Diamond Fork River.

1.1.2 Utah Lake, 16020201: This subunit includes two spotted frog breeding sites in Juab County: One population is located at Mona Springs (part of the Burraston Ponds Wildlife Management Area) and the other is located in wetlands south of Burraston Ponds (hereafter referred to as the Burraston Ponds population). New breeding sites were located in the Burraston Ponds population during sweep surveys conducted in 1999, these sites have since been included in the annual monitoring.

1.1.3 Provo River, 16020203: Two spotted frog populations occur within this subunit: one is found in wetlands along the Provo River above Jordanelle Reservoir (Jordanelle/Francis population), and the other occupies wetlands along the Provo River between Jordanelle and Deer Creek reservoirs (Heber Valley population).

1.1.4 Jordan River, 16020204: The Jordan River hydrologic unit was surveyed in 1992 by Ross et al. (1993) but no egg masses were found. No surveys have been conducted in the Jordan River drainage in subsequent years.

1.2 Sevier River GMU: The Sevier River GMU consists of three USGS hydrologic subunits.

1.2.1 San Pitch River, 1603004: This subunit contains the Fairview spotted frog population, which includes 11 breeding sites that have been monitored annually since 1992. Fifteen new sites were found during sweep surveys conducted in 1999-2000.

1.2.2 Middle Sevier River, 16030003: Spotted frogs have not been documented in this subunit.

1.2.3 Lower Sevier River, 16030005: Spotted frogs have not been documented in this subunit.

1.3 West Desert GMU: The West Desert GMU contains seven hydrologic subunits, five of which are covered in this report:

1.3.1 Ibapah Valley, 16020306: This subunit contains a large population of spotted frogs found throughout the Ibapah Valley. Two monitoring sites were established in 1997 to represent different habitat types in the valley. The south monitoring site is

typified by natural spring sources while the north monitoring site is pastureland that is artificially flooded.

1.3.2 Snake Valley, 16020301: The border between the UDWR Central and Southern Regions bisects Snake Valley. The Central Region monitors the Leland Harris and Miller Spring populations while the Southern Region monitors the Gandy and Bishop Spring populations.

1.3.3 Tooele Valley, 16020304: Spotted frog egg masses were discovered at one location, near the town of Vernon, during 2002 sweep surveys. There is no historical documentation of spotted frogs inhabiting this area.

1.3.4 Skull Valley, 16020305: Spotted frogs have not been documented in this subunit.

1.3.5 West Great Salt Lake, 16020308: Spotted frogs have not been documented in this subunit.

2. METHODS

Known breeding sites were surveyed weekly during the breeding season to collect information on the number of egg masses deposited and the development and metamorphosis of tadpoles. Upon locating an egg mass cluster, the number of egg masses within the cluster was recorded. Each cluster was visited weekly thereafter with only new egg masses within the cluster being counted. In addition, egg masses were classified into four developmental age class categories based upon the dominant embryo shape: 1) circular, 2) oblong or kidney shaped, 3) comma shaped, or 4) hatchlings. Furthermore, upon locating an egg mass cluster, the depth from the center of the egg mass cluster to the top of the water column and the distance from the center of the cluster to the shore were recorded. Water temperatures, pH, and dissolved oxygen levels were also recorded. Where possible, embryos were collected from individual egg masses (5 embryos each) at 10 sites throughout each population for future genetics studies. The number of egg masses observed during the breeding season is doubled; this number

represents the effective population size of spotted frog (N_e = the number of breeding individuals that contribute to the reproductive effort for the year).

HEBER VALLEY POPULATION MONITORING METHODS

Currently, the Utah Reclamation Mitigation Conservation Commission, University Nevada Reno, and the UDWR cooperatively study the spotted frog population in the Heber Valley. The goals of this cooperative effort are: (1) to evaluate population responses to habitat that was newly created during the Provo River Restoration Project (PRRP) construction; and (2) to determine spotted frog movements in natural conditions, in relation to newly created habitat, and in response to artificial relocation. Each egg mass cluster observed was recorded on digitized aerial photos and entered into an Arc View database (ESRI Inc. 1996) along with information on egg mass numbers per cluster and developmental stage. Subsequent weekly visits documented development, survivorship and additional egg masses. Spring sweeps, involving the surveys of all potential habitats, were conducted throughout the entire Provo River corridor between Jordanelle and Deer Creek reservoirs coinciding with the peak of egg mass deposition.

Surveys were conducted for all post-metamorphic life stages according to a Visual Encounter Survey (VES) protocol using a randomized walking pattern while maintaining a record of survey effort through time spent and area covered (Crump and Scott 1994). Locations of all spotted frogs were recorded on digitized aerial photographs and entered in an Arc View database along with the number and life stage of individual frogs, frog activity and environmental conditions (air temperature, cloud cover, wind speed based on Beauport scale, and relative water level). Hand-held dip nets were used to capture frogs. The following measurements were taken on all adult frogs: snout-vent length (SVL), weight, and sex (based upon presence or absence of nuptial pads). Age classes were determined using an approximate size-age relationship established with previously collected data (Ammon, 2001): young-of-the-year (YOY) <35mm SVL, juveniles <45 mm SVL, and adults >45 mm SVL. Adult frogs were scanned for presence of a PIT-tag (Passive Integrated Transponder). Those without PIT-tags were not marked, but instead were photographed to allow for identification based upon spotting pattern. Dorsal surface photos of adult frogs were taken using a Nikon Coolpix

4300 digital camera. Photos were labeled individually with date, site and time of capture, then further categorized by male versus female and organized into a dichotomous key of spotting patterns. Spots were classified as present or absent on the head, present or absent medially, laterally on the right and/or the left side. During times of low spotted frog activity, mesh minnow traps were used to increase encounter rates.

Chytrid Monitoring: In the fall of 2001, chytrid fungus (*Batrachonytrium dendrobatidis*) was detected in spotted frogs in three separate locations in the Heber Valley resulting in the initiation of an intensive monitoring plan. Chytrid fungus infects only the keratinized epithelium of amphibians, limiting it in tadpoles to their mouthparts. Normal spotted frog tadpoles exhibit well-defined black and bilaterally symmetrical oral-disk, jaw sheath (beak) and toothrows (2 upper, 2 lower). Tadpoles infected with chytrid fungus lack pigment in either toothrows or beak, which may be accompanied by redness and swelling in more advanced cases (Fellers et al, 2001). Examination was performed before tadpoles began to metamorphose since the beak and toothrows lose pigment with the transformation of the mouth.

All sites with egg masses were sub-sampled for tadpoles with the goal being 10 to 20 tadpoles from each egg mass site. Tadpoles were captured using a hand-held dip net and observed with a 10X or 16X magnification hand lens. Photos of abnormal tadpole mouths were taken.

In an effort to determine the effects of chytrid fungus on the post-metamorphic life stages of spotted frogs, surveys were conducted for mortalities throughout the field season. High mortalities may correlate with periods of thermal shifts (Sredl, 2000) due to the predilection of chytrid for cooler temperatures (Loncore et al, 1999, Fellers et al, 2001); therefore surveillance efforts are especially important at emergence in the spring and after the first cold snap of fall. Live frogs captured during VES were visually inspected for clinical signs of chytrid while being processed. Clinical signs include: loss of righting reflex, failure to seek shelter, reddening of ventral skin, extension of hind limbs, accumulations of sloughed skin (skin tags), ulcers or hemorrhage, secondary infections. Samples were collected for PCR testing from 11 frogs at 10 sites distributed evenly throughout the Heber Valley. One half of a broken toothpick was used to lightly

scrape the ventral thigh surface while the other half was used to scrape the abdomen in two directions. Samples were stored in screw-top vials filled with (75%) ethanol.

