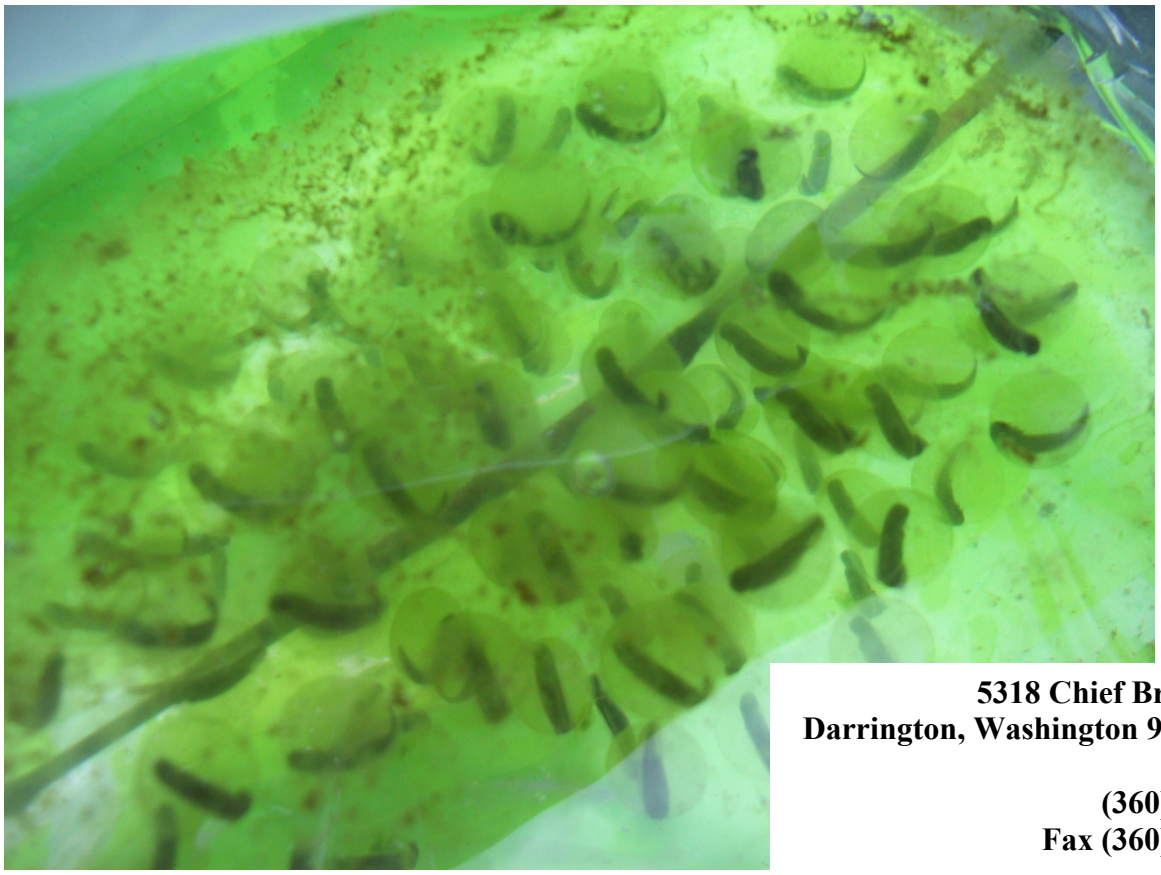
Sauk-Suiattle Amphibian Survey Report 2012

