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2008 Amphibian Distribution Surveys in Wadeable Streams and Ponds in Western and Southeast Oregon

2008 Amphibian Distribution Surveys in Wadeable Streams and Ponds in Western and Southeast Oregon

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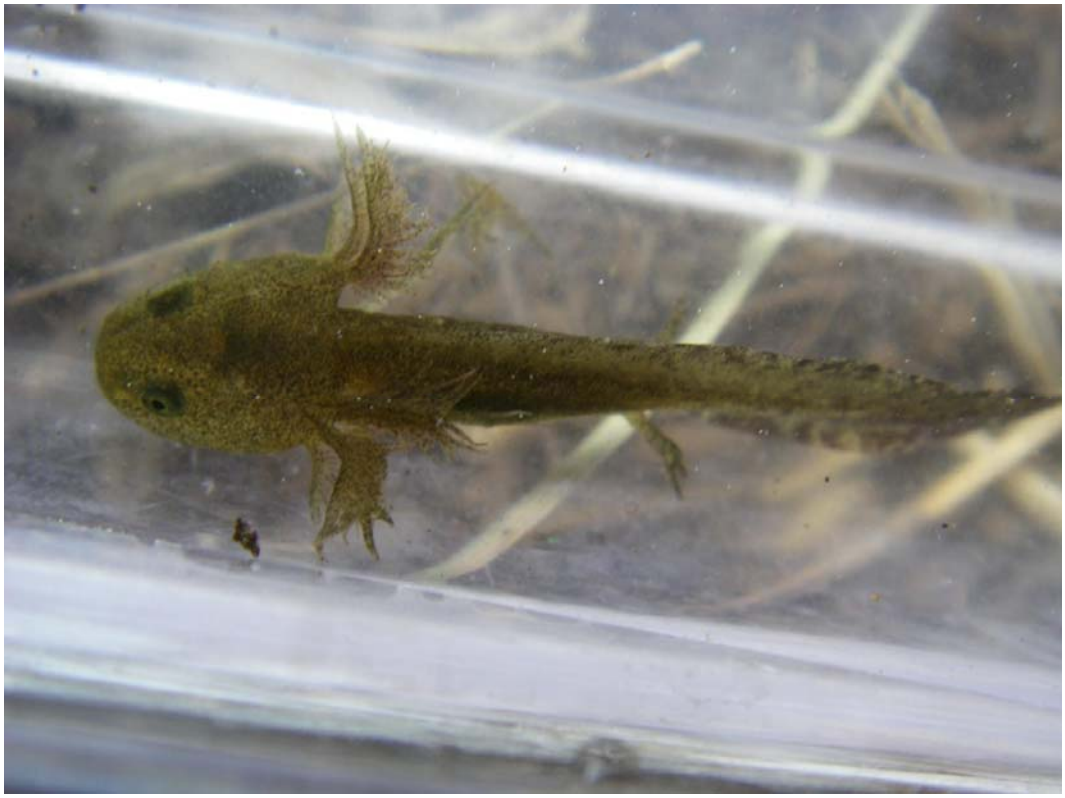

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INTRODUCTION

The ODFW Oregon Conservation Strategy identified monitoring needs for 17 amphibian species native to the state of Oregon that are designated as "Strategy species", or Species of Greatest Conservation Need (per USFWS requirements for State Wildlife Action Plans). The distribution of many species of amphibians in western Oregon is sparsely documented (Oregon Conservation Strategy, page 27). Although a broad-scale survey for amphibian presence would provide important baseline information about amphibian species composition and distribution, most studies have focused on limited areas.

The majority of Oregon's amphibians rely on aquatic habitats at some point of their life, either for breeding and juvenile development or to inhabit as adults. Most aquatic amphibians breed from late winter to early summer, and adults frequently remain in or near their breeding sites into the summer. Most tadpoles and juvenile amphibians are also active in and occupy aquatic habitats during the summer. Ongoing aquatic habitat and fish surveys are opportunities to observe species and life stages (breeding adults, tadpoles and juveniles) that occupy aquatic or riparian habitats during the summer.

One cost-effective approach is to combine amphibian surveys with existing aquatic habitat and fish surveys such as those conducted as part of the Oregon Plan for Salmon and Watersheds (OCSRI 1997). The Oregon Plan has been in place since 1997 and the monitoring component provides a survey framework for streams in the lower Columbia River and Oregon coast drainages. The sampling framework is also compatible with implementation of the aquatic components of the Conservation Strategy, as demonstrated by this study. This study describes the presence of amphibians in and along wadeable streams in coast and lower Columbia River drainages of Oregon, ponds and sloughs in the Willamette Valley, and selected streams in the Great Basin of southeast and central Oregon.

As a component of monitoring under the Oregon Plan, the Aquatic Inventories Project (AIP) conducts aquatic habitat surveys at randomly selected and spatially balanced sites across all 1st through 4th order streams in coastal and lower Columbia River drainages. The purpose of the habitat surveys is to describe stream morphology, instream physical habitat, and riparian vegetation. Because the surveyors were already observing features within and alongside the stream channel, they were able to record observations of amphibians. The amphibian component was consistent with the survey protocol used by the US Geological Survey's Amphibian Research and Monitoring Initiative (http://armi.usgs.gov/). The advantage of coupling an amphibian component with the OR Plan aquatic surveys was that it not only was an efficient use of resources, but more importantly, provided information using a statistically rigorous survey design across a broad geographic area.

The Native Fish Investigations Project began a six year study in 2007 to document the distribution and abundance of redband trout in the Great Basin region of Eastern Oregon. The site selection procedure is comparable to the statistical standards as the Oregon Plan survey design.

Amphibian data are also collected during three other survey projects, and although the site selection procedure does not conform to the same statistical standards as the Oregon Plan survey design, the projects offer a number of opportunities to collect amphibian occurrence information over a wide variety of habitats. The amphibian observations from these three projects are also included in this report. The three projects are as follows:

- AIP conducts aquatic habitat surveys on selected streams throughout the state.
- AIP conducts aquatic habitat surveys at stream habitat restoration projects in Western Oregon.
- Native Fish Project conducts surveys of pond and slough sites for Oregon chub in the Willamette Valley.

Due to the success of the 2006 and 2007 field studies, we continued our research during the summer of 2008 to improve our knowledge of distribution and community structure of amphibians. The summer 2008 surveys took place in 9 of Oregon's 10 ecoregions (Figure 1) (Thorson et al. 2003). Ecoregions provide a framework for discussing amphibian distribution across the state because they are relatively large areas defined by distinctive geographic and ecological (flora and fauna) characteristics.

The goals of our 2008 work were to:

- Increase the consistency, efficiency and ability of habitat crews in identifying amphibians through improved training.
- Increase knowledge of distribution, community structure, and habitat associations of amphibians in streams in:
    - Western Oregon coastal and lower Columbia drainages.
    - Ponds, sloughs and other off-channel aquatic habitats in the Willamette Valley.
    - Great Basin of eastern Oregon and selected streams in central Oregon.
- Combine the 2008 observations with the 2006-07 results.