Chytrid Prevention/Biosecurity Measures: Due to the presence of chytrid fungus in the Heber Valley and the fact that anthropogenic transportation of pathogens is a factor commonly driving the spread of wildlife emergent infectious diseases (Daszak et al, 2001), the following disease prevention protocol was established in 2002 and currently adhered to when conducting field work. Before leaving a site all mud and debris is removed from boots and gear and rinsed with clean water. Quat-128 (Waxie product) is applied at a 1:100 solution, as a disinfecting agent, to boots and other equipment by either spraying or submerging in a bath. Multiple sets of waders, nets, calipers etc., are utilized to allow gear to dry between disinfecting and use. A designated set of equipment (net head, caliper, container for use on scale, etc.,) is maintained for each hydrological distinct area and is stored in a separate container when not in use.

3. RESULTS

3.1 Wasatch Front GMU

3.1.1 Spanish Fork River: Weekly monitoring began 25 March 2004 and continued until 4 May 2004. A total of 34 egg masses were observed at monitoring sites: zero egg masses at Holladay Springs, nine egg masses at the Springville Hatchery pond, and 25 egg masses at Diamond Fork (Table 1).

The first egg masses were recorded at the Springville Hatchery pond on 25 March 2004 and the season peaked that same week. At Diamond Fork, the first egg masses were observed 6 April 2004 and the season peaked the same week. Egg masses were all at the water's surface, distance to shore was less than one meter, and water temperature ranged from 8.6 °C to 11.8 °C (mean=10.2 °C). Dissolved oxygen ranged from 2.25 to 3.35 mg/L (mean=2.80 mg/L) and pH ranged from 7.5 to 7.8 (mean=7.7).

3.1.2 Utah Lake: Weekly monitoring began on 23 March 2004 and continued until 19 April 2004. A total of ten egg masses were observed at monitoring sites: nine egg masses at Mona Springs and one egg mass south of Burraston Ponds (Table 1).

The first egg masses were observed at Mona Springs on 23 March 2004, and the season peaked that same week. Egg mass depth ranged from 0 cm to 2.0 cm (mean=1.0 cm), distance to shore ranged from 0.2 m to 2.0 m (mean=1.1 m), and water temperature ranged from 13.6 °C to 21.6 °C (mean=17.6 °C). Dissolved oxygen ranged from 3.87 to 6.13 mg/L (mean=5.00 mg/L) and pH ranged from 7.7 to 8.2 (mean=8.0).

At the Burraston Ponds population the first egg masses was observed on 29 March 2004 and the season peaked that same week. The egg mass was located at the water's surface and was 0.1 m from the shore. Water temperature was 18 °C and pH was 7.7 at the egg mass. Both spotted frog and Northern leopard frog (*Rana pipiens*) adults were observed at the Mona Springs and south Burraston Ponds sites in 2004.

3.1.3 Provo River: Weekly monitoring in Heber Valley, below Jordanelle Reservoir, began 22 March 2004. Surveys were conducted 22 March to 6 October 2004 for all post-metamorphic life stages. Observer hours from 22 March to 6 October total 504 hours. The first egg mass of 2004 was observed on 22 March and was oviposited within the preceding 24 hours. The peak of the breeding season occurred between 24 March and 8 April. A total of 791 egg masses (Table 1) were observed throughout the Heber Valley (Reaches 1 - 9) in 75 sites with egg masses numbers ranging from 1 - 52 per active site. One hundred and thirty-one egg masses were observed in the original monitoring sites and 660 in sites found since the original sites were designated, comprising 17% and 83% respectively of the 2004 egg mass totals in the Heber Valley. Twenty-two percent of the 660 egg masses were located in sites constructed as part of the Provo River Restoration Project. Breeding occurred in 12 new locations with 47 egg masses (6% of the overall 2004 reproductive effort for the Heber Valley population). Of these new breeding sites, five were constructed and two were enhanced by construction. Four sites were recently altered by beaver or muskrat activity creating more suitable habitat. Snow melt created suitable water for breeding in wetland S10, a southern mitigation wetland cell built by BOR in the 1990s, but warm weather rapidly evaporated the water leaving egg masses stranded. Frogs continue to colonize the 7-20, 7-30, 7-40 series of wetlands created in 2001. The first 2004 YOY was observed 16 June 2004.

Repatriation Site: The repatriation study site is situated between two sub-populations that are separated by 5 km of presently unoccupied river corridor. The nearest occupied breeding site to the repatriation site is 2.7 km. In 2004, a total of 33.9 hours were spent surveying the repatriation sites and surrounding wetlands (including the PRRP constructed ponds in Reach 5). Time spent in the original repatriation sites was 10.1 hours. Egg mass numbers remained stable in the original repatriation sites and increased significantly in Reach 5, from 2 egg masses in 2 sites last year and gained one new breeding location. There were two egg masses in each original repatriation site (4-3 and 4-2). Seven adults and 10 YOY were observed. Three PRRP constructed (spring 2002) Reach 5 ponds were colonized with a total of 14 egg masses. The nearest source of adult spotted frogs in the area is repatriation site 4-2 at approximately 1/4 mile to the southwest. There is no direct water connectivity to these newly colonized sites but many suitable ponds and a side channel exist for frogs to utilize en route. During the fall sweeps, one gravid female was observed in a PRRP constructed pond on the west side of the side-channel. No ponds in Reach 5, west of the side-channel have previously been documented as colonized.

Mark/Recapture Study and Population Estimate: In 2004, 15 tagged frogs were recaptured (compared to 28 in 2003). All recaptures were in the same pond of their original capture with the exception of one male, which had previously been captured in an adjacent site with a direct water connection. A total of 24 untagged frogs were recaptured, based on spotting pattern and photo identification. Two juvenile frogs marked with orange VIE were captured, one in the pond where the repatriation study took place and the other in a pond approximately 150 meters away. Including those frogs recaptured from the repatriation study, 39 adults and two juveniles were recaptured in 2004.

Construction Summary: Provo River Restoration Project construction occurred in Reaches 1, 2, and 3 from April to December 2004. Land acquisition in Reach 2 was finalized spring 2004 allowing construction on the final meander of the new river channel to begin the last week of April. No egg masses have been found in this location since

1997 when the area was wetter. Minnow traps were set north of the railroad tracks, in drainage ditches and a small channel to catch any frogs moving out of the area, as the water levels were further reduced for construction. No frogs were captured.

Removal of frogs and egg masses was focused on known breeding sites and documented frog locations. Frogs were translocated in anticipation of sites being impacted directly by construction equipment or indirectly through changing hydrology. Sites were visited weekly during the breeding season to locate egg masses and ensure that they were moved before hatching. A total of 4 egg masses were moved from two sites (1-2-5 and 1-11-1) to the nearest suitable habitat. Five egg masses in 1-11-1 hatched before they could be moved. This site and 1-11 were both encircled with drift fence during construction to keep frogs from dispersing into areas of heavy vehicle traffic. The new river alignment was planned to run directly through 1-2-5. All egg masses were removed in the spring but seven spotted frogs had been seen in this location in a single visit during the 2003 fall sweeps, indicating the importance of pre-construction clearance. Visual surveys were conducted twice daily along with day and night sets of minnow traps for two weeks. Additional wetlands were created along both sides of the new river channel in Reach 1. Creating neighboring strings of connected ponds enhanced existing sites and all culverts were removed. Areas of frog concentrations were not directly impacted. Work in Reach 3 required minimal pre-construction effort as no spotted frog sites were directly impacted. One site (3-16) was enclosed with drift fence.