by Scott Morris and Andrew McDonnell

Data collection and review by:
Lucas Wilson, Andrew McDonnell and Scott Morris



5318 Chief Brown Lane
Darrington, Washington 98241-9420

(360) 436-0131
Fax (360) 436-1511

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Executive Summary

Biologists throughout the Pacific Northwest have been striving for more coordinated regional amphibian monitoring that follow standardized methods. This report is based on weekly amphibian surveys during the spring of 2007 through 2012 in the Reservation Slough wetland on the east side of the Sauk-Suiattle Indian Reservation. Reservation Slough is the only wetland on the 25-acre reservation and has a Class 1 designation. Surveys were done as an update to the Sauk-Suiattle Wetlands Report, written in 2003. Visual Encounter Surveys were conducted to record number of juvenile and adult red-legged frogs (*Rana aurora)*, northwestern salamanders (*Ambystoma gracile*), long-toed salamanders (*Ambystoma macrodactylum*) and pacific chorus frogs (*Hyla regilla*). Egg masses were identified and tallied for each amphibian species by surveying the entire 5.5-acre wetland. In 2012 our weekly method for detecting pacific chorus frog egg masses was reduced from surveying 100% of the wetland area to randomly selecting and surveying 20% of the wetland area. Since 2007, results indicate pacific chorus frog, red-legged frog, northwest salamander, and long-toed salamander egg masses represent 83, 8, 7, and 2% of all identified egg masses, respectively. Distinct seasonal periodicity among species breeding patterns was noticeable as red-legged frog egg masses dominated early-season (February – March), pacific chorus frog egg masses were most prevalent late-season (March – May), and northwest and long-toed salamander egg masses peaked mid-season (March – April). Relative abundance of juvenile and adult amphibians was greatest in 2011 (32.55 individuals/hour) and least in 2012 (13.85 individuals/hour). Despite a change in study design in 2012, pacific chorus frogs continued to be most numerous and overall, exhibited greatest variation among years with respect to abundance than did other amphibian species. Although species of concern such as western toads (*Anaxyrus boreas*) have been identified in Reservation Slough, no toad egg strings have ever been found. Future changes in amphibian populations, species, or observation of deformities could serve a primary biological response to contamination, pollution, and climate change. As such, the Sauk-Suiattle Indian Tribe will continue and strive to improve our annual amphibian survey. Both the original report and this update were supported by grants from the U.S. Environmental Protection Agency.

Survey Objectives

The surveys were conducted in support of the Tribe's water quality program with the following objectives in mind:

1) *Assess the annual change in amphibian species and relative abundance.*
2) *Analyze the data to highlight potential water quality or habitat concerns.*
3) *Help expand the regional amphibian database.*

Description of Study Area

The survey area covers 5.5 acres of a roughly 10-acre wetland that follows the course of an oxbow slough of the Sauk River. The survey area is confined to the portion of the wetland owned by the Tribe and contains the best pond habitat. According to the Sauk-Suiattle Indian Tribe Wetlands Report (2003), Reservation Slough is a Class One wetland. The National Wetlands Inventory database describes the slough as a Palustrine forested and intermittently flooded area. Aerial photos show this slough was the main channel of the Sauk River in 1949. Sometime soon after, the main channel shifted to the east and has not reoccupied the slough, although channel migration will surely happen again someday. In previous years, floodwaters from the Sauk entered the slough at rates greater than 25,000 c.f.s. – a flood of roughly two-year occurrence. The slough also receives groundwater inputs and is wet year-round, although water levels fluctuate based on flow connectivity with the main channel, which avulses frequently; sometimes close, other times far from the slough mouth. Since 2011, the Sauk flow required to flush the slough is greater, because the mainstem has moved away. Beaver (*Castor canadensis*), otter (*Lontra canadensis*), and wood ducks (*Aix sponsa*) are among the many wildlife species that occupy the slough. The dominant plant species are red alder (*Alnus rubra*), reed canary grass (*Phalaris arundinacea*) and black cottonwood (*Populus trichocarpa*).

To the east is a forested upland area that separates the slough from the Sauk River. The upland is mainly hardwoods, including big leaf maples (*Acer macrophyllum*), but also has some conifers such as western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and Douglas fir (*Pseudotsuga menziesii*) in the canopy.

Survey Methods

Summary of protocols

Protocols are detailed in the Tribe's Surface Water Quality Monitoring Manual and Standard Operating Procedures. In summary, two to four people spread out through the Tribe's 5.5-acre portion of the wetland, looking for amphibians and their egg masses in a Visual Encounter Survey typically starting at 09:00 (Crisafulli, 1997; Fellars, 1997). Searches focus in particular on the most likely terrestrial habitat, and concentrated efforts were made in and near the wet spots at various depths. Egg masses were flagged and given individual numbers to avoid double counting and to assess their development.

