



Lewis and Clark National Historical Park Amphibian Inventory 2002 and 2005

Non-sensitive Version

Natural Resource Report NPS/NCCN/NRR—2015/1028.N



ON THE COVER

Amphibians detected at Lewis and Clark National Historical Park
Photograph by: Michael Layes

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Executive Summary

This document details amphibian inventories conducted in Lewis and Clark National Historical Park. These inventories were part of a larger effort to document species presence at five North Coast and Cascade (NCCN) Parks: Mount Rainier National Park (MORA), Ebey's Landing National Historical Reserve (EBLA), Lewis and Clark National Historical Park (LEWI), Fort Vancouver National Historical Park (FOVA), and San Juan Island National Historical Park (SAJH). Four of these NCCN parks (EBLA, LEWI, FOVA, and SAJH) had incomplete amphibian lists based on limited or undocumented data. Our primary goal was to meet the National Park Service Inventory and Monitoring program goal to assess more thoroughly the status of amphibian species listed as "expected" in the parks and to verify the occurrence of 90% of these species. Prior to this inventory, LEWI had a limited verified list of species occurring in the park; however complete searches of museum specimens and state records had not been conducted.

Our primary goal for LEWI was to search for the presence of historically documented or expected species: northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), Cope's giant salamander (*Dicamptodon copei*), Ensatina (*Ensatina eschscholtzii*), western red-backed salamander (*Plethodon vehiculum*), Dunn's salamander (*Plethodon dunni*), Van Dyke's salamander (*Plethodon vandykei*), northern Pacific treefrog (*Pseudacris regilla*), western toad (*Anaxyrus boreas*), northern red-legged frog (*Rana aurora*), Oregon spotted frog (*Rana pretiosa*), American bullfrog (*Rana catesbeiana*), Columbia torrent salamander (*Rhyacotriton kezeri*), rough-skinned newt (*Taricha granulosa*), and clouded salamander (*Aneides ferreus*).

This report provides an updated list of amphibian species present within LEWI. The report describes the methods used, results of the surveys, and discusses each species detected. The results include a summary of species documented at each survey site, information on species life stage and habitat, and maps showing the spatial distribution of amphibians in the park. The Appendices include more details on information documented in the inventory. Microsoft Excel spreadsheets have been submitted to the NCCN data manager. ArcGIS data depicting locations, slide photographs of sites surveyed, and digital (and slide) voucher photos for new species documented have been produced.

Voucher specimens for amphibians exist for many NCCN species in various park collections and other institutions. These collections, along with new data provided through this inventory, represent an historic amphibian collection for additional research in the future.

Twenty-five surveys were conducted in 2002 (Fort Clatsop National Memorial) and 40 surveys in 2005 (Fort Clatsop National Memorial, Sunset Beach, and Cape Disappointment). A total of 99,214 m² were surveyed for 11,218 search minutes, over 21 days.

We detected 10 of the 15 species we expected to find in LEWI and one new species that was not on our potential species list. Species detected in LEWI were the northwestern salamander, Columbia torrent salamander, rough-skinned newt, Cope's giant salamander, Ensatina, western red-back salamander, Dunn's salamander, northern Pacific treefrog, northern red-legged frog, and American

This report has had confidential information regarding park-sensitive species locations removed.

bullfrog. We also documented the coastal giant salamander (*Dicamptodon tenebrosus*), which was not on our list of expected species.

The northern red-legged frog was the most dominant aquatic breeding amphibian species documented, detected at 32 out of 65 sites, while the western red-backed salamander was the most dominant terrestrial breeding species, detected at 21 sites. We confirmed the presence of two species of Pacific giant salamanders. Detections of Cope's giant salamander and coastal giant salamander were limited to the Cape Disappointment and the Fort Clatsop units, respectively. The invasive American bullfrog was found at one site in Cape Disappointment and two sites in the Fort Clatsop unit.

Species names in this report have been verified and updated based on Crother (2008). Species absence is extremely difficult to determine and it is possible that some species that were not detected during our surveys but recorded historically or occasionally, may still be present in the park. Additional surveys of targeted habitats and unconfirmed species are recommended.

Data from these surveys were incorporated into a network amphibian database developed as a separate project and funded by the NCCN Inventory and Monitoring amphibian inventories (Galvan et al. 2005). We developed this database by consolidating existing network databases containing information relevant to amphibian distributions into one functional relational database, including data resulting from this inventory. The consolidated database describes the locations of amphibians in various life stages identified in pond, stream, and terrestrial surveys conducted within the NCCN. The database includes fields relevant to the study years, park names, survey types, coordinates, elevations, scientific and common names, and life stages. LEWI natural resource staff and the NCCN data managers will assume maintenance responsibilities for the database, including updating it to ensure compliance with NPS data management mandates. Metadata for the database was also included.

Note: This report has had content redacted to protect sensitive information, pursuant to the National Parks Omnibus Management Act, Section 207, 16 U.S.C. 5937. Redacted content is indicated by brackets []. In tables or figures with location information and where no amphibians were found or only sensitive species were found, we have stated "no non-sensitive species found."

This report has had confidential information regarding park-sensitive species locations removed.

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Introduction

The status of amphibian populations has long been a concern in the Pacific Northwest. Habitat requirements of amphibians in late-successional forests of the Pacific Northwest have received some attention by the U.S. Forest Service over the past 15 years but further work is needed to better understand how habitat variation affects population viability. Because amphibian species are associated with riparian systems, understanding the relationships between riparian management and amphibian population dynamics is a high priority. In addition, further work is needed to better understand the population dynamics of rare and locally endemic species.

Amphibians are important members of terrestrial and aquatic ecosystems because they occupy key trophic positions in food webs. As adults they can be top carnivores, and as eggs, larvae or juveniles, they may be the major food source of many other species including birds, mammals, fish and invertebrates. In some forest ecosystems, amphibians may comprise the major component of the vertebrate biomass (Burton and Likens 1975, Bury 1988). Moreover, amphibians are good “bioindicators” of environmental stress because of their complex life histories. Amphibian declines may be an early warning signal that other organisms also may be in danger of decline or extinction (Bury et al. 1980, Blaustein and Wake 1995, Phillips 1990, Wyman 1990, Wake 1991).

In 1994, Mount Rainier National Park (MORA), North Cascades National Park (NOCA) and Olympic National Park (OLYM) identified the lack of information on amphibian species distributions and abundances as the highest priority issue to address cooperatively with the newly created U.S. Geological Survey Biological Resources Division (BRD). The National Park Service (NPS) and BRD began inventories of aquatic breeding amphibians in these parks in 1996. The inventories continued through 1999 and resulted in the first published parkwide survey of amphibians for the park (Tyler et al. 2003, Bury and Adams 2000). Recent Vital Signs workshops for several of the NCCN parks identified amphibians as a high priority taxonomic group for long-term ecological monitoring.

Assessments of the status of amphibian populations in the Pacific Northwest have been difficult to complete because: 1) the number of long-term inventory and monitoring efforts has been limited, and 2) few if any comparable data sets are available (Olson and Leonard 1997). Yet human-related activities have disturbed many amphibian habitats (Fellers and Drost 1993, Blaustein and Wake 1995, Bury 1999). For example, fish stocking, logging practices, and alteration of streams, wetlands, and riparian areas, have had widespread impacts on amphibian communities.

The primary objective of this inventory was to document species presence at Lewis and Clark National Historical Park (LEWI) since the park’s amphibian and reptile lists were incomplete with limited supporting data. Our primary goal was to document, to the 90% verification level, amphibian species found in LEWI to meet the NPS Inventory and Monitoring program goal for vertebrates, which prior to this inventory had limited documentation of amphibians in the Park. Table 1 lists the amphibian species expected to be encountered in LEWI. State and federal species documentation lists, published references and local expertise were used to determine which species were expected to occur in the Park.

This report has had confidential information regarding park-sensitive species locations removed.

Table 1. Amphibian species expected to occur in Lewis and Clark National Historical Park, and their special status designation. T = federal threatened status; ** = federal species of concern; SC= State critical; SE= State Endangered (Washington); SV= State vulnerable; SM= State Monitor (Washington); Category; # = introduced species.

Genus and Species	Common Name	Code	Special Status Species ¹	Non-native Species
Terrestrial Breeding Species				
Caudata — Salamanders				
Ensatinas				
<i>Ensatina eschscholtzii oregonensis</i>	Oregon Ensatina	ENES		
Woodland Salamanders				
<i>Plethodon vehiculum</i>	Western red-backed salamander	PLVE		
<i>Plethodon vandykei</i>	Van Dyke's salamander	PLVA	SV (WA)	
<i>Plethodon dunni</i>	Dunn's salamander	PLDU	SC (WA)	
Climbing Salamanders				
<i>Aneides ferreus</i>	Clouded salamander	ANFE	SV	
Aquatic Breeding Species				
Caudata — Salamanders				
Mole Salamanders				
<i>Ambystoma gracile</i>	Northwestern salamander	AMGR		
<i>Ambystoma macrodactylum</i>	Long-toed salamander	AMMA		
Pacific Newts				
<i>Taricha granulosa</i>	Rough-skinned newt	TAGR		
Pacific Giant Salamanders				
<i>Dicamptodon copei</i>	Cope's giant salamander	DICO	SV, SM	
Torrent Salamanders				
<i>Rhyacotriton kezeri</i>	Columbia torrent salamander	RHKE	SV	
Anurans				
Brown Frogs				
<i>Rana aurora</i>	Northern red-legged frog	RAAU	**	
<i>Rana pretiosa</i>	Oregon spotted frog	RAPR	** , SC, SE	
American Water Frogs				
<i>Lithobates catesbeianus</i> (formerly <i>Rana catesbeiana</i>)	American bullfrog	RACAT		#
Chorus Frogs				
<i>Pseudacris regilla</i>	Northern Pacific treefrog	PSRE		
North American Toads				
<i>Anaxyrus boreas</i> (formerly <i>Bufo boreas</i>)	Western toad	BUBO	SV	

¹ ODFW 2008, USFWS 2013, WDFW 2014.

Study Area

Lewis and Clark National Historical Park (LEWI), is located near the mouth of the Columbia River on the Pacific coast in Clatsop County, Oregon and Pacific County, Washington (Figure 1). The purpose of the park is to preserve the historic, cultural, scenic, and natural resources associated with the arrival of the Lewis and Clark Expedition in the lower Columbia River area, and for the purpose of commemorating the culmination and the winter encampment of the Lewis and Clark Expedition in the winter of 1805-1806 following its successful crossing of the North American continent.

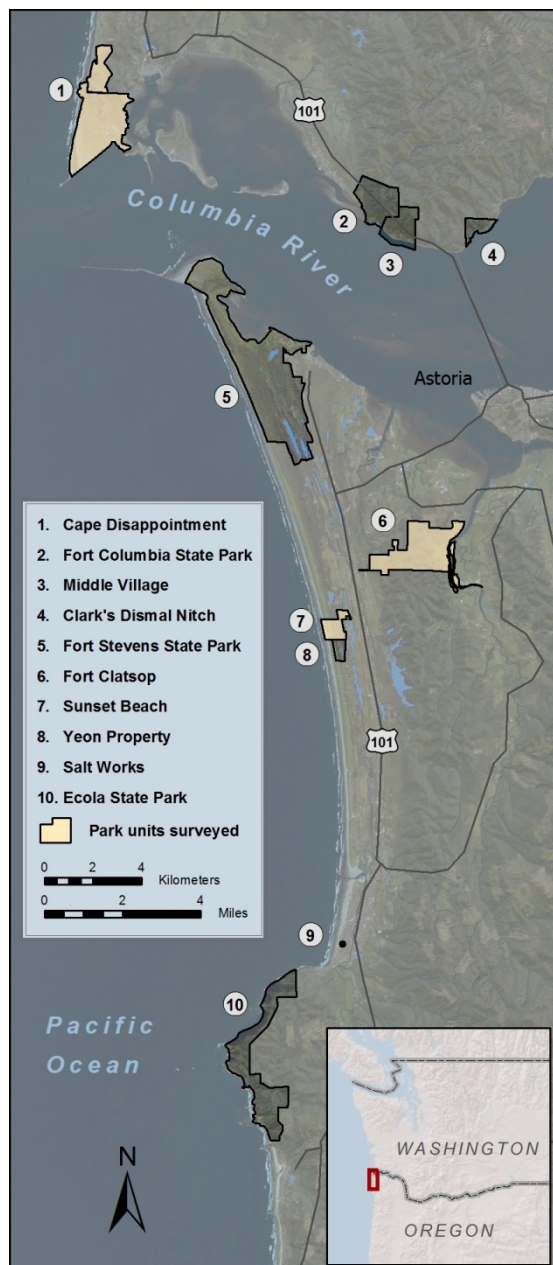


Figure 1. Lewis and Clark National Historical Park units and state parks.

This report has had confidential information regarding park-sensitive species locations removed.

The park is composed of nine disconnected units in Oregon and Washington. The central unit of the park is the Fort Clatsop site in Oregon, which was first established as a National Memorial in 1958, and the first area included in this inventory in 2002. The Fort Clatsop unit was expanded to about 1200 acres in 2002 under the Fort Clatsop Boundary Expansion Act. A major expansion came in 2004 with the passage of the Lewis and Clark National Historical Park Designation Act, which added units in Washington and additional sites in Oregon. Some of these additions were inventoried in 2005. The park now covers a total of 3,358 acres.

Six units within the park are managed or co-managed by LEWI with three in Washington: Cape Disappointment, Middle Village/Station Camp, and Dismal Nitch; and three in Oregon: Sunset Beach (and the recently added Yeon property), Fort Clatsop, and the Salt Works. LEWI also has cooperative relationships with three state parks: Fort Columbia, Fort Stevens, and Ecola State Parks.

Kagan et al. (2012), described vegetation habitat within LEWI. The park lies entirely within the Coast Range ecosystem. The climate along the coast is cool and wet, with average rainfall ranging around 179-254 cm (70-100 inches) per year. Winters and summers are mild with an average high of 19.5°C (67°F) and low of 1.5°C (35°F). The landscape along the coastline features rocky shores and headlands to sandy dunes, and transitions to temperate forest inland. A mosaic of prairie, forest, herbaceous, shrubland, and wetland habitats are present within LEWI. Forests are dominated by Sitka spruce (*Picea sitchensis*) with Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and red alder (*Alnus rubra*). Shore pine (*Pinus contorta*) has been widely planted for dune stabilization. Salt marshes and tidal wetlands are found along the coast, the Columbia River, and the Lewis and Clark River. Extensive wetlands in the park include fringing saltmarshes on the lower Columbia River, the tidally-influenced lower Lewis and Clark River and many low-gradient brackish sloughs and marshes. Freshwater streams and springs are numerous in park forests, and freshwater ponds are found in various habitats.

Land ownership maps and wetland maps were searched for all suitable habitats for which a safe and legal access route could be found. Sites within the original Fort Clatsop unit were inventoried in 2002. Sites in Cape Disappointment and Sunset Beach, as well as additional sites now within the Fort Clatsop unit were surveyed in 2005. Other areas within LEWI were not surveyed because property acquisition was still pending at the time of the 2005 surveys, or no amphibian habitat was present. A summary of site coordinates and elevation are presented in Table 3.