Chytrid Monitoring: A total of 577 tadpoles were sub-sampled from 46 sites. Tadpole sampling was unsuccessful at 29 sites despite efforts to conduct visual surveys, blind-sweeps with hand-held dip net and trapping using mesh and wire minnow traps. An additional five sites were completely dry at the time of tadpole surveys. Egg masses were moved from sites where dropping water levels were observed. Potential for tadpole capture was complicated at twelve of these sites as they each contained one egg mass. Of the 577 tadpoles sampled, 565 were normal in appearance, one had no pigmentation in beak and toothrows and an additional 11 tadpoles exhibited slight to questionable abnormalities that were not necessarily indicative of chytrid infection. The one tadpole lacking pigmentation was encountered in a site that had not previously been documented

as a chytrid infected location. During the 2004 field season, a total of 22 mortalities were observed: ten adults, nine juveniles, and three YOY. Six of the 22 mortalities appeared to be due to predation, two had symptoms consistent with chytrid fungus, while the remaining 14 had no visible indication of cause of death. One live juvenile exhibited symptoms consistent with chytrid. In addition to red rear feet, the frog was barely moving; floating on the water's surface with its hind limbs extended, and was unable to right itself.

Adult and juvenile mortalities, with the exception of one juvenile and two adults, were detected in the spring (March, April). All YOY mortalities were documented in the fall (September). Sixteen mortalities occurred in the spring and five mortalities occurred in the fall, whereas only one was observed in the summer. Cumulatively through tadpole monitoring and mortality surveys, nine sites have been implicated and three sites have been confirmed as being infected with chytrid fungus since 2001. Lab results from 2002 and 2003 mortalities have not been received from the National Wildlife Health Center.

Jordanelle/Francis population: Weekly monitoring began in the Jordanelle/Francis population on 2 April 2004 and continued until 30 April 2004. A total of 553 egg masses were observed. Seventy-three egg masses were observed in the original monitoring sites and 480 egg masses were observed in sites located in previous years sweep surveys (Table 1). Egg masses were first recorded on 2 April 2004 and the breeding season peaked that same week. Egg mass depth ranged from 0 cm to 5.0 cm (mean=0.8 cm), distance to shore was 0.1 m to 4.0 m (mean=1.1 m), and water temperature ranged from 5.6 °C to 17.3 °C (mean=11.8 °C). Dissolved oxygen ranged from 1.2 to 10.5 mg/L (mean=3.3 mg/L) and pH ranged from 6.5 to 8.0 (mean=7.3).

3.2 Sevier River GMU

3.2.1 San Pitch River: Weekly monitoring began 30 March 2004 and continued until 28 April 2004. A total of 99 egg masses were observed at monitoring sites (Table 2). The first masses were located on 30 March 2004 and the breeding season peaked that same week. Egg mass depth ranged from 0 cm to 3.0 cm (mean=0.9 cm), distance to shore ranged from 0.1 m to 1.3 m (mean=0.5 m) and water temperature ranged from 8.2

°C to 20.1 °C (mean=13.5 °C). Dissolved oxygen ranged from 2.8 to 11.5 mg/L (mean=6.5 mg/L) and pH ranged from 7.7 to 8.0 (mean=7.9). Twenty-three egg masses were observed at the 11 original monitoring sites and 76 masses at the 15 sweep survey sites (Table 2).

3.3 West Desert GMU

3.3.1 Ibapah Valley: Weekly monitoring began on 7 April 2004 and continued until 29 April 2004. A total of 31 egg masses were observed in this subunit (Table 3). The number of egg masses observed at the south Ibapah monitoring site totaled 31. Egg masses were first recorded at south Ibapah on 7 April 2004 and the breeding season peaked the same week. Egg mass depth ranged from 0 cm to 2 cm (mean=0.8 cm), distance to shore ranged from 0.2 m to 3.0 m (mean=0.9 m), and temperature ranged from 7.1 °C to 9.6 °C (mean=8.6 °C). Dissolved oxygen ranged from 3.59 to 5.71 mg/L (mean=4.91 mg/L), and pH ranged from 7.0 to 8.0 (mean=7.5). No egg masses were observed at the north Ibapah monitoring site.

3.3.2 Snake Valley: Weekly monitoring began 8 March 2004 and continued until 14 April 2004. A total of 746 egg masses were observed in this subunit (Table 3). Egg masses were first observed at the Miller Springs site on 18 March 2004 and the season peaked the same week. Three hundred and fifty-seven egg masses were observed at the Miller Springs site. Egg mass depth ranged from 1cm to 14 cm (mean=4.3 cm), distance to shore ranged from 0.1 m to 3.0 m (mean=0.9 m) and water temperature ranged from 16.5 °C to 25.6 °C (mean=20.7 °C). Dissolved oxygen ranged from 3.37 mg/L to 10.03 mg/L (mean=6.33 mg/L) and pH ranged from 7.1 to 8.0 (mean=7.8). The Leland Harris monitoring site contained a total of 389 egg masses. Egg masses were first observed on 19 March 2004 and the season peaked the same week. Egg mass depth ranged from 1 cm to 13 cm (mean=5.5 cm), distance to shore ranged from 0.1 m to 3.5 m (mean=1.1 m), and water temperature ranged from 4.19 °C to 14.1 °C (mean=10.2 °C). Dissolved oxygen ranged from 2.58 mg/L to 6.54 mg/L (mean=4.32 mg/L) and pH ranged from 7.5 to 8.0 (mean=7.9).

3.3.3 Tooele Valley: Weekly monitoring began at the Vernon site on 25 March 2004 and continued until 14 April 2004. A total of two egg masses were observed at the site (Table 3), both of which were observed the week of 6 April 2004. Egg masses were located at the water's surface and were approximately 3 meters from the shore. Water temperature was 10.4 °C, while dissolved oxygen was 3.96 mg/L, and pH was 7.5.

4. Discussion

Drought conditions continued for the sixth straight year in the Bonneville Basin of Utah. Reproductive effort has decreased continuously for six years at those spotted frog sites heavily influenced by the effects of drought. Drought conditions have reduced the amount of available breeding habitat, as well as other resources available to adult frogs during the summer and fall, perhaps leading to reduced egg formation in pre-hibernating females. This may account for the decreased number of egg masses. It is likely that when conditions are unfavorable, adult frogs may forgo breeding (Twitty 1966; Semlitsch et al. 1996) and that a reduction in egg mass numbers does not necessarily equate to a decrease in the adult frog population at any given site.

The populations of spotted frogs in the Provo River and San Pitch River subunits have not exhibited the same decrease in egg mass numbers. The stability of the Fairview population can be directly attributed to habitat enhancement activities, specifically addition and maintenance of a constant water supply at a few sites. The increase in the Jordanelle/Francis population is a result of finding new breeding sites and beaver dam habitats that are not as vulnerable to drought effects as spring wetland type complexes. The increase in egg mass numbers in the Heber Valley population can be directly attributed to activities associated with the PRRP. The goals of the restoration project, that are beneficial to spotted frog, include: 1) restore natural river patterns, 2) acquire and protect habitats, 3) maintain minimum instream flows, 4) create wetlands, 5) restore connectivity between habitats, and 6) restore habitat complexity and diversity. Restoration activities since 1999 have created over 210 wetlands within the 12-mile corridor, with approximately 65% constructed specifically for spotted frog. Thirty-nine percent of the newly created wetlands have been colonized by spotted frog (50 sites where frogs were observed and 32 sites of egg mass deposition). Over the five-year

construction period, 565 egg masses have been oviposited in newly created wetlands accounting for 20% of the reproductive output for the Heber Valley. Overall reproductive effort has increased 87% since 2001 in Heber Valley while reproductive effort has decreased >50% in most of the spotted frog populations outside of Heber Valley. The PRRP exemplifies how protecting and enhancing habitat can result in a positive population response.