Survey Amendments

In past years, surveys included revisiting each egg mass to track the progress of development, as well as weekly estimates of the percentage of eggs in each mass that appeared dead, but this data collection proved too time-consuming by mid-2009 because of the abundance of chorus frog egg masses. The data-collection method was modified at that time to simply identify new egg masses without revisiting old ones. Development data (eggs or tails) was still collected for the new masses, and this protocol was continued in 2012.

The survey in 2007 did not use any kind of boat to access deeper water and to see the edges from a different perspective. In 2008, a canoe was used, which was a marked improvement, although still not as good for visibility as the cataraft, which was used starting in 2009 and allows direct visibility underneath the boat.

The 2012 survey marked a change in survey method that should be noted at the outset. Whereas the previous five annual surveys used a complete census of all egg masses and juvenile and adult amphibians, in 2012 the census method to survey egg masses was deemed too intensive. Instead, the survey area was divided into a grid of horizontal sections, of which 20 percent were randomly chosen to be surveyed for pacific chorus frog egg masses. Each grid section covers 2 meters north/south, and traverses all suitable habitat east/west. That created 156 sections to cover the entire survey area. Each week, a random series of numbers from 1 to 156 was generated and then assigned in that random order to each section of the grid from bottom to top. We used a 20% sampling effort each week comprising of randomly selecting 31 grid sections. The assumption behind the 20% weekly effort was that by the end of the season we would have surveyed the entire area of the slough and avoided multiple day surveys. Surveyors concentrated their efforts to locate pacific chorus frog egg masses to only those specific grid sections for that particular week. Each week, the searchable grid sections changed based on random selection. The chosen grid sections were marked with flags the day before each survey, and surveyors used compass bearings to establish the east/west delineation.

The reason for this change is that the small pacific chorus frog masses can be too numerous to count in one day. Another reason is that pacific chorus frogs can lay more than one egg mass per frog annually, so survey results are less reliable as an indicator of population, compared to other species (Perrill and Daniel, 1983). The survey for egg masses of the other species continued as a complete census, because red-legged frogs and northwest salamanders produce egg masses that are much larger and much more easily seen. The survey for juvenile and adult amphibians continued as a complete census of the entire survey area also, because the whole area was still being walked by surveyors and the frogs typically move and are easily found. Given this change, comparing the 2012 data to the previous years requires caution. Adjusting the egg mass data to be directly comparable is not straightforward.

Data Collection

Amphibians were tallied by species and age (juvenile or adult) according to Corkran and Thoms (1996) and Jones et al. (2005). If species could not be determined easily, attempts were made to capture the animal by hand. The amphibian was kept moist while being handled, and released as soon as positively identified. Frogs that were seen too briefly to differentiate by species were tallied as "unidentified," with a best estimate regarding age.

Given how much the long-toed salamander egg masses can resemble eggs from pacific chorus frogs, the potential exists for surveys from previous years to have misclassified some long-toed salamander eggs as pacific chorus frog masses. To guard against such errors, the surveyors were trained to recognize the difference and were specifically looking for long-toed salamander masses in previous years, but the possibility still exists, given the similarities.

The 2012 survey began Feb. 29 and continued every week, ending May 16. No weeks were missed, although in previous years most surveys continued one week longer into May.

Results

2007 – 2012

Egg Masses

Since 2007, pacific chorus frog egg masses represented 83% of all egg masses identified. Pacific chorus frogs had the longest breeding season among amphibians studied. Generally, pacific chorus frogs breed late-season (April – May), red-legged frogs breed early-season (February – March), and northwest and long-toed salamanders breed mid-season (March – April) (Figures 3, 4, 5, and 6). With the exception of a trimodal distribution in 2012, breeding patterns of pacific chorus frogs were normally distributed (Figure 6).

Red-legged frogs had the second greatest percentage of total egg masses identified from 2007 – 2012 (8%). Northwest salamander egg masses contributed 7%, and long-toed salamander egg masses made up 2% of total egg masses identified, respectively. Additionally, whereas pacific chorus frog exhibited greatest variation, red-legged frog and northwest salamander egg mass numbers showed least variation among years (Table 1). Egg mass counts for northwestern salamanders were the most stable of all species encountered over the years, varying only between 103 and 109 masses since 2007 (Table 1). Red-legged frog egg mass numbers dipped in 2011, from an average of 126 the previous three years down to 70. In 2012, however, red-legged frogs rebounded to 103 egg masses.

