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Oregon Lake Watch, 2014 Annual Report

Meredith Jordan
Portland State University

Rich Miller
Portland State University, richm@pdx.edu

Angela L. Strecker
Portland State University, strecker@pdx.edu

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Final report submitted to the Oregon State Marine Board

Meredith Jordan, Rich Miller, and Angela Strecker

Portland State University, Center for Lakes and Reservoirs

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On the cover: Oregon Lake Watch Volunteer Bill Helsley looking for invasive plants at Cullaby Lake, Clatsop County, Oregon. Photo by volunteer Stan Geiger

Introduction

The Oregon Lake Watch (OLW) volunteer monitoring program is now in its second year of operation, continuing its focus on early detection of aquatic invasive species (AIS), with a secondary focus on lake water quality. The aquatic invasive species chosen as Watch List priorities for the OLW are based on the Oregon Department of Agriculture's Noxious Weed List (Oregon Department of Agriculture Noxious Weed Control Program 2014) as well as professional judgement (more information can be found in Oregon Lake Watch Final Report 2014). This report summarizes the data collected by 15 of 24 OLW volunteers over 2014, across 110 sampling events and 20 Oregon lakes. Data collected by trained volunteers includes sightings of both native and aquatic invasive plants and animals, as well as recordings of lake temperature profiles, and Secchi depth, a measure of clarity. Of the 16 original water bodies surveyed in OLW's first year (2013), 12 were surveyed again in 2014, and 8 are new waterbodies. Long-term monitoring of these lakes provides valuable information over time, and expanding the number of lakes monitored, especially in the case of monitoring for invasive species, means that more potentially harmful invasions can be stopped sooner. Ideally, the OLW will continue to monitor these current lakes, and expand their volunteer network to cover more waterbodies across Oregon as this program continues to grow.

New Zealand mud snail

Putting informed and trained citizen-scientists to work in tracking the potential spread of AIS is a well-established precedent. The Maine Volunteer Lake Monitoring Program is a prime example of a long-term volunteer monitoring program that has become invaluable to the quality of the state's lakes. It began in 1971 and now serves as the "primary provider of lake data for the state of Maine," supplying critical water quality and invasive species information to multiple agencies, including the EPA (http://www.mainevlmp.org). Similarly, the Wisconsin Citizen Lake Monitoring Network boasts over 1,100 volunteers monitoring over 850 lakes (http://dnr.wi.gov/lakes/clmn). Such an impressive expanse of trained volunteers and data collected did not occur overnight; the program began in 1986, and has grown to the extent that it is now under the umbrella of the Wisconsin Department of Natural Resources. Both programs employ online data collection portals, extensive training, and rely greatly on the expertise of program staff to develop long-term rapport with volunteers in their various communities.

The integrity of the data collected is critical to any volunteer monitoring program, and many studies have analyzed the accuracy of volunteer-collected data. Jordan et al. (2010) found that data collected by volunteer citizen-scientists was adequately accurate for the purposes needed, and that volunteer monitoring programs should be designed to keep a balance of simplicity of collection methods with relevance and usefulness of data collected. In a study on plant conservation through the Chicago Botanic Garden, Havens et al. (2012) found that volunteer dedication and interest was central to reliable data, and that the program staff's rapport with volunteers was critical to long-term volunteer retention.

Volunteer training, plant ID workshop

The Oregon Lake Watch based the design of its program accordingly on established Standard Operating Procedures for all aspects of data collection, from safety to plant and animal identification (for more detail, see Oregon Lake Watch Final Report 2014). A list of plant and animal species of interest was generated based on the Oregon Watch List from the Oregon Department of Agriculture (Table 1), and volunteers were trained in species identification and encouraged to submit photographs of questionable samples, or even send complete plant samples, to OLW staff, for confirmation.

Table 1. Watch List animal and plant species.

	Common name	Species name	Distribution and other notes
Animals	zebra mussels	*Dreissena polymorpha*	Not present in Oregon, very high priority AIS
	quagga mussels	*D. rostriformis bugensis*	Not present in Oregon, very high priority AIS
	red swamp crayfish	*Procambarus clarkii*	Limited to western Oregon
	ringed crayfish	*Orconectes neglectus*	Limited to southwestern Oregon
	rusty crayfish	*Orconectes rusticus*	Limited to John Day River watershed
	virile crayfish	*Orconectes virilis*	Not present in Oregon
	mystery snails	*Cipangopaludina chinensis/ C. japonica*	Scattered throughout Oregon
	New Zealand mudsnails	*Potamopyrgus antipodarum*	Scattered throughout Oregon
	Asian clams	*Corbicula fluminea*	Throughout Oregon, unknown distribution
Submersed plants	curly leaf pondweed	*Potamogeton crispus*	Scattered throughout Oregon
	Eurasian watermilfoil	*Myriophyllum spicatum*	Common in western Oregon and the Columbia Basin; ODA Class B noxious weed
	hydrilla	*Hydrilla verticillata*	Not present in Oregon, ODA Class A noxious weed
	South American waterweed	*Egeria densa*	Widespread in western OR; ODA Class B noxious weed
Floating plants	European water chestnut	*Trapa natans*	Not present in Oregon
	parrotfeather	*Myriophyllum aquaticum*	Widespread in W. OR; ODA Class B nox. weed
	South American spongeplant	*Limnobium laevigatum*	Not present in Oregon
	water primrose	*Ludwigia hexapatala, L. grandiflora, L. peploides*	Western Oregon; ODA Class B noxious weeds
	yellow floating heart	*Nymphoides peltata*	Limited in western and central OR; ODA Class A noxious weed
Emergent plants	common reed	*Phragmites australis ssp. australis*	Locally abundant along the Lower Columbia River; ODA Class A noxious weed
	flowering rush	*Botumus umbellatus*	Not present in Oregon
	giant reed	*Arundo donax*	No known naturalized populations in OR
	purple loosestrife	*Lythrum salicaria*	Widespread in OR; ODA Class B noxious weed

Volunteer recruiting

Volunteers were recruited through email, the Oregon Lake Watch Website, and direct contact with family, friends, and colleagues. Recruitment emails were sent out to prospective volunteers including previous lake watch program volunteers, Oregon Lakes Association members, soil and water conservation districts, watershed councils, and state and federal agencies in Oregon.

Potential volunteers were asked to fill out a brief survey intended to help refine the program and schedule training sessions (see Oregon Lake Watch Final Report 2014 for survey and more information). The survey included questions about volunteers' levels of experience with plant identification and water quality sampling, their ability to travel to and attend a training session, and their sampling equipment needs. The survey included an informed consent clause approved by the Human Subjects Research Review Committee at PSU.

Volunteer training

Three OLW volunteer training sessions were conducted in western and central Oregon during 2014 (Table 2). A total of 19 volunteers attended the trainings, 12 of which were new trainees. Each session lasted approximately six hours and included training in safe sample procedures, choice of sampling sites, AIS survey protocols, species identification techniques, water quality sampling protocols, and data recording requirements and use of the Online Data Entry portal. Species identification training included hands on training with fresh plant samples, pressed plant samples, preserved mussel and snail samples, and printed training materials. All training sessions included a short field trip to a waterbody to practice all aspects of a sampling event from selection of sampling sites to recording of data. The sessions concluded by issuing each volunteer a sampling kit which include a binder of training protocols and species identification sheets, the plant identification book, a double sided thatch rake, a modified minnow trap, a Secchi disk and viewing tube, ruler, and a Clinefinder™ water temperature probe.

Table 2. OLW training sessions conducted during 2014.

Training session location	Training date	New trainees	Returning trainees
Rooster Rock State Park, Multnomah County, OR	6/14/2014	0	6
Yoncalla Community Center, Yoncalla, OR	6/21/2014	9	0
Bend Public Library, Bend, OR	6/22/2014	3	1
Total new and returning volunteers at 2014 trainings			19
Volunteers trained in 2013, active in 2014, but did not attend 2014 training			5
Total active volunteers			24

Monitoring results summary

Sixteen of the 24 trained OLW volunteers surveyed at least one waterbody during 2014. Volunteers surveyed a total of 20 waterbodies that were located from central to northwest Oregon (Figure 1). AIS surveys were conducted or water quality samples were collected during 110 total sampling trips (Table 3). Rake or shoreline AIS surveys were conducted during 104 of the sampling events. Crayfish traps were set on a total of 9 dates at 4 of the waterbodies. Mussel substrates were deployed at four waterbodies and were checked for colonization a total of nine times. Water temperature was recorded at least once per site per waterbody during each trip and

Secchi depth was recorded during 55 of the 110 sampling trips. Detailed results of AIS and water quality sampling for each waterbody in the Waterbody Survey Reports section below.

Volunteers detected 6 Watch List Species in 2 of the 20 surveyed waterbodies (Table 5). Five Watch List Species were detected Cooper Creek Reservoir, and two in Suttle Lake. An additional AIS species that is not on the Watch List, reed canary grass (*Phalaris arundinacia*), was found at Benson Lake. The most commonly detected Watch List Species was Eurasian watermilfoil (*Myriophyllum spicatum*), which was recorded in both Cooper Creek Reservoir and Suttle Lake. Five of the six Watch List Species detected were invasive aquatic plants. The one animal Watch List Species, red swamp crayfish (*Procambarus clarkii*), was found in Cooper Creek Reservoir. Although this was the first detection of the species in the reservoir by an OLW program volunteer, the species had previously been detected in the reservoir (Pearl et al. 2013).

Aquatic plants exiting an Oregon lake. Photo by Rich Miller.

In 2013, Watch List Species were recorded at Salish Pond, Ollalie Lake and Cullaby Lake. In 2014, Watch List species were only found at two waterbodies: Cooper Creek Reservoir and Suttle Lake. It is possible that the Eurasian milfoil, curlyleaf pondweed and Chinese or Japanese mystery snails found at Salish Pond in 2013 were in such low densities in 2014 that these species were not observed in this second year of monitoring. Similarly, Asian clams were not observed in Ollalie Lake in 2014, though they were seen in 2013. Eurasian watermilfoil was previously observed in Suttle Lake in prior years, and its populations were again confirmed in 2014.