4.1 Wasatch Front GMU

4.1.1 Spanish Fork River: The number of egg masses observed at the Springville hatchery site decreased slightly from 12 in 2003 to nine in 2004 (Table 1 & Figure 1). A head-starting project was carried out at the Springville Hatchery in 2004. The project involved the rearing of tadpoles to metamorphosis in protective enclosures (UDWR Central Region Office, unpublished report). The project resulted in 83 YOY frogs and 43 tadpoles being released at the site. At Holladay Springs the number of egg masses observed decreased from five in 2003 to zero in 2004 (Table 1 & Figures 1 & 2). Conditions at Holladay Springs were very dry, with little irrigation water coming onto the site. Only two of the known breeding sites contained water. Current plans include conducting a head-starting program at Holladay Springs. The ability to conduct such a project will be determined by funding and the presence of egg masses. Egg mass numbers at Diamond Fork increased from seven in 2003 to 25 in 2004 (Table 1 & Figure 1). This year marked the second year of monitoring at Diamond Fork, future monitoring will determine if this large increase in egg masses observed continues. While spotted frog populations within this subunit fail to meet the Conservation Agreement goal of an effective population size of 1000 individuals, they do meet the requirement of an effective population size of 50 individuals (Table 1).

4.1.2 Utah Lake: Ten egg masses were observed at monitoring sites within Mona Springs and Burraston Ponds, the same number that was observed in 2004 (Table 1 & Figure 3). At the south Burraston sites the area was generally dry in areas that were not being irrigated, although some water was present at both the monitoring sites. Output from the springs at the Mona Springs complex is less than during normal hydrologic regimes but breeding habitat appears to be sufficient. Five springheads were dredged and

enhanced in Fall 2002 and spotted frogs have colonized one of the enhanced springhead ponds and one egg mass was oviposited in an enhanced springhead. The Utah Lake spotted frog population, currently estimated to be 20 adults, has failed to meet the Conservation Agreement goal of 1000 individuals. A head-starting program was conducted at Mona Springs in 2004, which resulted in the release of 88 YOY frogs and 48 tadpoles at the site.

4.1.3 Provo River: Egg mass trends continue to remain stable within the monitoring sites in the Heber Valley population, with a visible increase in numbers at new sites and particularly within constructed sites. These increases in reproductive output are in contrast to other populations of spotted frog in Utah that appear to be suffering the effects of drought. Frogs in the Heber Valley have the advantage of being in a managed water system where instream flows are maintained and new wetlands are being created as part of the PRRP (Table 1 & Figures 4 & 5). The Heber Valley had an estimated effective population size of 1,582 individuals thus, in the Provo River subunit, the goal of 1,000 individuals in the effective population has been met and exceeded by 582 individuals.

Unlike other populations, spotted frogs in the Heber Valley do not use spatially separated wetlands exclusively for breeding, summering, or over-wintering. Through mark-and-recapture Ammon (2001) found that most adults remain in the same wetland throughout the year, migrate seasonally over short (<100 m) distances, and occasionally move greater distances to new areas. Movements within a single site accommodate needs for reproduction, foraging, and hibernation. Breeding season encounter locations predominantly occurred in shallow, warm water shorelines with emergent vegetation whereas post-breeding locations were typically characterized by cooler, deeper water often containing more structure, such as woody debris or vegetation, which provides seasonal thermal refuge and cover.

Expansion of existing isolated populations is a goal identified in the Spotted Frog Conservation Agreement (Perkins and Lentsch 1998). The colonization of Reach 5 ponds in 2003, and continued expansion observed this year, concurs with the idea that spotted frog populations can be artificially expanded through suitable habitat creation and

restoration (Ammon, 2001). In addition, continued monitoring will document how the frogs further expand into newly created wetlands within Reach 5.

Chytrid monitoring: Chytrid fungus was detected in the Heber Valley population in 2001. Researchers currently working with chytrid fungus predicted a >90% population decline with the following progression: reduction in adults, resulting in a visible drop-off in post-metamorphic life stages, followed by a crash in egg mass deposition (David Green, pers. Comm.). Thus far, no significant declines have been observed in the population. Mortalities in 2004 continue to parallel 2002 and 2003 observations in seasonal patterns and numbers. Monitoring tadpoles has given us an indication of the prevalence of chytrid throughout the Heber Valley. Despite the fact that the number of potentially infected sites has consistently increased each year the proportion of observed tadpoles to those exhibiting symptoms remains extremely low (<2%).

Jordanelle/Francis population: The number of egg masses observed above Jordanelle Reservoir in the Jordanelle/Francis population increased from 441 in 2003 to 553 in 2004. The number of egg masses observed in the original monitoring sites has increased slightly since 2000 (Table 1 & Figures 4 & 6). However, the significant increase in the egg mass numbers is due to the discovery of new breeding locations with numerous egg masses. The Jordanelle/Francis spotted frog effective population size, including sweep sites, is estimated to be 1106 adults (Table 1 & Figures 4 & 6), exceeding the Conservation Agreement goal of 1000 individuals. One factor that most likely contributes to the high number of frogs present above Jordanelle Reservoir is the presence of beaver within the river corridor. Most of the spotted frog habitat is within beaver dam complexes along the floodplain of the Provo River. During the extended drought period these complexes have proved to be more stable than habitats in other populations.

4.2 Sevier River GMU: The Fairview spotted frog population experienced an overall decrease in total egg mass numbers in 2004, however the decrease was less pronounced in the monitoring sites (Table 2 & Figure 7). Several sweep sites were dry or

had very low water levels throughout the breeding season. The current effective population size estimate is 198 adults (Table 2 & Figure 7). A conservation easement was established with one property owner within the Fairview population, providing protection to two sweep sites. Planning is now underway to conduct habitat improvements at these sites. Efforts are proceeding to establish conservation easements with other property owners in the area. The San Pitch spotted frog population, currently estimated to be 198 adults, did not meet the Conservation Agreement goal of 1000 individuals.

4.3 West Desert GMU:

Ibapah Valley: The number of egg masses observed at monitoring sites decreased from 74 in 2003 to 31 in 2004 (Table 3, Figures 8 & 9). For the second year in a row no egg masses were observed at the north Ibapah monitoring site. This site fluctuates widely in egg mass numbers, due to the seasonal and temporary nature of the water on this site. In 2004 the only water available for breeding was small, stagnant pools found at the base of the dikes. Irrigation water, which maintains this site, was in short supply and was only present for a couple of weeks. It may be necessary to find a more stable and suitable monitoring site within the Ibapah Valley to replace the north monitoring site. At the south Ibapah Valley monitoring site, impacts from cattle continue to be severe, with little regrowth of rushes or cattails damaged by cattle, and dead cows present in the springheads. The Ibapah Valley spotted frog population, currently estimated to be 62 adults in the effective population, did not meet the Conservation Agreement goal of 1000 individuals.

Snake Valley: The number of egg masses observed decreased from 850 in 2003 to 746 in 2004 (Table 3, Figures 10 & 11). With a spotted frog effective population currently estimated to be 1,492 adult frogs, the Snake Valley population exceeds the Conservation Agreement goal of 1000 individuals.

Tooele Valley: The number of egg masses observed in the Vernon population increased from zero in 2003 to two in 2004 (Table 3). This population was discovered during sweep surveys conducted in 2002 when four egg masses were observed. Continued monitoring at this site will provide more information about the status of this

population. This site receives the majority of its water through return irrigation flows and has the possibility of going dry during drought conditions. Efforts need to be made to provide habitat improvements for this population to ensure adequate water is present to support frogs in this area. A head-starting project will be conducted at the Vernon site in 2005, if landowner approval is secured and egg-masses are present.

