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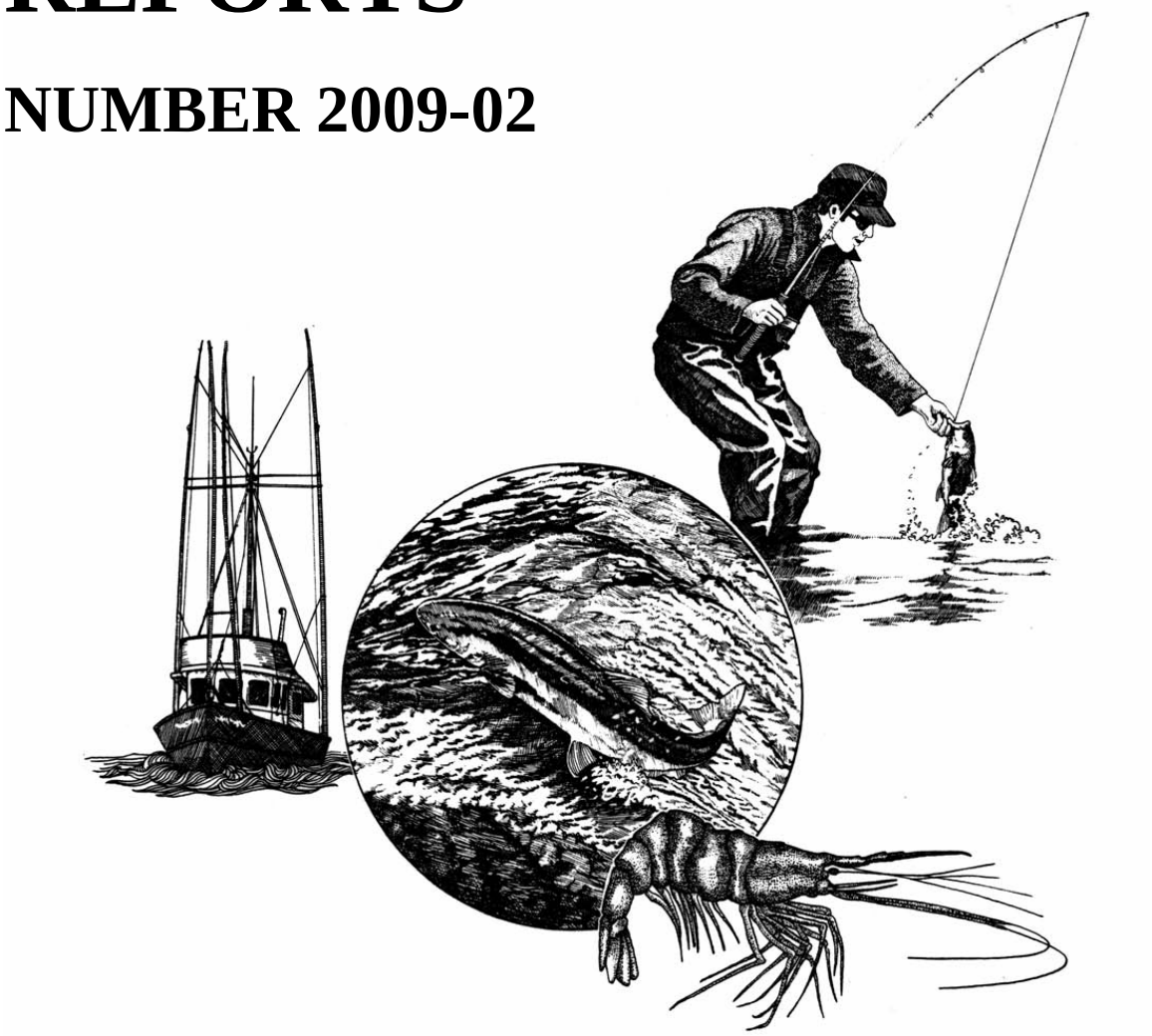

FISH DIVISION
Oregon Department of Fish and Wildlife

Distribution of amphibians in wadeable streams and ponds in western and southeast Oregon

Distribution of Amphibians in Wadeable Streams and Ponds in Western and Southeast Oregon

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INTRODUCTION

The Oregon Conservation Strategy (ODFW 2006) 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 much information about amphibian distribution, most studies have focused on limited areas. One cost-effective approach is to combine amphibian observational surveys with existing aquatic habitat surveys 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 coastal 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 (wadeable) 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. 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.

In the summer of 2006, AIP began collecting amphibian occurrence data during physical stream habitat surveys as a pilot study to determine if our standard survey protocol could be modified to document distribution of amphibians characterized as Strategy Species under the Oregon Conservation Strategy. During the summer season, field crews observed four strategy species of amphibians and eleven amphibian species total. The potential to use these data to fill the gaps within the known current distribution of amphibians and to potentially develop a habitat-based distribution models for these species led to the summer 2007 work.

Amphibian data are also collected during four 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 four projects are also included in this report. The four 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.
- Surveys to document the distribution of Oregon chub also record amphibian data from over 1,000 pond and slough sites within the Willamette Valley floodplain since 1991.

- The Native Fish Investigations Project began a study in 2007 to document the distribution and abundance of Redband Trout in the Great Basin region of Eastern Oregon.

Surveys in the summer of 2007 occurred in 8 of Oregon's 10 ecoregions (Figure 1)(Omernick 1994). Ecoregions are relatively large areas defined by distinctive geographic and ecological characteristics; flora and fauna communities and geographic conditions are typically distinct. Ecoregions provide an ecological framework for describing amphibian distribution across the state.

The goals of our 2007 work were to:

- Increase the consistency, efficiency and ability of habitat crews in identifying amphibians through improved training.
- Increase knowledge of distribution and habitat associations of amphibians in streams in western Oregon (location, stream size and type), and infer distribution in all coastal and lower Columbia drainages.
- Describe temporal changes in stream habitat use by amphibians (seasonal, annual).
- Estimate surveyor bias by comparing standard crew data with intensive resurveys.
- Describe distribution of amphibians in ponds, sloughs and other off channel aquatic habitats in the Willamette Valley.
- Describe distribution of amphibians in the Great Basin of eastern Oregon.

Many 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 many adults 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. The aquatic habitat and redband trout surveys are appropriate opportunities to observe species and life stages (breeding adults, tadpoles and juveniles) that occupy aquatic or riparian habitats during the summer. Likewise the Oregon chub surveys are likely to observe amphibian species and life stages in ponds and sloughs during the spring and fall. These types of surveys are an efficient and cost-effective means to collect information on amphibian species that are closely tied to aquatic habitat throughout their life cycle. Amphibian species that are more terrestrial in nature may be better surveyed through a different approach.