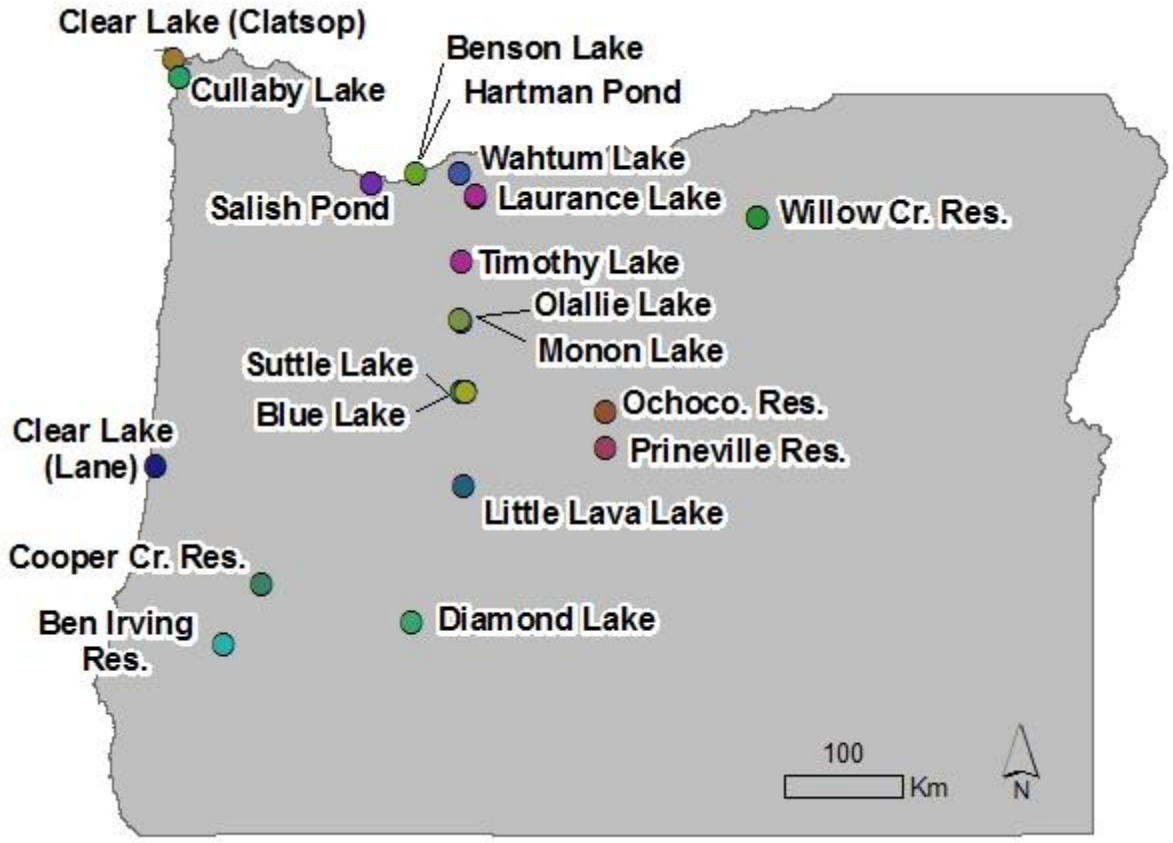


Figure 1. Location of the 20 waterbodies surveyed by OLW volunteers during 2014.

Table 3. Summary of OLW survey sites and sampling efforts during 2014.

Lake Name	Site Name	Latitude	Longitude	In OLW Portal?	Number of dates completed						
					Samplings	Secchi	Temperature	Substrate checks	Crayfish trap	Rake toss	Shoreline observation
Benson Lake	2014_1_launch	45.5779	-122.1237	Y	1					1	1
Benson Lake	2014_1_MultnomahInlet	45.5774	-122.1211	Y	2					1	2
Benson Lake	2014_1_outlet	45.5778	-122.1266	Y	1					1	1
Benson Lake	2014_1_tempprofile	45.5779	-122.1227	Y	1	1	1				
Benson Lake	Picnic Area/Launch site	45.5770	-122.1259	Y	1					1	1
Benson Lake	Secchi/temp site	45.5776	-122.1246	Y	1	1	1				
Ben Irving Reservoir*				N	2	2	2				
Blue Lake (Jefferson Co)	Boat dock	44.4147	-121.7668	Y	4	4	4				3
Clear Lake (Lane Co)	East side	43.3800	-123.2802	Y	1	1				1	1
Clear Lake (Clatsop Co)*				N	2	2	2			2	
Diamond Lake (Douglas) *				N	2	2	2				
Cooper Creek Res.	Deepest location	46.0806	-123.9025	Y	2	2	2	1		2	2
Cooper Creek Res.	Swimming Beach (east)	43.3758	-123.2588	Y	1	1	1				1
Cooper Creek Res.	West Boat Dock near dam	43.3806	-123.2811	Y	1						1
Cullaby Lake (Clatsop Co)*				N	2						
Hartman Pond	North Fishing Dock	45.5771	-122.1322	Y	1				1		
Laurance Lake	Deep spot	45.4603	-121.6623	Y	2	2	2				
Laurance Lake	Site 1	45.4581	-121.6643	Y	2					2	2
Laurance Lake	Site 2	45.4574	-121.6617	Y	2					2	2
Laurance Lake	Site 3	45.4587	-121.6740	Y	2					2	2
Little Lava Lake	Little Lava Boat Ramp	43.9110	-121.7570	Y	1	1	1				1
Monon Lake	Mon-1, north	44.7967	-121.7797	Y	2	2	2				2
Monon Lake	Mon-2, south basin	44.7925	-121.7879	Y	2	2	2				2
Ochoco Reservoir	Boat Launch	44.3052	-120.7029	Y	1					1	1
Ochoco Reservoir	Confluence (early season)	44.3126	-120.6649	Y	1					1	1
Ochoco Reservoir	Desert	44.2939	-120.7043	Y	1					1	1
Ochoco Reservoir	East end (late season)	44.3112	-120.6671	Y	2					2	1
Ochoco Reservoir	Lake Front Lane	44.3027	-120.7044	Y	1					1	1
Ochoco Reservoir	North Beach	44.3124	-120.6835	Y	1					1	1
Ochoco Reservoir	Northwest shore near dam	44.2999	-120.7209	Y	1					1	1
Ochoco Reservoir	Ochcrayfish1	44.3052	-120.7001	Y	2				2		
Ochoco Reservoir	Ochcrayfish2	44.3000	-120.7201	Y	1				1		
Ochoco Reservoir	South Beach	44.3000	-120.6928	Y	1					1	1
Ochoco Reservoir	Southeast shorte	44.3067	-120.6792	Y	1					1	1
Ochoco Reservoir	The Loo	44.2947	-120.7047	Y	2			2			
Ochoco Reservoir	Water Quality	44.2997	-120.7168	Y	4	4	4				
Olallie Lake	OLA-1, Peninsula Ramp	44.8029	-121.7789	Y	3	3	3				3
Olallie Lake	OLA-2, deep	44.8084	-121.7885	Y	1	1	1				1

Table 4. Summary of OLW survey sites and sampling efforts during 2014, continued

Lake Name	Site Name	Latitude	Longitude	In OLW Portal?	Number of dates completed						
					Samplings	Secchi	Temperature	Substrate checks	Crayfish trap	Rake toss	Shoreline observation
Prineville Reservoir	Roberts Bay West	44.1256	-120.7146	Y	3					3	3
Prineville Reservoir	West	44.1276	-120.7041	Y	5	5	5				
Prineville Reservoir	Big Island	44.1207	-120.7374	Y	5	5	5				
Prineville Reservoir	Crayfish 2	44.1185	-120.6881	Y	1				1		
Prineville Reservoir	Crayfish 3	44.1341	-120.7348	Y	1				1		
Prineville Reservoir	Crayfish 4	44.1327	-120.7316	Y	1				1		
Prineville Reservoir	Crayfish 5	44.1283	-120.7208	Y	1				1		
Prineville Reservoir	Honey Pot	44.1208	-120.6959	Y	4			4			
Prineville Reservoir	Owl Creek CG	44.1500	-120.6862	Y	1					1	1
Salish Pond, NE	Rocky Spit	45.5285	-122.4479	Y	2					2	1
Salish Pond, NE	South shore	45.5282	-122.4464	Y	3					3	1
Salish Pond, NE	West-end dock	45.5295	-122.4481	Y	9	9	9			1	2
Suttle Lake	atlas site	44.4226	-121.7362	Y	4	4	3			2	1
Suttle Lake	Red buoy at east end	44.4176	-121.7516	Y	1	1	1			1	1
Timothy Lake	Deep spot	45.1188	-121.7701	Y	2	2	2				
Timothy Lake	Site 1	45.1161	-121.7714	Y	2					2	2
Timothy Lake	Site 2	45.1082	-121.7914	Y	2					2	2
Timothy Lake	Site 3	45.1141	-121.8023	Y	2					2	2
Wahtum Lake	1 - far side	45.584	-121.7933	Y	2						2
Wahtum Lake	2 - outflow	45.5814	-121.7997	Y	2						2
Wahtum Lake	3 - trail access	45.5819	-121.795	Y	2				1		1
Wahtum Lake	deep spot	45.5821	-121.7942	Y	2	2	2				
Willow Creek Res.	Willow Creek Res.	45.3459	-119.5432	Y	2	2	2	2	1	1	2

*Indicates data collected but not entered into OLW Portal

Table 5. Watch List, other AIS, and native species reported by OLW volunteers.

	Benson Lake	Ben Irving Res.	Blue Lake (Jefferson)	Clear Lake (Lane)	Clear Lake (Clatsop)	Cooper Creek Res.	Cullaby Lake	Laurance Lake	Diamond Lake	Hartman Pond	Little Lava Lake	Monon Lake	Ochoco Reservoir	Ollalie Lake	Prinveville Reservoir	Salish Pond, NE	Suttle Lake	Timothy Lake	Wahtum Lake	Willow Creek Res.
Number of AIS spp. reported	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Myriophyllum spicatum, Eurasian milfoil						X											X			
Nymphaea odorata, fragrant waterlily						X														
Potamogeton crispus, curly leaf pondweed																	X			
Egeria densa, Brazilian elodea						X														
Corbicula fluminea, Asian clam						X														
Procambarus clarkii, red swamp crayfish						X														
Phalaris arundinacia, reed canary grass*	X																			
Native species reported																				
Brasenia schreberi, water shield	X																			
Carex spp., sedges																		X		
Ceratophyllum demersum, coontail	X															X				
Chara spp. muskgrass	X														X					
Elodea canadensis, Canadian waterweed	X															X	X			
Juncus sp., rushes																				
Potamogeton sp., waterweed	X					X									X		X			X
Nitella sp., brittlewort	X															X				
Nuphar polysepala, yellow water lily				X																
Pacifastacus leniusculus, signal crayfish			X										X		X				X	
Myriophyllum sp., water milfoil															X		X			
Schoenoplectus sp., bulrush															X					
Spirea douglasii, rose spirea	X																			
Typha sp., cattail	X														X					
Other emergent plants															X					
Other submerged plants															X				X	
Juga sp., river snail	X																			
Other gastropod, snails	X																			

Temperature profile and Secchi depth data are available for 14 of the 20 survey lakes. The minimum and maximum surface water temperatures both occurred at Salish Pond, located in the Fairview/Gresham area, ranging from 5.4ºC during February to 26.7 ºC during August (Table 6). The mixed surface layer (epilimnion) depths of the lakes ranged from 1.5 m in Laurance Lake to 10 m in Prineville Reservoir. Secchi transparencies ranged from 1.4 m in Willow Creek Reservoir to 16 m in Blue Lake (Jefferson County). The range of Secchi transparencies indicates a wide range of trophic status across the lakes. The low Secchi transparency of Benson Lake, for instance, indicates the lake is likely eutrophic. A eutrophic lake is generally high in nutrients which support dense algal and aquatic plant growth, and in lakes and reservoirs in developed and agricultural areas, nutrient-rich run-off is often a contributor to lake eutrophication. At the other extreme, the high transparency of Wahtum Lake indicates the lake is oligotrophic. Oligotrophic lakes are generally low in the nutrients that support algal and aquatic plant growth. Mesotrophic lakes fall in-between these two extremes. Lake trophic status can change seasonally, and in response to a pulse of nutrients, as after a high-volume storm event.