Fort Clatsop National Memorial (FOCL)

FOCL is located near the northwest corner of Oregon, just south of Astoria, and at the time of the initial survey, encompassed 125.2 acres. The topography of the FOCL unit varies from estuarine mudflats in the Lewis and Clark valley to steeper forested slopes and benches of the eastern toe-slope of Clatsop Ridge, the northern-most portion of the Oregon Coast Range. Elevation ranges from 6 feet to 60 feet. Fort Clatsop National Memorial contains several small, unnamed streams and several ephemeral or perennial springs. Ten types of wetlands occur within the park in palustrine, estuarine and riverine systems, as identified by the National Wetland Inventory, and ranging in size from a few square feet to many acres. Wetlands comprise approximately half the unit's acreage (NPS 1994). Wetlands are found along the Lewis and Clark River, adjacent to streams and springs, and in isolated

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pockets within upland swale depressions. Upland vegetation consists of upland forests of alder, big-leaf maple, wet hemlock, and Sitka spruce, as well as disturbed forest and non-native herbaceous vegetation types (Kagan et al. 2012). Sites inventoried in Fort Clatsop are noted in Figure 2. Field sites within the original boundary are designated by “FC” in Table 3 and Figure 3.

Fort Clatsop Expansion

The Fort Clatsop National Memorial Expansion Act and Lewis and Clark National Historical Park Designation Act added approximately 1,080 acres to the Fort Clatsop Unit including the top of the Clatsop Ridge between 2002 and 2005. Elevations range from 6 feet to 300 feet. The majority of the added acreage was former industrial timberland consisting of planted western hemlock and Douglas-Fir. The expanded acreage also includes red alder uplands, red alder riparian areas, and Sitka spruce swamps (Kagan 2012). Field sites in the expanded Fort Clatsop unit are designated by “LE” in Table 3 and Figure 3.

Cape Disappointment

Cape Disappointment State Park (formerly Fort Canby State Park) is the northernmost unit of LEWI and is a 1,882-acre Washington State Park on the Long Beach Peninsula, fronted by the Pacific Ocean. Vegetation and habitat consists of open water wetlands, salt and brackish marsh, willow swamp, alder swamp/riparian, conifer swamp/riparian; and upland forests of alder, mesic hemlock, Sitka spruce; pine, shrub, and grass dune; and herbaceous headland vegetation types (Kagan et al. 2012). Sites inventoried in Cape Disappointment are noted in Table 3 and Figure 4.

Sunset Beach

This 120-acre recreation area is about 10 miles south of Astoria, OR, marks the west trailhead of the Fort-to-Sea Trail - a 6.5 mile route that recreates the experience Lewis and Clark and the Corps of Discovery encountered as they traveled between Fort Clatsop and the Pacific Ocean during the famous winter of 1805-1806. Sunset Beach contains open water wetlands, and vegetation types including willow swamps, freshwater marshes, and dune vegetation (shrubs, pines, and grasses), as well as non-native herbaceous (Kagan et al. 2012). Sites inventoried in Sunset Beach are noted in Table 3 and Figure 5.

Methods

The focus of the surveys at LEWI was to inventory and confirm presence of amphibian species. Aquatic and terrestrial surveys were conducted. Incidental observations were also recorded. Surveys were conducted in the spring of 2002 (April 30 to May 9) and 2005 (from March 29 to April 21).

All amphibians encountered were recorded on data sheets. Photographs depicting key identification characteristics were taken for previously unconfirmed species. No voucher specimens were collected.

Survey Site Selection

Land ownership maps and wetland maps were searched for all suitable habitats for which a safe and legal access route could be found. Habitats surveyed are described below.

Aquatic Surveys

Aquatic lentic habitats included ponds, lakes, and wetland complexes; and in 2005 surveys included the surrounding terrestrial areas. Aquatic habitats were described and surveyed with visual searches conducted according to modified protocols initially developed by Dr. Michael J. Adams, USGS-BRD (Appendix A), under the Amphibian Research and Monitoring Initiative (ARMI). Visual surveys of ponds and palustrine or estuarine wetlands were conducted by a minimum of two people. Surveyors walked the perimeter of the wetland, stopping every 10 m or at 20 evenly spaced 8 stations to scan for embryos and larvae. One person waded and the other person walked on shore. All amphibian life stages observed while walking the perimeter were recorded. Dip net sweeps were made to capture individuals to ensure definitive species identification. Identified animals were released at the point of capture. Cover items were moved to check for larvae. Vegetated areas and other habitats likely to harbor embryos and larvae were also searched. Field habitat was documented through mapping and measurements including environmental zones (littoral, riparian, inlet/outlet stream channels, limnetic) and macrohabitat; air and water temperatures; water depth; aquatic vegetation; and substrate including coarse woody debris.

Aquatic lotic habitats included streams, springs, and riverine wetlands, and in 2005, surveys included the surrounding terrestrial areas. In 2002, visual surveys of lotic areas were conducted using protocols described by Tory, et al. (2003) except that the entire stream was surveyed rather than 100m segments. Two surveyors moving upstream carefully searched for amphibians by an initial visual inspection of the area from wetted stream bank to wetted stream bank. Next, crew members searched for amphibians by lifting and replacing habitat features of the stream substrata such as woody debris and rocks across the stream width. Crew members carefully searched habitat edges and crevices by probing with feet, hands, or D-net, to flush animals into visible locations. Since all survey streams were < 2m width, habitats were systematically inspected for amphibians from one bank to the other. Amphibians were captured with D-nets or aquarium nets during surveys. Captured amphibians were measured and identified to species and life stage before release at capture sites following completion of the survey. Amphibian life stages were identified for each animal encountered.

This report has had confidential information regarding park-sensitive species locations removed.

In 2005, the aquatic visual surveys were used for all sites surveyed. The lentic areas were often massive wetlands and pond networks created by beavers. The lotic systems were typically tiny low gradient streams <0.5m wide. The streams surveyed at the Fort Clatsop expansion were extremely impacted by several rounds of logging. These streams were too small and slow moving to use standard stream survey protocols. While surveying the aquatic systems we also conducted surveys of areas surrounding surface waters including streamside and forested areas, using light touch techniques to detect terrestrial breeding amphibian species.

Fish Presence

Fish presence in aquatic breeding sites was documented to further characterize amphibian habitat. Lake and pond shallows, lake surfaces, and inlets and outlets were searched for fish presence and recorded on datasheets as presence or not detected and species, if known.

Water quality

Water quality of aquatic breeding sites was characterized at 46 sites. A HACH Sension 156 multi-parameter meter was used to measure pH, conductivity ($\mu\text{S}/\text{cm}$), and dissolved oxygen (mg/L). In addition, water sample dissolved oxygen and conductivity were determined in the field at some sites using a YSI 57 Dissolved Oxygen and a self-calibrating Hach™ 44600 portable meter, respectively. All meters were calibrated before use. The pH meter was calibrated with prepared pH buffer and check solutions. Electrodes were triple-rinsed with de-ionized water between uses. Air and water temperatures were measured with a stem thermometer. Air temperature was measured in the shade and one meter above ground. Water temperature was measured 10 cm below the surface of the water.

Terrestrial Surveys

Surveys for terrestrial breeding amphibians the Fort Clatsop unit were conducted in 2002 only due to time constraints, and with the goal of documenting as many species as possible, we abandoned this method for surveys in 2005. In 2002, a number of plots (with a radius of 30m) were established for each area with suitable habitat present. Where possible, the center of each plot was at least 75 m from any forest edge. Searches for amphibians were made within these plots for a minimum of 30 minutes. Search time was doubled or tripled in some cases if amphibian habitat was spatially complex.

Field habitat measurements were taken to aid in future amphibian studies but detailed analysis of these data is beyond the scope of this inventory report. Field habitat measurements were recorded from the center of each plot and included the primary forest association series (see Appendix C); canopy cover to the nearest 20%; slope and aspect; presence of streams, seeps, or talus; the relative percent cover of each overstory species present and any deciduous trees present; size class categories for the percent of stems from each tree species; the absolute cover of understory components for the three most dominant species in each category, using the six cover categories, and the percent cover of grasses, mosses, and large organic debris. Course woody debris was recorded for four survey sites. The distance (cm) that the line was in contact with down wood was recorded along with the decay class for each object. These habitat data in Appendix C have been entered, verified, and stored electronically in the NCCN Inventory Project workspace on the Olympic National Park file server for future use.

This report has had confidential information regarding park-sensitive species locations removed.

Each plot was searched for a minimum of 30 worker-minutes during daylight (>one hour after sunrise and before sunset). A search consisted of workers methodically visually searching for amphibians over the entire area of the plot and looking under as much loose wood, bark, or rock that can be lifted and restored to a condition similar to its original state.

Surveys for terrestrial breeding species in 2005 were conducted using the visual survey techniques, as described above under the Aquatic Surveys, combined with methodical visual searches for amphibians over the entire site surrounding water bodies, searching under loose wood, bark, or rock. Visual searches for terrestrial amphibians were also conducted along stream banks.

Incidental Observations

When unmapped amphibian habitat was encountered, field crews surveyed these areas and recorded the area and amount of time the area was searched; general habitat description; location coordinates; general weather conditions; species encountered life stage; and snout-vent length. Incidental surveys were also used in areas of thick brush.

Voucher Specimens

All amphibians encountered were recorded on data sheets. Photographs depicting key identification characteristics were taken for previously most unconfirmed species. No voucher specimens were collected but voucher photographs were taken for most species observed. Tail clips were collected from Giant Salamanders for DNA analysis to confirm identification of Pacific or Cope's giant salamander.

In 2005, 34 tail clips were collected from Pacific giant salamanders (*Dicamptodon* species) from 13 sites in three watersheds to confirm the identification of Pacific or coastal giant salamander and Cope's giant salamander through DNA analysis. Snout-vent length, life stage of animal, location and elevation of samples collected is presented in Table 2. DNA analysis was conducted by Dr. Andrew Storfer, School of Biological Sciences, Washington State University, Pullman, Washington.

This report has had confidential information regarding park-sensitive species locations removed.

Table 2. Date, tail clip identification number, snout-vent length of animal, life stage of animal, location (in UTM), and elevation for *Dicamptodon* sp. from Lewis and Clark National Historical Park. [* sensitive species location removed].

Site ID	Watershed	Date	Tail Clip Num.	SVL (mm)	Life Stage	UTM E	UTM N	Elevation (ft) ¹
LE2	Lower Lewis And Clark River	29-Mar-05	CLIP 3	82	A	431281	5108803	49.93
LE3	Lower Lewis And Clark River	29-Mar-05	CLIP 1	65	A	431226	5108667	78.02
LE3	Lower Lewis And Clark River	29-Mar-05	CLIP 2	82	A	431226	5108667	78.02
LE4	Lower Lewis And Clark River	29-Mar-05	CLIP 4	25	L	431316	5109547	47.78
LE7	Lower Lewis And Clark River	30-Mar-05	CLIP 5	50	L	430941	5109657	93.79
LE10	Skipanon River	31-Mar-05	CLIP 6	27	L	430593	5108525	86.57
LE11	Skipanon River	31-Mar-05	CLIP 7	48	L	430514	5108342	83.84
LE11	Skipanon River	31-Mar-05	CLIP 8	65	L	430514	5108342	83.84
LE11	Skipanon River	31-Mar-05	CLIP 9	25	L	430514	5108342	83.84
LE14	Lower Lewis And Clark River	5-Apr-05	CLIP 10	26	L	430866	5108339	163.92
LE14	Lower Lewis And Clark River	5-Apr-05	CLIP 11	24	L	430866	5108339	163.92
LE14	Lower Lewis And Clark River	5-Apr-05	CLIP 12	50	L	430866	5108339	163.92
LE15	Lower Lewis And Clark River	5-Apr-05	CLIP 13	52	L	430825	5108217	172.39
LE15	Lower Lewis And Clark River	5-Apr-05	CLIP 14	48	L	430825	5108217	172.39
LE15	Lower Lewis And Clark River	5-Apr-05	CLIP 15	42	L	430825	5108217	172.39
LE17	Skipanon River	5-Apr-05	CLIP 16	48	L	430119	5108812	88.30
LE17	Skipanon River	5-Apr-05	CLIP 17	52	L	430119	5108812	88.30
LE17	Skipanon River	5-Apr-05	CLIP 18	45	L	430119	5108812	88.30
LE17	Skipanon River	5-Apr-05	CLIP 19	26	L	430119	5108812	88.30
LE17	Skipanon River	5-Apr-05	CLIP 20	24	L	430119	5108812	88.30
LE17	Skipanon River	5-Apr-05	CLIP 21	36	L	430119	5108812	88.30
LE18	Skipanon River	6-Apr-05	CLIP 22	22	L	430038	5108490	56.35
LE18	Skipanon River	6-Apr-05	CLIP 23	28	L	430038	5108490	56.35
LE18	Skipanon River	6-Apr-05	CLIP 24	28	L	430038	5108490	56.35
LE20	Skipanon River	7-Apr-05	CLIP 25	58	L	429814	5108382	38.15
LE20	Skipanon River	7-Apr-05	CLIP 26	45	L	429814	5108382	38.15
LE20	Skipanon River	7-Apr-05	CLIP 27	42	L	429814	5108382	38.15
LE20	Skipanon River	7-Apr-05	CLIP 28	23	L	429814	5108382	38.15
LE20	Skipanon River	7-Apr-05	CLIP 29	42	L	429814	5108382	38.15
*			CLIP 1A	35	L			
*			CLIP 2A	23	L			
*			CLIP 3A	22	L			
*			CLIP 4A	58	L			
*			CLIP 5A	63	L			

¹Elevation derived from GIS using DEM (digital elevation model) data derived from LIDAR

This report has had confidential information regarding park-sensitive species locations removed.



Figure 2. Cape Disappointment State Park, 2005 survey (CD01).

Results

Forty-six aquatic and five terrestrial surveys were conducted in 2002, and 2005, and an additional 14 incidental observations were documented. A total area of 99214 m² was searched in 11,218 minutes, over 21 days. All surveys were conducted between April 30, 2002 and May 9, 2002, and between March 29, 2005 and April 21, 2005.

Sites within the original Fort Clatsop unit were inventoried in 2002. Sites in Cape Disappointment and Sunset Beach, as well as additional sites now within the Fort Clatsop unit were surveyed in 2005. Other areas within LEWI were not surveyed because property acquisition was still pending at the time of the 2005 surveys, or no amphibian habitat was present. A summary of site coordinates and elevation are presented in Table 3.

Table 3. Lewis and Clark National Historical Park survey site locations, watersheds, and associated Universal Transverse Mercator (UTM) coordinates and elevation.