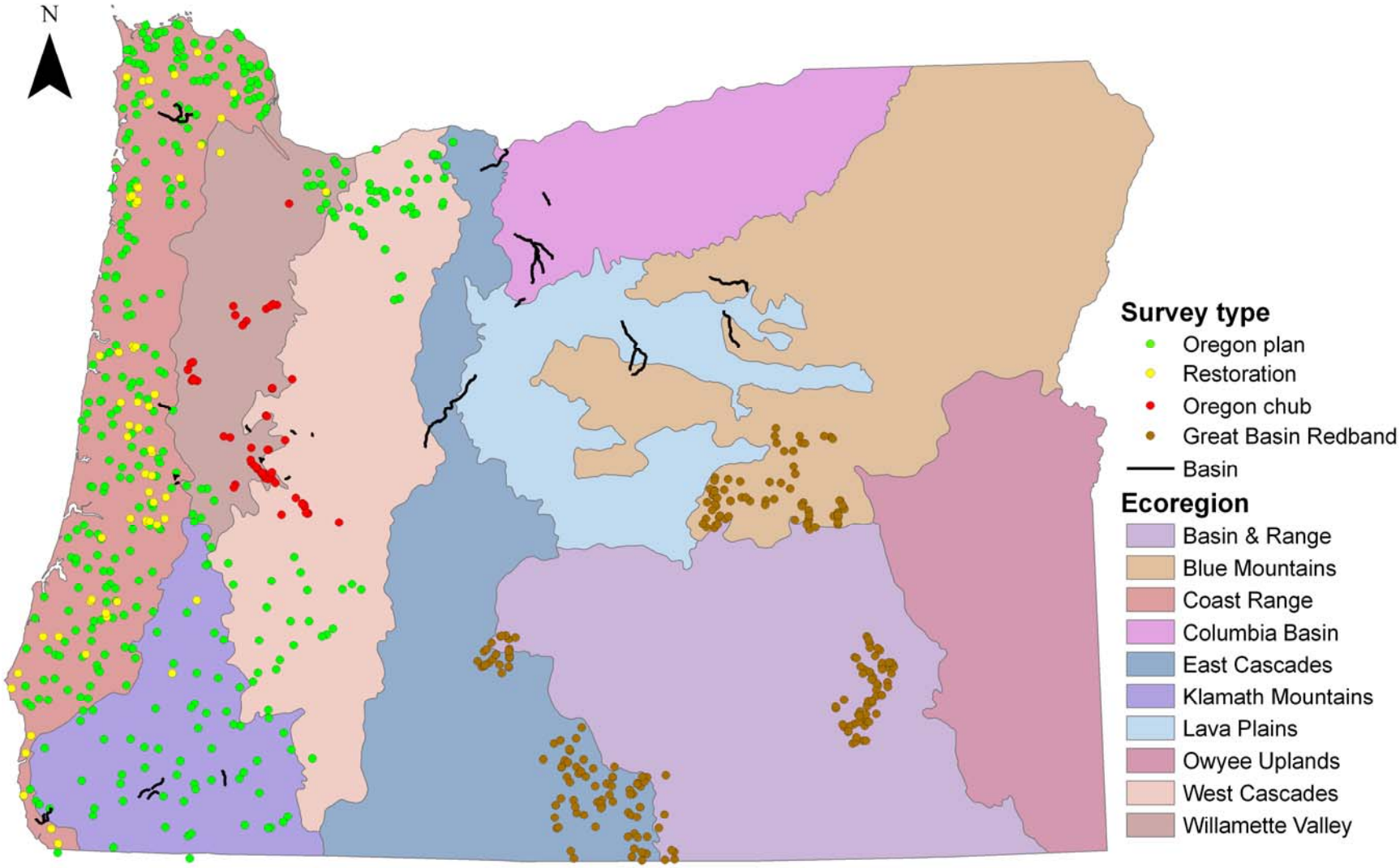


Figure 1. 2008 Oregon Plan, Restoration, Basin, Oregon chub and Great Basin Redband survey locations.

METHODS

Survey Projects

Amphibian sampling was coupled onto five ongoing survey projects. While the primary goal of these projects was to collect fish and habitat data, amphibian observations were recorded concurrently. Previous studies found parallels between the habitat and fish sampling methods that were utilized and standard amphibian sampling procedures (Bangs and Jones 2009).

Oregon Plan habitat surveys

The Generalized Random Tessellation Stratified design (GRTS) (Stevens and Olsen 2004) was used to randomly select 350 sites within coast range and lower Columbia basins (Figure 1). This survey design allows inferences to be drawn about amphibians in streams that were part of the frame from which the sample sites were randomly drawn. Sample sites begin at the selected point, and are surveyed in an upstream direction. Approximately 25% of the selected surveys are visited once, 25% are revisited annually, 25% are revisited every 3 years and 25% are revisited every 9 years. Sites in medium size streams are 1000 meters in length, and sites in small and headwater streams are 500 meters in length.

Habitat surveys record stream morphology, instream habitat, and riparian characteristics. A reference guide to Oregon amphibians was developed and included with the sampling manual that crews carried in the field and all personnel attended an amphibian identification component during their training. Crews identified and noted amphibian presence during stream and riparian surveys. Sampling was completed through a walking survey, and data are collected on a channel habitat unit basis.

A crew (hereafter referred to as a resurvey crew) also revisited 30 sites after they were initially surveyed to establish variability in observations and surveyor bias. We then estimated surveyor bias by comparing standard crew data with the intensive resurveys.

Basin habitat surveys

Basin habitat surveys are very similar to Oregon Plan habitat surveys, except that we selected the streams to be surveyed (non-random) and the streams were surveyed from mouth to headwaters (census). Streams were surveyed in the Illinois, Nehalem, Rogue, Salmon and Siuslaw river basins (Oregon coast), and Coast Fork Willamette, Middle Fork Willamette and McKenzie river basins (Willamette River). In Eastern Oregon streams were surveyed in the Deschutes, John Day and Threemile river basins (Figure 1).

As with Oregon Plan habitat surveys, crews identified and noted amphibian presence as they walked the stream and riparian transects.

Restoration habitat surveys

Restoration habitat surveys are very similar to Oregon Plan habitat surveys, except that we selected the streams to be surveyed (non-random) and the surveyed length was determined by the portion of the stream in which restoration treatment was planned or had been completed. Each restoration site was surveyed before the restoration treatment, immediately after treatment, and every five years. Sixty-five restoration sites were sampled during the summer of 2008 (Figure 1). As with Oregon Plan habitat surveys, crews identified and noted amphibian presence as they walked the stream and riparian transects.

Oregon Chub fish surveys

Site selection was based upon historical distribution and current knowledge of habitat types preferred by Oregon chub (Figure 1). These sites are typically low gradient, low flow, and off-channel habitats, such as disconnected sloughs, ponds, and channels with an organic or silt rich substrate. Locations that contain Oregon chub populations are revisited annually to establish population trends. The sampling for Oregon chub typically occurred from April through May, and from September through October, to avoid sampling during the Oregon chub spawning season. Some sampling outside of those months has occurred.