Table 6. Ranges of surface water temperature, epilimnetic depth, and Secchi depth observed in each survey lakes during 2014 and trophic status of the lakes inferred from Secchi depth.

Waterbody	Surface water temperature (ºC)	Epilimnion depth (m)	Secchi depth (m)	Trophic status based on Secchi depth
Benson Lake	19.6 – 23.2	Not stratified	2.5	Eutrophic
Ben Irving Reservoir	Data not entered into Online Data Portal			
Blue Lake (Jefferson Co.)	10 – 17.9	2	12.4 - 16	Oligotrophic
Clear Lake (Lane Co.)	Not sampled	n/a	5.6	Oligotrophic
Clear Lake (Clatsop Co.)				
Cooper Creek Reservoir	25	3.5	5.9	Oligotrophic
Cullaby Lake	Data not entered into Online Data Portal			
Diamond Lake (Douglas Co.)	Data not entered into Online Data Portal			
Hartman Pond	Water quality not sampled			
Laurance Lake	15.5 -22.6	1.5	4.7 – 6.2	Oligotrophic
Little Lava Lake	15.6	2.5	> max depth	Not sampled
Monon Lake	13.6 -23.6	5	11.2**	Oligotrophic
Ochoco Reservoir	17.5 – 22.5	6	2.6 - 6.2	Mesotrophic - Oligotrophic
Olallie Lake	13.4 – 21.7	4.5	> max depth	Not sampled
Prineville Reservoir	17.4 – 23.6	5.5 - 10	2.8 - 5.2	Mesotrophic - Oligotrophic
Salish Pond, NE	5.4 – 26.7	3.5	1.5 – 4.6	Eutrophic to mesotrophic
Suttle Lake	12.7 – 19.9	6.5	4.2 – 6.5	Oligotrophic
Timothy Lake	18.6 - 23.9	7.5	4.9	Oligotrophic
Wahtum Lake	18.4 – 23.9	6 - 7.5	11	Oligotrophic
Willow Creek Reservoir	16.9 – 23.9	6 – 6.5	1.4 – 3.9	Eutrophic - Mesotrophic

**2013 data only.

Discussion

It is worth noting that some Watch List Species observed in 2013 were not seen in 2014. While it would be easy (and certainly preferable) to consider this shift a success in the fight against invasive aquatic species, it is more likely the result of year-to-year variance. Two years of monitoring data are not sufficient to show trends over time. These variations in observances in fact support the importance of long-term monitoring: sampling dates occurring in different months, after different weather events, and taking into consideration temperature variability from year to year could mean the difference between the presence or perceived absence of a Watch List species. Volunteer monitoring over many years, as has been seen in Maine and other states with successful programs, would allow trends (such as infestation by a certain AIS or eutrophication of a previously oligotrophic system) to become more apparent. This wealth of data could support agencies' and watershed councils' efforts to expedite management efforts to mitigate the impacts of invasive species on Oregon's lakes. Further, with continued volunteer monitoring, the Oregon Lake Watch has the ability to extend its reach to potentially collect more data on waterbodies of concern, and help to focus outreach efforts to those lakes and reservoirs in particular. These first years of the Oregon Lake Watch have been both productive and indicative of the need for continued long-term volunteer outreach and monitoring.

Waterbody survey reports

Benson Lake, Multnomah County

Benson Lake in Multnomah County is a 40-acre lake located in Benson State Park in the Columbia River Gorge (Figure 2). The lake was surveyed for AIS and water quality twice during 2014. Shoreline surveys did not reveal any Watch List AIS, though reed canary grass (*Phalaris arundinacea)*, an invasive, common non-native species was observed. American waterweed (*Elodea canadensis)*, a common native species was also observed.

Temperature profiles and Secchi transparency were measured at one location for both dates. The surface water temperature in June was approximately 20ºC and was mixed down to a depth of two 2.75 meters. The surface water temperature in August warmed to 23ºC and was mixed to a depth of 1.5 meters. The Secchi transparency reached 2.25 m.

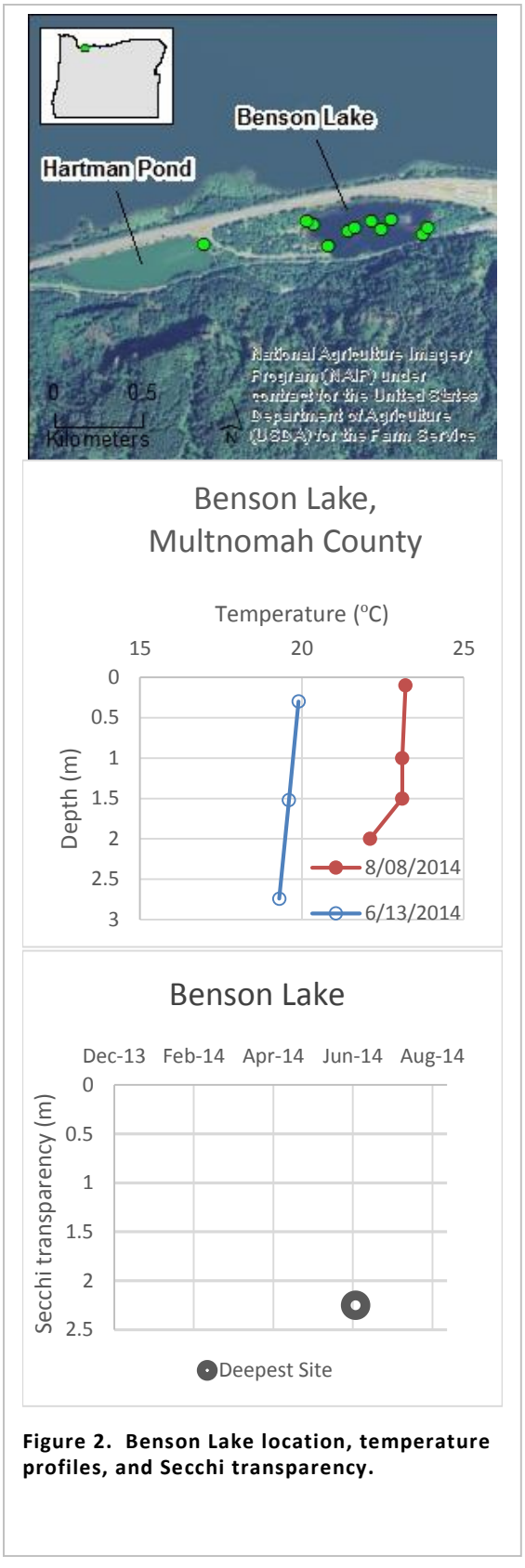


Figure 2. Benson Lake location, temperature profiles, and Secchi transparency.

BLUE LAKE, JEFFERSON COUNTY

Blue Lake in Jefferson County is a small, 54-acre Cascade Mountain lake with a maximum depth of greater than 300 feet (Atlas of Oregon Lakes, Johnson et al. 1985) (Figure 3). The lake was surveyed by OLW volunteers four times during 2014 off the boat dock using minnow traps and shoreline surveys. No AIS species were detected. One native animal species, the signal crayfish (*Pacifastacus leniusculus*), was recorded via the Online Data Entry Portal.

The lake was stratified during the July 2014 sampling event, with mixing to approximately 4 meters. By the fourth and final sampling event in October 2014, the lake appeared to be more evenly mixed, with temperatures ranging from 10.5 ºC at the surface to 6.4 ºC at 12m. Secchi transparency ranged from 12.4m to 16m, indicating it is an oligotrophic lake.

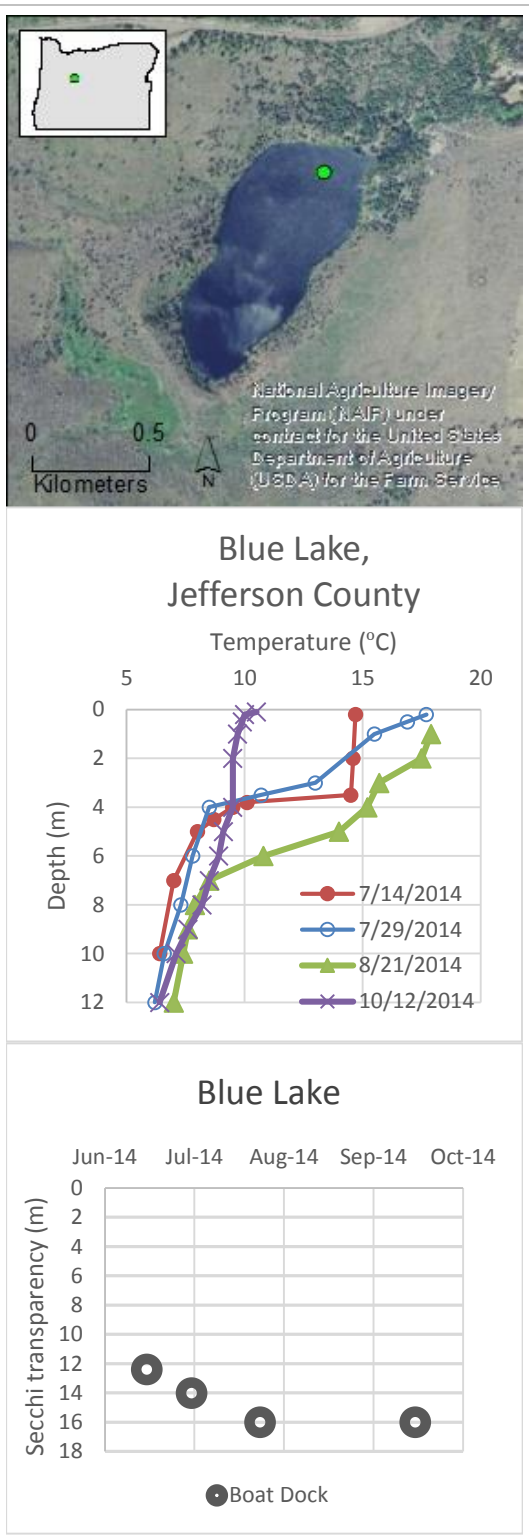


Figure 3. Blue Lake location, temperature profile, and Secchi transparency.