Field Site ID	Location Description	Watershed	Date	UTM E NAD 83	UTM N NAD 83	Elevation (m) ¹	Elevation (ft) ¹
FC1	Maintenance Road to Burn Shed	Lower Lewis And Clark River	30-Apr-02	432344	5109254	1.01	3.32
FC2	Ditch S. of Dike on S. side of Lewis & Clark River	Lower Lewis And Clark River	30-Apr-02	432512	5109018	1.09	3.59
FC3	Salamander Creek drainage	Lower Lewis And Clark River	1-May-02	431764	5109396	17.49	57.38
FC4	east of FC3	Lower Lewis And Clark River	1-May-02	431866	5109403	17.25	56.58
FC5	Boundary Trail & Perkins Road	Lower Lewis And Clark River	1-May-02	431709	5109190	14.35	47.09
FC6	Lewis and Clark drainage	Lower Lewis And Clark River	1-May-02	432162	5109372	2.83	9.29
FC7	Near Maintenance Yard	Lower Lewis And Clark River	1-May-02	432195	5109422	3.99	13.09
FC8	Boundary Trail, Near Salamander Creek	Lower Lewis And Clark River	2-May-02	431731	5109312	19.85	65.12
FC9	Boundary Trail & Perkin's Road	Lower Lewis And Clark River	2-May-02	431706	5109168	15.20	49.88
FC10	Maintenance Road to Burn Shed	Lower Lewis And Clark River	2-May-02	432359	5109482	3.00	9.85
FC11	Lewis and Clark drainage	Lower Lewis And Clark River	2-May-02	431894	5109183	3.33	10.94

This report has had confidential information regarding park-sensitive species locations removed.

Table 3. Lewis and Clark National Historical Park survey site locations, watersheds, and associated Universal Transverse Mercator (UTM) coordinates and elevation (continued).

Field Site ID	Location Description	Watershed	Date	UTM E NAD 83	UTM N NAD 83	Elevation (m) ¹	Elevation (ft) ¹
FC12	old county road between clay pond & Iron spring	Lower Lewis And Clark River	2-May-02	431814	5109112	8.93	29.30
FC13	Dike Between Canoe landing & S. Park Boundary	Lower Lewis And Clark River	2-May-02	432235	5108838	0.08	0.25
FC14	Clay Pot Pond (S of Visitor Parking Lot)	Lower Lewis And Clark River	7-May-02	431953	5109146	2.48	8.15
FC15	Association Pond on N boundary of park	Lower Lewis And Clark River	7-May-02	432476	5109607	3.35	10.99
FC16	Willow Thicket on Association Land (reed canary grass)	Lower Lewis And Clark River	7-May-02	432445	5109488	2.80	9.20
FC17	Willow Thicket on Association Land (ephemeral pool)	Lower Lewis And Clark River	7-May-02	432466	5109431	0.04	0.12
FC18	Dike east of burn shed	Lower Lewis And Clark River	7-May-02	432431	5109231	2.59	8.51
FC19	Small slough East of Historic spring	Lower Lewis And Clark River	7-May-02	432364	5109225	1.87	6.13
FC20	Forest between VC and overflow parking	Lower Lewis And Clark River	7-May-02	432032	5109190	2.73	8.94
FC21	Wetland below Iron Spring	Lower Lewis And Clark River	7-May-02	432019	5109010	2.62	8.60
FC22	Salamander Creek from confluence of Hansen Creek to Headwaters	Lower Lewis And Clark River	8-May-02	431705	5109364	19.68	64.55
FC23A RMI	ARMI Alder Creek (high tide level to Park boundary)	Lower Lewis And Clark River	8-May-02	431924	5108905	1.77	5.82
FC23T HERP	THERP Alder Creek drainage	Lower Lewis And Clark River	9-May-02	431924	5108905	1.77	5.82
FC24	Historic Spring near Fort Clatsop	Lower Lewis And Clark River	9-May-02	432231	5109188	0.02	0.08
LE1	Lewis and Clark drainage	Lower Lewis And Clark River	29-Mar-05	431412	5108690	17.15	56.27
LE2	Lewis and Clark drainage	Lower Lewis And Clark River	29-Mar-05	431281	5108803	15.22	49.93

This report has had confidential information regarding park-sensitive species locations removed.

Table 3. Lewis and Clark National Historical Park survey site locations, watersheds, and associated Universal Transverse Mercator (UTM) coordinates and elevation (continued).

Field Site ID	Location Description	Watershed	Date	UTM E NAD 83	UTM N NAD 83	Elevation (m) ¹	Elevation (ft) ¹
LE3	Lewis and Clark drainage	Lower Lewis And Clark River	29-Mar-05	431226	5108667	23.78	78.02
LE4	Lewis and Clark drainage	Lower Lewis And Clark River	29-Mar-05	431316	5109547	14.56	47.78
LE5	Lewis and Clark drainage	Lower Lewis And Clark River	30-Mar-05	430604	5109091	50.40	165.35
LE6	Lewis and Clark drainage	Lower Lewis And Clark River	30-Mar-05	430689	5109001	44.73	146.74
LE7	Lewis and Clark drainage	Lower Lewis And Clark River	30-Mar-05	430941	5109657	28.59	93.79
LE8	Skipanon drainage	Skipanon River	30-Mar-05	429535	5108106	11.71	38.43
LE9	Skipanon drainage	Skipanon River	30-Mar-05	429402	5108182	18.55	60.86
LE10	Skipanon drainage	Skipanon River	31-Mar-05	430593	5108525	26.39	86.57
LE11	Skipanon drainage	Skipanon River	31-Mar-05	430514	5108342	25.56	83.84
LE12	Lewis and Clark drainage	Lower Lewis And Clark River	4-Apr-05	431996	5108568	2.62	8.61
LE13	Lewis and Clark drainage	Lower Lewis And Clark River	4-Apr-05	431760	5108382	2.98	9.76
LE14	Lewis and Clark drainage	Lower Lewis And Clark River	5-Apr-05	430866	5108339	49.96	163.92
LE15	Skipanon drainage	Lower Lewis And Clark River	5-Apr-05	430825	5108217	52.55	172.39
LE16	Skipanon drainage	Skipanon River	5-Apr-05	430009	5108806	36.26	118.97
LE17	Skipanon drainage	Skipanon River	5-Apr-05	430119	5108812	26.91	88.30
LE18	Skipanon drainage	Skipanon River	6-Apr-05	430038	5108490	17.18	56.35
LE19	Skipanon drainage	Skipanon River	6-Apr-05	429881	5108571	7.56	24.79
LE20	Skipanon drainage	Skipanon River	7-Apr-05	429814	5108382	11.63	38.15
LE21	Skipanon drainage	Skipanon River	7-Apr-05	429582	5108246	17.04	55.90
LE22	Lewis and Clark drainage clay pond	Lower Lewis And Clark River	11-Apr-05	431952	5109239	9.05	29.71
LE23	Lewis and Clark drainage Netul Pond closes to s. entrance	Lower Lewis And Clark River	11-Apr-05	432292	5107574	2.81	9.22
LE24	Lewis and Clark drainage Netul north ponds/stream	Lower Lewis And Clark River	11-Apr-05	432231	5107908	3.53	11.57

This report has had confidential information regarding park-sensitive species locations removed.

Table 3. Lewis and Clark National Historical Park survey site locations, watersheds, and associated Universal Transverse Mercator (UTM) coordinates and elevation (continued).

Field Site ID	Location Description	Watershed	Date	UTM E NAD 83	UTM N NAD 83	Elevation (m) ¹	Elevation (ft) ¹
LE25	Lewis and Clark drainage wetland across from Netul Landing	Lower Lewis And Clark River	12-Apr-05	432520	5107668	2.67	8.77
LE26	Sunset Beach Pond south of road across from trailhead	Lower Necanicum River	12-Apr-05	427638	5105460	7.21	23.65
LE27	Lewis and Clark drainage - Association Pond	Lower Lewis And Clark River	13-Apr-05	432415	5109795	3.04	9.96
LE28	Sunset Beach Wetland just N or parking lot	Lower Necanicum River	13-Apr-05	427670	5105578	7.61	24.96
LE29	Sunset Beach (biggest lake)	Lower Necanicum River	13-Apr-05	427542	5106009	7.42	24.34
LE30	Lewis and Clark drainage - wetland at end of Hansen Creek	Lower Lewis And Clark River	14-Apr-05	431875	5109801	2.49	8.15
CD1	Wetland 500m NW of McKenzie Head	Long Beach	18-Apr-05	417719	5126748	4.88	16.00
CD2	Tributary to stream on side of Loop Road (side trib) west of Robert Gray Dr, east of N. Head Rd.	Chinook River	19-Apr-05	418804	5127300	24.26	79.61
CD3	West of Robert Gray Dr, east of N. Head Rd.; SW of CD2	Chinook River	19-Apr-05	418687	5127268	10.37	34.02
CD4	Stream draining S. from Spur Road to N. Head Light House	Long Beach	19-Apr-05	417720	5127476	23.46	76.96
CD5	Stream that feeds lake O'Neil	Long Beach	19-Apr-05	418245	5127392	11.57	37.96
CD6	Lake McKenzie	Long Beach	20-Apr-05	418111	5126101	3.91	12.83
CD7	Beards Hollow wetland	Long Beach	20-Apr-05	418060	5128600	5.97	19.58
CD8	O'Neil Lake, and large wetland to the North	Long Beach	20-Apr-05	418454	5126322	5.07	16.64
CD9	Drainage off N. Head flowing NW by Beards Hollow	Long Beach	21-Apr-05	417554	5128372	33.31	109.30
CD10	Stream just s. of Beard's Hollow	Long Beach	21-Apr-05	417926	5128159	32.61	107.00

¹Elevation derived from GIS using DEM (digital elevation model) data derived from LIDAR

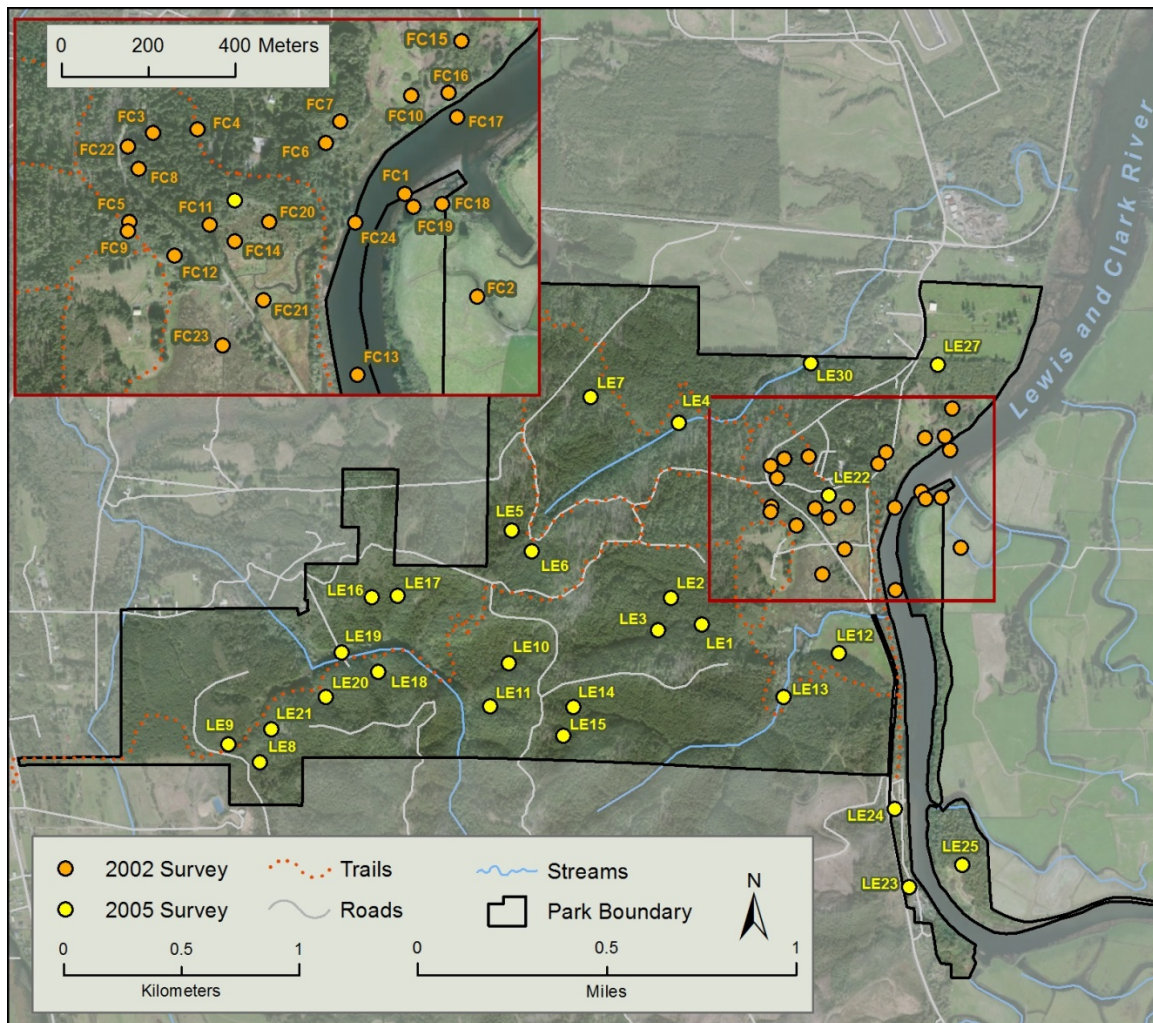


Figure 3. Amphibian survey site locations at Fort Clatsop unit.