Fish sampling was conducted using baited mesh minnow traps, a seine, and dip nets. Minnow traps were fished on the bottom or in the water column for 3 to 18 hours, often overnight or over multiple days. All fish, reptiles, and amphibians captured were identified. Physical and biological habitat characteristics were measured at each site.

Great Basin Redband fish surveys

GRTS protocol was used to randomly select sites within the range of redband trout in the Catlow Valley, Chewaucan, Silver Lake, Goose Lake, Malheur Lakes and Warner Valley basins (Miller et al. 2010). The findings reported here represent 250 sites on public and private lands (Figure 1).

Site length was set at 30 wetted widths, with a minimum length of 30 meters and a maximum length of 100 meters. Fish were sampled by electrofishing except in areas where electrofishing was ineffective due to water depth or turbidity, seines, fyke nets and minnow traps were used. Dip nets were used at sites with low water depth or with heavy vegetation. Physical and biological habitat characteristics were recorded.

Amphibian and reptile species were recorded when observed at each site. A reference guide to amphibians specific to region was developed and included with the sampling manual that crews carried in the field. All personnel attended an amphibian identification session during their training.

RESULTS

Sixteen of Oregon's 32 amphibian species were observed, including 7 strategy species (Oregon Conservation Strategy, pages 337-341, 375) (Table 1). Because of difficulty identifying species, crews were instructed to identify Pacific giant salamanders and Cope's giant salamanders as the same species, *Dicamptodon tenebrosus*. Western Red-backed and Dunn's salamanders were similarly lumped together as *Plethodon* spp.

Table 1. Taxonomic details of amphibian species observed.

Order	Caudata (Salamanders)	Strategy Species
Family	Ambystomatidae (Mole Salamanders)	
	Ambystoma gracile (Northwestern Salamander)	
	Ambystoma macrodactylum (Long-toed Salamander)	
	Ambystoma tigrinum (Tiger Salamander)	
Family	Dicamptodontidae (Giant Salamanders)	
	Dicamptodon tenebrosus (Pacific Giant Salamander)	X
Family	Salamandridae (Newts)	
	Taricha granulosa (Rough-skinned Newt)	
Family	Plethodontidae (Woodland Salamanders)	
	Ensatina eschscholtzii (Ensatina)	
	Plethodon dunni (Dunn's Salamander)	
	Plethodon vehiculum (Western Red-backed Salamander)	
Order	Anura (Frogs and Toads)	
Family	Leiopelmatidae (Bell Toads)	
	Ascaphus truei (Tailed Frog)	X
Family	Bufonidae (True Toads)	
	Bufo boreas (Western Toad)	X
Family	Hylidae (Treefrogs)	
	Pseudacris regilla (Pacific Treefrog)	
Family	Ranidae (True Frogs)	
	Rana aurora (Red-legged Frog)	X
	Rana luteiventris (Columbia Spotted Frog)	X
	Rana cascadae (Cascades Frog)	X
	Rana boylii (Foothill Yellow-legged Frog)	X
	Rana catesbeiana (American Bullfrog)	

Survey crews observed amphibians at 381 of 961 sites (Tables 2 and 3). Surveys took place in nine ecoregions across the state, and amphibians were found in every ecoregion. Amphibians were observed during surveys as early as April and as late as the end of October. The Coast Range ecoregion had the highest observed number of species, with ten amphibian species. The largest number of amphibians was observed in the Willamette Valley, primarily rough-skinned newts and bullfrogs.

Western Oregon ecoregions had the highest percentage of sites (45-62%) with amphibians observed in Oregon. Amphibians were observed at 62% of the Willamette Valley sites, 49% of the Klamath Mountain sites, 48% of the West Cascades sites, and 45% of the Coast Range sites.

All of the Eastern Oregon ecoregions had low percentages of sites where amphibians were observed (Table 3). Amphibians were observed at 10% of the sites in the Basin and Range, 19% of the sites in the East Cascades, 36% of the sites in the Blue Mountains, 29% of the sites in the Lava Plains, and 28% of the sites in the Columbia Basin ecoregions. Pacific treefrogs, Columbia spotted frogs and western toads were the only native amphibians identified in Eastern Oregon.

Table 2. Number of sites with amphibian observations in ecoregions of western Oregon.

	Coast Range	Willamette Valley	Klamath Mountains	West Cascades
Rough-skinned Newt	71	46	13	25
Pacific Giant Salamander	33	1	22	11
Northwestern Salamander	1	19		10
Long-toed Salamander		2		
Ensatina	1			
Plethodon	11			
Tiger Salamander				
Red-legged Frog	23	6	3	12
Yellow-legged Frog	9	1	7	1
Cascades Frog				2
Tailed Frog	4			
Pacific Treefrog	13	2	8	5
Spotted Frog				
Western Toad				
Bullfrog	2	27	4	10
Unknown Amphibian	69	9	8	17
Sites with amphibians	157	53	46	54
Sites surveyed	347	86	93	113

Table 3. Number of sites with amphibian observations in ecoregions of eastern Oregon.

	East Cascades	Columbia Basin	Lava Plains	Basin and Range	Blue Mountains
Tiger Salamander					1
Pacific Treefrog	12	1	2	1	1
Spotted Frog	1			2	8
Western Toad	2		2	1	1
Bullfrog					5
Unknown Amphibian	5	12	5	5	14
Sites with amphibians	20	8	6	9	28
Sites surveyed	106	29	21	89	77

Oregon Plan surveys were conducted at more sites and across the largest geographic area than other survey projects (Figure 1). Consequently, the highest number and diversity of amphibian species were observed during these surveys (Table 4, Figure 2).

Table 4. Number of sites with amphibian observations for each survey type.

Species	Oregon Plan	Restoration	Basin	Oregon chub	Redband	Total
Rough-skinned Newt	56	27	27	45		155
Pacific Giant Salamander	42	9	16			67
Northwestern Salamander	1		1	28		30
Long-toed Salamander				2		2
Ensatina		1				1
Plethodon	5	5	1			11
Tiger Salamander					1	1
Red-legged Frog	29	6	3	6		44
Yellow-legged Frog	8	5	5			18
Cascades Frog	2					2
Tailed Frog	2	2				4
Pacific Treefrog	15	3	17	4	6	45
Spotted Frog					11	11
Western Toad			2		4	6
Bullfrog	5		4	34	5	48
Unknown Amphibian	74	12	35		23	144
Sites with amphibians	165	39	73	56	48	381
Sites surveyed	381	65	192	73	250	961