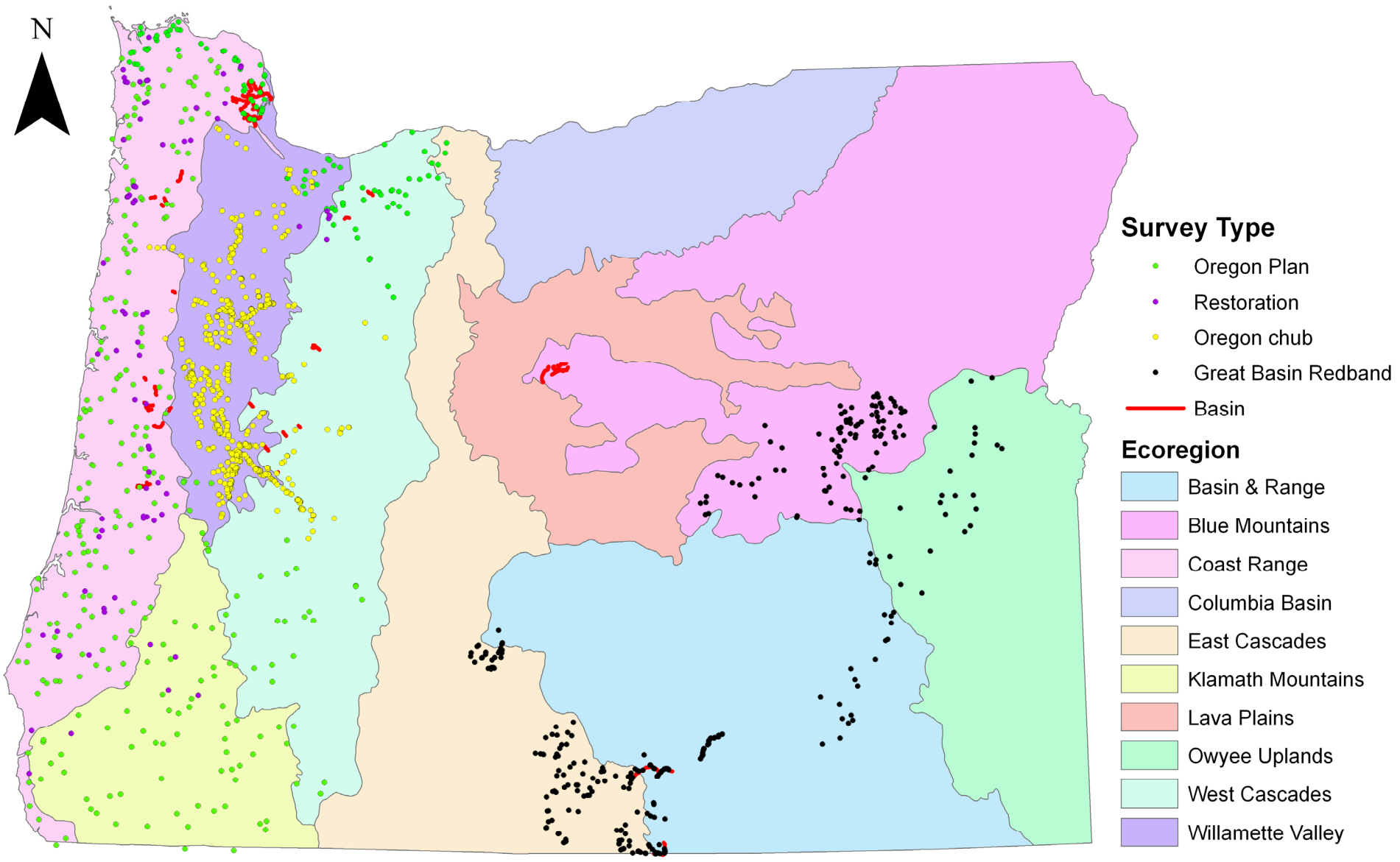

Figure 1. 2007 Oregon Plan, Restoration, Basin and Great Basin Redband survey locations. Oregon chub locations are all sites sampled from 1991 to 2007.

METHODS

Standard Amphibian Sampling Procedures

Visual encounter surveys typically search a specific area or habitat for a fixed period of time looking for amphibians. This sample design assumes that each individual has the same chance of being observed, that each species has the same likelihood of being observed, that each individual will be recorded only once per survey, and that two surveyors simultaneously sampling the same area would produce similar results. Visual encounter surveys were most compatible with habitat survey procedures, and would provide adequate information on the occurrence of amphibians during the summer. Other, more intensive methods, such as the following, are more compatible with fish sampling procedures.

Straight line drift fences and traps are another common sampling technique to capture amphibians. The fence creates a barrier to amphibians traveling on the surface substrate, and directs them into either pitfall or funnel type traps. This sampling method may not be suitable for some individuals that live mostly in fallen logs, debris, or underground.

Breeding surveys are a common sampling technique for many aquatic amphibians, which tend to congregate during their breeding periods. This type of survey targets species that breed in large numbers at ponds and streams, rather than species that either breed in small groups, at small ephemeral or disconnected habitats, viviparous species, or species with terrestrial nests. Amphibian species vary greatly in their breeding seasons, and the time at which a site is used may vary due to temperature, water levels, or other factors. Some species tend to stay at breeding sites for a longer period of time than other species, and individuals of a particular species in one habitat type may vary from individuals of the same species in another habitat type. Some amphibians may only be active at breeding sites at a particular time of day. All of these factors should be considered when observing amphibians at breeding sites (Heyer et al 1994).

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, amphibians were frequently observed. Each of these projects was able to combine an amphibian component to fish or habitat surveys to collect data concurrently.

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 describe stream morphology, instream habitat, and riparian characteristics. A reference guide to Oregon amphibians was developed and included with the survey manual that crews carried in the field. All personnel attend an annual training session which includes an

amphibian identification component. The protocol specifies that crews identify and note amphibian presence while walking upstream and on transects that extend 30m perpendicular to the stream. Data are recorded on a habitat unit by unit basis.

A separate 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. The resurvey crew was trained more intensively to locate and identify amphibians. We then estimated surveyor bias by comparing standard crew data with the intensive resurveys.

Visual encounter survey methods for amphibians can be readily incorporated into the habitat surveys. The survey crews walk along a predetermined length of stream, conducting a visual search for amphibians. Visual encounter surveys are time constrained; the time that it takes to sample habitat depends upon the length and complexity of the site and the speed of the surveyors. The time it takes to sample a site typically varies greatly between crews, and habitat complexity typically varies greatly both within a site and between sites. Larger, more conspicuous species such as bullfrogs, Pacific giant salamanders and rough-skinned newts are probably easier to locate than the smaller species such as Dunn's salamanders or camouflaged species such as tailed frogs.

Seasonal amphibian surveys

Three sites were selected for once-monthly surveys from June through September by an experienced crew. Sites were geographically diverse and known to contain a variety of amphibian species. We conducted semi-intensive surveys to locate and identify amphibians, with an emphasis on describing seasonal changes in abundance. During the initial survey we set start and end locations on the stream to standardize the survey segment for subsequent visits. Sites selected for intensive surveys were in Big Creek, Dixon Creek and Clear Creek. These sites were sampled in 2006, and each site appeared to have high amphibian species diversity and abundance. Site selection was also based on spatial distribution; each of these sites occurs in a different ecoregion that is sampled by the Oregon Plan.

Big Creek is in the central coast south of Yachats. The start of the site was 250 meters upstream of where the creek enters the ocean. The site was 996 meters long. The riparian vegetation was a combination of deciduous trees with a diameter of 15 – 30 cm at breast height (dbh) and shrubs. The valley surrounding the survey was forested, and comprised of mature timber (50 – 90 cm dbh) and large timber (30 – 50 cm dbh).

Dixon Creek is a tributary of the North Umpqua River, north of Roseburg. The site was 520 meters long. The dominant riparian vegetation was a mix of young deciduous and conifer trees (3 – 15 cm dbh). The valley around the site is a pasture for cattle grazing with some areas of oak savannah.

Clear Creek is a tributary to the Clackamas River. The site was located at Metzler County Park and was 1,036 meters long. The riparian vegetation was a combination of coniferous trees with a dbh of 30 – 50 cm and shrubs.

Sampling was conducted through a visual walking survey, with crews searching carefully for amphibians. This survey design is similar to standard visual encounter surveys for amphibians, in that each site visit the sampling took roughly the same amount of time to complete. The intensive sites were sampled more thoroughly, and the assumptions that each individual has the

same chance of being observed, and that each species has the same likelihood of being observed were more likely met during sampling.

Basin habitat surveys

Basins 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 Alsea, Nehalem, Nestucca, Trask, Smith and Siuslaw river basins (Oregon coast), Scappoose and Sandy basins (Columbia River), and. Clackamas, Santiam, and McKenzie River Basins (Willamette River). In Eastern Oregon streams were surveyed in the Crooked River (Deschutes River) and Warner basins (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.

This sample design is similar to both the straight line drift fence, trap sampling technique and breeding site surveys. The minnow traps used to capture Oregon chub are identical to the funnel traps designed for terrestrial amphibians. Traps are set in and along the edges of aquatic vegetation, and in a variety of available habitats at the sample sites. The aquatic amphibians swim or walk into the submerged traps. Similar to surveys at breeding sites, the majority of the chub habitats are also the preferred breeding habitats for many amphibian species. High numbers of both adult and juvenile amphibians are commonly observed at Oregon chub sites. Many sites are trapped overnight, which might improve chances of observing nocturnal species.

Great Basin Redband fish surveys

GRTS protocol was used to randomly select sites within the range of redband trout in the Catlow, Chewaucan, Fort Rock, Goose Lake, Malheur Lakes, Malheur River and Warner Lakes basins. The findings reported here represent 319 sites on public lands managed by the USFS, BLM, and USFWS (Figure 1).

A reference guide to amphibians that could be encountered in the sampling area was developed and included with the sampling manual that crews carried in the field. All personnel also attended an amphibian identification component during their training.

Field crews located the sites using handheld GPS units and topographical maps. The GRTS point represented the downstream end of the sample site. Site length was set at 30 wetted widths, with a minimum length of 30 meters and a maximum length of 100 meters. Blocknets were placed on the upstream and downstream boundaries of the site, and fish were sampled by electrofishing. 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. Amphibian and reptile species were recorded. Physical and biological habitat characteristics were measured at each site.

While electrofishing is not a preferred technique for amphibian sampling, amphibians are often encountered. Once an electric field is generated in the water, amphibians hidden in the substrate, vegetation or other cover types become agitated, and are easily observed and captured by the surveyors.

RESULTS

Fifteen of Oregon's 32 amphibian species were identified, 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. Western red-backed and Dunn's salamanders were similarly lumped together.