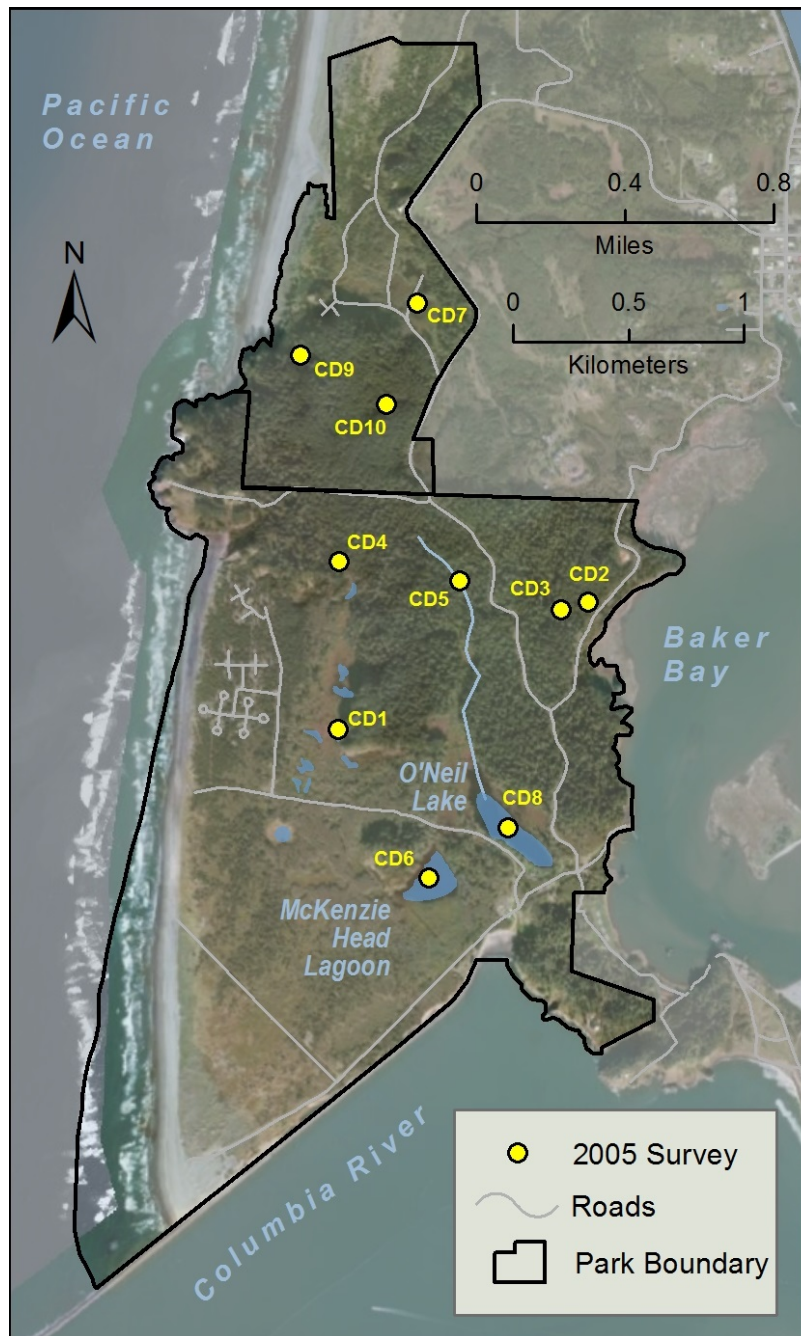


Figure 4. Amphibian survey site locations at Cape Disappointment unit.

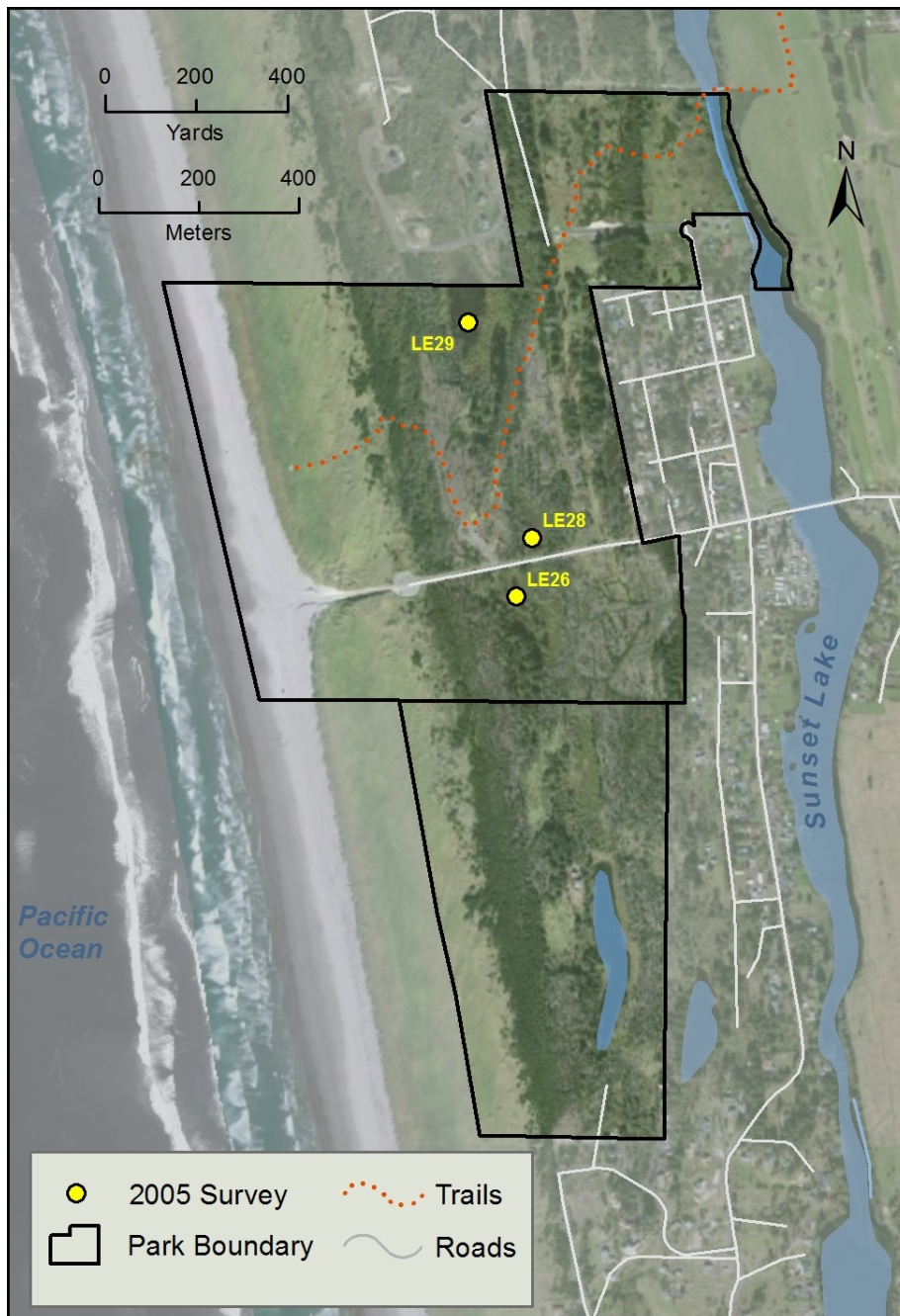


Figure 5. Amphibian survey site locations at Sunset Beach unit.

This report has had confidential information regarding park-sensitive species locations removed.

Amphibian observations are mapped in Figures 6 through 9. Results for all survey locations are summarized below (Table 4) and in Figure 10. Detailed results by species, life stage, and total count at each survey location are presented in Appendix B. Aquatic and terrestrial habitats for amphibian species detected are presented in Figures 11 and 12.

Ten of the expected 15 amphibian species were documented for LEWI and one additional species not expected but documented. Species detected in LEWI were the northwestern salamander, Columbia torrent salamander, rough-skinned newt, Cope's giant salamander, *Ensatina*, western red-back salamander, Dunn's salamander, northern Pacific treefrog, northern red-legged frog, and American bullfrog. We also detected Pacific giant salamander, which had not been on our "expected" species list.

Several survey sites had more than one species present. Two species were detected at 12 sites, three species were detected at 16 sites, 4 species were detected at 10 sites, and five species were detected at four sites (all within the Fort Clatsop unit).

Fish were present at 16 sites: five in the Cape Disappointment unit, 10 in the Fort Clatsop unit, and one in the Sunset Beach unit. Fish species observed included sculpin (19%), stickleback (52%), largemouth bass (10%), yellow perch (5%), and coho salmon (14%). Aquatic breeding species occurrence with fish at these sites included northwestern salamander, rough-skinned newt, northern Pacific treefrog, northern red-legged frog, American bull frog, and coastal giant salamander.

This report has had confidential information regarding park-sensitive species locations removed.

Table 4. Survey sites description and location, and all species detected [sensitive species removed].

Site ID	Date	Area Surveyed (m2)	Search Minutes	Survey Type	Location Description	Amphibian Species	Other Species
CD1	4/18/2005	4000	480	Aquatic	Cape Disappointment - wetland 500m nw of mckenzie head	AMGR, PSRE, RAAU, TAGR	stickleback
CD2	4/19/2005	3	60	Aquatic	Cape Disappointment - tributary to stream on side of Loop Road (side trib) west of Robert Gray Dr, east of N. Head Rd.	RAAU	
CD3	4/19/2005	18	180	Aquatic	Cape Disappointment - west of Robert Gray Dr, east of N. Head Rd.; sw of CD2	RAAU, PLVE, TAGR	
CD4	4/19/2005	18	180	Aquatic	Cape Disappointment - stream draining s. from spur road to n. head light house	ENES, RAAU, PLVE	
CD5	4/19/2005	150	190	Aquatic	Cape Disappointment - stream that feeds Lake O'Neil, west of N. Head Rd.	TAGR, RAAU, PLVE	sculpin
CD6	4/20/2005	1000	420	Aquatic	Cape Disappointment - Lake Mckenzie	PSRE, RACAT, TAGR	stickleback, largemouth bass, yellow perch
CD7	4/20/2005	1000	240	Aquatic	Cape Disappointment - Beards Hollow wetland	RAAU, TAGR, PSRE, AMGR	stickleback
CD8	4/20/2005	70000	300	Aquatic	Cape Disappointment - Oneil Lake, and huge wetland to north	RAAU, PSRE, TAGR	stickleback, largemouth bass
CD9	4/21/2005	10	180	Aquatic	Cape Disappointment - Drainage off N. Head flowing NW by Beards Hollow	No non- sensitive species found	
CD10	4/21/2005	3	90	Aquatic	Cape Disappointment - Stream just s. of Beard's Hollow	TAGR, RAAU	
FC1	4/30/2002	20	30	Incidental	Fort Clatsop - Maintenance Road to Burn Shed	ENES, RAAU	

This report has had confidential information regarding park-sensitive species locations removed.

Table 4. Survey sites description and location, and all species detected [sensitive species removed] (continued).

Site ID	Date	Area Surveyed (m2)	Search Minutes	Survey Type	Location Description	Amphibian Species	Other Species
FC2	4/30/2002	240	80	Aquatic	Fort Clatsop - ditch across Lewis & Clark River	AMGR, PSRE, RAAU	
FC3	5/1/2002	2827	60	Terrestrial	Fort Clatsop - Salamander Creek drainage	ENES, PLVE, TAGR	
FC4	5/1/2002	2827	60	Terrestrial	Fort Clatsop - East of FC3	ENES, PLVE	
FC5	5/1/2002	0.5	2	Incidental	Fort Clatsop - Boundary Trail & Perkins Road	PLVE	
FC6	5/1/2002	2827	90	Terrestrial	Fort Clatsop -Lewis and Clark drainage	RAAU	
FC7	5/1/2002	1	4	Incidental	Near Maintenance Yard	PLVE	
FC8	5/2/2002	10	30	Incidental	Fort Clatsop - Boundary Trail, Near Salamander Creek	ENES	
FC9	5/2/2002	20	40	Incidental	Fort Clatsop - Boundary Trail & Perkin's Road	PLVE	
FC10	5/2/2002	30	60	Incidental	Fort Clatsop - Maintenance Road to Burn Shed	ENES	
FC11	5/2/2002	2827	60	Terrestrial	Fort Clatsop - Lewis and Clark drainage	ENES, PLVE, RAAU	
FC12	5/2/2002	1	2	Incidental	Fort Clatsop - old county road between clay pond & Iron spring	RAAU	
FC13	5/2/2002	360	120	Incidental	Fort Clatsop - Dike Between Canoe landing & S. Park Boundary	AMGR, PSRE	
FC14	5/7/2002	80	50	Aquatic	Fort Clatsop - Clay Pit Pond (S of Visitor Parking Lot)	AMGR, RAAU	
FC15	5/7/2002	200	60	Aquatic	Fort Clatsop - Association Pond on N boundary of park	AMGR, RAAU	
FC16	5/7/2002	5	10	Incidental	Fort Clatsop - Willow Thicket on Association Land (reed canary grass)	RAAU	
FC17	5/7/2002	5	10	Incidental	Fort Clatsop - Willow Thicket on Association Land (ephemeral pool)	RAAU	

This report has had confidential information regarding park-sensitive species locations removed.

Table 4. Survey sites description and location, and all species detected [sensitive species removed] (continued).

Site ID	Date	Area Surveyed (m2)	Search Minutes	Survey Type	Location Description	Amphibian Species	Other Species
FC18	5/7/2002	1	5	Incidental	Fort Clatsop - Dike east of burn shed	RAAU	
FC19	5/7/2002	40	40	Incidental	Fort Clatsop -Small slough East of Historic spring	RAAU	
FC20	5/7/2002	100	60	Incidental	Fort Clatsop - Forest between VC and overflow parking	RAAU	
FC21	5/7/2002	100	60	Incidental	Fort Clatsop - Wetland below Iron Spring	RAAU	
FC22	5/8/2002	100	240	Aquatic	Fort Clatsop - Salamander Creek from confluence of Hansen Creek to Headwaters	No non-sensitive species found	
FC23 - A	5/8/2002	200	510	Aquatic	Fort Clatsop -Alder Creek (high tide level to Park boundary)	PLVE, RAAU	sculpin, coho salmon
FC23 - T	5/9/2002	2827	300	Terrestrial	Fort Clatsop - Alder Creek drainage	PLVE, PSRE, RAAU	
FC24	5/9/2002	15	120	Aquatic	Historic Spring near Fort Clatsop	No non-sensitive species found	unknown fish
LE1	3/29/2005	9	90	Aquatic	Fort Clatsop - Lewis and Clark drainage	No non-sensitive species found	
LE2	3/29/2005	8	120	Aquatic	Fort Clatsop-Lewis and Clark drainage	PLVE, DITE, PSRE, ENES	
LE3	3/29/2005	8	150	Aquatic	Fort Clatsop-Lewis and Clark drainage	PLVE, DITE	
LE4	3/29/2005	88	150	Aquatic	Fort Clatsop-Lewis and Clark drainage	PLVE, DITE	sculpin
LE5	3/30/2005	3	90	Aquatic	Fort Clatsop-Lewis and Clark drainage	No non-sensitive species found	
LE6	3/30/2005	8	180	Aquatic	Fort Clatsop-Lewis and Clark drainage	TAGR	
LE7	3/30/2005	4	320	Aquatic	Fort Clatsop-Lewis and Clark drainage	DITE, PLVE	
LE8	3/30/2005	220	140	Aquatic	Fort Clatsop - Skipanon drainage	AMGR, PSRE, RAAU, TAGR	sculpin
LE9	3/30/2005	8	120	Aquatic	Fort Clatsop - Skipanon drainage	No non-sensitive species found	
LE10	3/31/2005	4	190	Aquatic	Fort Clatsop - Skipanon drainage	PLVE, ENES, DITE	

This report has had confidential information regarding park-sensitive species locations removed.

Table 4. Survey sites description and location, and all species detected [sensitive species removed] (continued).