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Table 1: Number of egg masses observed within the Wasatch Front GMU 1992-2004.

Subunit	Population	Number of Egg Masses												2004 Population Estimate	Goal
		1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004		
Spanish Fork River	Springville	12	7	6	0	65*	87	44	50	25	9	12	9	18	1000 or 50
	Holladay Springs	36	24	33	29	64	122	144 (192)	135 (160)	52 (68)	27 (27)	5 (5)	0	0	1000 or 50
	Diamond Fork											7	25	50	1000 or 50
Utah Lake	Mona/ Burraston	15	5	66	63	148	78	61 (78)	111 (120)	69 (73)	33 (33)	8 (10)	10 (10)	20	1000
Provo River	Heber Valley	272	120	156 (167)	323 (473)	219 (491)	176 (372)	206 (438)	151 (431)	123 (418)	206 (557)	176 (615)	131 (791)	1582	1000
	Jordanelle/ Francis	63	92	79	29	21	21	20 (63)	59 (99)	31 (165)	44 (260)	50 (441)	73 (553)	1106	50

* First year Springville Hatchery pond was included in the totals.

( ) total egg masses for that year including egg masses from sweep survey sites

Table 2: Number of egg masses observed within the Sevier River GMU 1992-2004.

Subunit	Population	Number of Egg Masses												2004 Population Estimate	Goal
		1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004		
San Pitch River	Fairview	54	35	34	24	24	22	17 (25)	59 (137)	20 (153)	8 (86)	24 (138)	23 (99)	198	1000

( ) total egg masses for that year including sweep data

Table 3: Number of egg masses observed within the West Desert GMU 1993-2004.

Subunit	Population	Number of Egg Masses												2004 Population estimate	Goal
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004		
Ibapah Valley	Ibapah Valley	2195	X	X	X	735 (2321)	440*	621	327	387	201	74	31	62	1000
Snake Valley	Miller/Leland Harris	739	X	847	1291	910	2154	2066	1887	1956	1865	850	746	1492	1000
Tooele Valley	Vernon										4	0	2	4	1000

* Changes occurred in the area included in the monitoring sites (size of area was reduced).
X = Not surveyed
( ) total egg masses for that year including sweep data

Figure 1. Number of egg masses observed (including sweep data) in the Spanish Fork River subunit, 1992-2004.

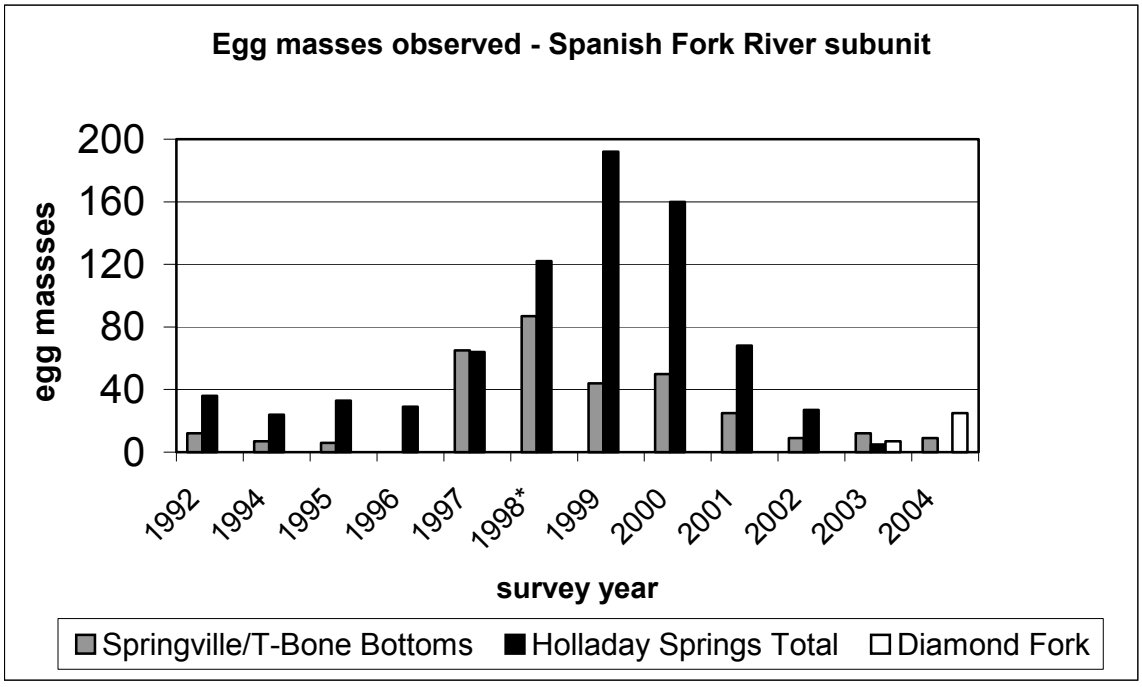

Figure 2. Number of egg masses observed in the Holladay Springs population, 1992-2004.

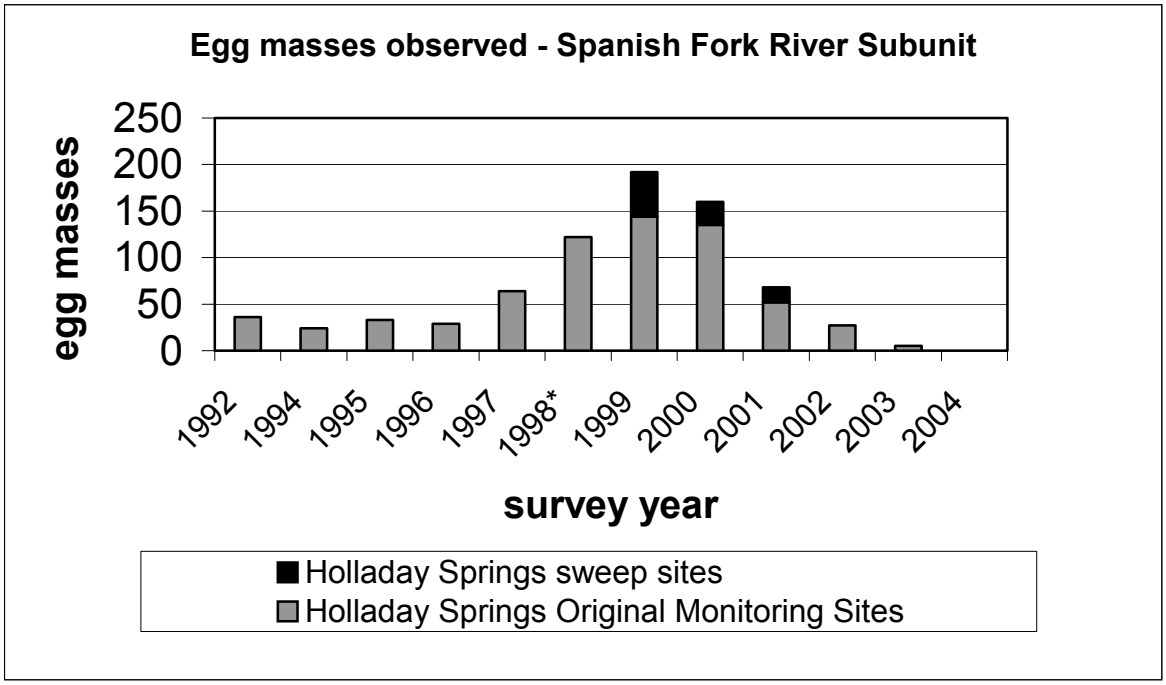

Figure 3. Number of egg masses observed (including sweep data) in the Utah Lake subunit, 1992-2004.