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)	
Family	Dicamptodontidae (Giant Salamanders)	
	Dicamptodon copei (Cope's Giant Salamander)	X
	Dicamptodon tenebrosus (Pacific Giant Salamander)	
Family	Salamandridae (Newts)	
	Taricha granulosa (Rough-skinned Newt)	
Family	Plethodontidae (Woodland Salamanders)	
	Plethodont dunni (Dunn's Salamander)	
	Plethodont 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 pretiosa (Oregon Spotted Frog)	X
	Rana cascadae (Cascades Frog)	X
	Rana boylii (Foothill Yellow-legged Frog)	X
	Rana catesbeiana (American Bullfrog)	

The Willamette Valley, Klamath Mountains and Cascades West ecoregions had the highest percentage of sites with amphibians observed in Oregon (Table 2). Amphibians were observed at 51% of the Willamette Valley sites, 52% of the Klamath Mountain sites and 61% of the Cascades West sites. Most were rough-skinned newts and bullfrogs observed during the Oregon Chub project. Surveyors working in the Klamath Mountains ecoregion saw quite a few amphibians, but were only able to identify about half of them. Amphibians were encountered throughout the sampling period (Tables 3 and 4).

Thirty-four percent of the sites within the Coast Range ecosystem had amphibians present. The relative success of observing amphibians in the Coast Range ecoregion was due in part to the high abundance of rough-skinned newts and Pacific giant salamanders.

All of the Eastern Oregon ecoregions had low percentages of sites where amphibians were observed. Amphibians were observed at 27% of the sites in the Basin and Range, 18% of the sites in the East Cascades, 16% of the sites in the Blue Mountains, and 13% of the Owyhee Uplands ecoregions. Pacific treefrogs, spotted frogs and western toads were the only amphibians identified in Eastern Oregon.

Table 2. Amphibian occurrences for all of the survey types listed by ecoregion.

	Coast Range	Willamette Valley	Cascades West	Klamath Mountains	East Cascades	Basin and Range	Blue Mountains	Owyee Uplands	Totals
Rough-skinned Newt	73	144	50	3					270
Pacific Giant Salamander	32		12	8					52
Northwestern Salamander		75	37						112
Long-toed Salamander		3							3
Plethodon	9								9
Red-legged Frog	13	2	2	1					18
Yellow-legged Frog	3		3						6
Cascades Frog			2						2
Tailed Frog	5		2						7
Pacific Treefrog	11	3		2	12	5			33
Spotted Frog						3	6	1	10
Western Toad					10				10
Bullfrog	3	286	29						318
Unknown Amphibian	59	6	19	15	3	3	9	2	116

Table 3. Amphibian observations per month for all survey types.

Species	Feb	April	May	June	July	Aug	Sept	Oct
Rough-skinned Newt		41	74	35	70	37	31	6
Pacific Giant Salamander				6	27	17	5	
Northwestern Salamander		29	39	12	1	2	18	9
Long-toed Salamander			2		1			
Plethodon				1	4	5		
Red-legged Frog		1	6	2	5	3		
Yellow-legged Frog				1	1		3	
Cascade Frog					1	1		
Tailed Frog				2	3	5		
Pacific Treefrog		1		5	7	7	6	
Spotted Frog				1	3	5	1	
Western Toad					7	2	1	
Bullfrog	1	50	101	51	24	5	40	42
Unknown Amphibian				7	47	44	15	
Western Pond Turtle		8	18	3	2	2	10	2

Table 4. Sampling frequency for each survey type per month. For Oregon Plan and Restoration, Great Basin Redband, and Oregon chub the number listed represents the number of sites sampled per month. The number listed for Basin surveys represents the number of sampled stream reaches per month. Oregon chub surveys are from 1991 to 2007.

Method	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.
Oregon Plan and Restoration					16	134	147	71	7
Basin Survey					10	65	66	22	
Great Basin Redband					22	160	179	90	
Oregon chub	1	1	87	201	135	67	9	90	138

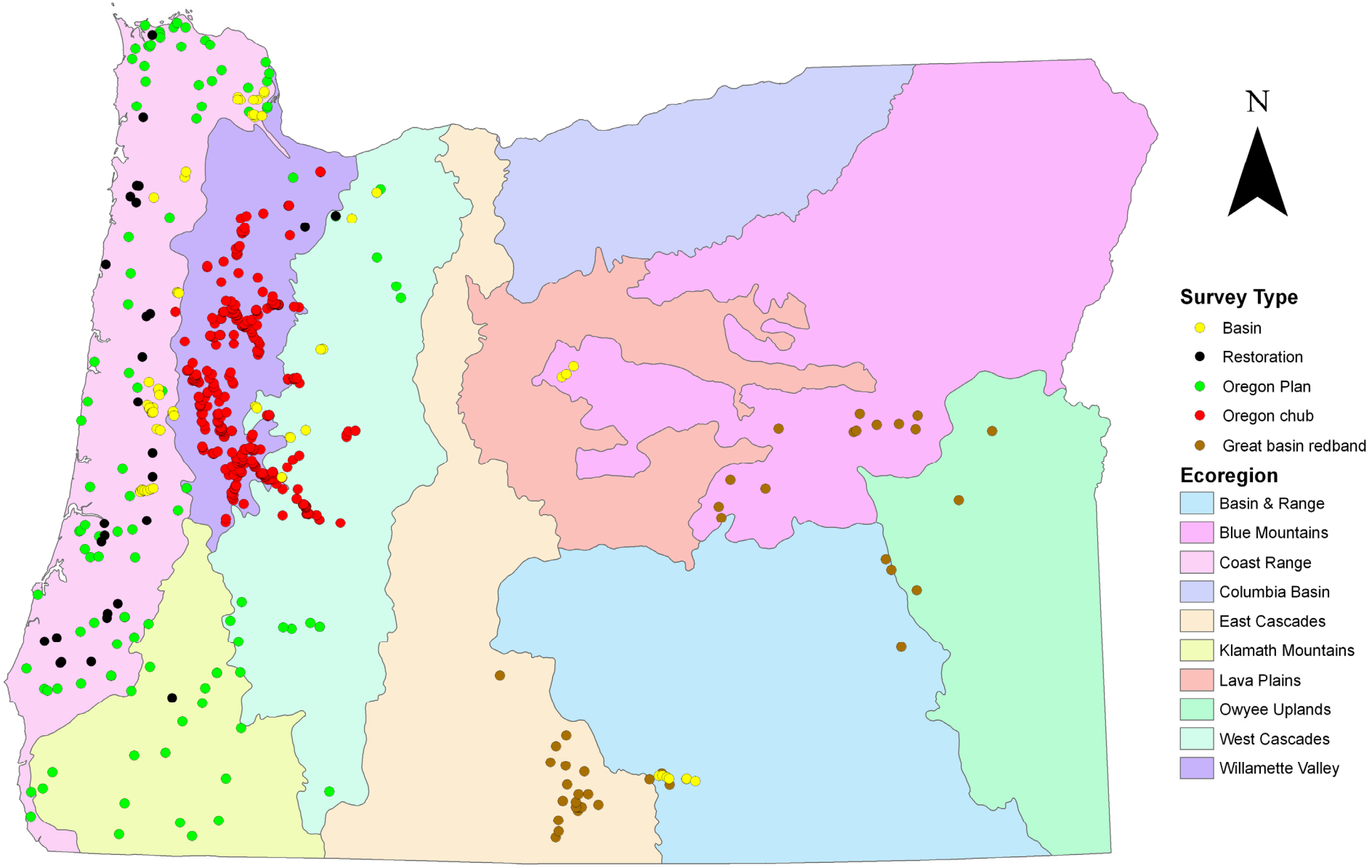

Figure 2. Distribution of amphibian occurrences by survey type. Gray lines denote 4th field hydrologic units.

Amphibian observations during Oregon Plan and Habitat Restoration surveys

Ten two-person Oregon Plan and habitat restoration crews observed 208 amphibians at 138 of 270 sites (51%) during the summer of 2007 (Figure 2, Table 5). Sixty-five of the 208 (31%) amphibians observed were unidentified. Site lengths ranged from 343 to 1,997 meters, and the average site length was 866 meters. Sampling began on June 25th and was completed October 11th.

Table 5. Amphibian occurrence at Oregon Plan sites, listed by ecoregion.

	Coast Range	Willamette Valley	Cascades West	Klamath Mountains
Rough-skinned Newt	50	2	4	3
Pacific Giant Salamander	17		8	8
Plethodon	8			
Red-legged Frog	13			1
Yellow-legged Frog	3		3	
Cascades Frog			2	
Tailed Frog	3			
Pacific Treefrog	10			2
Bullfrog	3	2	1	
Unknown Amphibian	36	5	9	15

Thirty Oregon Plan sites were resurveyed. The resurvey crews observed fourteen amphibians at 12 of the 30 sites (40%). However, there was little consistency between the resurvey and Oregon Plan crew. Of the 12 sites where amphibian observations were made, there were only 3 sites where both the resurvey and Oregon Plan crews observed amphibians. There were 9 sites where only the resurvey crew observed amphibians. However, there were 6 sites where only the Oregon Plan crews observed amphibians. Across the two visits, amphibians were observed at 18 of 30 sites (60%).