Site ID	Date	Area Surveyed (m2)	Search Minutes	Survey Type	Location Description	Amphibian Species	Other Species
LE11	3/31/2005	15	180	Aquatic	Fort Clatsop - Skipanon drainage	TAGR, DITE, PLVE	
LE12	4/4/2005	300	330	Aquatic	Fort Clatsop - Lewis and Clark drainage	PSRE, TAGR, RAAU, AMGR, RACAT	stickleback
LE13	4/4/2005	603	840	Aquatic	Fort Clatsop - Lewis and Clark drainage	RAAU, TAGR, AMGR	stickleback, coho
LE14	4/5/2005	40	180	Aquatic	Fort Clatsop - Lewis and Clark drainage	DITE, PLVE,	
LE15	4/5/2005	40	150	Aquatic	Fort Clatsop - Skipanon drainage	DITE, TAGR	
LE16	4/5/2005	40	150	Aquatic	Fort Clatsop - Skipanon drainage	TAGR, PLVE	
LE17	4/5/2005	41	150	Aquatic	Fort Clatsop - Skipanon drainage	DITE	
LE18	4/6/2005	40	200	Aquatic	Fort Clatsop - Skipanon drainage	DITE, RAAU	
LE19	4/6/2005	1140	500	Aquatic	Fort Clatsop - Skipanon drainage	TAGR, RAAU, AMGR, PSRE	sculpin, stickleback
LE20	4/7/2005	50	220	Aquatic	Fort Clatsop - Skipanon drainage	PLVE, DITE	
LE21	4/7/2005	30	130	Aquatic	Fort Clatsop - Skipanon drainage	PLVE	
LE22	4/11/2005	240	80	Aquatic	Fort Clatsop - Lewis and Clark drainage clay pond	AMGR	
LE23	4/11/2005	70	120	Aquatic	Fort Clatsop - Netul Pond closes to s. entrance	PSRE, TAGR,	stickleback
LE24	4/11/2005	240	140	Aquatic	Fort Clatsop- Netul north ponds/stream	RAAU, RACAT, PSRE	coho, stickleback
LE25	4/12/2005	1000	570	Aquatic	Fort Clatsop-wetland across from Netul Landing	PSRE, RAAU, AMGR	
LE26	4/12/2005	800	300	Aquatic	Sunset Beach Pond south of Sunset Beach Rd across from trailhead	PSRE, AMGR, RAAU, TAGR	
LE27	4/13/2005	100	120	Aquatic	Fort Clatsop - Association Pond	No non-sensitive species found	
LE28	4/13/2005	400	90	Aquatic	Sunset Beach Wetland just N of parking lot and Sunset Beach Rd.	RAAU, PSRE, AMGR	

This report has had confidential information regarding park-sensitive species locations removed.

Table 4. Survey sites description and location, and all species detected [sensitive species removed] (continued).

Site ID	Date	Area Surveyed (m2)	Search Minutes	Survey Type	Location Description	Amphibian Species	Other Species
LE29	4/13/2005	1000	495	Aquatic	Sunset Beach (biggest lake)	PSRE, RAAU	stickleback
LE30	4/14/2005	800	300	Aquatic	Fort Clatsop - wetland at end of Hansen Creek	AMGR, RAAU, PSRE	stickleback

AMGR = northwestern salamander; DITE = coastal giant salamander; ENES = Oregon Ensatina; PLVE = western red-backed salamander; PSRE = northern Pacific treefrog; RAAU = northern red-legged frog; RACAT = American bullfrog; TAGR = rough-skinned newt. [Sensitive species have been removed from the table].

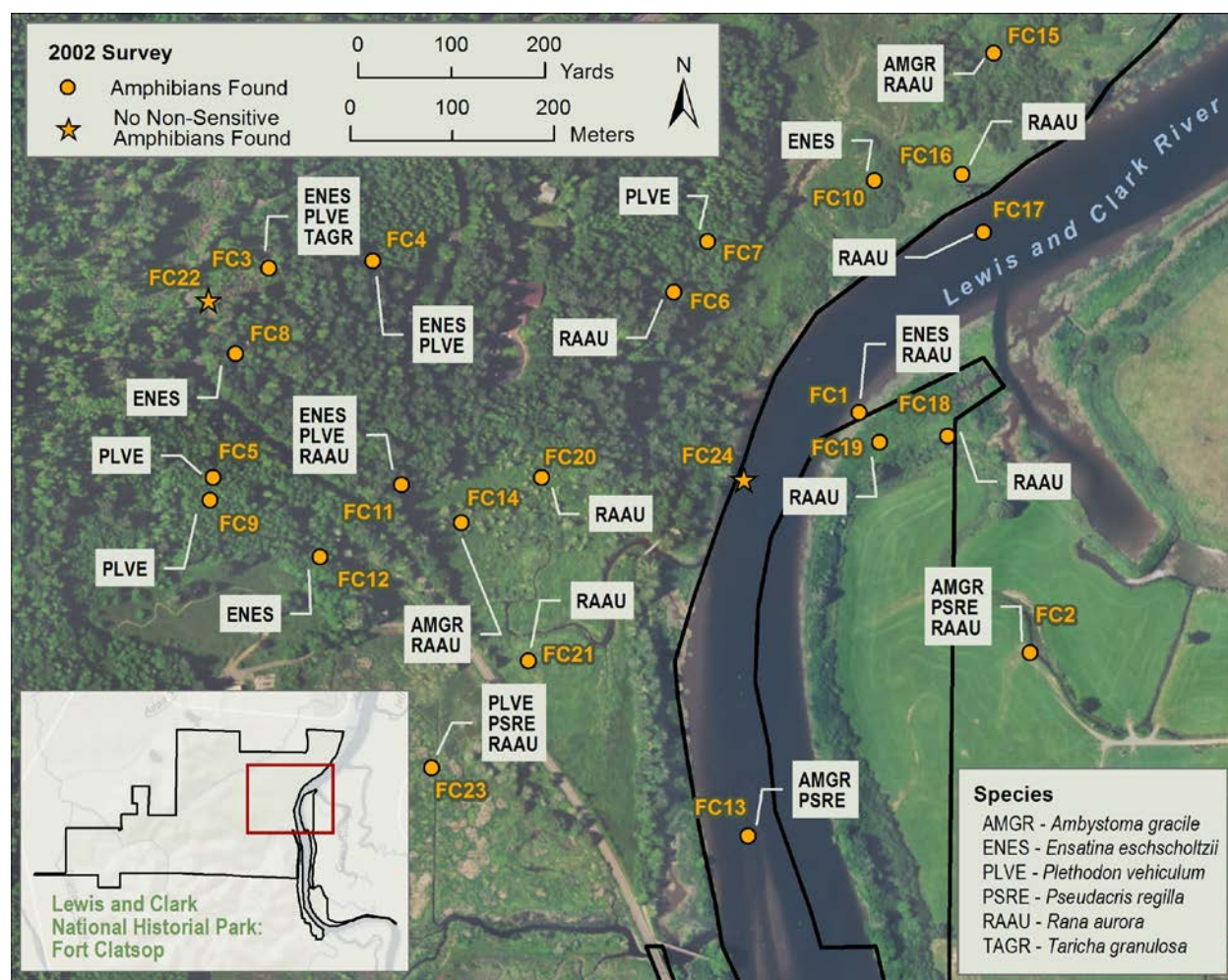


Figure 6. 2002 observations of amphibian species in Fort Clatsop unit. [Sensitive species removed].

This report has had confidential information regarding park-sensitive species locations removed.

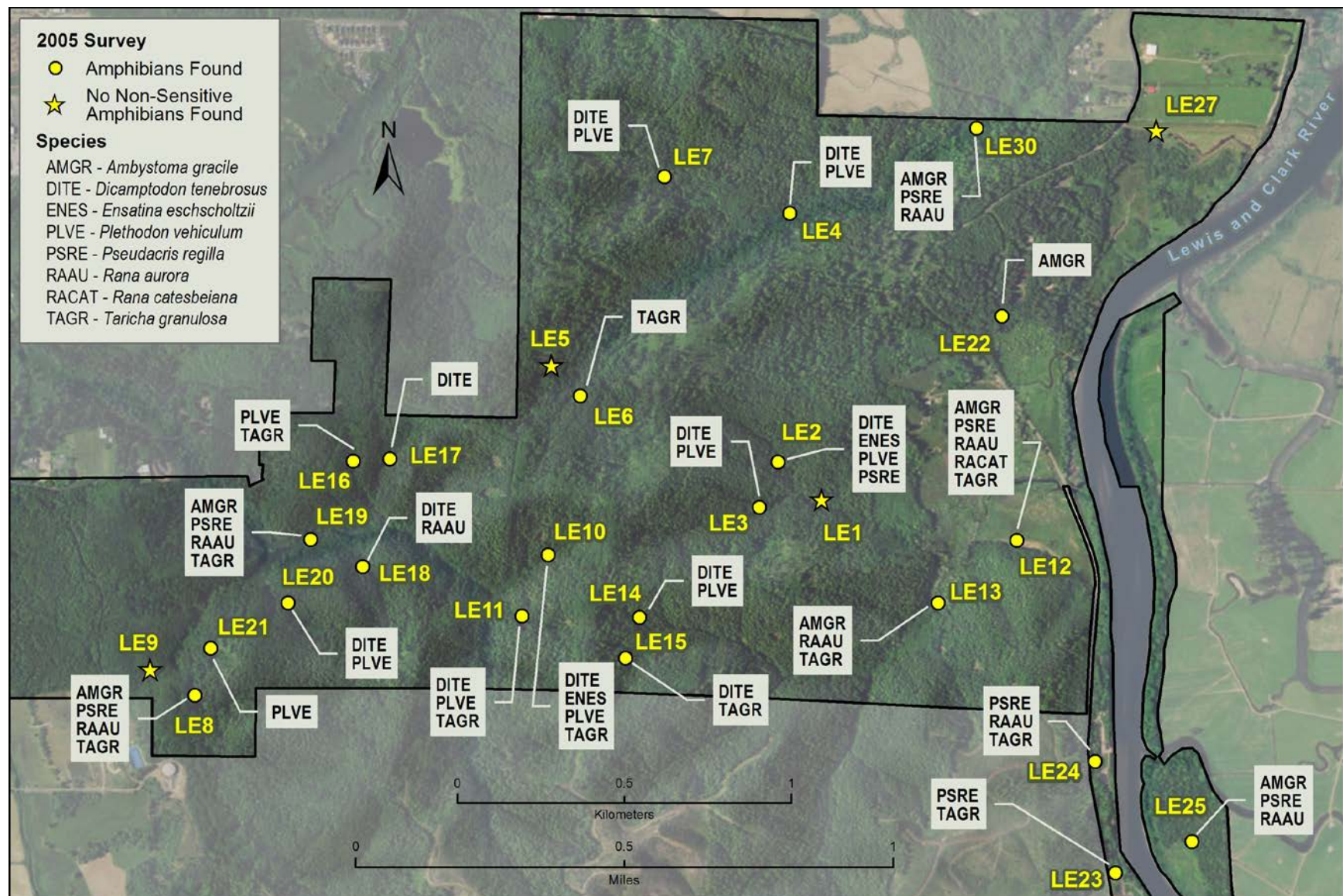


Figure 7. 2005 observations of amphibian species in Fort Clatsop unit. Note that RACAT is the code for American bullfrog and the genus name has recently been changed from *Rana* to *Lithobates*. [Sensitive species removed].

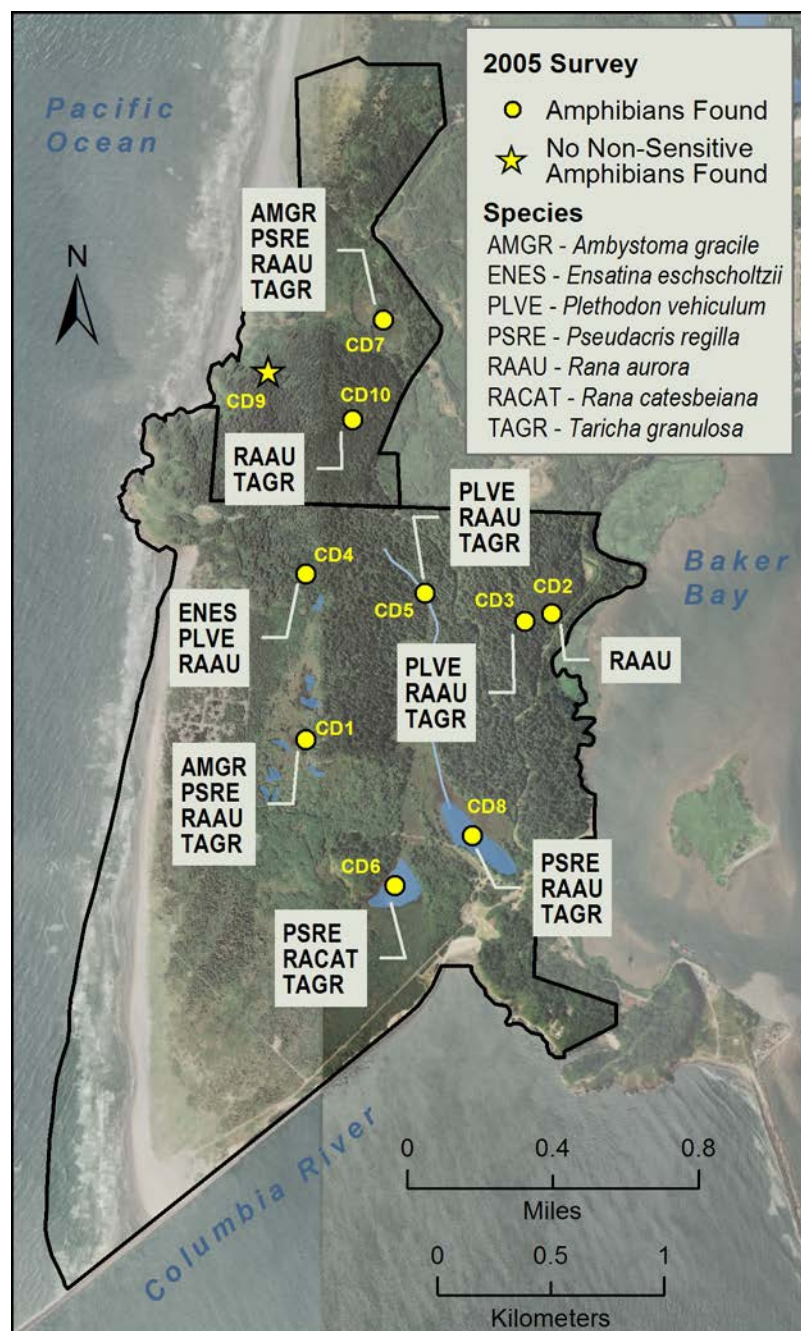


Figure 8. 2005 observations of amphibian species in the Cape Disappointment unit. Note that RACAT is the code for American bullfrog and the genus name has recently been changed from *Rana* to *Lithobates*. [Sensitive species removed].