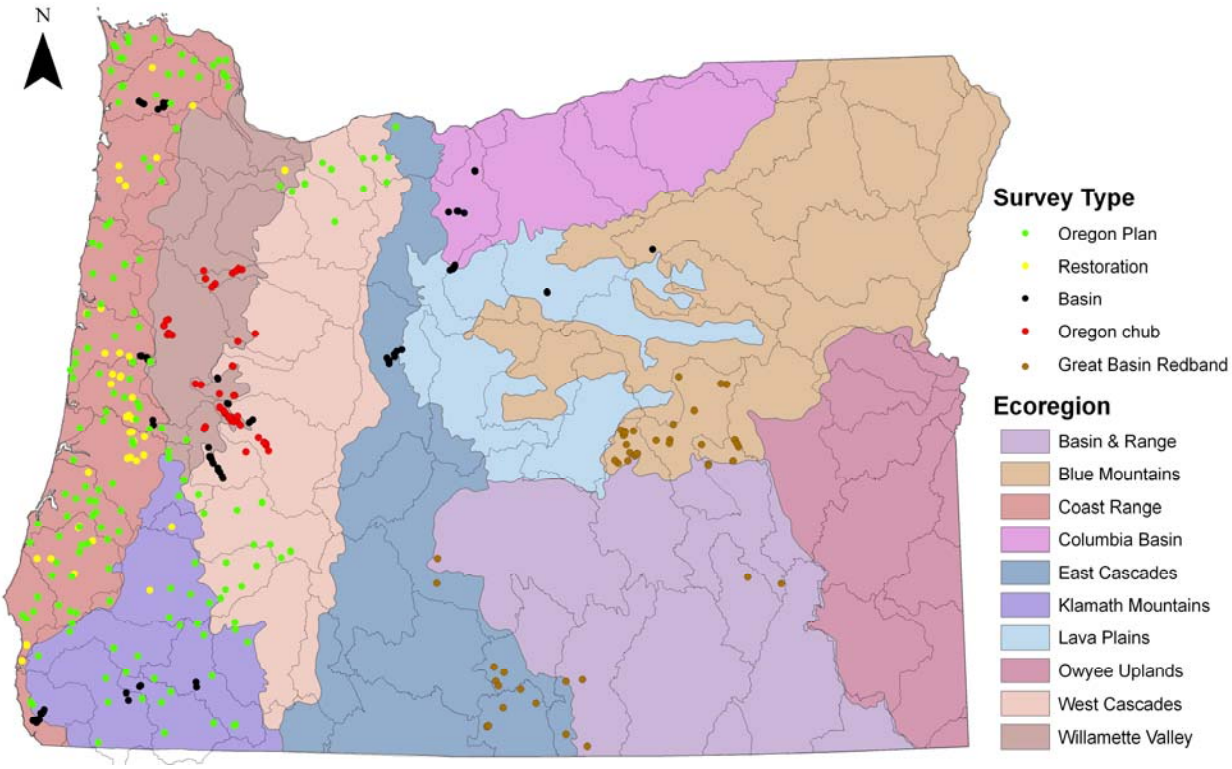


Figure 2. Distribution of amphibian occurrences by survey type. Gray lines denote 4th field hydrologic units.

Results by species

Rough-skinned Newt (*Taricha granulosa*)

Rough-skinned newts were the most encountered amphibian on the west side of the state with 155 occurrences (Figure 3). Rough-skinned newts were observed in the Coast Range, Willamette Valley, West Cascades, and Klamath Mountains ecoregions. Only adult forms of this species were identified.

The breeding season for rough-skinned newts overlaps the typical sampling schedule for the Oregon chub surveys (April – May) and the beginning of the Oregon Plan surveys (June). The high number of observations of this species is probably due to it being diurnal, and active within the water column of ponds, low gradient streams and beaver ponds.

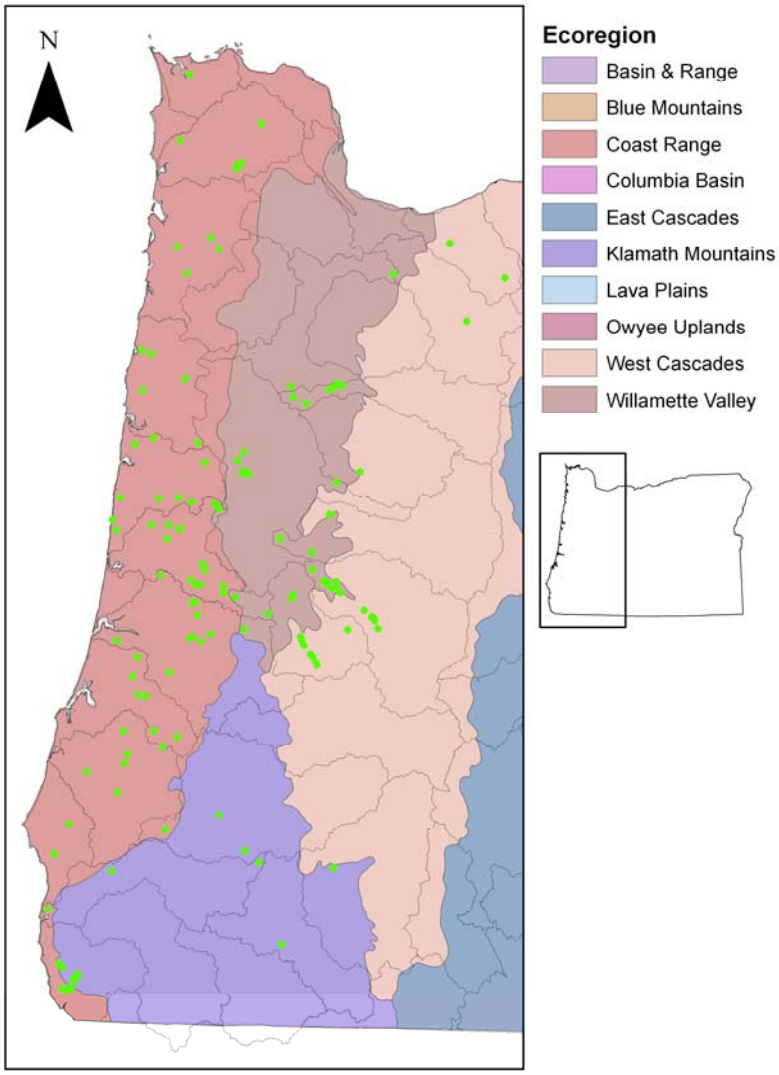


Figure 3. Rough-skinned newt distribution at Oregon Plan, Oregon chub, Restoration, and Basin sites. Gray lines denote 4th field hydrologic units.

Pacific Giant Salamander (*Dicamptodon tenebrosus*)

Pacific giant salamanders were encountered throughout western Oregon, but were observed most frequently in the coast range south of the Yaquina River (Figure 4). Pacific giant salamanders were observed at 67 locations by Oregon Plan, Restoration, and Basin survey crews. This species was found in the Coast Range, Willamette Valley, Cascades West and Klamath Mountains ecoregions. Juveniles, neotenic forms, and metamorphosed adults were observed. Crews were instructed not to differentiate between Cope's giant salamander and Pacific giant salamander due to identification difficulties.

Northwestern Salamander (*Ambystoma gracile*)

Northwestern salamanders were encountered from April through October along the Willamette River and its tributaries south of the city of Salem in the Willamette Valley, Coast Range, and West Cascades ecoregions (Figure 4). This species was encountered at 28 locations in ponds and low gradient streams during Oregon chub surveys, and once during Oregon Plan and Basin surveys. Larvae, juveniles, neotenic forms, and metamorphosed adults were observed.