Surveys at restoration sites were conducted by the Oregon Plan crews. Forty-eight amphibians were observed at 29 sites. Seventy-four restoration sites were sampled in 2007, and amphibians were encountered at 39% of the sites.

Oregon Plan sites in western Oregon had the highest richness of species of any of the survey types. They were the only survey type to encounter foothill yellow-legged frogs and Cascades frogs. Surveys were located in the Coast Range, Willamette Valley, Klamath Mountains and West Cascades ecoregions.

Oregon Plan crews observed 145 amphibians in pools units, 113 amphibians in fast water units, 18 in slow water, off channel units and 12 in dry or puddled units (Table 6). Ninety percent of the amphibian observations were in habitats in the primary stream channel, while the other 10% were observed in puddled, dry or off channel units.

Table 6. Oregon Plan amphibian occurrence by habitat type (Moore et al. 2007).

	Off Channel	Pool	Fast Water	Puddled or Dry
Percentage of Units	1.7	34.4	57.5	6.5
Rough-skinned Newt	10	71	27	2
Pacific Giant Salamander		14	25	1
Plethodon	1	4	4	1
Red-legged Frog		8	7	3
Yellow-legged Frog	2	6	2	1
Tailed Frog	1	1	1	
Pacific Treefrog	1	3	10	
Cascade Frog		1	1	
Bullfrog		6	3	
Unknown Amphibians	3	31	33	4
Total	18	145	113	12
Percentage of Amphibians	6	50	39	4

Seasonal Amphibian Surveys

Rough-skinned newts and yellow-legged frogs were observed throughout the summer in Big Creek and Dixon Creek, respectively (Table 7). While other species were present during the seasonal surveys, they were often only observed once or in low numbers during the survey. rough-skinned newts and yellow-legged frogs were selected to compare and describe temporal changes in stream habitat use for these two species.

Table 7. Results of the monthly intensive surveys. The code RSN refers to rough-skinned newts, PGS to Pacific giant salamanders, RLF to red-legged frogs, YLF to yellow-legged frogs, Tailed to tailed frogs, TF to Pacific treefrogs, and WT to western toads.

Site	Date	Weather	Temp	RSN	PGS	RLF	YLF	Tailed	TF	WT
Big Creek	6/25/07	Sunny	19	32		1		1		
Big Creek	7/11/07	Overcast	16	28		4				
Big Creek	8/2/07	Sunny	21	4						
Big Creek	9/10/07	Cloudy	16	1					2	
Dixon Creek	6/12/07	Sunny	24	7			39			
Dixon Creek	7/9/07	Sunny				1	47			
Dixon Creek	7/31/07	Sunny	24				38			
Dixon Creek	9/17/07	Overcast					32		1	
Clear Creek #7	6/13/07	Overcast	18		1	1				
Clear Creek #7	7/18/07	Rain								1
Clear Creek #7	8/23/07	Sunny	22							
Clear Creek #7	9/10/07	Sunny	25							

Rough-skinned newt observations dropped considerably during last half of the summer (Figure 3). The high number of observations during the early summer may be due to the breeding season of Rough-skinned newts, which typically begins in March or April and extends to June or early July. While Rough-skinned newt occurrences on Big Creek seem to drop off halfway through the summer, surveys at other sites recorded newts in high numbers throughout the summer.

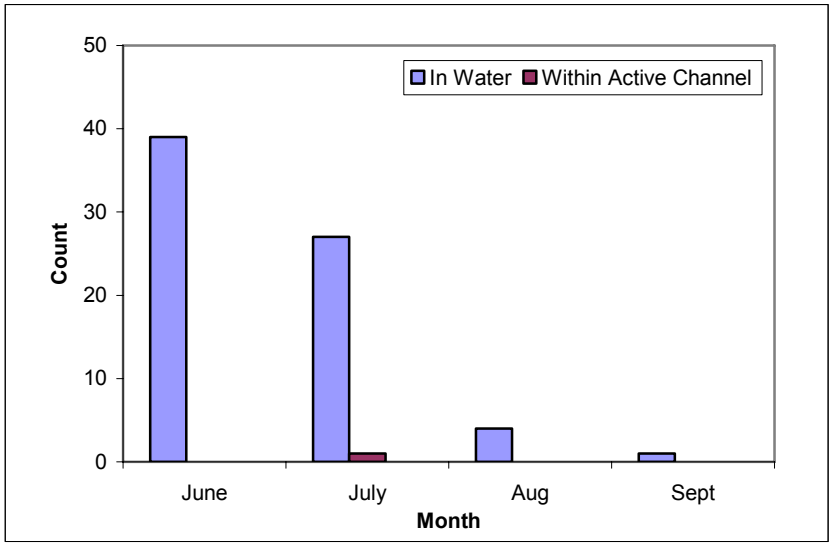

Figure 3. Number of rough-skinned newts encountered on Big Creek per month. Active channel refers to the dry area between wetted surface and the edge of the bank.

From June through August the crew observed an average of 16 adult and 25 yellow-legged frog tadpoles per visit at the Dixon Creek site (Figure 4). In September however the crew did not observe a single tadpole, but observed 32 adults during that survey. The yellow-legged frog tadpoles metamorphosed between the August and September in Dixon Creek, and were observed as juvenile frogs in September. While yellow-legged frogs were observed each month during the other Oregon Plan surveys, the highest numbers were observed in September.

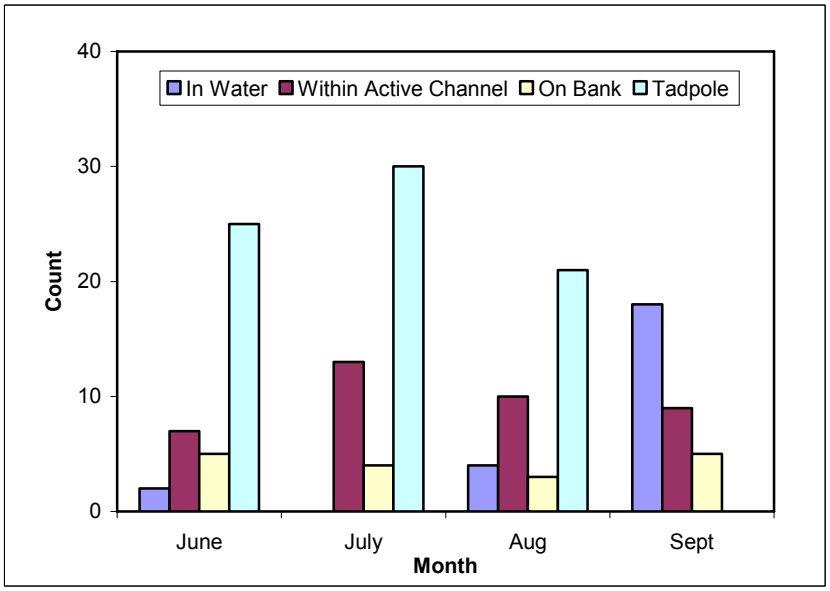

Figure 4. Yellow-legged frog adult, juvenile, and tadpole occurrence at Dixon Creek by month and location. All tadpoles were observed in water.

Amphibian Observations during Basin habitat surveys

Amphibians were encountered on 35 of the 57 creeks surveyed in 2007 by the basin survey crews (Figure 2, Table 8). Amphibians were observed on 62% of the sampled creeks. Of the 100 amphibians observed, 39 (39%) were unidentified. Creeks were located in the Coast Range, Willamette Valley, Cascades West and Blue Mountains ecoregions. Basin surveys covered a greater range of ecoregions than any other survey type.

Table 8. Amphibian occurrence at Basin survey sites, listed by ecoregion.

	Coast Range	Willamette Valley	Cascades West	Basin and Range	Blue Mountains
Rough-skinned Newt	23	4	3		
Pacific Giant Salamander	14		4		
Plethodon	1				
Red-legged Frog			2		
Tailed Frog	2		2		
Pacific Treefrog	1	1		3	
Bullfrog		1			
Unknown Amphibian	23	1	10	2	3

Amphibian surveys during Oregon Chub fieldwork

Amphibians were encountered at 379 of the sites sampled by the Oregon chub project. Sites were sampled in the Willamette Valley, Cascades West and Coast Range ecoregions (Figure 2, Table 9. Amphibian data were collected from 1991 to 2007, with yearly sampling started as early as February 2nd and continued as late as October 25th. However the majority of the sampling occurred in April to May and September to October. Sampling was typically completed annually at sites where Oregon chub were present. The amphibian data presented lists all amphibians observed over all years that each site was sampled.