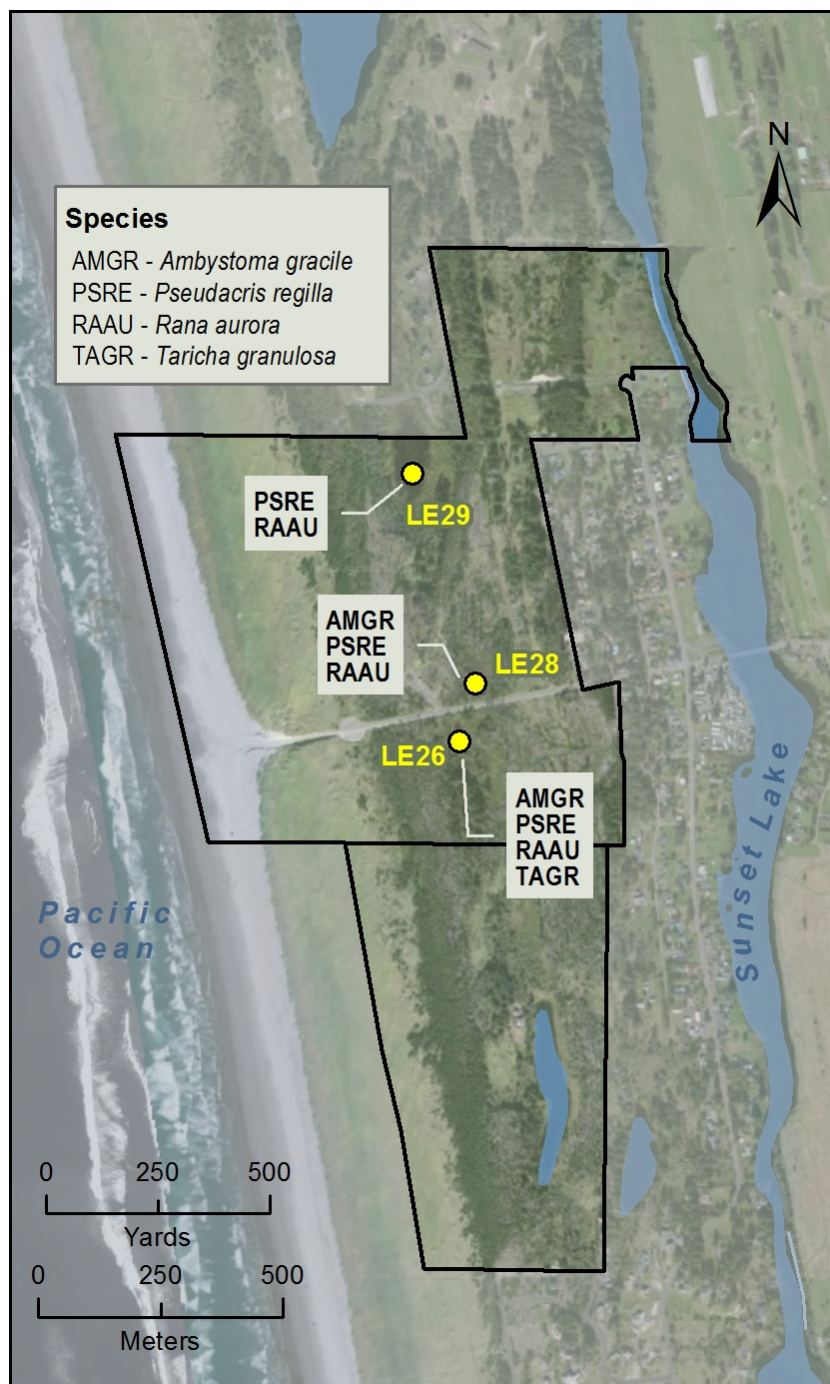


Figure 9. 2005 observations of amphibian species in the Sunset Beach unit.

All amphibian species detected at LEWI inventory sites are presented in Figure 10. The most dominant aquatic breeding species was northern red-legged frog, occurring at 22% of all sites inventoried. The most dominant terrestrial breeding species detected was western red-backed salamander, occurring at 14% of all sites inventoried. Aquatic breeding species were detected in a variety of habitats including temporary and seasonal surface water bodies, man-made or altered wetlands and developed areas, and natural systems such as beaver ponds. Terrestrial breeding species

This report has had confidential information regarding park-sensitive species locations removed.

were detected in various habitats including mixed forests in decaying wood as well as in man-made wood piles from trail maintenance or other park management activities. Six species were documented outside of the targeted sample sites in the Fort Clatsop unit (Incidental surveys, Figure 18).

We detected 10 species of amphibians in the Fort Clatsop Unit: northwestern salamander, coastal giant salamander, *Ensatina*, western red-back salamander, Dunn's salamander, northern Pacific treefrog, northern red-legged frog, American bullfrog, Columbia torrent salamander, and rough-skinned newt (Figures 14 through 18). Nine amphibian species were detected in the Cape Disappointment unit: northwestern salamander, Cope's giant salamander, *Ensatina*, western red-backed salamander, northern Pacific treefrog, northern red-legged frog, American bullfrog, Columbia torrent salamander, and rough-skinned newt (Figures 19 and 20). Four amphibian species were detected in the Sunset Beach unit: northwestern salamander, northern red-legged frog, northern Pacific treefrog, and rough-skinned newt (Figure 21).

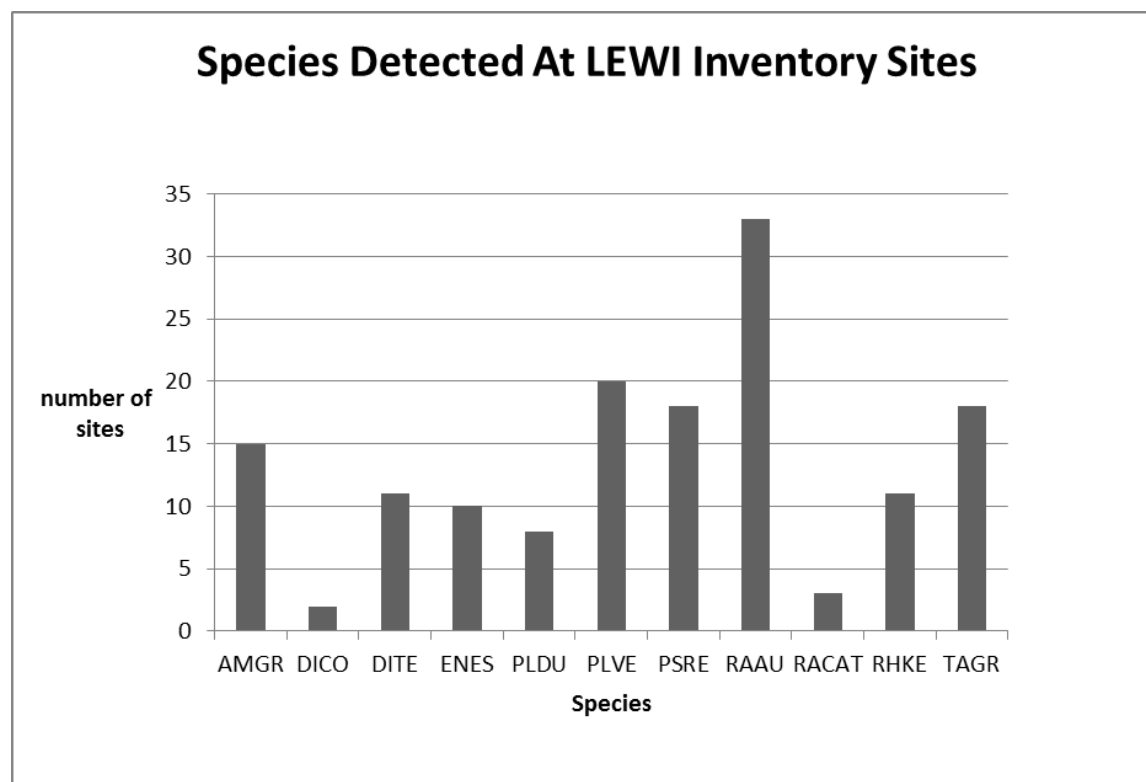


Figure 10. All species detected at sites in Lewis and Clark National Historical Park. AMGR = northwest salamander; DICO = Cope's giant salamander; DITE = coastal giant salamander; ENES = Oregon *Ensatina*; PLDU = Dunn's salamander; PLVE = western red-backed salamander; PSRE = northern Pacific treefrog; RAAU = northern red-legged frog; RACAT = American bullfrog; RHKE = Columbia torrent salamander; TAGR = rough-skinned newt.

Amphibians were detected at all but five sites inventoried. These sites are all within the Fort Clatsop unit. FC24, at the time of the survey appeared to be a permanent natural, clear spring with no

emergent vegetation, with a relatively low pH (5.97) and conductivity measurement (50 μ S/cm)¹. LE1 and LE5 are shallow stream sites with silty bottom substrate located within the Lower Lewis and Clark watershed with pH and conductivity measurements of 6.13 and 90.5 μ S/cm and 6.4 and 105.6 μ S/cm, respectively. LE9 is a shallow clear stream site in the Skipanon River watershed with a pH of 6.03 and conductivity of 157.8 μ S/cm. LE27 was a cloudy, stained wetland meadow with 80% emergent vegetation and bottom substrate of leaves and grass.

Water quality results for all sites are presented in Table 5. Water temperatures at survey sites ranged from 7.0 to 14.3°C. Measurements of pH ranged from 5.21 at LE22 to a high of 7.12 at LE16. Conductivity ranged from 40 μ S/cm at FC14 to a high of 900 μ S/cm at LE23. Dissolved oxygen ranged from 0.9 mg/L at FC2, a shallow ditch, to 14.5 mg/L. Maximum and minimum water quality measurements for sites where all life stages of amphibians were documented are presented in Table 10.

Air temperatures ranged from 6 to 14°C. About 30% of aquatic survey sites were shallow, less than 0.5m deep. Emergent vegetation cover for aquatic sites ranged from 0 to 90%. Detailed descriptions of aquatic survey sites are presented in Appendix C Tables C-1 and C-2.

Table 5. Air and water temperatures and water quality measurements for pH, conductivity, and dissolved oxygen for aquatic survey sites where amphibians (all life stages) were detected (nd = no data).

Field Site ID	Weather	Wind	Air Temp (°C)	Water Temp (°C)	pH	Conductivity (μ S/cm)	Dissolved Oxygen (mg/L)
CD1	Clear	Gusty	12	12.8	6.14	250	7.3
CD2	Overcast	Calm	10	11.3	6.35	280	8.9
CD3	Clear	Calm	10	9.7	6.56	230	9.9
CD4	Clear	Calm	14	10.2	6.25	217	9.9
CD5	Clear	Gusty	14	10.2	6.17	203	10.3
CD6	Overcast	Calm	12	13.0	6.65	208	7.4
CD7	Overcast	Light	10	11.4	6.33	194	7.6
CD8	Overcast	Gusty	12	14.3	nd	208	8.0
CD9	Overcast	Calm	11	9.8	5.96	411	9.8
CD10	Overcast	Calm	11	10.3	6.71	239	11.1
FC2	Overcast	Calm	14	12.0	6.66	250	0.9
FC14	Overcast	Calm	9	7.0	5.76	40	12.5
FC15	Overcast	Calm	10	11.0	5.27	140	nd
FC22	Overcast	Calm	10	9.0	5.29	nd	14.5
FC23	Clear	Calm	12	10.0	6.52	60	10.0
FC24	Clear	Calm	9	11.0	5.97	50	9.5
LE1	Rain	Light	8	9.2	6.13	91	12.9
LE2	Rain	Light	9	9.1	5.96	95	12.3

¹ Field conditions were later clarified by park staff noting this site as an ephemeral, not permanent water body.

This report has had confidential information regarding park-sensitive species locations removed.

Table 5. Air and water temperatures and water quality measurements for pH, conductivity, and dissolved oxygen for aquatic survey sites where amphibians (all life stages) were detected (nd = no data) (continued).

Field Site ID	Weather	Wind	Air Temp (°C)	Water Temp (°C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)
LE3	Overcast	Light	9	8.3	6.80	82	13.6
LE4	Rain	Light	10	9.3	6.46	95	13.2
LE5	Overcast	Calm	10	8.5	6.40	106	13.0
LE6	Overcast	Calm	10	8.9	6.73	105	10.4
LE7	Overcast	Calm	12	9.5	6.66	125	11.3
LE8	Clear	Calm	13	10.0	6.60	137	11.2
LE9	Overcast	Calm	11	10.2	6.30	158	9.2
LE10	Overcast	Light	8	9.5	6.98	156	11.4
LE11	Clear	Calm	10	9.5	6.91	150	9.5
LE12	Clear	Calm	9	10.2	5.65	91	5.0
LE13	Clear	Calm	9	9.0	6.40	94	10.9
LE14	Rain	Light	6	9.3	6.90	116	11.6
LE15	Rain	Light	12	8.5	6.95	111	11.7
LE16	Clear	Calm	12	9.6	7.12	157	11.3
LE17	Rain	Gusty	12	9.3	7.02	156	11.2
LE18	Clear	Calm	11	9.5	6.54	118	10.2
LE19	Overcast	Calm	12	10.0	6.90	129	10.8
LE20	Rain	Light	11	9.7	6.99	144	10.9
LE21	Rain	Light	10	9.4	6.58	141	10.7
LE22	Overcast	Gusty	10	8.5	5.21	102	8.2
LE23	Rain	Light	10	12.4	6.41	900	11.3
LE24	Overcast	Light	11	12.0	6.20	100	9.6
LE25	Rain	Gusty	8	8.4	6.13	199	8.0
LE26	Clear	Gusty	10	10.0	6.53	237	9.4
LE27	Overcast	Calm	8	7.5	5.62	126	8.6
LE28	Overcast	Light	11	9.7	6.59	210	6.3
LE29	Rain	Gusty	10	11.8	6.66	220	8.1
LE30	Rain	Light	9	7.2	6.83	87	7.5