Relative Abundance

Weekly survey efforts ranged from 5.33 (2007) to 11.56 hours (2009) (Table 3). Based on these efforts we had an average of 181 (±92) amphibian sightings per year from 2007 to 2012 (range of 90 (2008) to 334 (2011)) (Table 2). Relative abundance was variable among years with the greatest being 21.39 (2007) and least being 13.85 (2012) amphibian sightings per hour (Table 4). Among years we found an average relative abundance of 19.92 (±6.96) sightings per hour. The 2011 survey found the most western toads (29) of any of the years. Since the surveys began in 2007, western toads have only been found in three of the six survey years. In 2011, all 29 were juveniles.

2012

Egg Masses

The 2012 survey found fewer total egg masses than recent years, red-legged frogs and northwestern salamanders still generated similar numbers of eggs as previous years. Compared to preceding years, red-legged frogs had a longer breeding season in 2012 (Figure 6). Despite the longer breeding season, however, 103 red-legged frog egg masses were identified; comparable to the 110 average (±25). Pacific chorus frog egg masses were not found until April 4th and had the least numbers since the 2008 survey (Figure 6) (Table 1). Northwest salamander comprised of 103 out of 1,129 egg masses found in 2012; slightly below the 110 5-year average, however within the margin of error (±25). Only 1 long-toed salamander egg mass was found in 2012, down from 28 in 2011, and 51 in 2010 (Table 1).

Relative Abundance

The weekly survey effort in 2012 was 9.17 hours, down from 10.26 in 2011 and 10.93 in 2010 (Table 3). This level of effort was slightly less than the 6-year weekly survey average of 8.94 hours, however, within the margin of error (±2.54). Juvenile and adult amphibians counted in 2012 (127) was less than those found in 2011 (334) and below the 6-year study average of 181 (Table 2). Additionally, 2012 had the least relative abundance value since the survey began (13.85 amphibian sightings per hour) and was below the 19.92 (±6.96) 6-year study average. Of those 127 amphibians identified in 2012, 35 were red-legged frogs (approximately one-third as many as 2011), 91 were pacific chorus frogs (less than half the 2011 total), and only 1 was a western toad. No deformities were recorded.

Discussion

The 2012 amphibian survey took place weekly from February 29th to May 16th. This was the first year a randomized transect design was used to survey for pacific chorus frogs egg masses. As such, direct comparison among years in terms of egg mass numbers, may not precisely reflect total pacific chorus frog egg masses in Reservation Slough. Whereas the pacific chorus frog egg mass numbers were less than average, the

916 egg masses found, may suggest it is a reliable value as the count total was within the standard deviation of 634 egg masses.

Greater variation in the timing of new pacific chorus frog egg masses was observed in 2012 than in previous years. This can most likely be attributed to the new randomized grid. For example, during weeks when the grid did not include the most productive habitat for chorus frog breeding (4/11, 4/25), numbers dropped. It is difficult to determine exactly how many egg masses were accounted for at later dates and how many were completely missed by using a grid, however, results suggest that at least some portion is picked up later. For example, when we surveyed the most productive portions of the slough (4/4, 4/18, and 5/2), pacific chorus frog egg mass numbers increased. Further supporting this argument are field data showing a high proportion of chorus frog egg masses that had developed tails, indicating they had probably been there more than one week. If a bell curve is artificially drawn on the 2012 data, one could make the argument that adjusting for the peaks and valleys (that might be caused by the grid), the actual graph might look closer to the bell curve if a complete census had been taken. Additionally, the variation in numbers of chorus frog egg masses raised questions about whether differences in survey effort or experience could be exaggerating the differences of the annual totals. This seems most likely the case in 2007 and 2008, the first two years of the survey, when crews were least experienced in identifying the small chorus frog egg masses. In those years, 212 and 195 chorus frog masses were found, respectively. The possibility that egg masses were undercounted those years should be considered, because later years found at least 1,000.