Oregon chub encountered the highest number of rough-skinned newt and bullfrog occurrences of any of the survey types. It was the only survey type to encounter Northwestern salamanders or Long-toed salamanders.

Table 9. Amphibian and Western Pond Turtle occurrence at Oregon chub sites, listed by ecoregion.

	Coast Range	Willamette Valley	Cascades West
Rough-skinned Newt		138	43
Pacific Giant Salamander	1		
Northwestern Salamander		75	37
Long-toed Salamander		3	
Red-legged Frog		2	
Pacific Treefrog		2	
Bullfrog		283	28
Western Pond Turtle		34	11

Amphibian surveys during Great Basin Redband fieldwork

The 2007 Great Basin Redband surveys began on June 25th and finished September 20th. The Great Basin Redband sites were located in the East Cascades, Basin and Range, Blue Mountains and Owyhee Uplands ecoregions. Amphibians were observed at 43 sites (Figure 2, Table 10). Of the 46 amphibians observed, 12 were unidentified (26% of the amphibians observed were unidentified). Spotted frogs and western toads were only observed in eastern Oregon sites. No amphibian mortalities were recorded during sampling.

Table 10. Amphibian occurrence at Great Basin Redband sites, listed by ecoregion.

	East Cascades	Basin and Range	Blue Mountains	Owyee Uplands
Pacific Treefrog	12	2		
Spotted Frog		3	6	1
Western Toad	10			
Unknown Amphibian	3	1	6	2

Results by species

Rough-skinned newt (*Taricha granulosa*)

Rough-skinned newts were the second most encountered amphibian on the west side of the state with 270 occurrences (Figure 5) in the Coast Range, Willamette Valley, Klamath Mountains, and West Cascades ecoregions. They were found at elevations ranging from 5 to 626 meters, and at water temperatures from 6 to 26 degrees Celsius. Newts were observed from April through October. 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.

Pacific Giant Salamander (*Dicamptodon tenebrosus*)

Pacific Giant Salamanders were encountered from June through September throughout western Oregon, but were observed most frequently in the coast range south of the Yaquina River (Figure 6). Pacific Giant Salamander observations were the most commonly recorded species on Basin and Oregon Plan surveys, and 52 occurrences were recorded. This species was found in the Coast Range, Cascades West and Klamath Mountains ecoregions. They were encountered from 21 to 1255 meters in elevation, and at water temperatures from 10 to 18 degrees Celsius. 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.

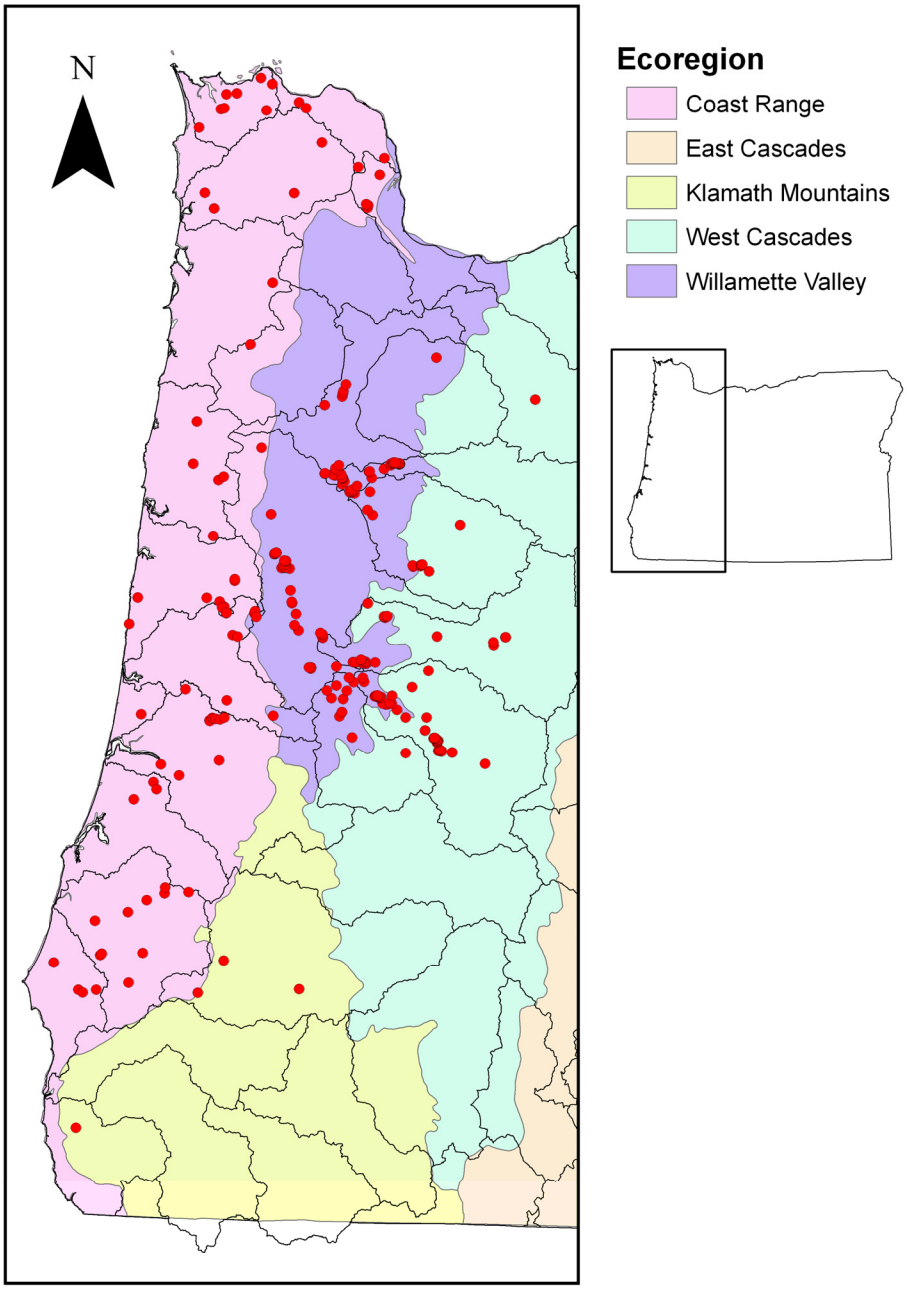

Figure 5. Rough-skinned newt distribution at Oregon Plan, Oregon chub, and Basin sites. Gray lines denote 4th field hydrologic units.

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 and West Cascades ecoregions (Figure 6). This species was encountered 112 times in ponds and low gradient streams during Oregon chub surveys. They were found at elevations ranging from 56 to 622 meters, and at water temperatures from 7 to 26 degrees Celsius. Larva, juveniles, neotenic forms, and metamorphosed adults were observed.

Long-toed Salamander (*Abystoma macrodactylum*)

Long-toed Salamanders were encountered at three locations near the city of Eugene near the Amazon Canal and the Long Tom River (Figure 6) in the Willamette Valley ecoregion. Long-toed Salamanders were encountered at an elevation of approximately 125 meters, and at water temperatures from 14 to 24 degrees Celsius. This species was only encountered during Oregon chub surveys in May and June. All of the individuals encountered were juvenile or neotenic forms.