Cooper Creek Reservoir, Douglas County

Cooper Creek Reservoir is part of the Cooper Creek system within the Umpqua River Basin (Figure 7). In addition to recreational uses, it provides drinking water for the nearby town of Sutherlin. OLW volunteers conducted AIS surveys on July 15, 2015 at two locations in the reservoir: at the swimming beach, east of the East Boat Ramp, and at the West Boat Dock.

Three AIS species were observed during the surveys: Eurasian watermilfoil (*Myriophyllum spicatum*), Brazilian elodea (*Egeria densa*), and Asian clams (*Corbicula fluminea*).

Non-native (but non-invasive) species found at both survey sites included fragrant water lily (*Nymphaea odorata*) and pondweed (*Potamogeton* sp.).

Surface water temperatures on both sampling dates were around 23ºC. A temperature profile was recorded on August 29, 2014, and showed stratification with mixing to only about 4 meters. Secchi transparency was recorded at approximately 6 meters.

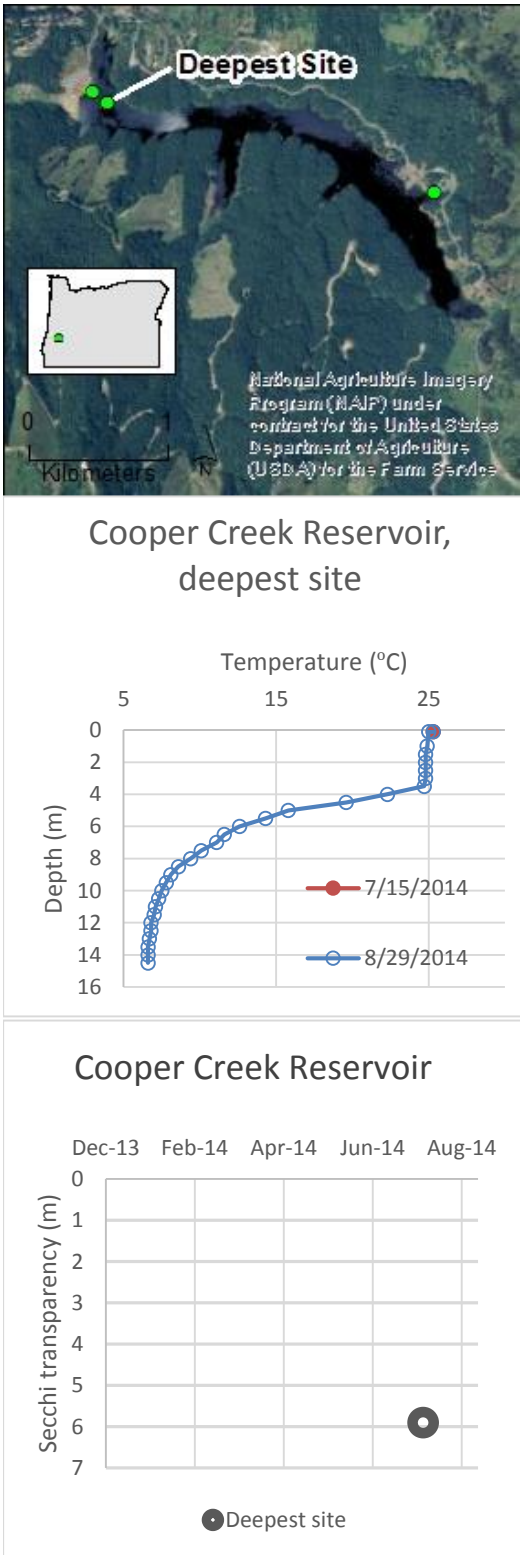


Figure 4. Cooper Creek Reservoir location, Secchi transparency, and temperature profiles.

LAURANCE LAKE, HOOD RIVER COUNTY

Laurance Lake is a small irrigation supply and recreation reservoir located north of Mount Hood in the Mount Hood National Forest (Figure 5). The reservoir was surveyed for AIS, temperature profiles and Secchi transparency at two points during the summer of 2014. AIS surveys were conducted using rake toss and shoreline zig-zag methods. No AIS were detected during the surveys.

Surface temperature in the lake was above 23ºC in August of 2014, and had dropped to 19 ºC by mid-September, where temperatures were mostly mixed below 1.5 meters. The 2014 averages of multiple Secchi transparency measurements ranged from 4.8 to 6. meters 1 (July and August respectively) which is a marked increase in water clarity from the 2013 measurement of 3.6 meters.

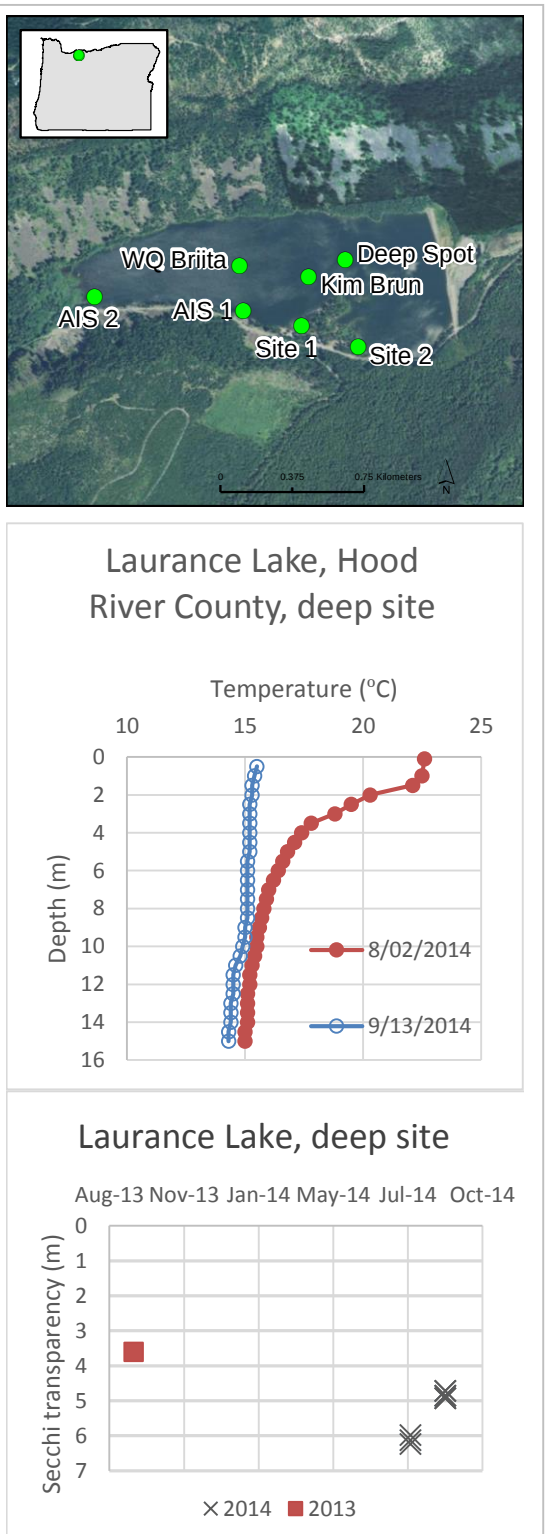


Figure 5. Laurance Lake location, Secchi transparency, and temperature profiles.

Little Lava Lake, Deschutes County

Little Lava Lake is a shallow, 56-hectare lake located in the located in the Cascade Range within the Deschutes National Forest, and it serves as a primary water source source for the Deschutes River (

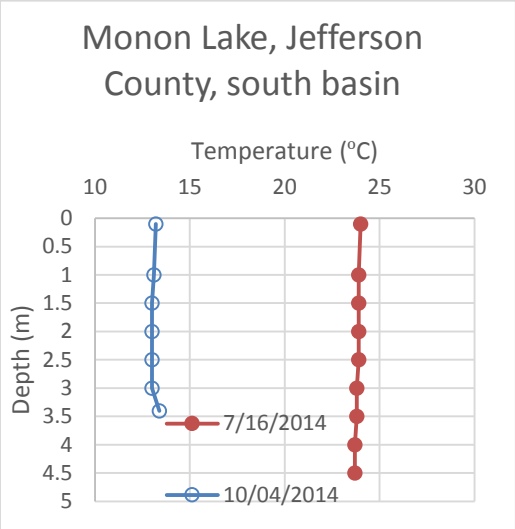


Figure). OLW volunteers surveyed the lake once during the summer of 2014. No AIS were detected.

Temperature measurements were taken off of the boat ramp. Surface water temperatures were close to 16ºC reaching 13.2ºC at 3 meters. Surface waters were mixed down to 2.5m. Secchi transparency measurements were not taken at this sampling event.

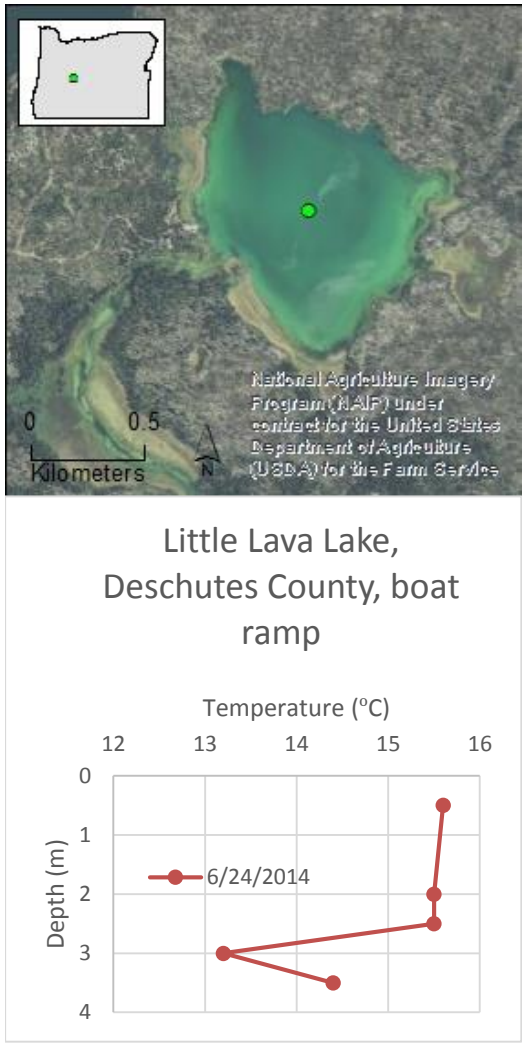


Figure 9. Little Lava Lake sampling locations and temperature profiles.