From 2009 to present, the surveys are more directly comparable. Training and experience levels of the crews were more consistent and the use of the cataraft continued. In 2008, the numbers were much lower, most likely because crews were not using a boat, nor chest-waders, and thus only surveyed the edges of water. Egg mass numbers for red-legged frogs and northwestern salamanders would seem more reliable than sightings as an indicator of relative abundance, because each female only lays one egg mass – sightings, on the other hand, can be subject to weather, which affects amphibian activity levels. So whereas the number of red-leggeds found in the survey increased considerably in 2011, the egg mass numbers dropped by almost half. Conversely, in 2012, the number of red-leggeds found decreased but their egg masses showed an increase, closer to the yearly average.

Long-toed salamanders typically represent the least abundant amphibian species found in the slough. These salamanders breed in winter when temperatures are above freezing, so given the start of our spring survey we are probably catching the tail end of their breeding season (Bull, 2005). Surveys in 2010 and 2011 recorded relatively small numbers of long-toed egg masses – other years have turned up none. According to Hayes (2010), farther inland in places such as the Sauk River where the winter climate is colder, long-toed salamanders could be expected to breed later than in Puget Sound, by an average of 10 days. In south Puget Sound, long-toed salamander egg masses are typically not found much past February (Hayes 2010), which would mean the last masses would be expected to show up sometime in March for this species in the Sauk-Suiattle wetland. The survey in 2010 found the long-toed masses in March. The survey in 2011, however,

found the long-toed masses in April. One possible explanation is that the 2011 data is in error, and that the few long-toed masses found that year were simply pacific chorus frog masses that were misidentified because of their similarity. The 2010 data seems more certain, based on a positive identification of long-toed hatchlings that year at egg masses that were closely monitored. The 2010 data also falls in line better with the expectation of the end of that species' breeding season. The other explanation might be that the 2011 data simply documented a much later burst of long-toed breeding than would be expected, although this seems less likely.

Other factors can influence breeding patterns, success, and abundance of amphibians. In past years, water levels in the main pond increased because of a beaver dam, causing the pond to spill and flood the adjacent grassy clearing to an approximate depth of 18 inches. Water levels in the slough, however, were considerably lower during the 2010, 2011 and 2012 survey seasons (likely because of the more distant main channel of the Sauk providing less winter flood flushes). These fluctuations likely increased suitable amphibian habitat during the wetter years and compressed the habitat in more recent, drier years, but the population response has not necessarily followed those fluctuations. Low-lying pockets in the reed canary grass next to the main pond had been especially favored by pacific chorus frogs for breeding in 2008 and 2009, when the water level rose to fill in most of those pockets, but the lower water levels visibly constricted the area of breeding habitat in 2010, even more so in 2011 and 2012. This did not seem to affect the chorus frogs, however, as surveys in 2010 recorded almost 2,000 egg masses for that species, far more than 2009, when water levels expanded potential breeding habitat.

Given the seemingly stable amphibian population in Reservation Slough it seems habitat and water quality impairments are not affecting this ecosystem. Future inventory of amphibians in this Class 1 wetland will allow us to monitor amphibian populations and help us identify any negative ecological affects.

Literature Cited

Bull, E. L., 2005. Long-Toed Salamander. *In*: Jones, L.C., Leonard, W. P., and Olson, D. O., editors. Amphibians of the Pacific Northwest. Seattle, Wa. pp. 34 – 37.

Corkran and Thoms, 1996. Amphibians of Oregon, Washington, and British Columbia. Canada. Lone Pine Publishing.

Crisafulli, C. M., 1997. A Habitat-Based Method for Monitoring Pond-Breeding Amphibians. Northwest Fauna 4: 83 – 111.

Fellars, G. M., 1997. Design of Amphibian Surveys. Northwest Fauna 4: 23 – 34.

Hayes, Marc P., 2010. Senior Research Scientist, Washington Department of Fish and Wildlife. Personal communication.

Jones, L. C., Leonard, W.P., and Olson, D. O., 2005. Amphibians of the Pacific Northwest. Seattle Wa.