Long-toed Salamander (*Abystoma macrodactylum*)

Long-toed salamanders were encountered at two locations in the Willamette Valley ecoregion (Figure 4). This species was only encountered during Oregon chub surveys. All of the individuals encountered were juvenile or neotenic forms.

Plethodon (most likely *P. dunni or P. vehiculum*)

Members of the genus *Plethodon* were encountered at 11 locations in western Oregon (Figure 4). Oregon Plan, Restoration, and Basin survey crews recorded members of this genus in the Coast Range ecoregion.

Crews reported difficulty identifying this genus down to species level. The species encountered were most likely *P. dunni* or *P. vehiculum.* Surveyors reported spotting these individuals after seeing movement in the riparian areas of the creek.

Ensatina (*Ensatina eschscholtzii*)

A single ensatina was encountered in the Coquille River basin in the Coast Range ecoregion during the summer of 2008 (Figure 4).

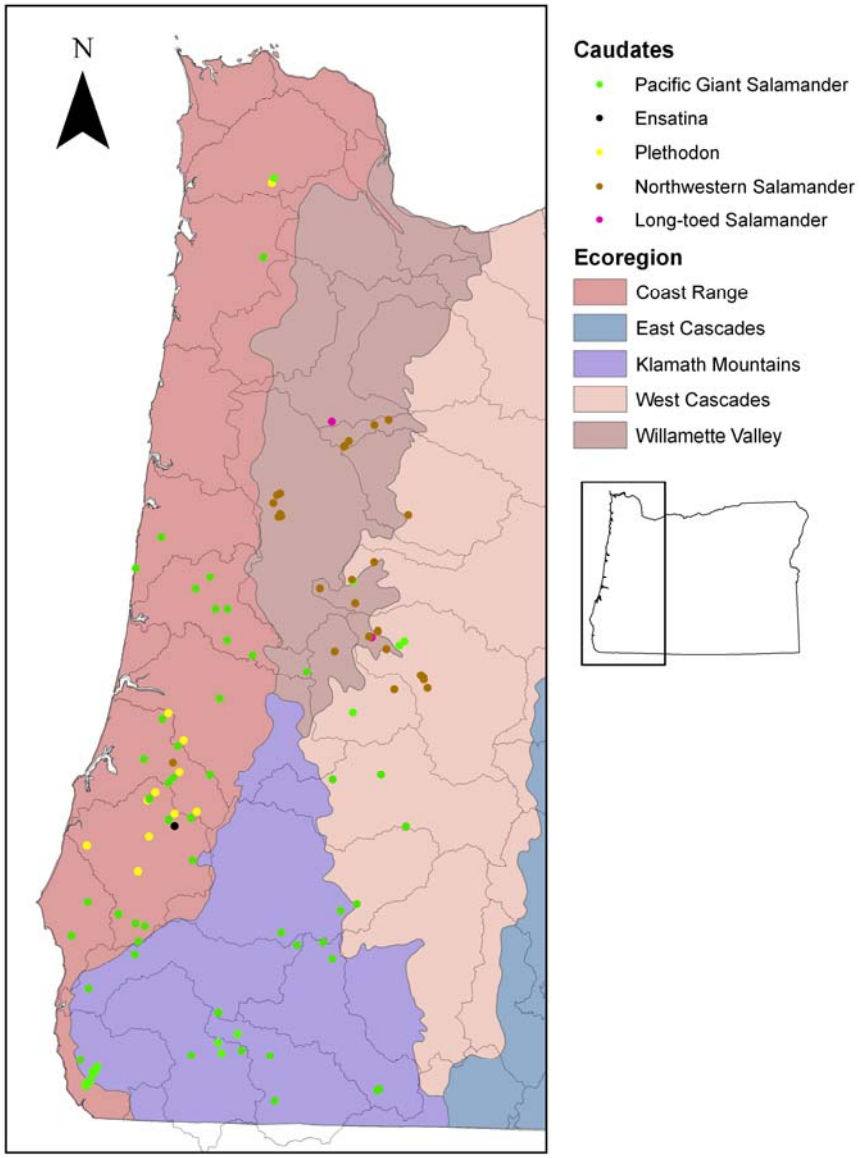


Figure 4. Native caudate distribution in western Oregon. Gray lines denote 4th field hydrologic units.

Western Toad (*Bufo boreas*)

Adult western toads were encountered in a wide range of habitats in eastern Oregon (Figure 5). They were observed at 6 locations in the East Cascades, Lava Plains, Basin and Range, and Blue Mountain ecoregions. Survey crews did not record any juvenile Western Toads.

Columbia Spotted Frog (*Rana luteiventris*)

Columbia spotted frogs were encountered in the Malheur Lakes and Chewaucan regions of eastern Oregon (Figure 5). Columbia spotted frogs were observed at 11 locations during redband

trout surveys. They were observed in the East Cascades, Basin and Range, and Blue Mountain ecoregions. Tadpoles and adult frogs were observed.

Foothill Yellow-legged Frog (*Rana boylii*)

Foothill yellow-legged frogs were encountered by Oregon Plan, Restoration and Basin surveys at 18 locations in the Coast Range, Willamette Valley, Klamath Mountains and West Cascades ecoregions in western Oregon (Figure 5). Tadpoles and adult frogs were observed.

Red-legged Frog (*Rana aurora*)

Red-legged frogs were observed throughout western Oregon (Figure 5). They were encountered at 44 locations in the Coast Range, Willamette Valley, Klamath Mountains and West Cascades ecoregions. Oregon Plan surveys had the highest number of observations. Tadpoles and adult frogs were observed.

Cascades Frog (*Rana cascadae*)

Cascades frogs were observed by Oregon plan crews at two locations (Figure 5) in the West Cascades ecoregion. Only adult frogs were observed.

Tailed Frog (*Ascaphus truei*)

Tailed frogs were observed from July through September. Thirty-six individuals were encountered at 4 locations (Figure 5) in the Coast Range ecoregion in western Oregon. Tadpoles and adult frogs were observed.

Pacific Treefrog (*Psuedacris regilla*)

Pacific treefrogs were observed at 45 locations throughout the state (Figure 5). Individuals occurred in the Coast Range, Willamette Valley, Klamath Mountains, West Cascades, East Cascades, Columbia Basin, Lava Plains, Basin and Range, and Blue Mountains ecoregions. Tadpoles and adult frogs were observed. Individuals were observed in a wide range of habitats ranging from isolated coastal streams to areas of open desert.