MONON LAKE, JEFFERSON COUNTY

Monon Lake is one of a large group of small glacially carved lakes located on a high plateau at the crest of the Cascade Mountains to the north of Mount Washington (Figure 10). OLW volunteers surveyed the lake using the shoreline zig-zag method twice during the summer of 2014. No AIS were detected at either site.

On each date, temperature profiles were conducted at two sites: a shallow south basin site and a deeper north basin site. Surface water temperatures at both sites were close to 27ºC mid-July and cooled to 22ºC by October. Both sites had shallow thermoclines, where the temperature dropped off dramatically at 0.1 meters on both sampling dates.

Secchi transparency measurements were not taken in 2014. In 2013, the Secchi disk was visible on the bottom at the deepest part of the lake during all sampling events (Figure 11). Since this was nearly 12 m, the lake is considered oligotrophic.

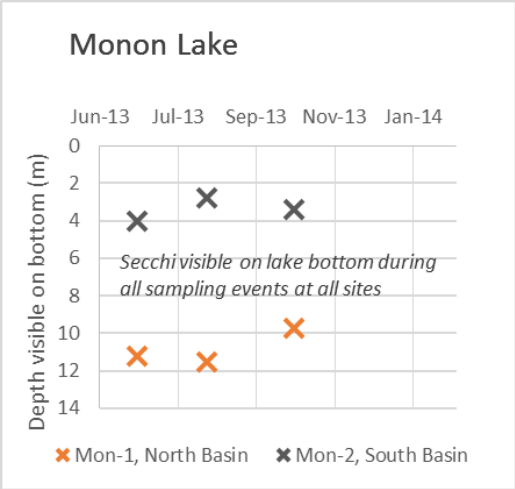
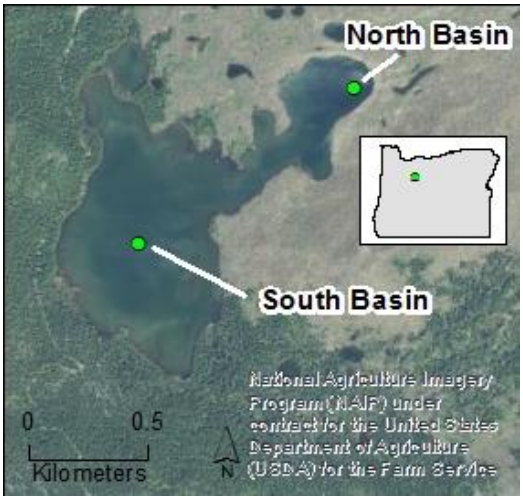
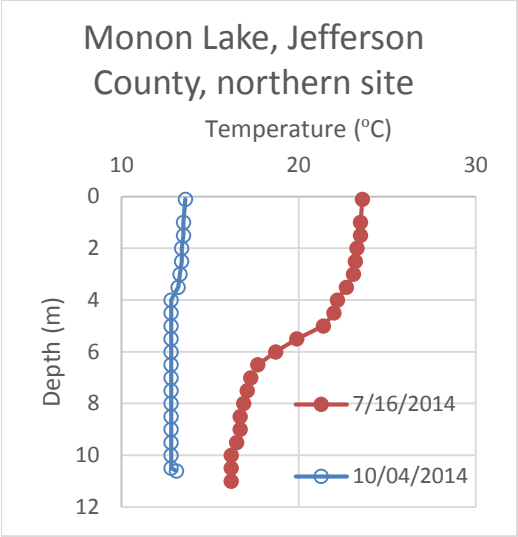


Figure 11. 2013 Monon Lake Secchi measurements.





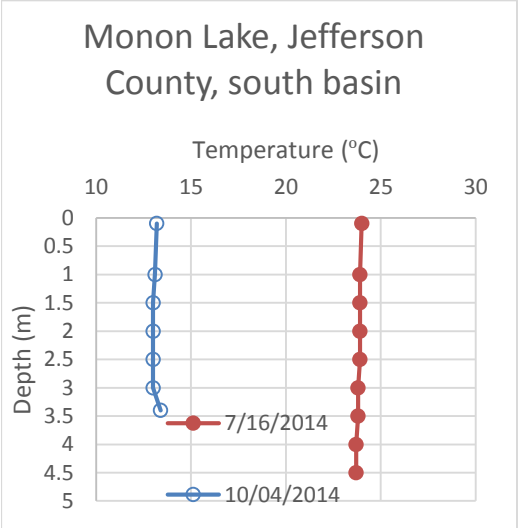


Figure 10. Monon Lake sampling locations

OCHOCO RESERVOIR, CROOK COUNTY

Ochoco Reservoir in Crook County lies in Central Oregon on the western slope of the Ochoco Mountains (Figure 12). It began as an irrigation impoundment that was later stocked with fish for recreational use. Water levels continue to fluctuate greatly for irrigation withdrawals for surrounding agricultural uses. OLW volunteers surveyed for AIS at eleven locations and four sampling dates across the reservoir, and no AIS were observed. The native signal crayfish (*Pacifastacus leniusculus*) was present in three of the survey sites.

Temperature profiles and Secchi transparency (Figure 13) were measured at one site at all four sampling events. Temperature profiles showed similar trends across the summer sampling dates, with surface water mixing to approximately 7 meters. Surface temperatures ranged from 17 ºC in June to a high of 22 ºC in August. Water clarity ranged from 2.6 meters to 6.2 meters.

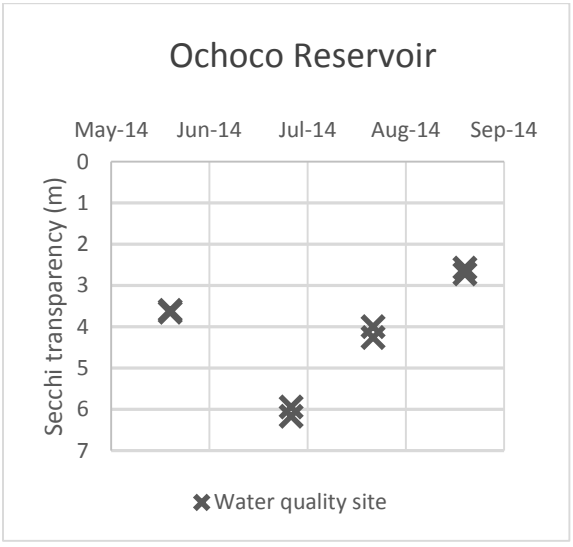
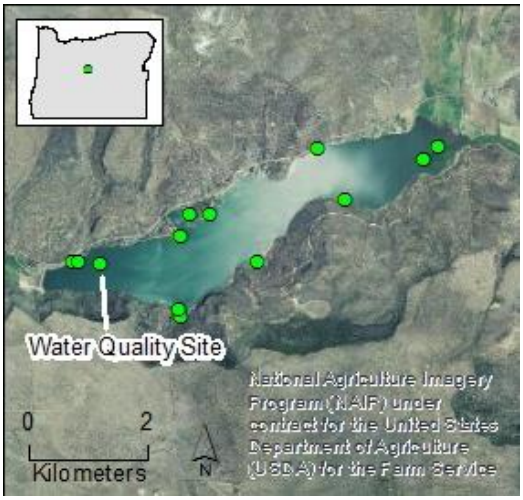


Figure 13. Ochocho Reservoir Secchi measurements.



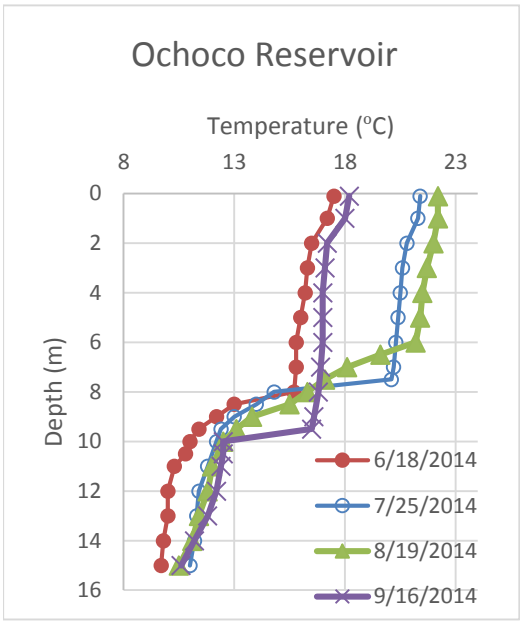


Figure 12. Ochoco Reservoir sampling locations and temperature profiles.

Olallie Lake, Jefferson County

Olallie Lake is one of the larger of the multitudes of glacially carved lakes along the crest of the Cascade Mountains north of Mount Washington, Oregon (4). OLW volunteers surveyed the lake for AIS by shoreline observation and rake toss methods. No AIS species were observed.

Temperature profiles were measured at two sites during each sampling event. Surface temperatures at both the "Deep" site and the "Peninsula Ramp" site ranged up to 28ºC. The lake was thermally mixed through the water column at the Peninsula Ramp site during July and October. Surface waters were mixed down to 4 m at the "Deep" site during the July sampling event (Figure 15). Secchi transparency measurements were not taken in 2014. In 2013, water clarity was greater than the depth at each sampling site, and since the Secchi was visible to a minimum of 12 m, the lake is considered oligotrophic.