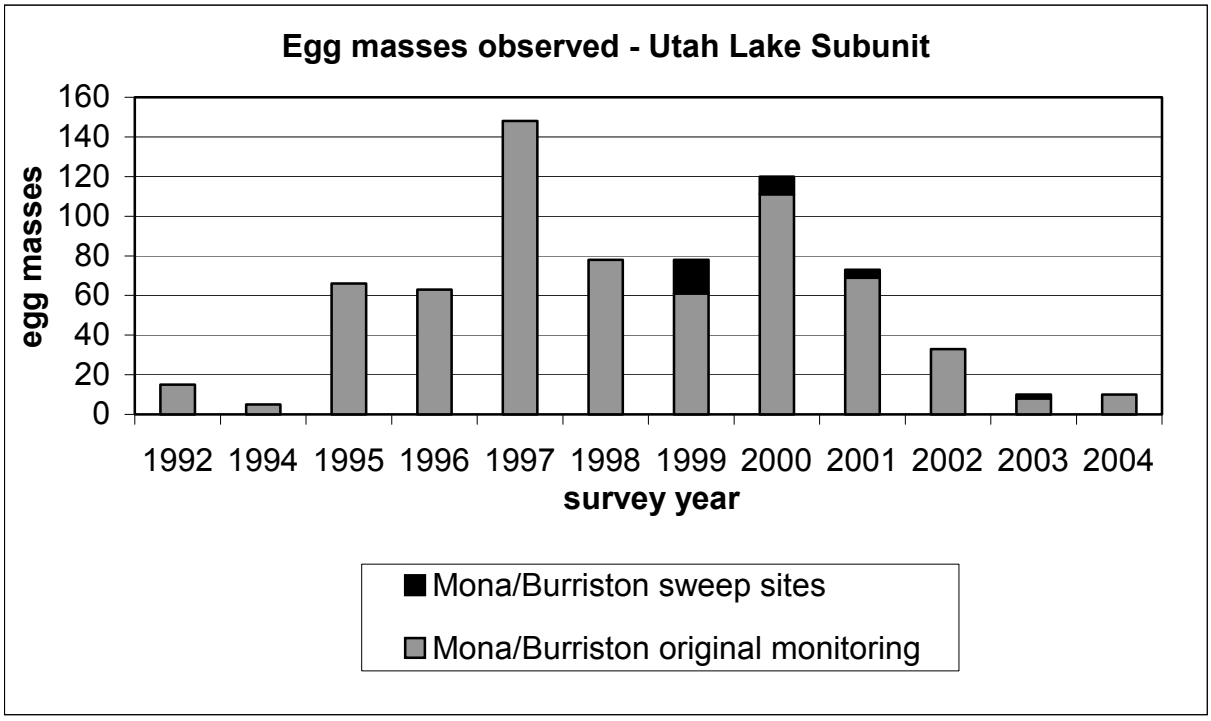

Figure 4. Number of egg masses observed (including sweep data) in the Provo River subunit, 1992-2004.

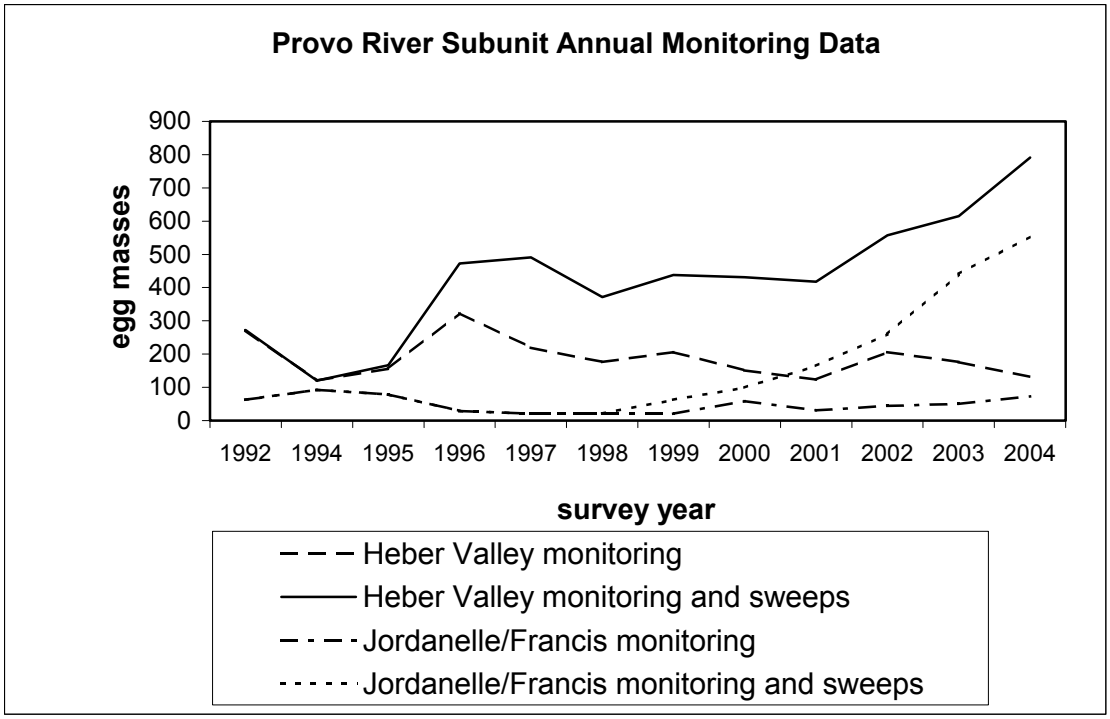

Figure 5. Number of egg masses observed (including sweep data) in the Heber Valley population, 1992-2004.

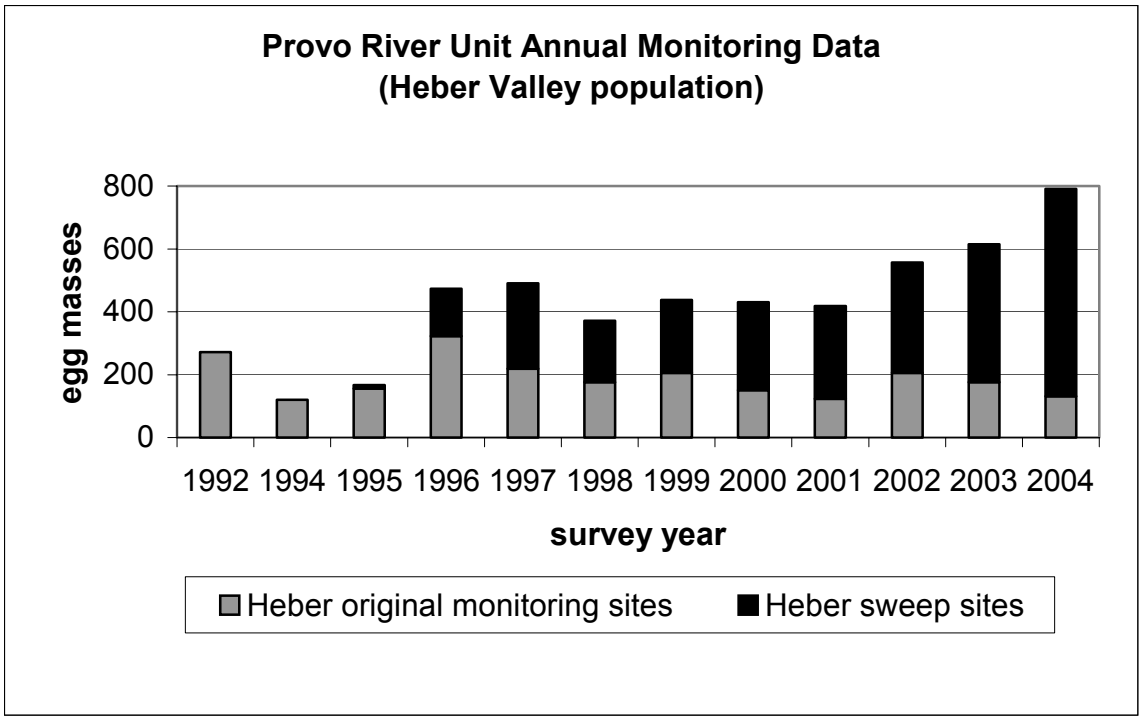

Figure 6. Number of egg masses observed (including sweep data) in the Jordanelle / Francis population, 1992-2004.