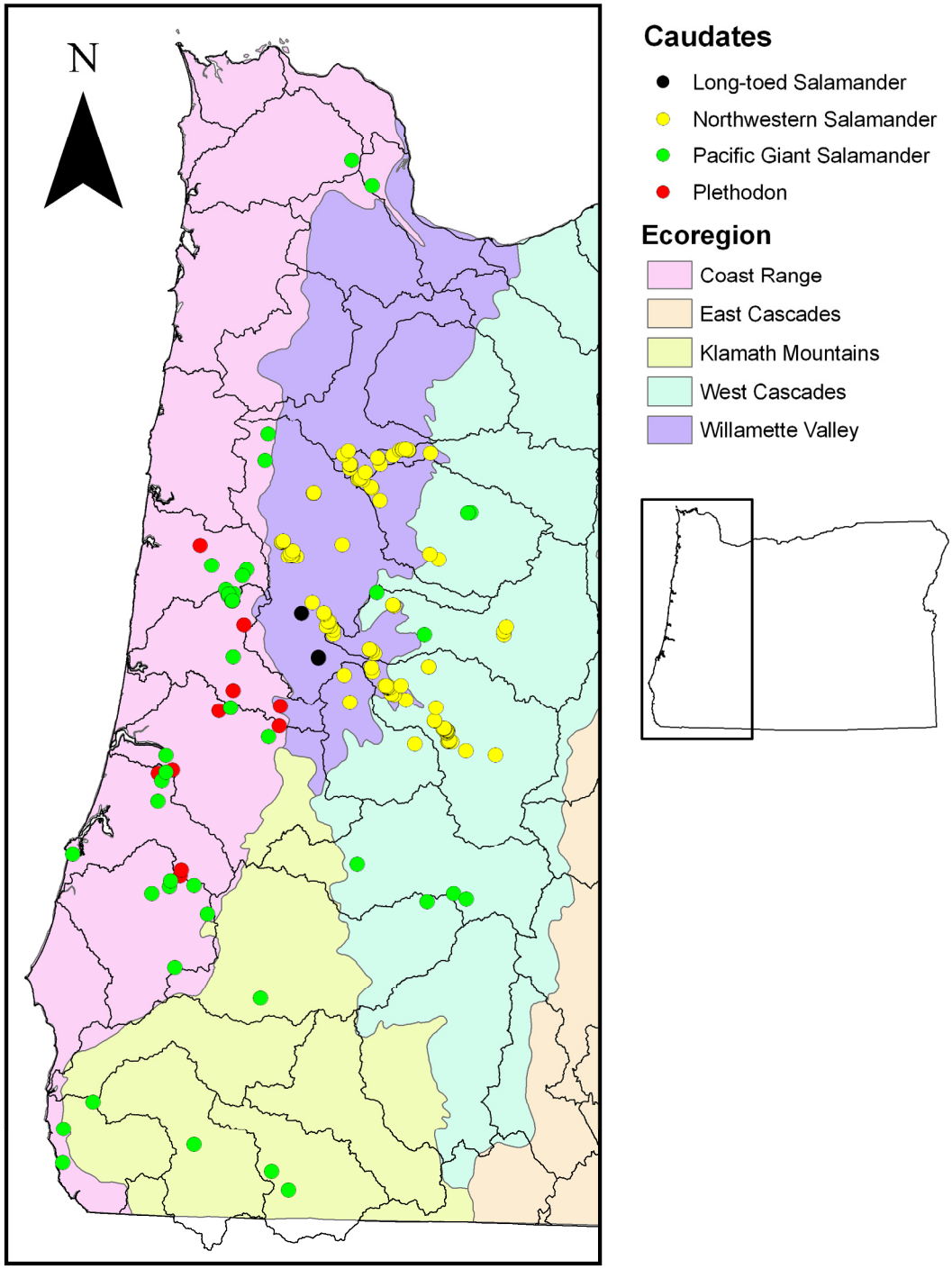

Figure 6. Caudate distribution in Western Oregon. Gray lines denote 4th field hydrologic units.

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

Members of the genus *Plethodon* were encountered at 9 locations in western Oregon (Figure 6). Basin and Oregon Plan survey crews recorded members of this genus in the Coast Range and Willamette Valley ecoregions from June through August. They were encountered from 126 to 462 meters in elevation and at water temperatures from 11 to 16 degrees Celsius.

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.

Western Toad (*Bufo boreas*)

Adult western toads were encountered from July through September in a wide range of habitats on both the east and sides of the Cascade Mountains (Figure 7). In western Oregon they were encountered in Big Creek south of the Alsea River (Coast Range ecoregion) and on Clear Creek, a Clackamas River tributary (Willamette Valley ecoregion). On the east side of the state they were observed at 10 locations in the Goose Lake, Chewaucan and Fort Rock basins (East Cascades ecoregion). Western toads were found at elevations ranging from sea level to 195 meters on the west side of the state, and between 1526 and 2168 meters on the east side. Water temperatures at the sites where western toads were observed ranged from 6 to 26 degrees Celsius. Survey crews did not record any juvenile western toads.

Spotted Frog (*Rana pretiosa*)

Spotted frogs were encountered throughout the Malheur River and Malheur lakes region of eastern Oregon (Figure 7). Spotted frogs were observed at 10 locations during redband trout surveys. They were observed from June through September in the Basin and Range, Blue Mountains and Owyee Uplands ecoregions. Spotted Frogs were found at elevations ranging from 916 to 2168 meters with water temperatures ranging from 11 to 21 degrees Celsius. Only adult frogs were observed, although a number of unidentified tadpoles in the Malheur River system are likely spotted frogs.

Foothill Yellow-legged Frog (*Rana boylii*)

Foothill yellow-legged frogs were encountered by Oregon Plan surveys at six locations in the West Cascades and Coast Range ecoregions in western Oregon (Figure 7) from June through September. Individuals were observed at elevations ranging from 27 to 1145 meters, with water temperatures ranging from 6 to 24 degrees Celsius. Tadpoles and adult frogs were observed.

This species is known to occur at elevations up to 550 meters (Leonard et al, 1993). Two of the observations made for this species were above 1100 meters in elevation. One of these sites is located in the headwaters of the Clackamas River, which is north of their documented range (Leonard, pg 134). Further study at these 2 sites is recommended to verify the distribution of yellow-legged frogs in the upper reaches of the Clackamas River.

Red-legged Frog (*Rana aurora*)

Red-legged frogs were observed throughout western Oregon (Figure 7). There were 27 individuals encountered at 18 locations in the Coast Range, Willamette Valley and West Cascades ecoregions. Individuals were observed at elevations ranging from 11 to 338 meters,

and water temperatures from 6 to 19 degrees Celsius. Oregon Plan surveys had the highest number of observations. Observations were made in April and from June through September. Tadpoles and adult frogs were observed.

Cascades Frog (*Rana cascadae*)

Cascades frogs were observed by Oregon plan crews at two locations (Figure 7) in July and August in the West Cascades ecoregion. These individuals were observed at elevations between 1,255 and 1,473 meters with water temperatures from 10 to 16 degrees Celsius. Only adult frogs were observed.

Tailed Frog (*Ascaphus truei*)

Tailed frogs were observed from June through August at seven locations in Western Oregon (Figure 7) in the Coast Range and West Cascades ecoregions. Observations occurred at elevations between 17 and 518 meters with water temperatures from 9 to 13 degrees Celsius. Only tadpoles were observed.

Pacific Treefrog (*Psuedacris regilla*)

Pacific treefrogs were observed at 26 locations throughout the state (Figure 7). Individuals occurred in the coast range, Willamette Valley, Klamath Mountains, Basin and Range, West Cascades and East Cascades ecoregions. Observations occurred at elevations between 22 and 2075 meters with water temperatures from 6 to 22 degrees Celsius. Observations were made in April, and from June through September. Only adult frogs were observed. Individuals were observed in a wide range of habitats ranging from isolated coastal streams to areas of open desert.