Perrill, S.A., and Daniel, R., 1983. Multiple Egg Clutches in *Hyla regilla, H. cinerea and H. gratiosa*. *In*: Copeia. Vol. 1983, No. 2. Pp. 513 – 516.

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Table 1 – Amphibian egg mass counts for Reservation Slough from 2008 through 2012.

The egg mass count in **2008**:	
- Red-legged frog:	118
- NW salamander:	43
- Pacific chorus frog:	195
Total:	357

Egg masses in **2009**:	
- Red-legged frog:	129
- NW salamander:	104
- Pacific chorus frog:	1,209
Total:	1,442
Unidentified:	18

Egg masses in **2010**:	
- Red-legged frog:	130
- NW salamander:	107
- Pacific chorus frog:	1,933
- Long-toed salamander:	51
- Unidentified:	15
Total:	2,236

Egg masses in **2011**:	
- Red-legged frog:	70
- NW Salamander:	103
- Pacific chorus frog:	1,330
- Long-toed salamander:	28
- Unidentified:	0
Total:	1,531

Egg masses in **2012**:	
- Red-legged frog:	103
- NW salamander:	109
- Pacific chorus frog:	916
- Long-toed salamander:	1
- Unidentified:	0
Total:	1,129

Table 2 – Yearly amphibian sightings in Reservation Slough from 2007 through 2012.

	Amphibian sightings:
2007	114
2008	90
2009	240
2010	184
2011	334
2012	127

Table 3 – Weekly average of survey efforts in Reservation Slough from 2007 through 2012.

Survey effort, weekly average:	
2007	5.33
2008	6.38
2009	11.56
2010	10.93
2011	10.26
2012	9.17

Table 4 – Yearly amphibian sightings standardized per hours surveyed.

Amphibian sightings per surveyor hour:

2007	114/5.33	hours = 21.39 (amphibians/hour)
2008	90/6.38	hours = 14.11
2009	240/11.56	hours = 20.76
2010	184/10.93	hours = 16.83
2011	334/10.26	hours = 32.55
2012	127/9.17	hours = 13.85

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Figure 1 – 2006 aerial photograph of Sauk-Suiattle Indian Reservation (loop with houses), Sauk River (right), and 5.5-acre Class 1 wetland, Reservation Slough (outlined in blue).

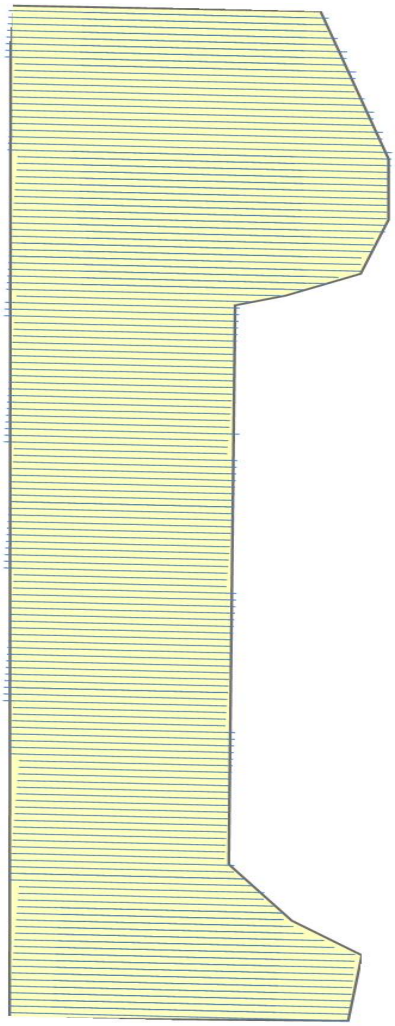

Figure 2 – Transect grid used to create randomized 2-meter transects for weekly pacific chorus frog egg mass surveys.