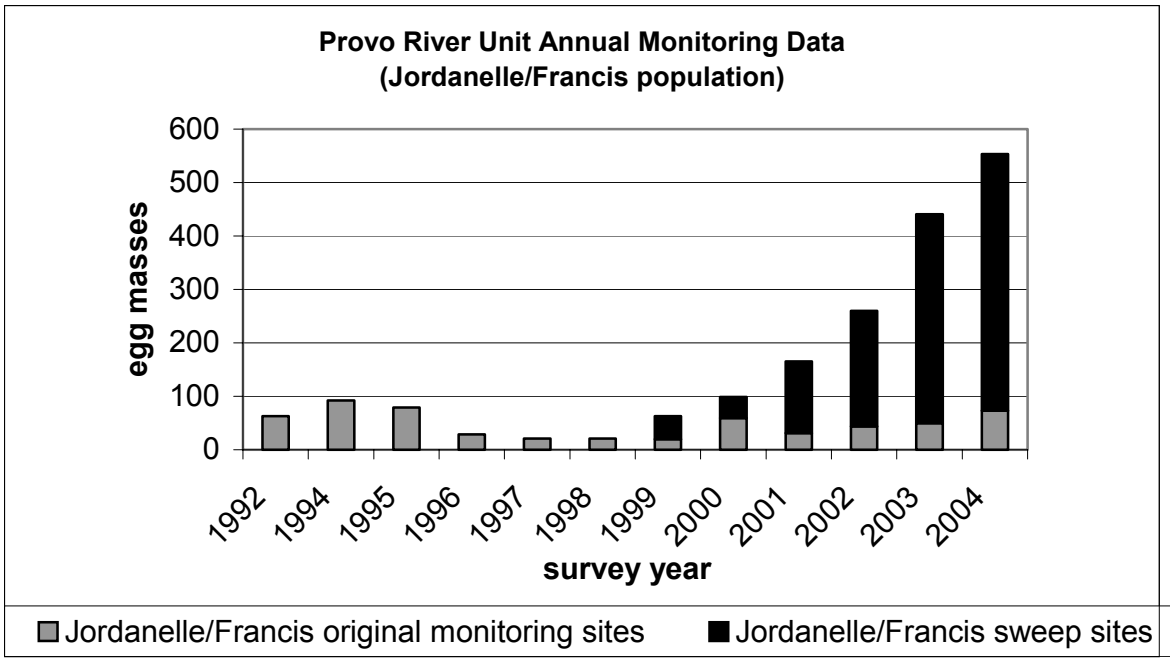

Figure 7. Number of egg masses observed (including sweep data) in the San Pitch subunit, 1992-2004.

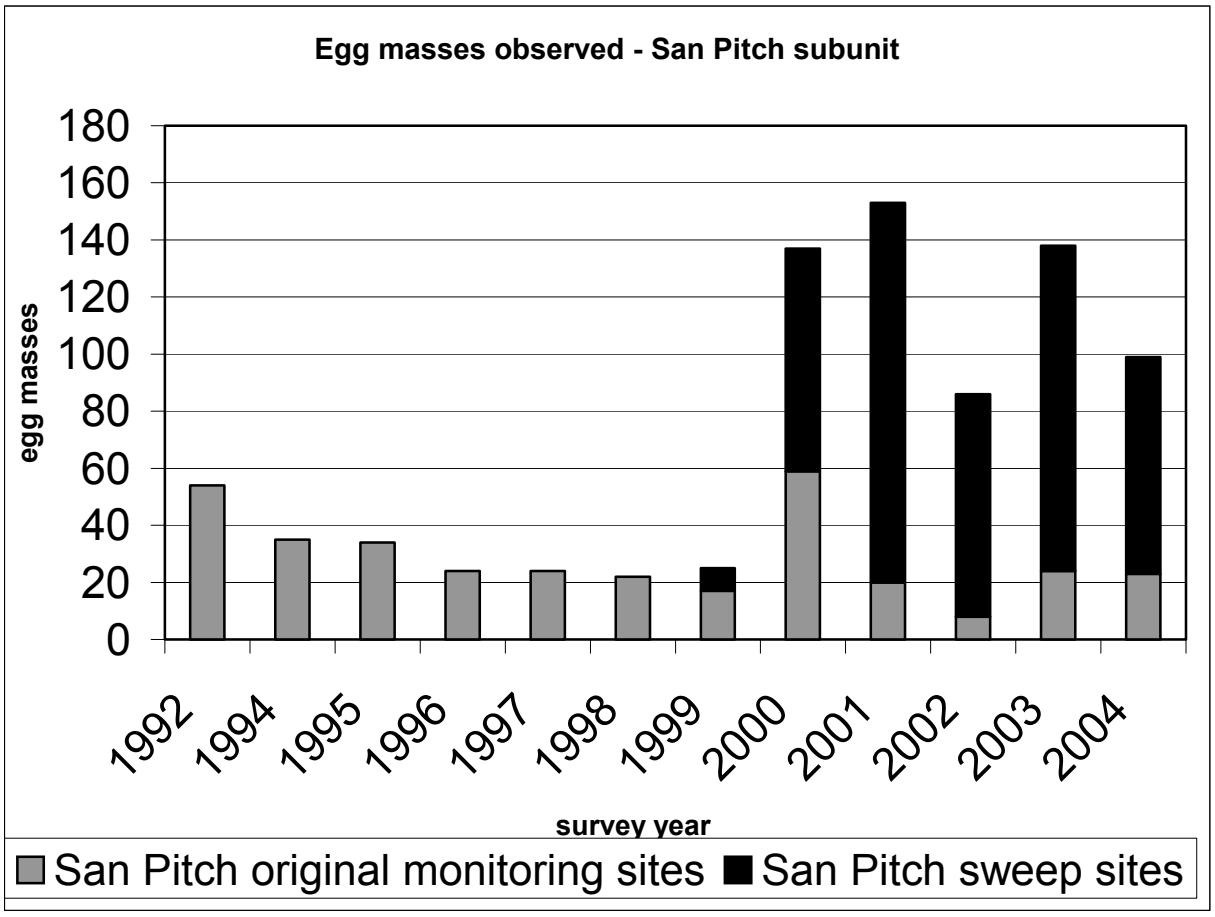

Figure 8. Number of egg masses observed in the Ibapah Valley subunit, 1993-2004.