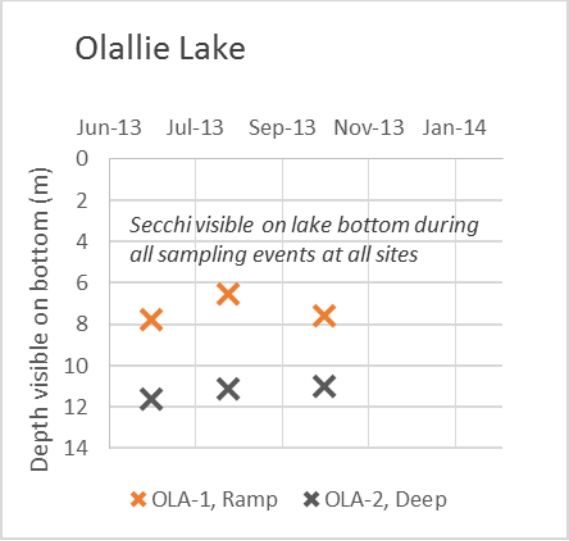
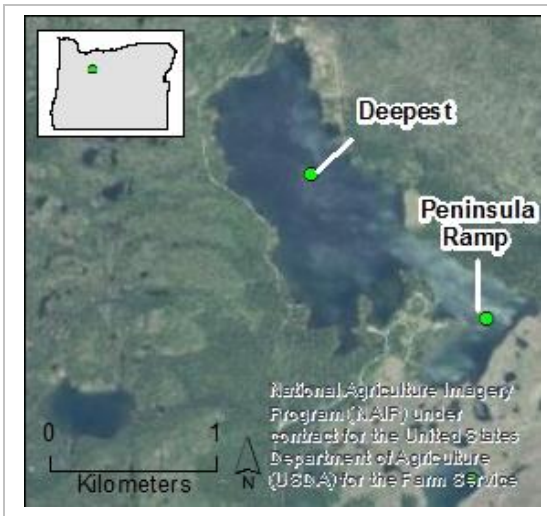
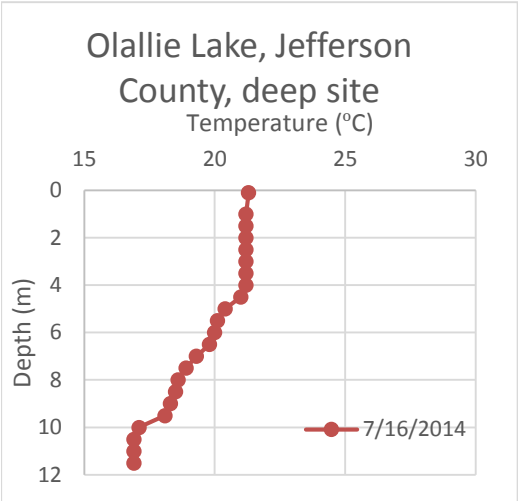


Figure 15. 2013 Olallie Lake Secchi measurements.





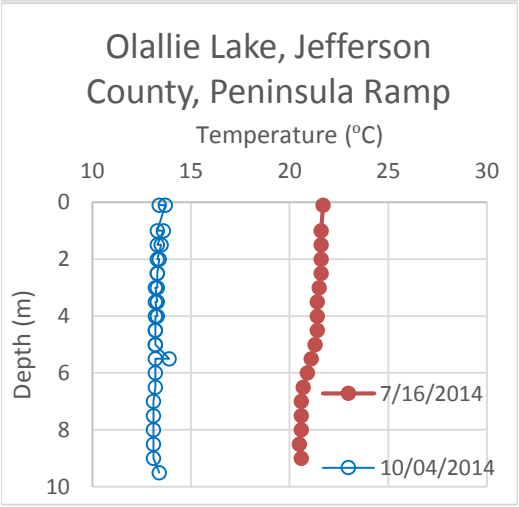
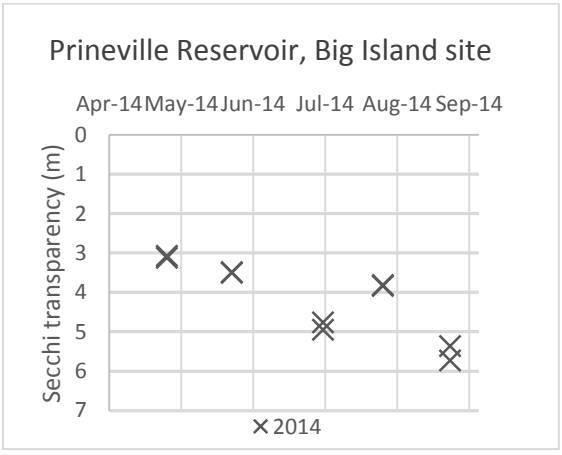


Figure 14. Olallie Lake sampling locations and temperature profiles.

PRINEVILLE RESERVOIR, CROOK COUNTY

Prineville Reservoir is a large impoundment of the Crooked River in central Oregon (Figure 16). The reservoir is popular for boating and other recreational activities. OLW volunteers surveyed one site in the reservoir for AIS using rake toss, shoreline zig-zag methods, and minnow trap methods on July 13, 2013 and no AIS species were found.

Temperature profiles were measured on five dates at two sites. Surface water temperatures ranged up to nearly 24ºC (76ºF) and were well mixed to six meters during July and increased to near ten meters in September 2013 (Figure 17).



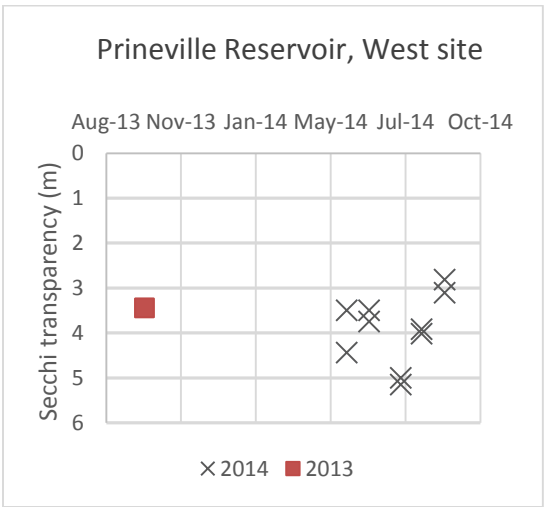
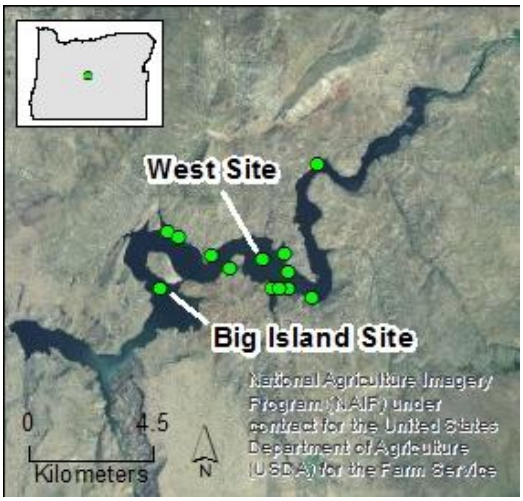
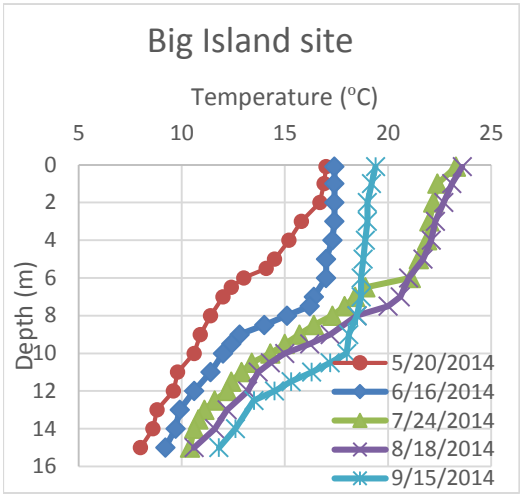


Figure 17. Prineville Reservoir Secchi transparency.





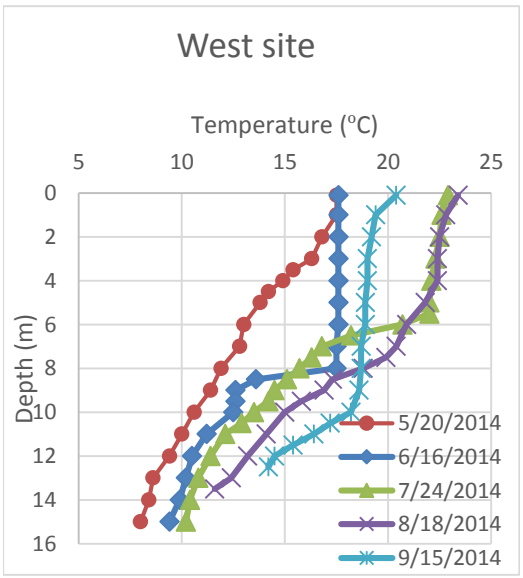


Figure 16. Prineville Reservoir location and temperature profiles.

SALISH POND, NORTHEAST, MULTNOMAH COUNTY

Salish Ponds are a series of four ponds located within the Portland's suburban cities of Gresham and Fairview, Oregon (Figure 18). Volunteers surveyed for AIS on the northeast pond on four sampling dates and collected temperature and water clarity data on nine sampling dates in 2014. Two Watch List submerged plant species were reported: Eurasian watermilfoil (*Myriophyllum spicatum*) and curly leaf pondweed (*Potamogeton crispus*). No Watch List animal species was recorded; however, a Chinese mysterysnail (*Cipangopaludina chinensis*) was detected during a 2013 OLW survey. Native species recorded included coontail (*Ceratophyllum demersum*), Canadian waterweed (*Elodea canadensis*), pondweed (*Potamogeton* sp.), brittlewort (*Nitella* sp.), rush (*Juncus* sp.), cattail (*Typha* sp.), and Physa snails (Physidae family).

The pond was thermally stratified at around three meters depth during the summer and temperatures ranged up to 27ºC. Secchi transparency decreased from 4.5 meters down to 1.5 meters over the course of the summer, indicating the pond is eutrophic.