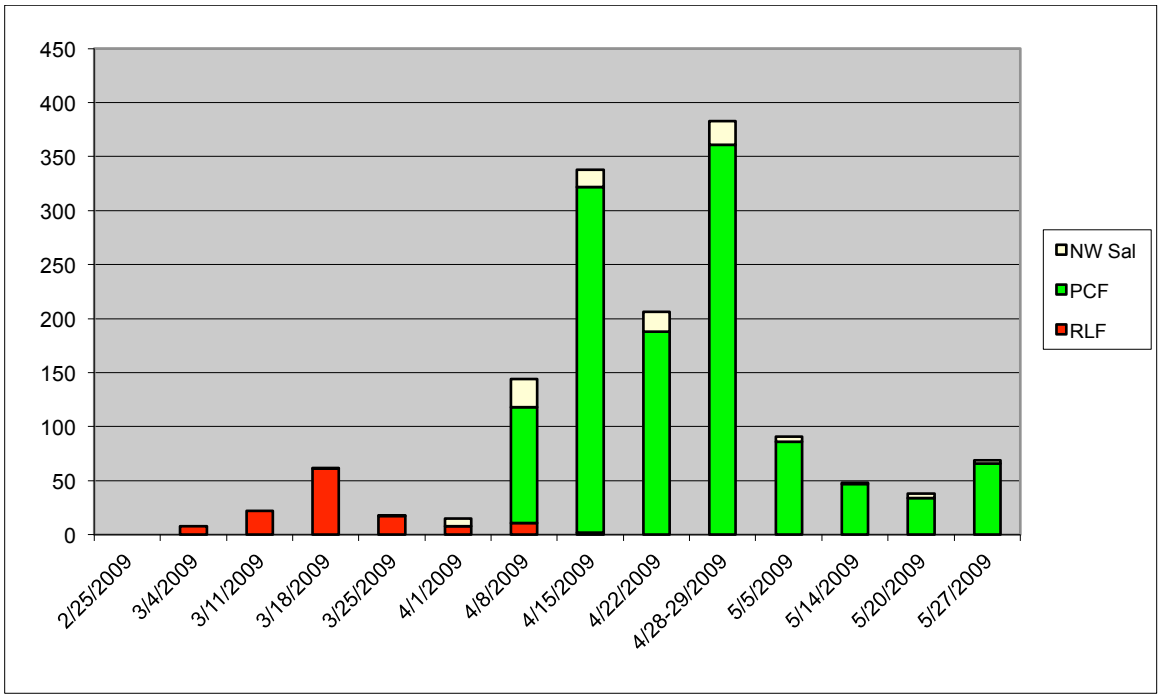

Figure 3 – New weekly egg masses collected in Reservation Slough during 2009 season.

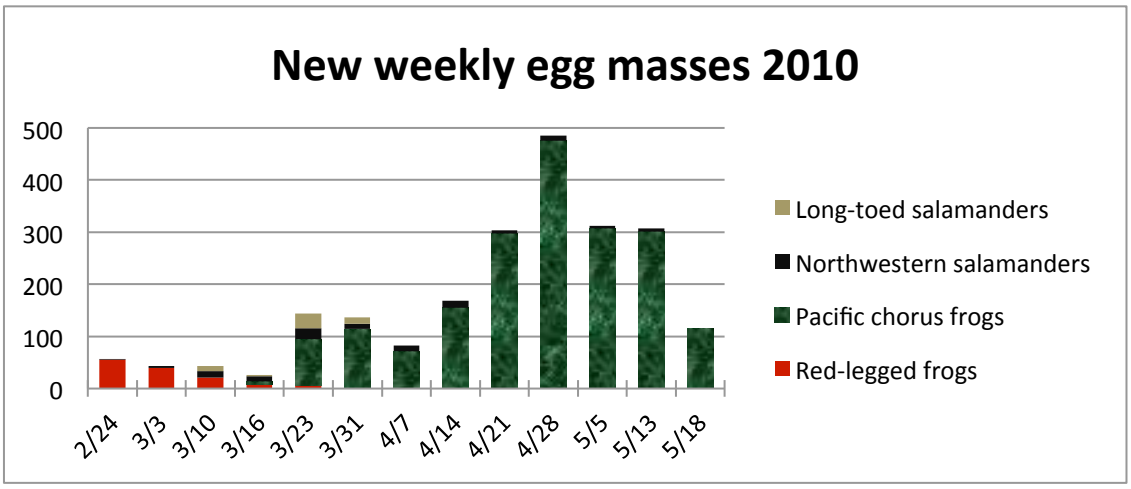

Figure 4 – New weekly egg masses collected in Reservation Slough during 2010 season.