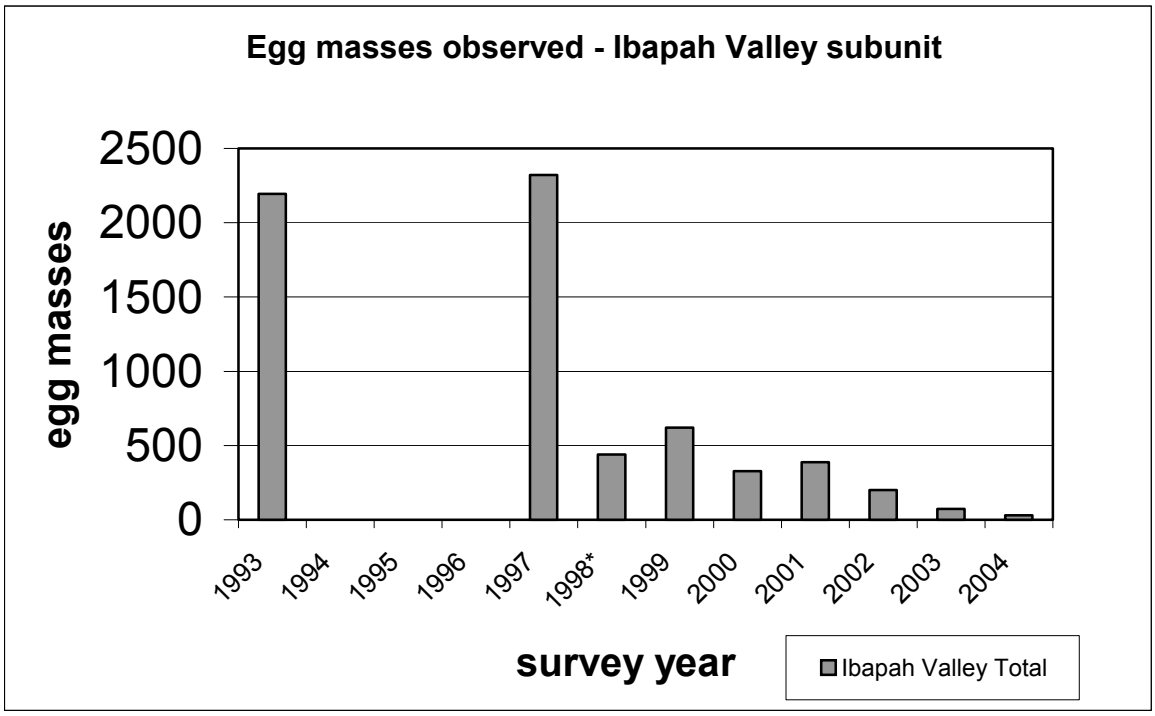

Figure 9. Number of egg masses observed in the Ibapah Valley subunit, 1993-2004.

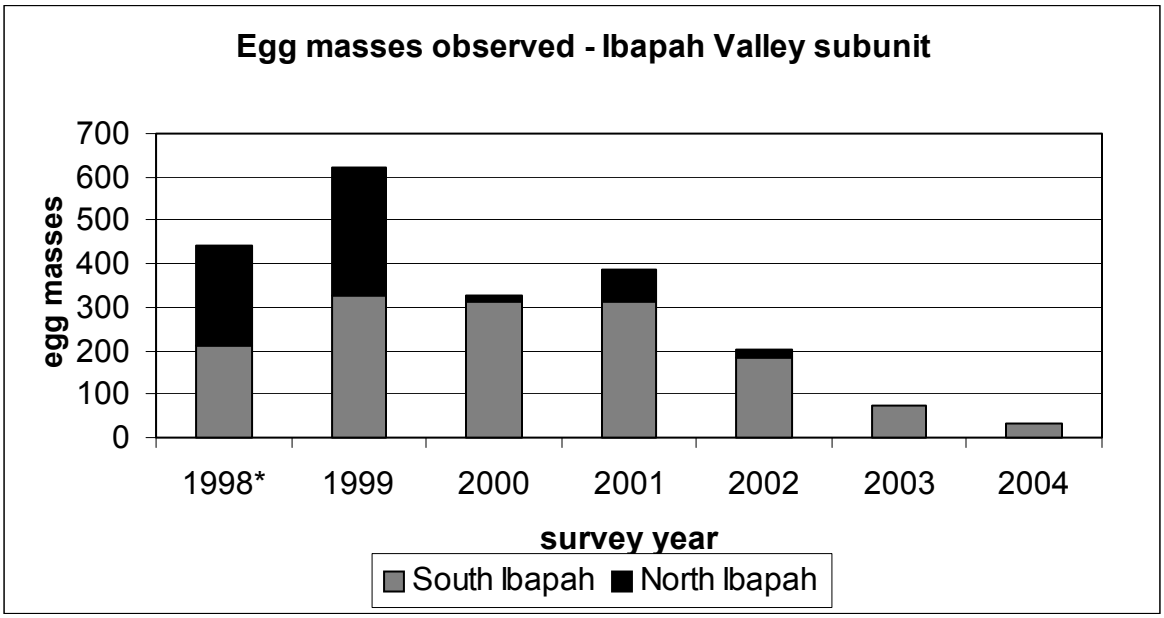

Figure 10. Number of egg masses observed in the Snake Valley subunit, 1993-2004.

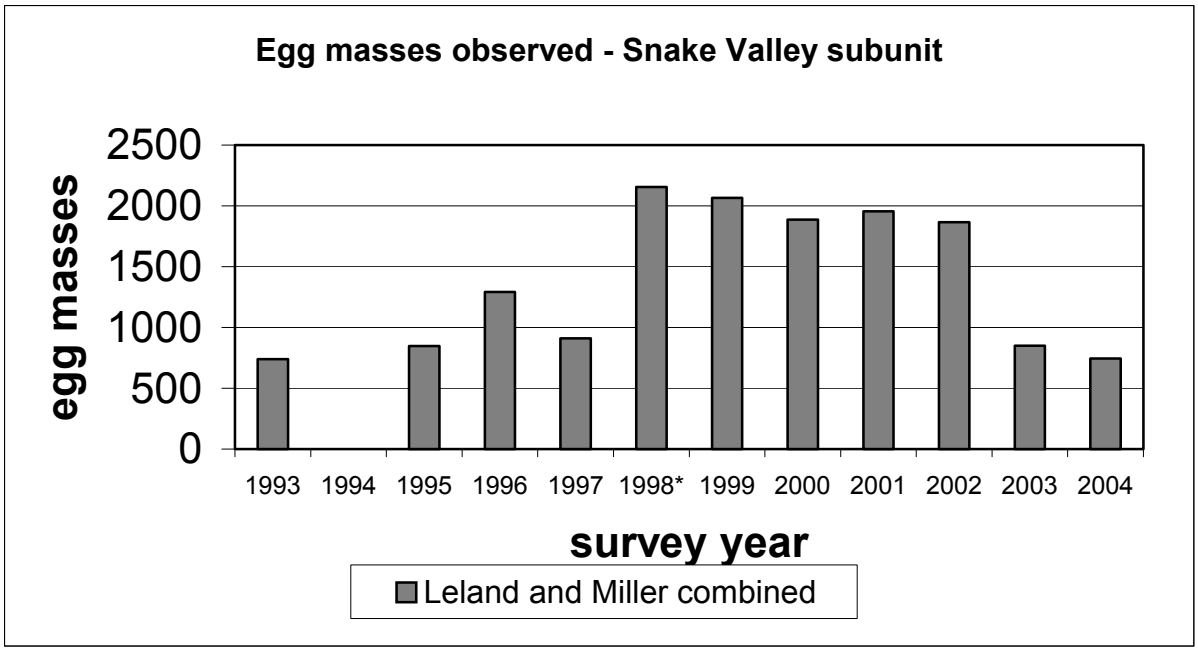

Figure 11. Number of egg masses observed in the Snake Valley subunit, 1993-2003.