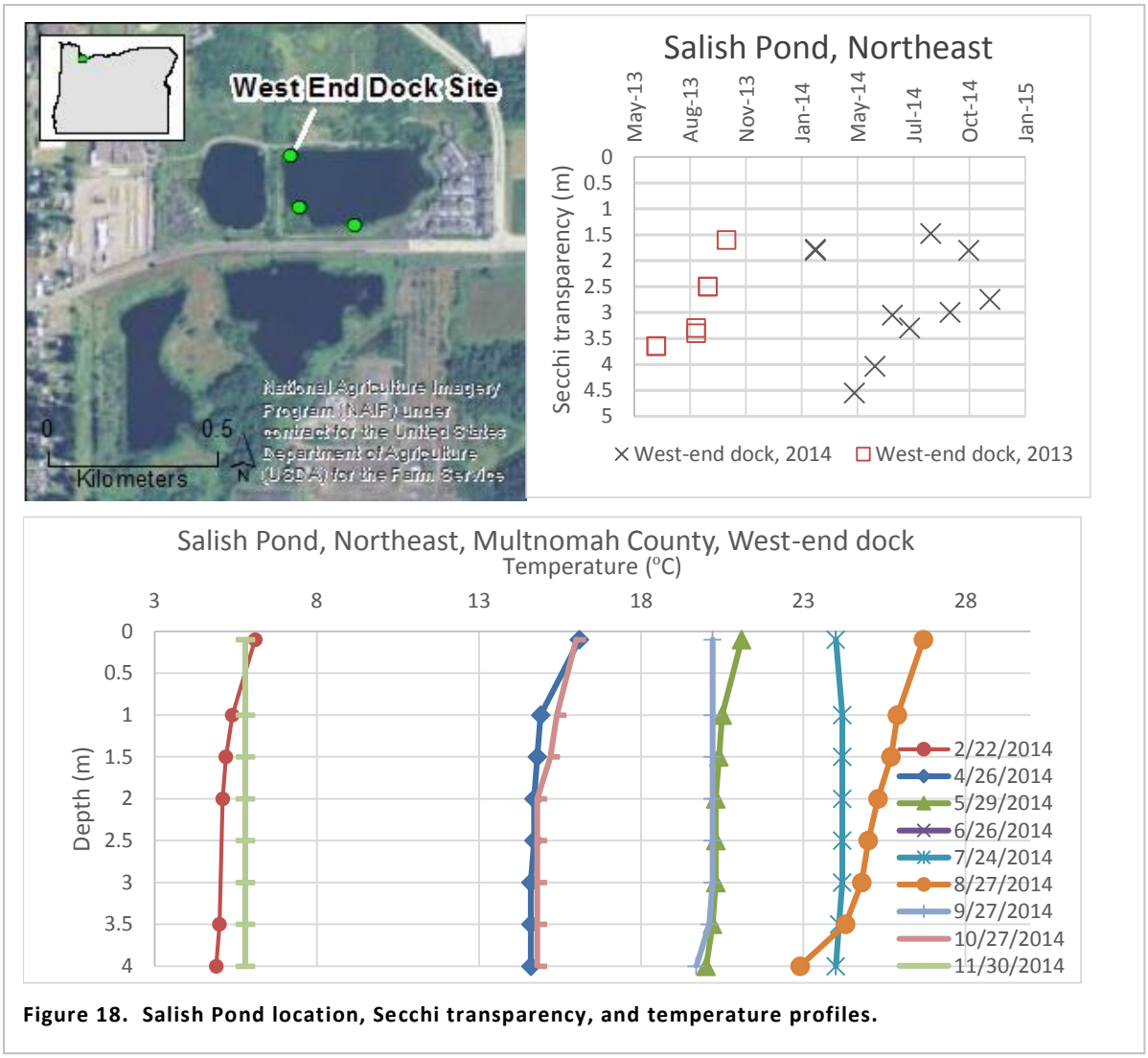
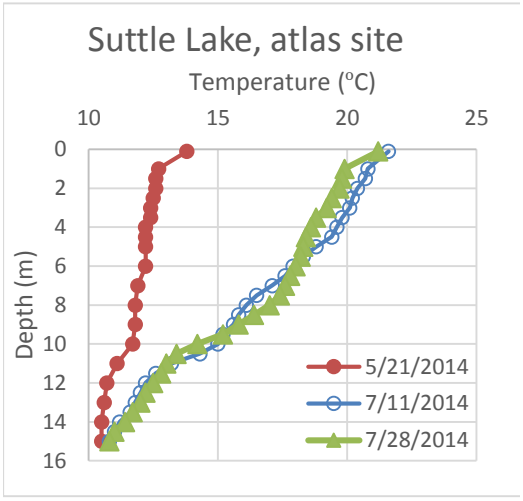


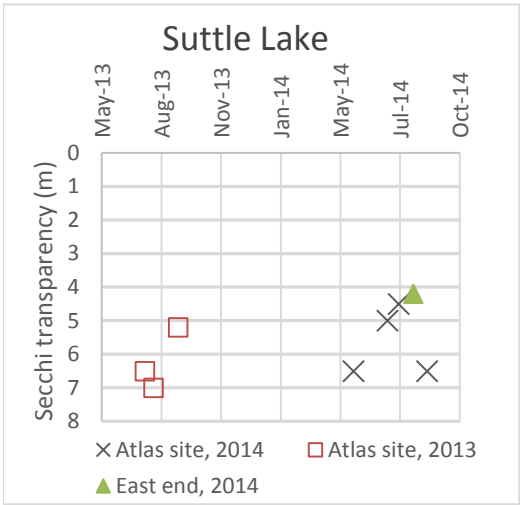
Figure 18. Salish Pond location, Secchi transparency, and temperature profiles.

SUTTLE LAKE, JEFFERSON COUNTY

Suttle Lake is a popular recreation lake located in the Deschutes National Forest on the east side of the Cascade Range (Figure 19). A Zebra/Quagga mussel substrate deployed at the Suttle Lake Lodge dock was checked by volunteers on two dates during 2013 and no mussels were founds. Rake toss sampling was conducted on two dates and shoreline zig-zag sampling was conducted one of the days. A *Myriophyllum* species was collected that had more than 14 leaflet pairs and may be the AIS *M. spicatum* or a hybrid of *M. spicatum* and the native *M. sibribium*. *M. spicatum* has been noted in the lake in the past. No other AIS were detected. A crayfish trap was deployed on one of the sampling dates near the Link Creek inlet and no crayfish were captured.

Temperature profiles and Secchi transparency measurements were collected at the Suttle Lake "Atlas Site" (Figure 19) on three dates. The lake was well-mixed below 1.5 m on the first sampling date in May but had stratified by July sampling dates. One temperature profile taken at the east end site in August showed mixing below 1m. Secchi transparency ranged from 4.2 m to 6.5 m which indicates that the lake is oligotrophic.





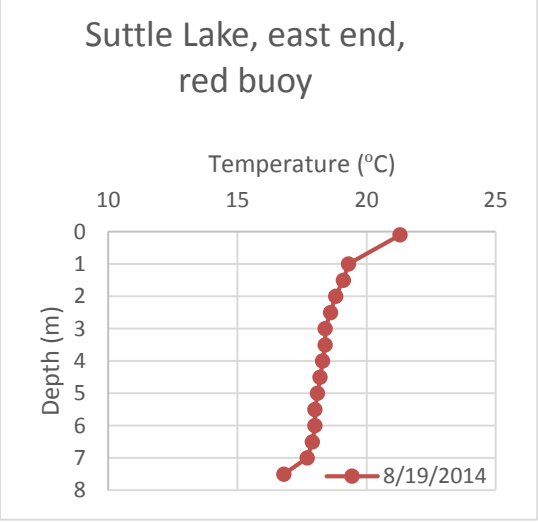


Figure 19. Suttle Lake location, temperature profile, and Secchi transparency.

TIMOTHY LAKE, CLACKAMAS COUNTY

Timothy Lake is a large reservoir in the Mount Hood National Forest and operated by Portland General Electric (Johnson et al. 1985). The Lake is a very popular recreation destination. The reservoir was surveyed by volunteers on two sampling dates during 2014. AIS were surveyed at three sites (Sites 1-3 on Figure 20) on three dates using crayfish trap, rake toss, and shoreline zig-zag methods. No AIS were detected during the surveys. Native signal crayfish shells were noted along the shoreline. None, however, were captured in the crayfish traps.

Temperature profiles and Secchi transparency was measured at the "Deep Spot" on two dates. The reservoir appeared stratified for the August 2014 sampling, but was mixed down to eight meters during the by the September sampling event. Averaged Secchi measurements were 5.14m in August 2014, and 4.96m in August. The high transparency of the water indicates that the reservoir is oligotrophic, though Secchi transparency was considerably greater in 2013 samples.

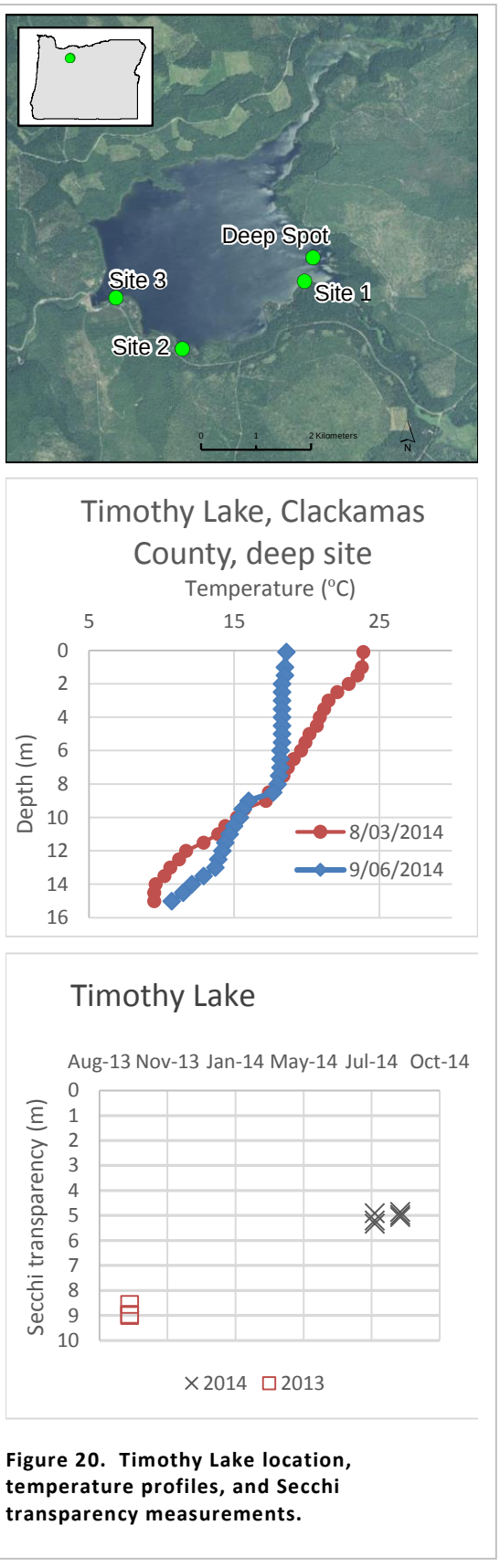


Figure 20. Timothy Lake location, temperature profiles, and Secchi transparency measurements.

WAHTUM LAKE, HOOD RIVER COUNTY

Wahtum Lake is a small, deep lake located north of Mount Hood in the Mount Hood National Forest. Volunteers surveyed the lake two times during the summer of 2014. Three shoreline sites were surveyed for AIS (Figure 21) using the shoreline zig-zag method. One site was also surveyed using rake tosses and a minnow trap. No AIS were detected. Native sedges (*Carex spp*.) and native signal crayfish (*Pacifastacus leniusculus*) were observed.

Two temperature profiles and Secchi transparency measurements were conducted at the "Deep Spot" site in 2014. The lake was well mixed to a depth of 6 m with distinct stratification during summer sampling dates. Secchi transparency was 11m which is indicative of an oligotrophic lake.