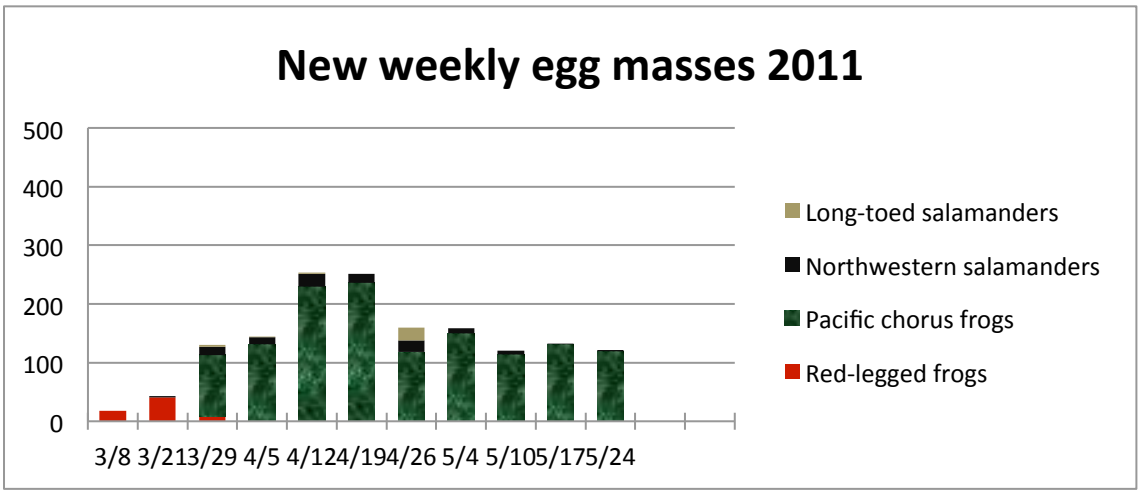

Figure 5 – New weekly egg masses collected in Reservation Slough during 2011 season.

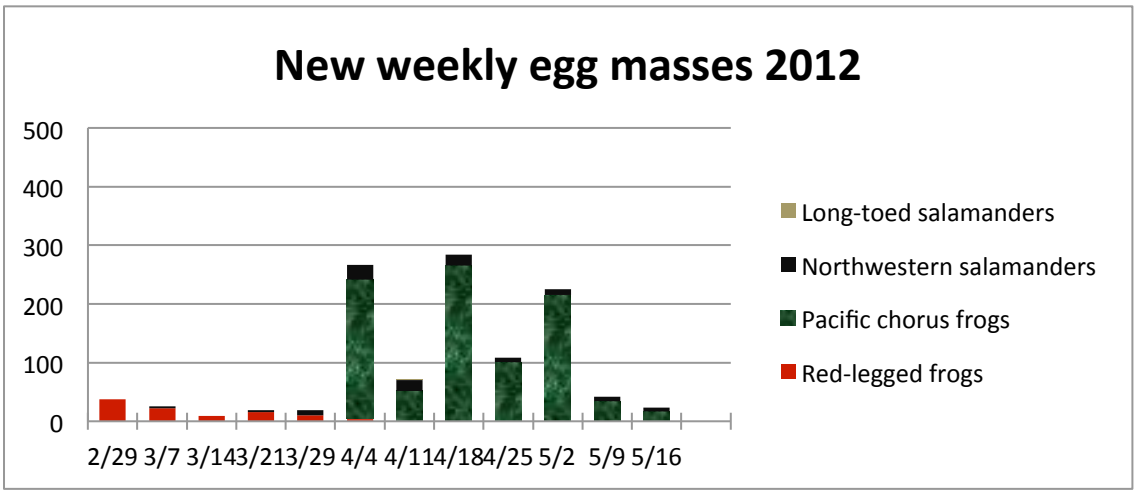

Figure 6 – New weekly egg masses collected in Reservation Slough during 2012 season.