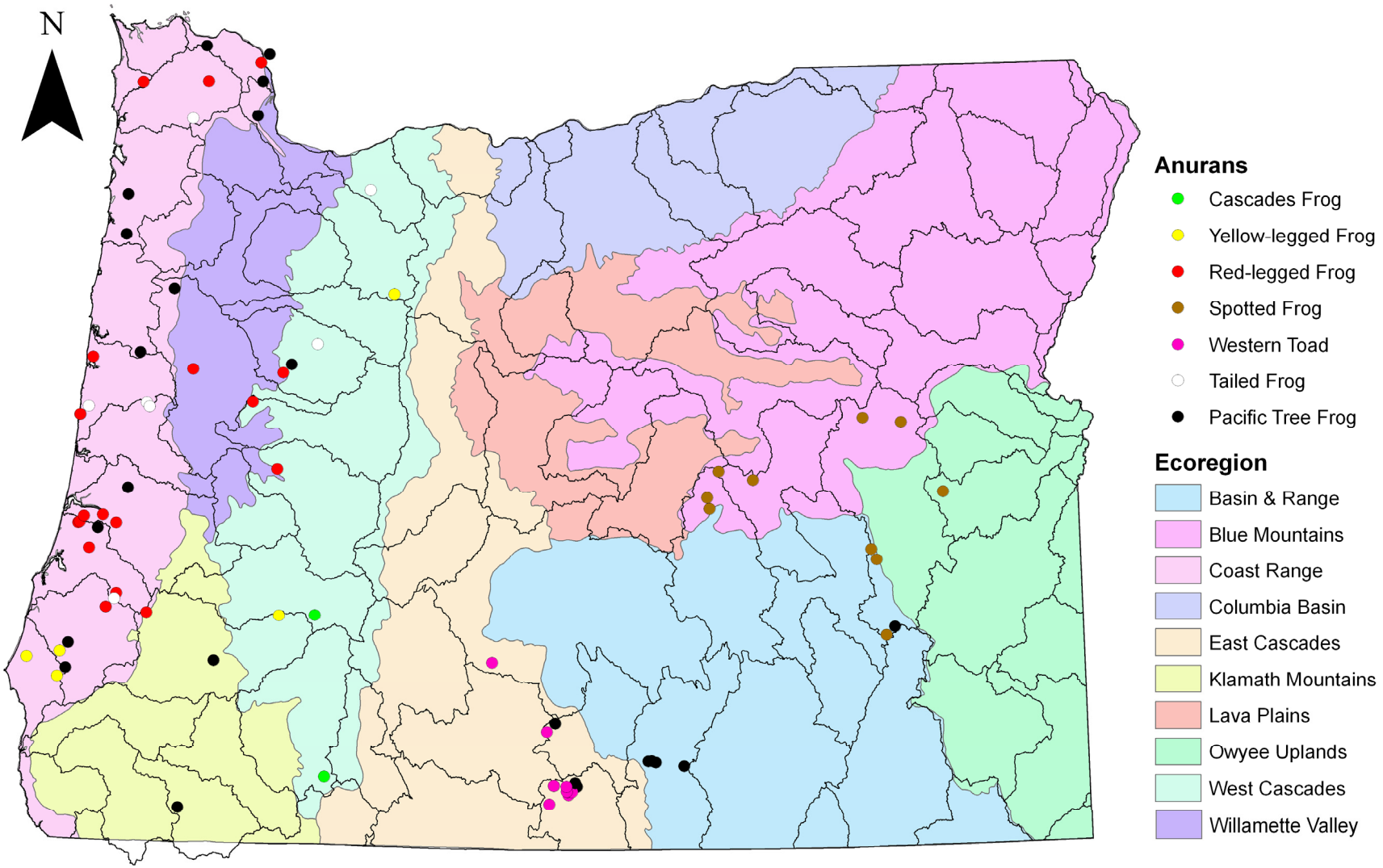

Figure 7. Native anuran distribution at survey sites across Oregon. Gray lines denote 4th field hydrologic units

American Bullfrog (*Rana catesbeiana*)

Bullfrogs are considered an invasive species in Oregon, and concern is growing about their distribution and ability to compete with native species. Bullfrogs were observed at 318 sites in western Oregon (Figure 8), and were the most commonly observed amphibian in the state. While bullfrogs were present at sites in the Coast Range and West Cascades ecoregions from February through October, the bulk of the observations were made in the Willamette Valley ecoregion. Observations occurred at elevations between 4 and 438 meters with water temperatures from 6 to 26 degrees Celsius. 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.

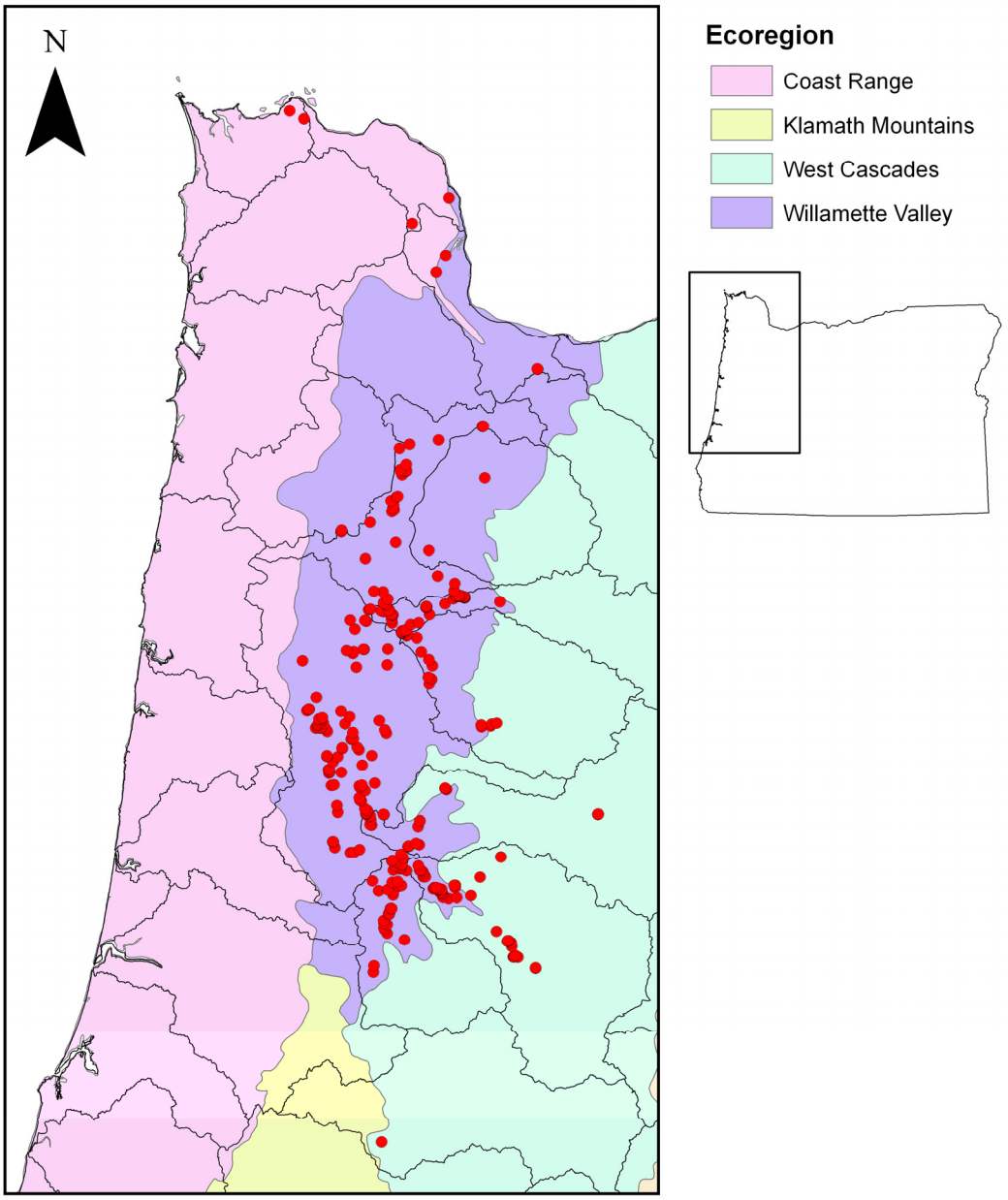

Figure 8. Bullfrog distribution at Basin Survey, Oregon chub and Oregon Plan sites. Gray lines denote 4th field hydrologic units.

Western Pond Turtle (*Clemmys marmorata*)

Western pond turtles were observed at 45 sites in the Willamette Valley and West Cascades ecoregions (Figure 9). Observations occurred at elevations between 30 and 401 meters with water temperatures from 9 to 26 degrees Celsius. Observations were made from April through October. Western pond turtles were only observed during Oregon chub surveys, and were usually observed associated with pond and slough habitat.