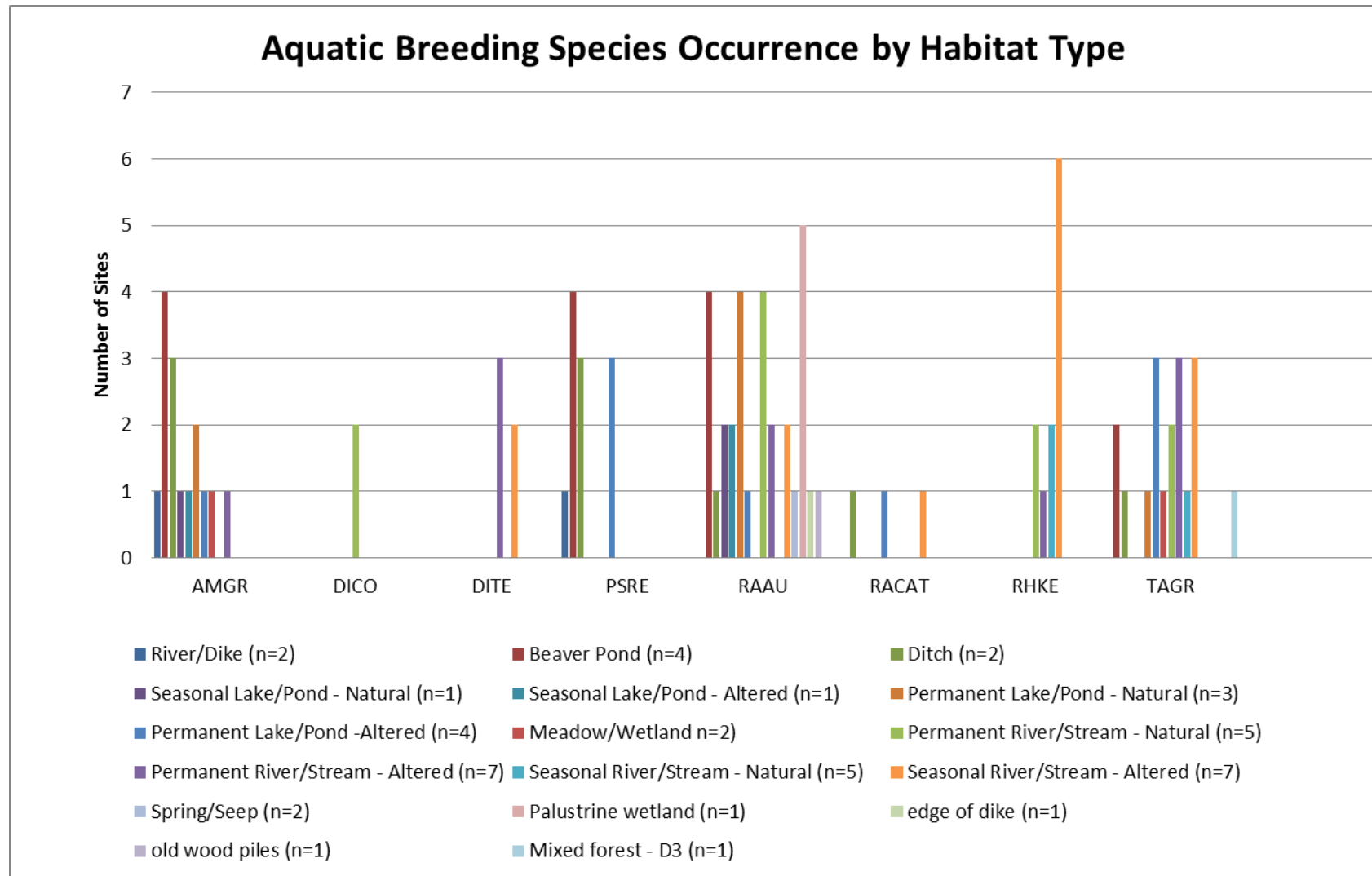


Figure 11. Aquatic breeding species occurrence for various habitat types at Lewis and Clark National Historical Park. AMGR = northwestern salamander, DICO= Cope's giant salamander, DITE= coastal giant salamander, PSRE = northern Pacific treefrog, RAAU= northern red-legged frog, RACAT= American bullfrog, RHKE= Columbia torrent salamander, TAGR= rough-skinned newt.

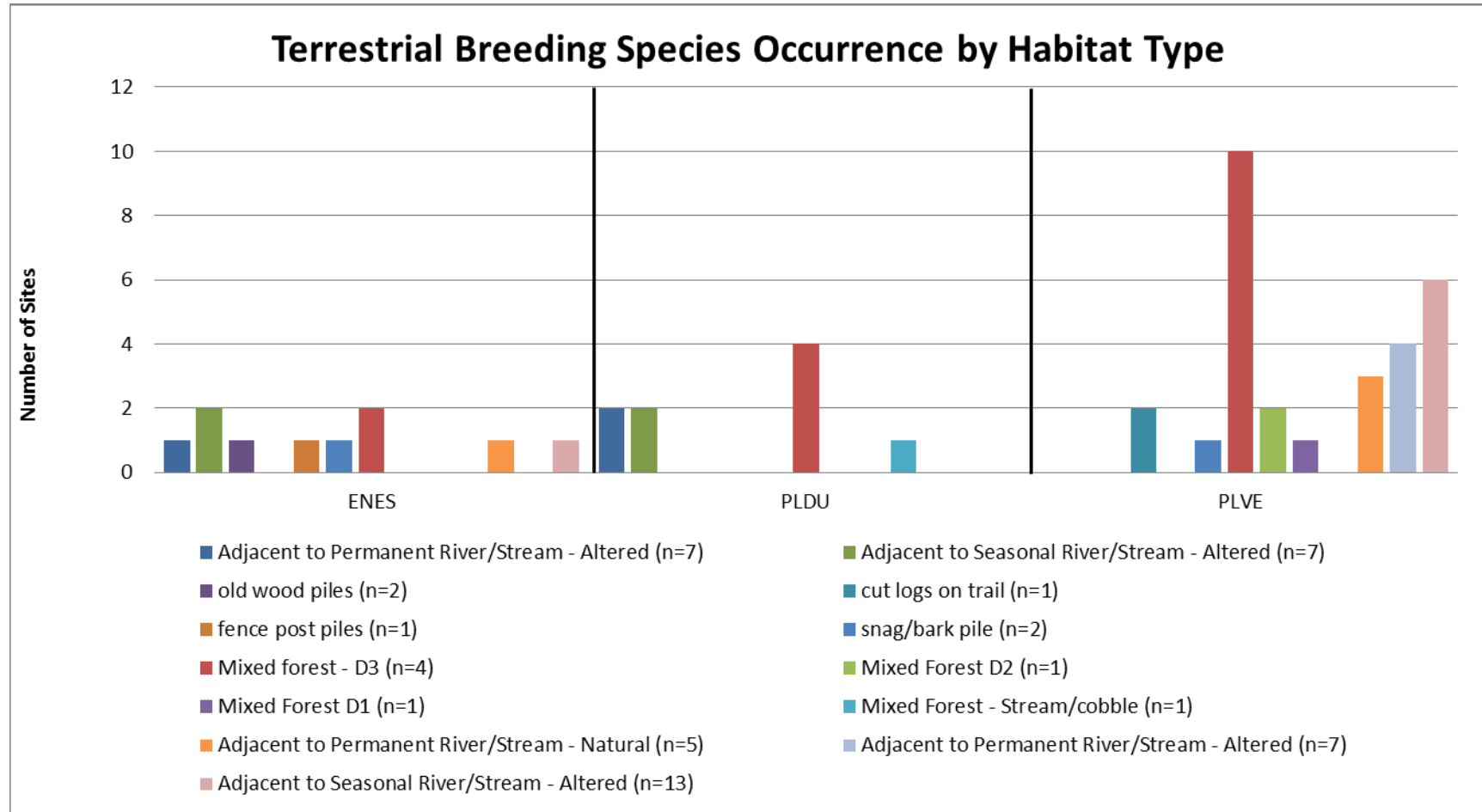


Figure 12. Terrestrial breeding amphibian species occurrence for various habitat types at Lewis and Clark National Historical Park. ENES = *Ensatina*, PLDU= Dunn's salamander, PLVE= western red-backed salamander.

This report has had confidential information regarding park-sensitive species locations removed.

Results of DNA analysis to differentiate Pacific Giant Salamander species are presented in Table 6.

Table 6. Results of DNA analysis for Dicamptodon species and associated collection dates, tail clip identification numbers, snout-vent length of animals, life stage of animal, location (in UTM), and elevation (ft). [* sensitive species location removed].

Site ID	Date	Tail Clip Num.	Species	SVL (mm)	Life Stage	UTM E	UTM N	Elevation (ft)
LE2	29-Mar-05	CLIP 3	<i>D. tenebrosus</i>	82	A	431281	5108803	47.78
LE3	29-Mar-05	CLIP 1	<i>D. tenebrosus</i>	65	A	431226	5108667	49.93
LE3	29-Mar-05	CLIP 2	<i>D. tenebrosus</i>		A	431226	5108667	78.02
LE4	29-Mar-05	CLIP 4	<i>D. tenebrosus</i>	25	L	431316	5109547	47.78
LE7	30-Mar-05	CLIP 5	<i>D. tenebrosus</i>	50	L	430941	5109657	93.79
LE10	31-Mar-05	CLIP 6	<i>D. tenebrosus</i>	27	L	430593	5108525	86.57
LE11	31-Mar-05	CLIP 7	<i>D. tenebrosus</i>	48	L	430514	5108342	83.84
LE11	31-Mar-05	CLIP 8	<i>D. tenebrosus</i>	65	L	430514	5108342	83.84
LE11	31-Mar-05	CLIP 9	<i>D. tenebrosus</i>	25	L	430514	5108342	83.84
LE14	5-Apr-05	CLIP 10	<i>D. tenebrosus</i>	26	L	430866	5108339	163.92
LE14	5-Apr-05	CLIP 11	<i>D. tenebrosus</i>	24	L	430866	5108339	163.92
LE14	5-Apr-05	CLIP 12	<i>D. tenebrosus</i>	50	L	430866	5108339	163.92
LE15	5-Apr-05	CLIP 13	<i>D. tenebrosus</i>	52	L	430825	5108217	172.39
LE15	5-Apr-05	CLIP 14	<i>D. tenebrosus</i>	48	L	430825	5108217	172.39
LE15	5-Apr-05	CLIP 15	<i>D. tenebrosus</i>	42	L	430825	5108217	172.39
LE17	5-Apr-05	CLIP 16	<i>D. tenebrosus</i>	48	L	430119	5108812	88.30
LE17	5-Apr-05	CLIP 17	<i>D. tenebrosus</i>	52	L	430119	5108812	88.30
LE17	5-Apr-05	CLIP 18	<i>D. tenebrosus</i>	45	L	430119	5108812	88.30
LE17	5-Apr-05	CLIP 19	<i>D. tenebrosus</i>	26	L	430119	5108812	88.30
LE17	5-Apr-05	CLIP 20	<i>D. tenebrosus</i>	24	L	430119	5108812	88.30
LE17	5-Apr-05	CLIP 21	<i>D. tenebrosus</i>	36	L	430119	5108812	88.30
LE18	6-Apr-05	CLIP 22	<i>D. tenebrosus</i>	22	L	430038	5108490	56.35
LE18	6-Apr-05	CLIP 23	<i>D. tenebrosus</i>	28	L	430038	5108490	56.35
LE18	6-Apr-05	CLIP 24	<i>D. tenebrosus</i>	28	L	430038	5108490	56.35
LE20	7-Apr-05	CLIP 25	<i>D. tenebrosus</i>	58	L	429814	5108382	38.15
LE20	7-Apr-05	CLIP 26	<i>D. tenebrosus</i>	45	L	429814	5108382	38.15
LE20	7-Apr-05	CLIP 27	<i>D. tenebrosus</i>	42	L	429814	5108382	38.15
LE20	7-Apr-05	CLIP 28	<i>D. tenebrosus</i>	23	L	429814	5108382	38.15
LE20	7-Apr-05	CLIP 29	<i>D. tenebrosus</i>	42	L	429814	5108382	38.15
*		CLIP 1A	<i>D. copei</i>	35	L			
*		CLIP 2A	<i>D. copei</i>	23	L			
*		CLIP 3A	<i>D. copei</i>	22	L			
*		CLIP 4A	<i>D. copei</i>	58	L			
*		CLIP 5A	<i>D. copei</i>	63	L			

This report has had confidential information regarding park-sensitive species locations removed.

Aquatic surveys covered 84,386 m² and 10,175 minutes of searching. A summary of species and life stages for the aquatic surveys is presented in Figure 13.

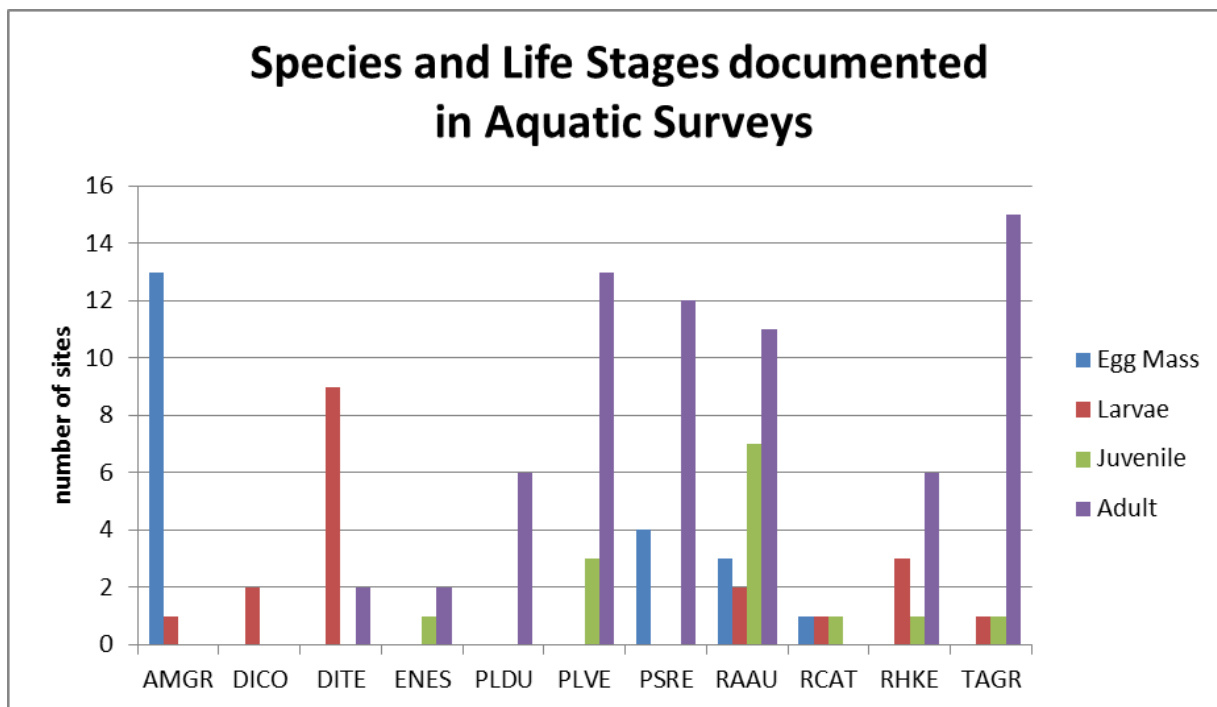


Figure 13. Species and life stages detected in aquatic surveys in Lewis and Clark National Historical Park. AMGR = northwestern salamander; DICO = Cope's giant salamander; DITE = coastal giant salamander; ENES = Oregon Ensatina; PLDU = Dunn's salamander; PLVE = western red-backed salamander; PSRE = northern Pacific treefrog; RAAU = northern red-legged frog; RACAT = American bullfrog; RHKE = Columbia torrent salamander; TAGR = rough-skinned newt.

Species detected and their life stages documented in each unit are presented in Figures 14 through 21.