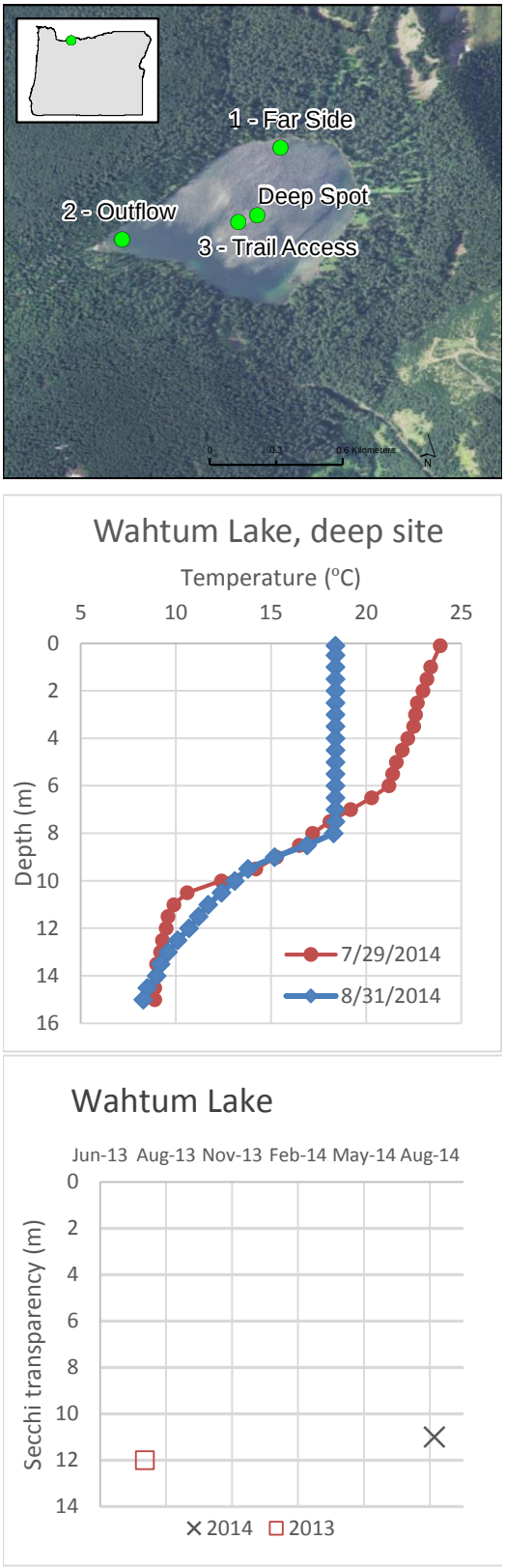
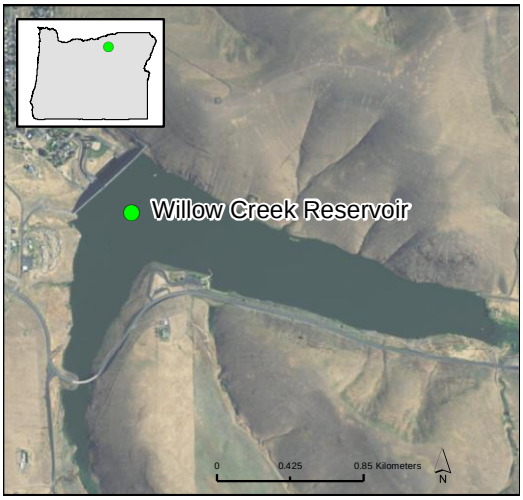


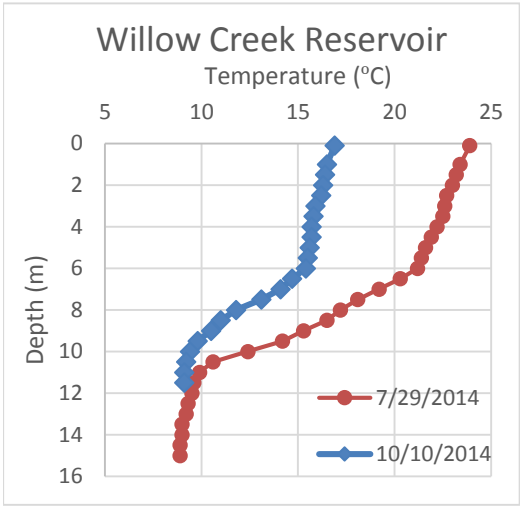
Figure 20. Wahtum Lake location, temperature profiles, and Secchi transparency measurements.

WILLOW CREEK RESERVOIR, MORROW COUNTY

Willow Creek Reservoir is a 154 ac (0.62 km^2) reservoir in northeast Oregon just upstream from the town of Heppner (Figure 21). A volunteer surveyed the reservoir for AIS using the rake toss and shoreline zig-zag methods on one occasion during 2014. Native pondweed (*Potamogeton* sp.) and blue-green algae were observed. No AIS species were detected.

Temperature profiles and Secchi transparency were measured twice at the same location in 2014. Surface waters were quite warm on July 29, 2014 at nearly 24ºC and well mixed to a depth of 6 m. Secchi transparency measurements varied greatly between sampling dates, with transparency at 3.9 meters in July, and only 1.4 meters in October 2014. This clarity borders on eutrophic conditions.





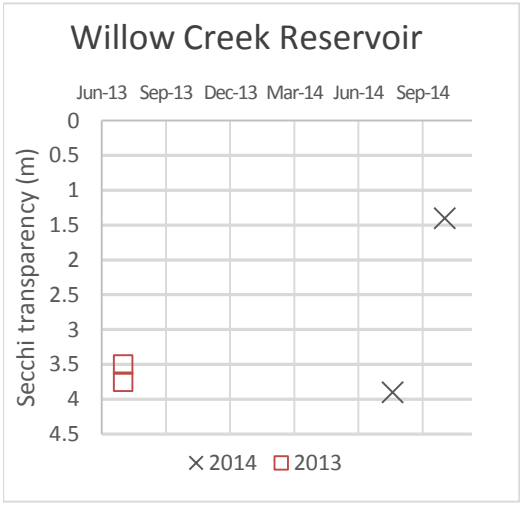


Figure 21. Willow Creek Reservoir location, temperature profile, and Secchi transparency.

BEN IRVING RESERVOIR (DOUGLAS CO), CLEAR LAKE (CLATSOP CO), CULLABY LAKE (CLATSOP CO), AND DIAMOND LAKE (DOUGLAS CO)

Four lakes were surveys during 2014, but data have not been entered into the Data Entry Portal (Figure 22). Temperature profiles, Secchi measurements, plant surveys, and crayfish surveys were conducted in Ben Irving Reservoir on two dates during 2014. The same surveys were conducted at Clear and Cullaby Lake on two occasions, although crayfish traps were not deployed. Temperature profiles and Secchi transparency measurements were conducted by OLW volunteers at Diamond Lake on two dates during 2014. No invasive species were detected in any of the four lakes. Reports will be updated once the data from these four lakes is entered into the Online Data Entry Portal.

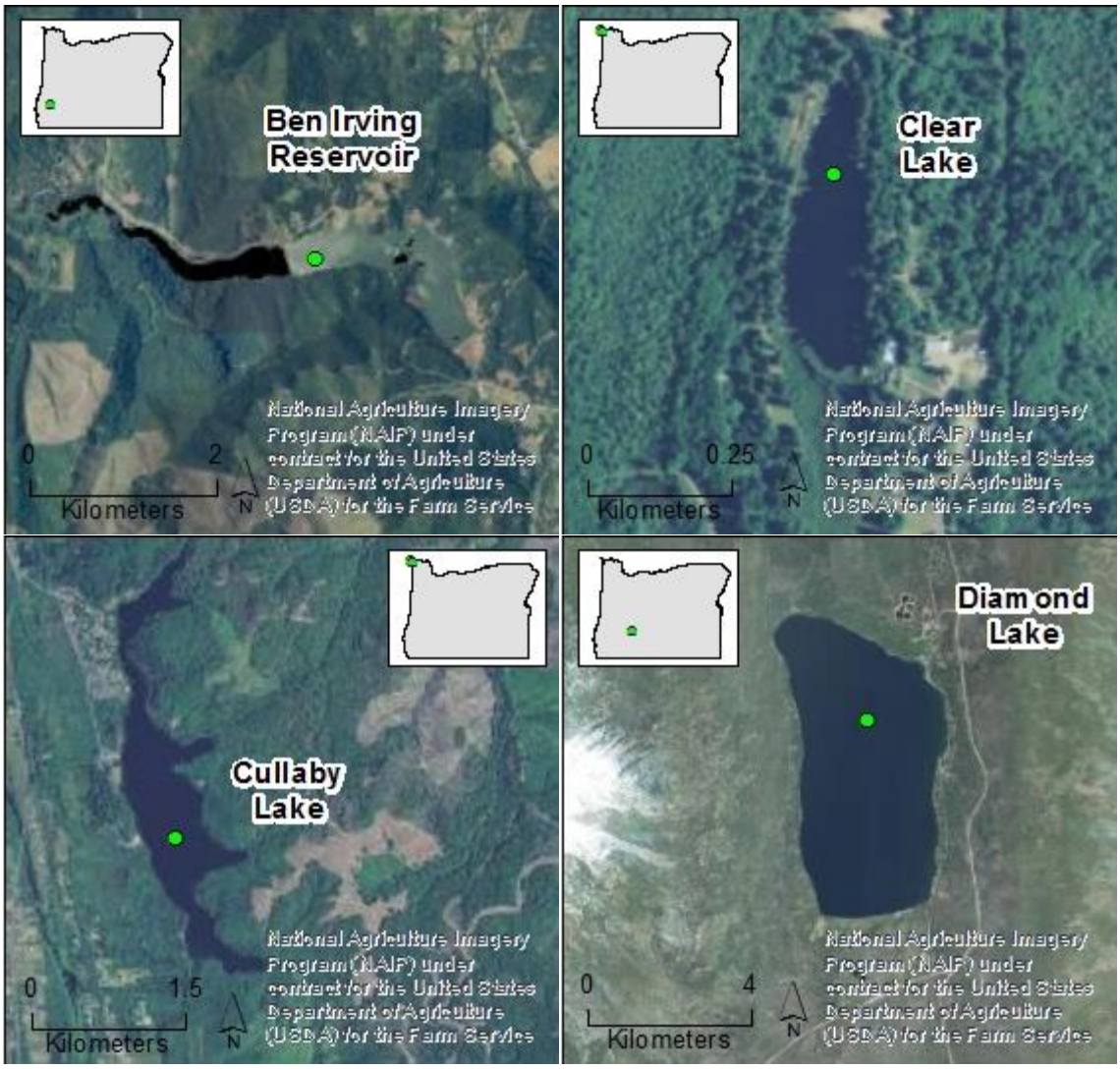


Figure 22. OLW lakes that were surveyed, but data have not been entered into the Online Data Entry Porta..

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