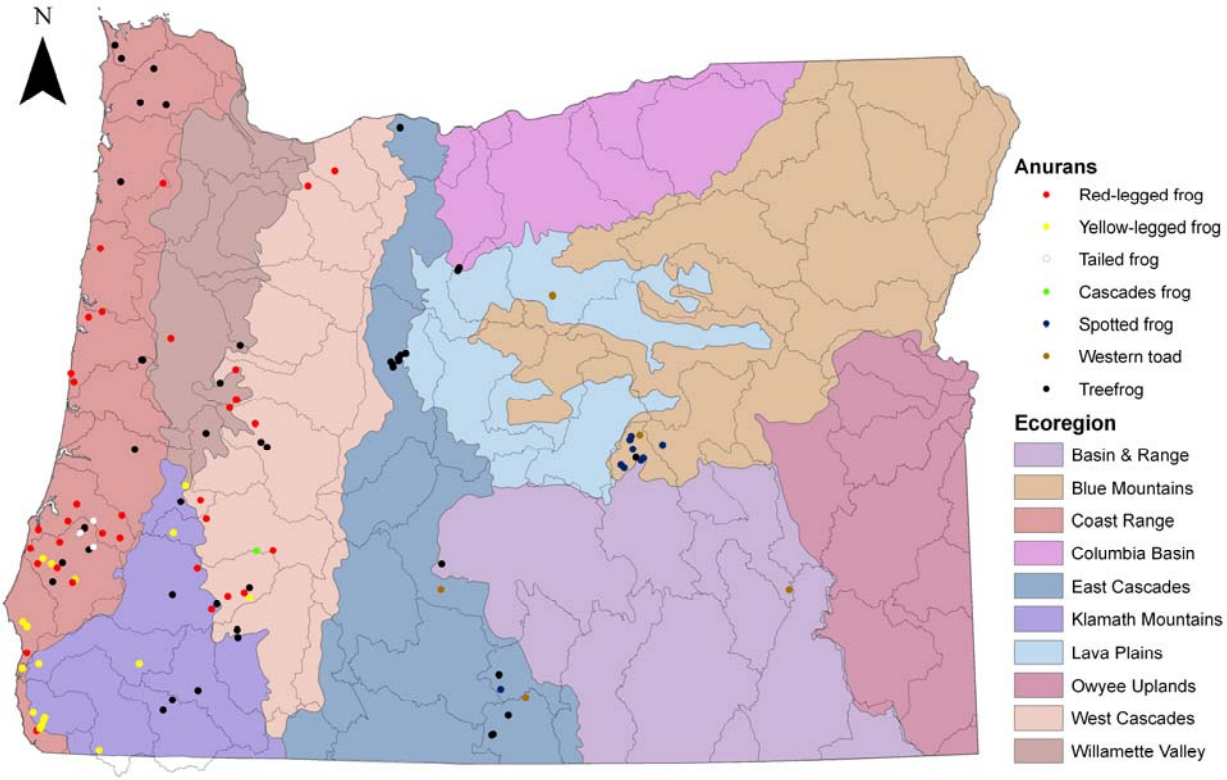


Figure 5. Native anuran distribution at survey sites across Oregon. Gray lines denote 4th field hydrologic units.

American Bullfrog (*Rana catesbeiana*)

Bullfrogs are nonnative and are considered an invasive species in Oregon. There is growing concern about their distribution and ability to prey on and outcompete native species. Bullfrogs were observed at 48 locations (Figure 6), and were the most commonly observed amphibian in the state. While bullfrogs were present at sites in the Coast Range, Klamath Mountains, and West Cascades ecoregions, the majority of the observations were made in the Willamette Valley ecoregion. Oregon chub surveys had the highest number of observations. These records include observations of tadpole, juvenile and adult frogs. Bullfrogs were typically observed in isolated ponds, beaver ponds, off-channel habitats and other slow water environments.

Tiger Salamander (*Ambystoma tigrinum*)

Tiger salamanders are thought to be an invasive species introduced into southeast Oregon as fishing bait. In 2007, Great Basin Redband crews reported observing a juvenile caudate, but failed to take photographs or otherwise identify the individual encountered. In 2008, Great Basin Redband crews surveying in the same area were able to identify the individual as a tiger salamander (Figure 6). This observation was made in the Blue Mountains ecoregion in the Silvies River basin. Only juvenile salamanders were observed.

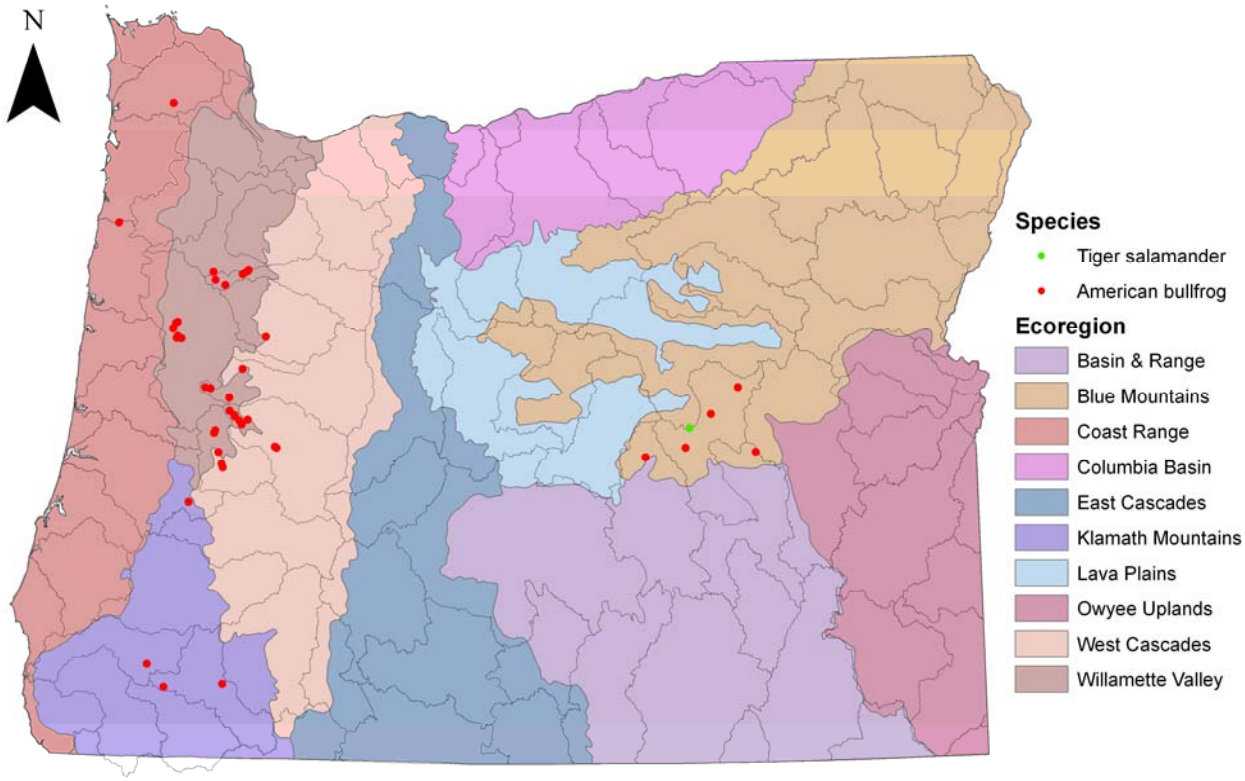


Figure 6. Bullfrog and tiger salamander distribution at Basin Survey, Oregon chub, Great Basin Redband and Oregon Plan sites. Gray lines denote 4th field hydrologic units.