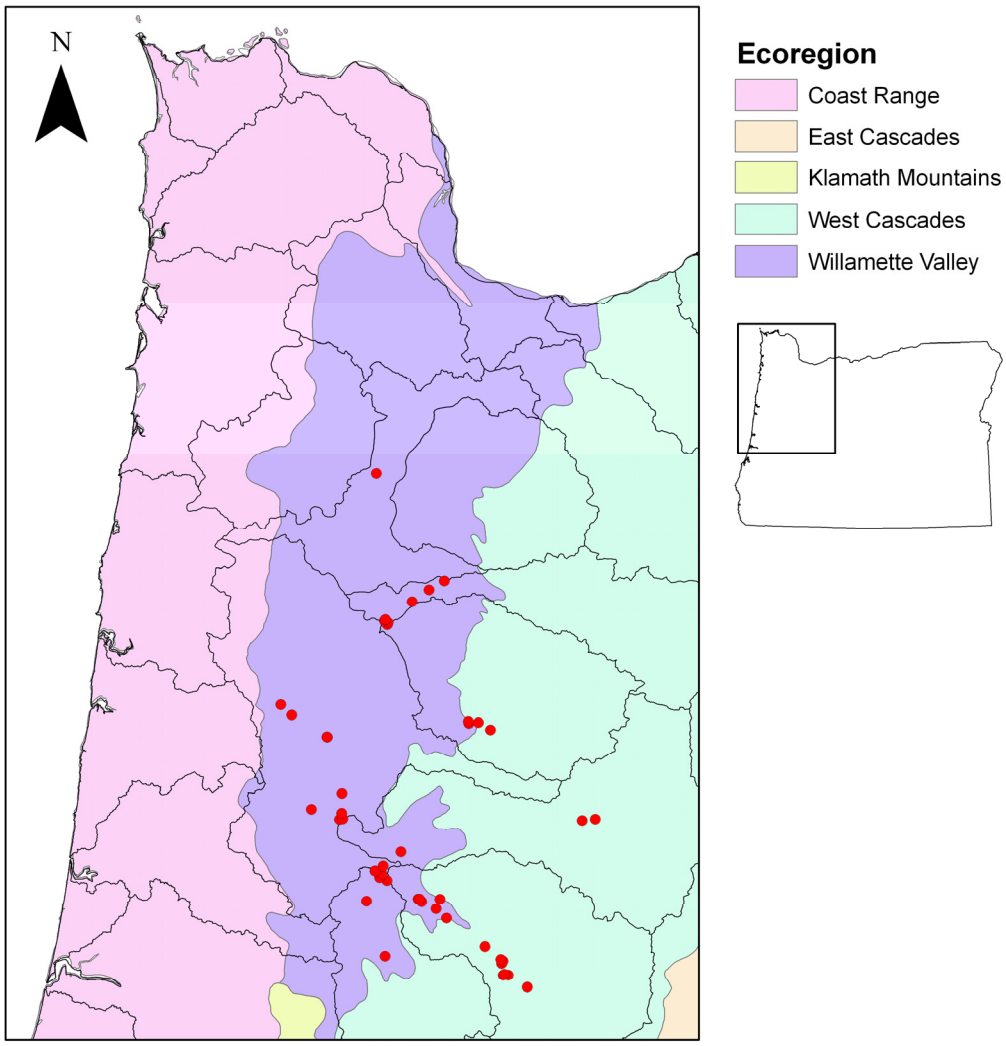

Figure 9. Western pond turtle distribution. Gray lines denote 4th field hydrologic units.

DISCUSSION

This study is the first broad-scale survey to describe the distribution of amphibians 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. The Oregon Conservation Strategy highlights the importance of understanding amphibian distribution. This study has demonstrated that incorporating amphibian surveys into fish and aquatic habitat surveys appears to be a cost-effective approach to attain this information. The survey design that was employed (GRTS) selected sites in a random but spatially balanced fashion in coastal and lower Columbia basins

in a sample frame of all 1st through 4th order (wadeable) streams. In the Great Basin of eastern Oregon, the GRTS protocol selected sites in wadeable streams on public lands. Surveys conducted at sites selected with the GRTS protocol provide inference to unsurveyed streams within the sample frame. Although the survey methods used are recognized as standard for amphibian observations, the project was not without challenges. Surveys were conducted by 52 individuals who, while trained and carried an identification guide, were not amphibian specialists. Also, surveys were conducted during spring and summer without knowledge as to the temporal presence of each species or life stage through the wide range of areas we worked. Despite these limitations, these surveys represented a substantial effort to expand the limited knowledge of community structure and distribution of amphibians in Oregon.

Temporal Data

At two sites selected for seasonal sampling, a trend was observed in the number of amphibians observed over time. The rough-skinned newts at Big Creek were much more abundant earlier in the spring (summer). Rough-skinned newt occurrences still remained high elsewhere throughout the summer, without the sharp decline in observed at the Big Creek site. Differences in habitat, regions, or climates may have altered the period in which rough-skinned newts occupied aquatic habitats. Other populations of rough-skinned newts may prefer aquatic habitats through the summer, or have a breeding season that begins later. Regardless, rough-skinned newts were observed frequently throughout the summer.

The yellow-legged frog tadpoles at Dixon Creek metamorphosed between August and September. The number of observed adult frogs jumped in September at the seasonal sampling sites, and paralleled the sharp decline in tadpole observations. The number of frogs that were observed by the other sampling crews was also highest in September.

Tadpoles are often unidentified by crews because tadpoles tend to swim into deep or turbid water, and may be seen only momentarily. It would be advantageous to sample in September at some sites to confirm yellow-legged frog presence, as there would be a greater opportunity to observe an adult frog.

Habitat Data

Amphibian presence was detected in a large variety of habitats. In general, more amphibians were observed in pool or pond habitats than any other type. Members of the same species were encountered a variety of habitats, spanning a great change in elevation, and in a wide range of temperatures. Amphibian presence was compared to land use and vegetation type at the watershed level, but no consistent relationship was apparent.

Surveyor Bias

Increased ability to both observe and identify amphibians was a primary goal of the summer work. Of the 1,011 amphibians observed, 266 were unidentified. Oregon Plan crews had the highest percent of unidentified amphibians at 31%. Basin surveys share similar survey methods to the Oregon Plan surveys, and 39% of the amphibians they observed were unidentified. There were no differences between the training, objectives, or resources available to the Oregon plan and Basin survey crews. The resurvey crew, which had more experience and better training, had only a 5% unidentified amphibian rate.

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.

Amphibians observed by the Great Basin redband trout crews were unidentified 26% of the time. The electrofishers that the crews used to catch fish were also effective in capturing amphibians. Crews were able to handle the amphibians that they observed which may have increased their identification ability.

While the resurvey crew should have had a higher ability to observe amphibians (because of experience), they observed amphibians at a similar percentage of sites as the regular Oregon Plan crews. Of the 30 sites that were surveyed by Oregon Plan and resurvey crews, amphibians were found at 12 sites by the resurvey crew and on 9 sites by the Oregon Plan crews. There were only 3 sites where the Oregon Plan and resurvey crews were able to locate amphibians at the same site. This suggests that the observability of amphibians may vary from day to day, and time of day, confounding even experienced surveyors.

The repeatability of observation at the same site was in general very low. For this reason these data should not be used to determine the population dynamics or the absence of amphibians at a site. However, the information collected may be very useful in locating new populations or areas where further study efforts could be located. If species presence in a certain area should be attainable through a visual walking survey and amphibian presence wasn't detected at sites visited more than once, then a more intensive amphibian sampling at those sites may be important.

Survey Type Comparison

Each survey type differed in the method, location, and the variety of species that they were able to observe. Oregon Plan and basin survey crews used visual observations while conducting habitat surveys, Great Basin fish survey crews used electrofishing equipment and minnow traps, and the Oregon chub crew used minnow traps, dipnets and pole seines. Despite the variety of methods utilized, all of the survey types were successful at locating amphibians.

The visual techniques used by habitat surveyors were successful in observing yellow-legged and Cascades frogs. Most of the Oregon Plan streams are outside much of the typical Oregon range for both species, but nonetheless they were able to detect their presence at several sites. The Oregon Plan sampling also observed the highest species richness compared to the other survey types. The walking survey design works well to identify amphibians in riparian areas if the crew is alert and ready to watch for movement as a frog jumping away from them, or aware enough to observe a salamander in riparian vegetation. The majority of the crews reported observing amphibians first by noticing movement, after which they were able to locate the individual. The Oregon Plan surveys are the only survey type to cover a statistically random sampling of points throughout the west side of the state. The power of the OR Plan surveys is the ability to infer distribution in similar streams within the sample frame. For example, if we observed a particular species in some medium size, low gradient streams, we may infer that the species is present in similar streams in that sample frame. Basin surveys cover a large amount of ground on a single stream, and conduct surveys throughout the state. Oregon Plan and Basin crews often survey very remote areas where access is difficult. The ability to collect data

at remote sites may also be important in identifying ranges and habitat needs of amphibian species.

The Oregon chub survey type relies both on visual observations of juvenile and adult amphibians at their survey types, but also on capturing amphibians in the minnow traps used in sampling. At many sites minnow traps are effective in catching large numbers of rough-skinned newts, northwestern salamanders and bullfrog tadpoles. Western pond turtles have been visually observed, seined and dip netted at chub sites. While sites are not randomly selected, there are a large number of sights along the Willamette River and its tributaries that have been sampled. Sites that contained Oregon chub are visited annually, and changes in amphibian occurrence could be detected. Visual observation at chub sites is typically ineffective for northwestern salamanders, long-toed salamanders and Pacific giant salamanders, due to the general turbid water in many of the ponds sampled. Many of the sites are trapped overnight, which may enable the capture of amphibians that are nocturnally active. The only observations of northwestern salamanders, long-toed salamanders and western pond turtle were on Oregon chub surveys.

The Great Basin Redband surveys detected high numbers of western toads, and it was the only survey type to observe spotted frogs. While site selection was statistically random, amphibian data was only available for sites on public land. The electrofishing techniques used by the crews were extremely effective in capturing amphibians in the water column. No amphibian mortalities from the electrofishing were reported. Crews were able to locate and capture amphibians that were hiding in thick aquatic vegetation that hid the individual from visual observation.

CONCLUSION

The survey techniques were effective in reporting amphibian presence, but are not effective in determining the population dynamic 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 findings with other studies may yield valuable results in assessing changes in amphibian distribution. The Oregon Plan surveys occur annually and may be useful for assessing change in distribution over time.

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 limit the amount of unidentified species reported. The unknown amphibians that are recorded by crews are unlikely to include more common species such as rough-skinned newts, and are more likely to include species that crews have not seen before. Preparing crews to accurately identify these individuals should be made a priority to expanding future work.

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