DISCUSSION

This study continues the amphibian surveys begun in 2007 in aquatic habitats in coastal and lower Columbia basins of western Oregon, in the Willamette Valley, and in the basin and range province of south central Oregon. This study has demonstrated that adding amphibian surveys to ongoing fish and aquatic habitat surveys is a cost-effective approach to achieve a key research objective in the Oregon Conservation Strategy. The GRTS survey design of the Oregon Plan habitat and Redband trout surveys selected sites in a random and spatially balanced pattern across a large region to assess amphibian presence and species composition in the coast and lower Columbia basins in western Oregon and in the Great Basin of eastern Oregon. The survey design affords broad spatial coverage and permits assumptions about amphibian presence in unsurveyed streams. Because we do not observe amphibians at some sites even though present, we are somewhat limited in our ability to extrapolate to all unsurveyed streams with the sample frame or area. However, it does increase the probability or likelihood that these species are present in similar streams within the respective range of distribution for each species. For example, plethodons were observed at many of the sites in the Coos and Coquille basins on the mid-South coast. We would expect that plethodons are also present in other streams of similar size in those basins. However, until we can establish firm habitat associations for each species, our powers of inference will remain limited outside of the sample frame.

Although the methods used are recognized as standard for amphibian surveys the project was not without challenges. Surveys were conducted by 50 individuals who, while trained and carried an identification guide, were not amphibian specialists. Despite these limitations, these surveys represented a substantial effort to expand the limited knowledge of community structure and distribution of amphibians in Oregon.

Comparison of 2007 and 2008 Occurrence Data

Our primary goal is to increase the knowledge of the distribution of amphibians across the state. Multiple years of data are needed because of the variability in weather and local conditions that may impact the visibility and behavior of amphibians, seasonality, surveyor bias, and the distribution of survey locations. In 2007 we observed 1,011 amphibians (Bangs and Jones 2009). We combined these observations with the 826 observations at 961 sites made in 2008 to provide a more comprehensive map of amphibian ranges across the state (Figures 7, 8, and 9).

Habitat Data

Amphibians were detected in a variety of stream and pond habitats. Some species were encountered in a variety of habitats, spanning a wide range in elevation and stream size. Some species were observed across the region, while others were observed at very few sites. We conducted a more exhaustive analysis of potential habitat associations with the 2007 data with little success (Bangs and Jones 2009), and expect to combine four years of data following the 2009 and 2010 field seasons to further explore potential habitat associations.

Surveyor Bias

Observation and identification of amphibians was a primary goal of the surveys. Of the 826 amphibians observed, 197 were unidentified. Oregon Plan and Basin survey crew were unable to identify 26% and 40% of the amphibians they observed, respectively. There were no differences between the training, objectives, or resources available to the Oregon Plan and Basin survey crews.

All of the amphibians observed during the Oregon chub project were identified. The Oregon chub project is typically able to handle the amphibians that they observed, as they were caught in minnow traps. Many of the Oregon chub sites are visited multiple times in order to obtain mark-recapture population estimates, which may have aided in their ability to identify amphibians. The crew for this project also remains the same year after year, so there may be an experience component to their ability to identify amphibians as well.

Redband trout crews were unable to identify 46% of the amphibians. In general, the use of electrofishers to collect fish may have increased the number of amphibians observed and handled, and aided in accurate identification.

Figure 7. Distribution of caudates in 2007 and 2008. The left panel shows only rough-skinned newt observations. The right panel shows all other caudate observations.

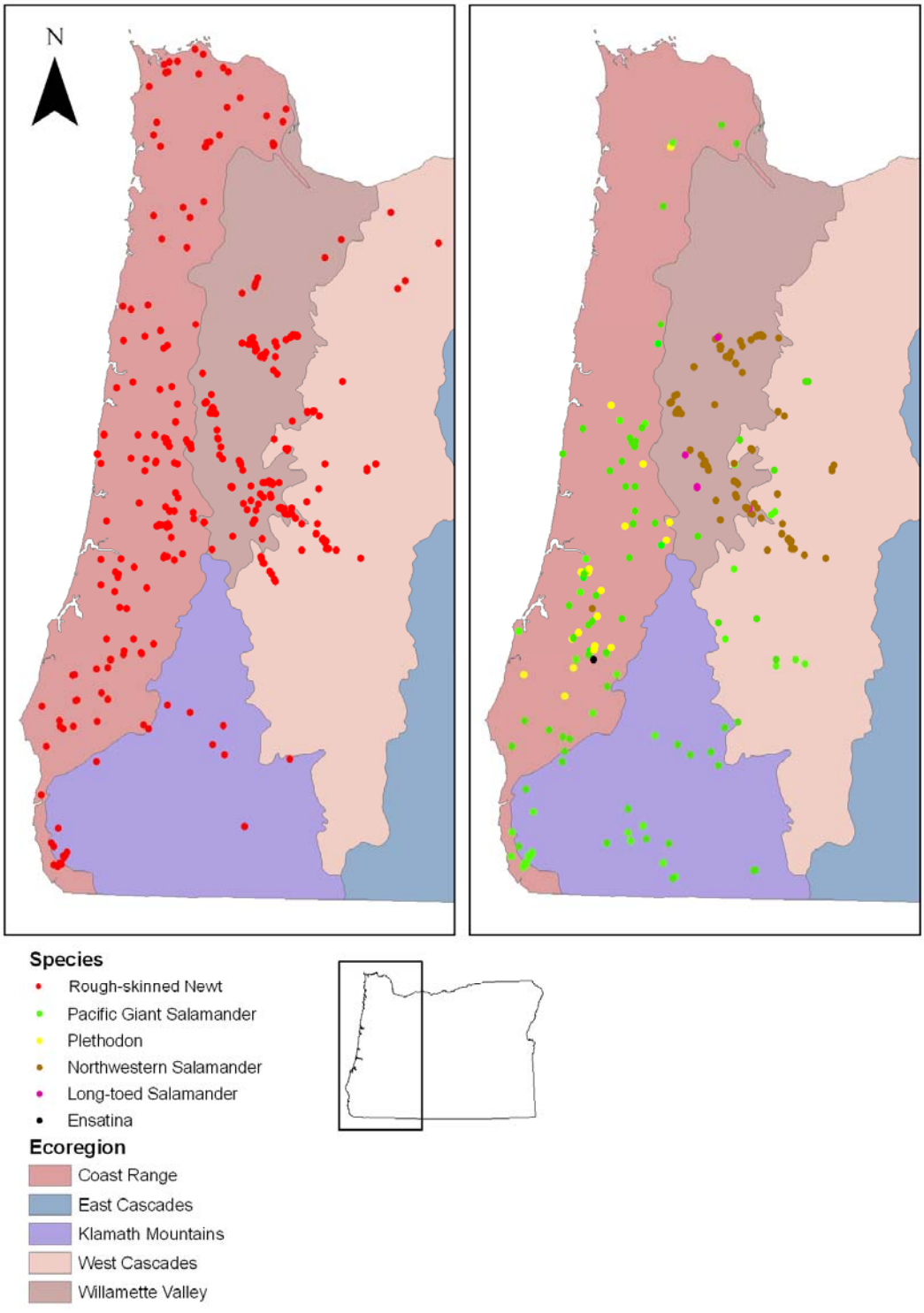


Figure 8. Distribution of anurans in 2007 and 2008.

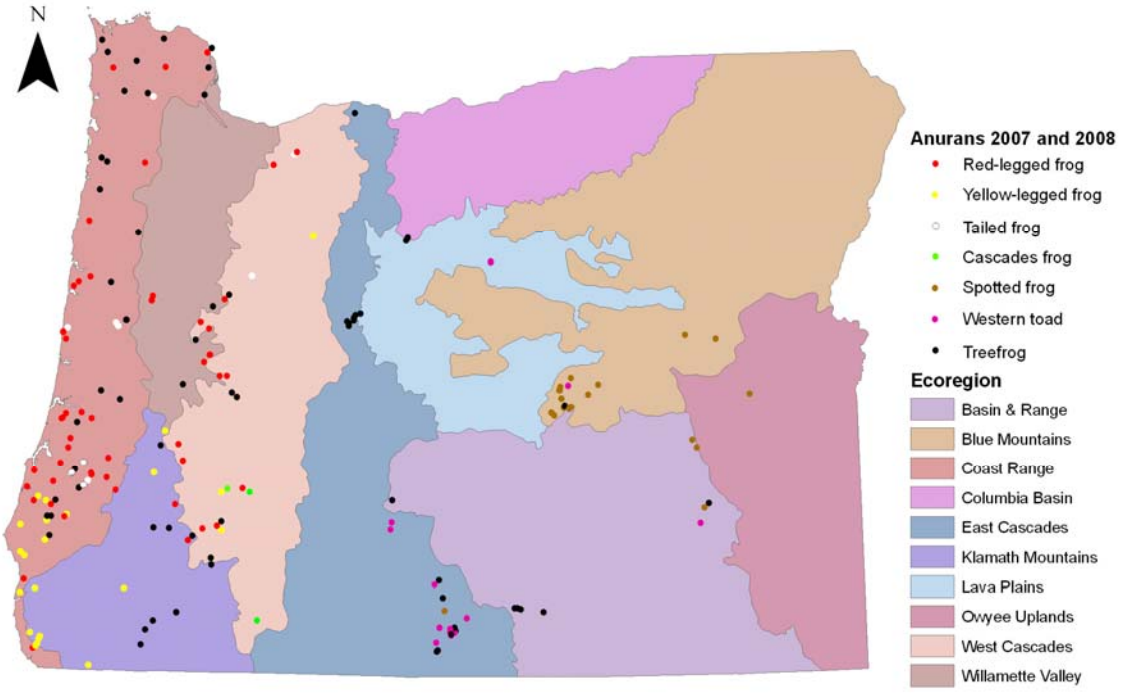
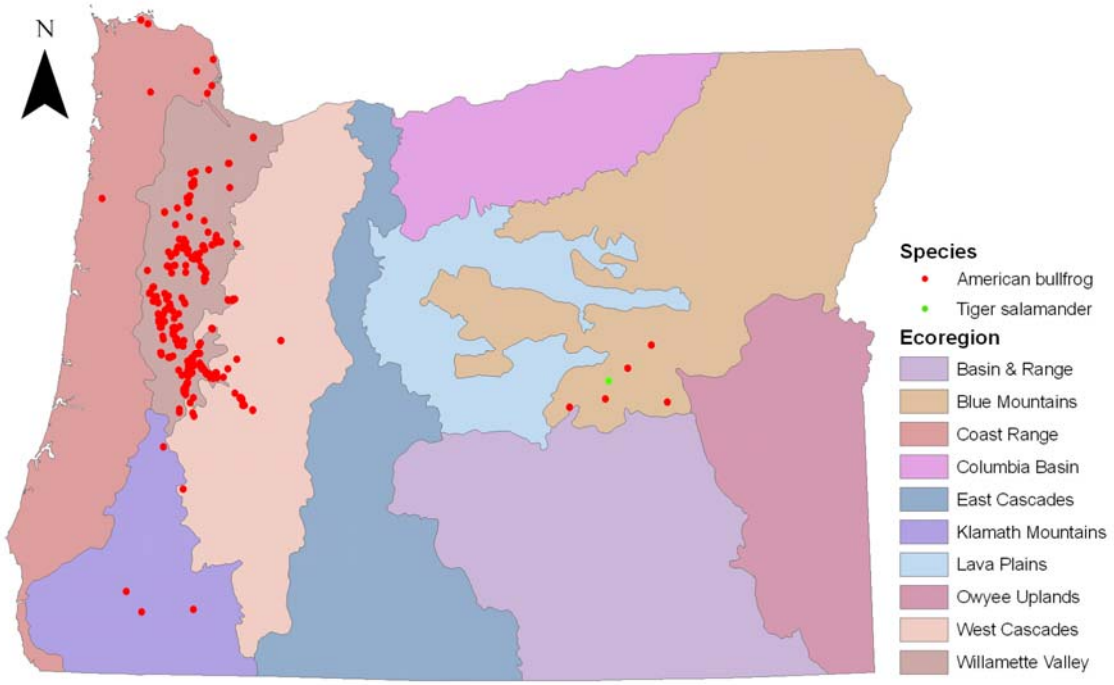


Figure 9. Distribution of American bullfrog and tiger salamanders in 2007 and 2008.



While the resurvey crew should have had a higher ability to observe amphibians (because of experience), they observed amphibians at a similar frequency of sites as the regular Oregon Plan crews. Of the 23 sites that were surveyed by Oregon Plan and resurvey crews, amphibians were found at 8 sites by the resurvey crew and at 12 sites by the Oregon Plan crews. There were only 5 sites where the Oregon Plan and resurvey crews were able to locate amphibians at the same site. Amphibians may change behavior (affect probability of observation) with season or life stage, temperature, weather, or time of day.

The repeatability of observation at the same site was consistently very low in 2007 also (Bangs and Jones 2009). For this reason, these data should not be used to establish the absence of amphibians at a site. However, the information collected may be very useful in identifying current distribution, locating new populations or areas where further study efforts could be intensified. In addition, annual data collected supplements the current distribution information for amphibians throughout Oregon.

CONCLUSION

The survey techniques were effective in reporting amphibian presence, but are not effective in determining the population dynamics or the absence of amphibians at a site. A goal for future work may be to compare our survey designs against a complete species inventory or population estimates at sample sites. Comparing our surveys with habitat, landscape, or climate data from other studies may yield valuable results in assessing changes in amphibian distribution.

All of the projects that collected amphibian data in this report are ongoing. With the current protocols in place, the potential exists to gain a much larger database of amphibian occurrences. The resolution of the data collected may not be able to detect amphibian decline until species are extirpated from an area. However the data collected will be useful in determining current distributions for the species encountered on these surveys.

Future goals for this work should include more thorough training of crews to increase the identification of species. Unidentified amphibians may include rarely sighted taxa. Preparing crews to accurately identify these individuals should be made a priority to expanding future work. Additional years of occurrence data will provide more comprehensive and up-to-date maps of amphibian distribution and range.

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