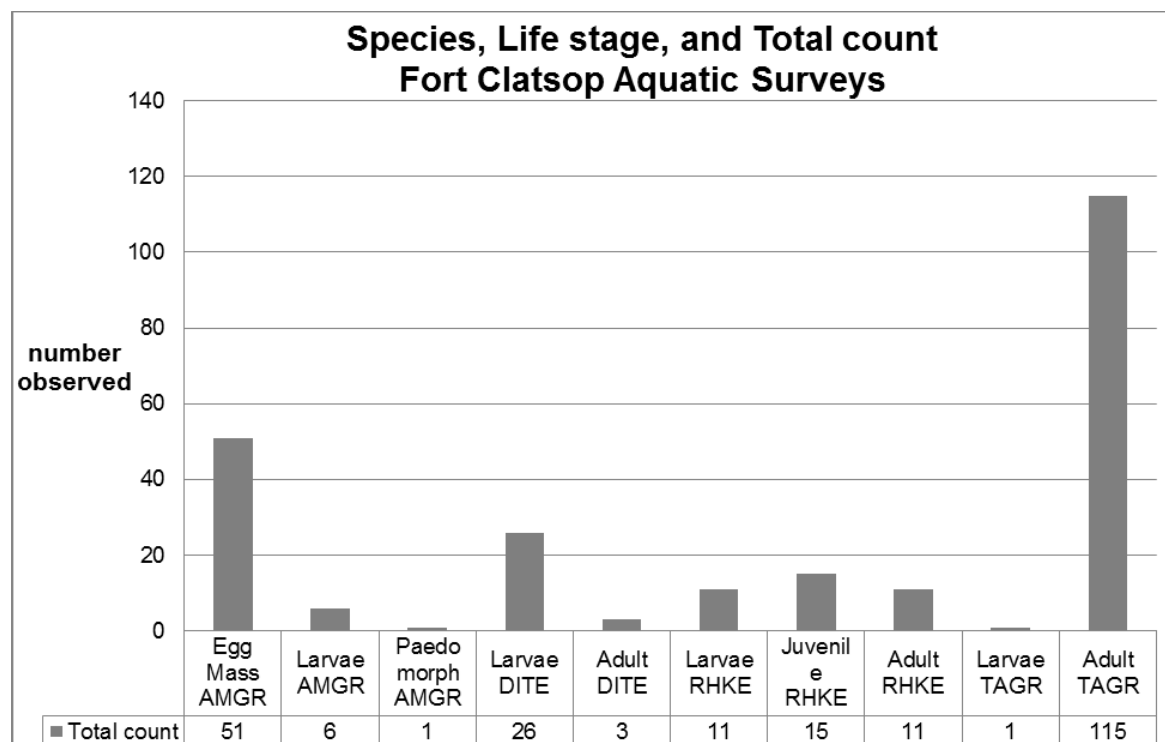


Figure 14. Results of Fort Clatsop unit Surveys for aquatic breeding amphibian species. AMGR = northwestern salamander; DITE = coastal giant salamander; RHKE = Columbia torrent salamander; TAGR = rough-skinned newt.

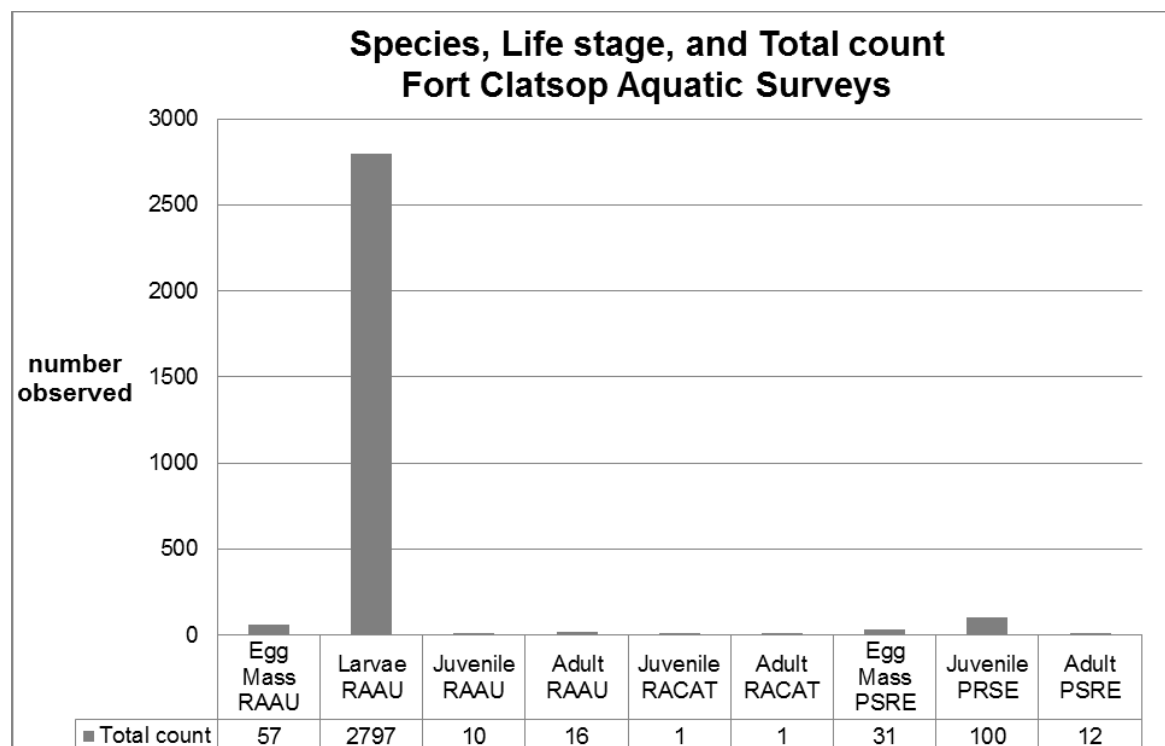


Figure 15. Results of Fort Clatsop unit Surveys for frog species. PSRE = northern Pacific treefrog; RAAU = northern red-legged frog.

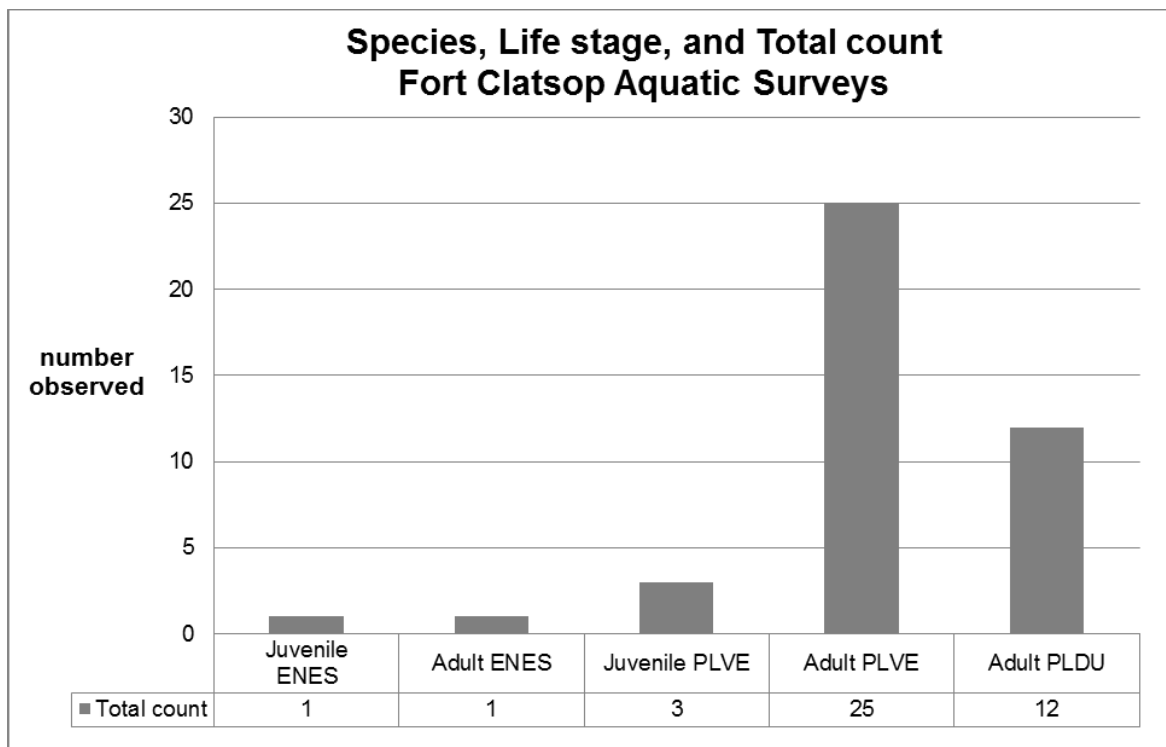


Figure 16. Results of Fort Clatsop unit Surveys for terrestrial breeding amphibian species detected during aquatic surveys. ENES = Oregon Ensatina; PLVE = western red-backed salamander; PLDU = Dunn's salamander.

Terrestrial surveys were conducted only within the Fort Clatsop unit during 2002 and results are presented in Figure 17. Terrestrial breeding species documented in these surveys were adult and juvenile Ensatina, Dunn's salamander, and western red-backed salamander. Aquatic breeding species documented in terrestrial surveys included adult and juvenile northern red-legged frog, adult Columbia torrent salamander, and adult rough-skinned newt. General measurements were taken to further describe habitat and are presented in Appendix tables C-3 and C-4.

This report has had confidential information regarding park-sensitive species locations removed.

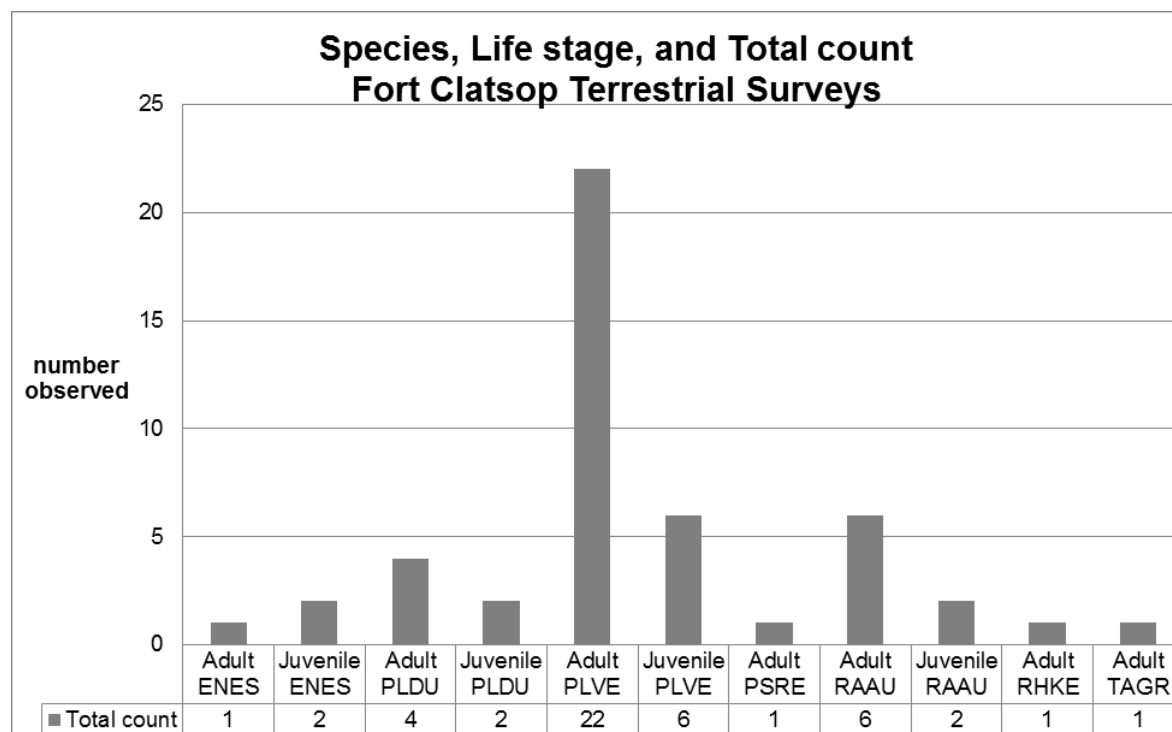


Figure 17. Results of Fort Clatsop unit Terrestrial Surveys. ENES = Oregon Ensatina; PLVE = western red-backed salamander; PLDU = Dunn's salamander; PSRE = northern Pacific treefrog; RAAU = northern red-legged frog; RHKE = Columbia torrent salamander; TAGR = rough-skinned newt.

Incidental survey results are presented in Figure 18 and include documentation of adult Ensatina, western red-backed salamander, adult and juvenile northern red-legged frogs, northern Pacific treefrog and adult and egg masses.

Terrestrial breeding species documented in terrestrial surveys were detected at sites with soil temperatures ranging from 9 to 10 degrees C and air temperatures from 9 to 13 degrees C. Soil and air temperature minimums and maximums for terrestrial breeding species are presented in Table 7.

Table 7. Air and soil temperatures for terrestrial breeding species detected in terrestrial surveys at the Fort Clatsop unit.

Species	Air Temp Max(C)	Air Temp Min (C)	Soil Temp Max(C)	Soil Temp Min (C)
ENES	10	9	10	9
PLDU	12	9	10	9
PLVE	12	9	10	9

Environmental conditions and habitat description for terrestrial survey sites is presented in Table 8. Environmental conditions for incidental surveys are presented in Table 9. Additional details are presented in Appendix C.

This report has had confidential information regarding park-sensitive species locations removed.

Table 8. Observed slope, aspect, forest type, percent cover, and vegetation and aspect for terrestrial survey sites.

Field Site ID	Date	Location Description	Slope (%)	Aspect	Forest Type	% Cover	Habitat Description	Stream	Seep	Talus
FC3	05-May-02	Salamander Creek drainage	20	NW	Mixed	100	mixed forest overstory: western hemlock, Sitka spruce, red alder; understory: western hemlock, huckleberry (<i>Vaccinium</i> species), sword fern (<i>Polystichum munitum</i>), deer fern (<i>Blechnum spicant</i>), salal (<i>Gaultheria shallon</i>), lady fern (<i>Athyrium filix-femina</i>).	Y	N	N
FC4	01-May-02	East of FC3	0	N	Mixed	80	mixed forest overstory: western hemlock, Sitka spruce, red alder; understory: western hemlock, salal, sword fern, red elderberry (<i>Sambucus racemosa</i>), deer fern, salmonberry (<i>Rubus spectabilis</i>)	N	N	N
FC6	01-May-02	Lewis and Clark drainage	10	SE	Mixed	100	mixed forest overstory: Sitka spruce, western hemlock, red alder; understory: western hemlock, salmonberry, sword fern, false lily-of-the-valley (<i>Maianthemum dilatatum</i>), deer fern, skunk cabbage (<i>Lysichitum americanum</i>), salal	N	Y	N
FC11	02-May-02	Lewis and Clark drainage	5	WSW	Mixed	100	mixed forest overstory: Sitka spruce, western hemlock, red alder; understory: western hemlock, salmonberry, western sword fern, trillium (<i>Trillium ovatum</i>), azalea (<i>Rhododendron</i> species), deer fern, false lily of the valley, huckleberry, lady fern	N	N	N
FC23	09-May-02	Alder Creek drainage		SE	Mixed	60	mixed forest overstory: red alder, Sitka spruce, western hemlock, Douglas fir (<i>Pseudotsuga menziesii</i>); understory: vine maple (<i>Acer circinatum</i>), salmonberry, sword fern, skunk cabbage, red elderberry, deer fern	Y	Y	N

This report has had confidential information regarding park-sensitive species locations removed.

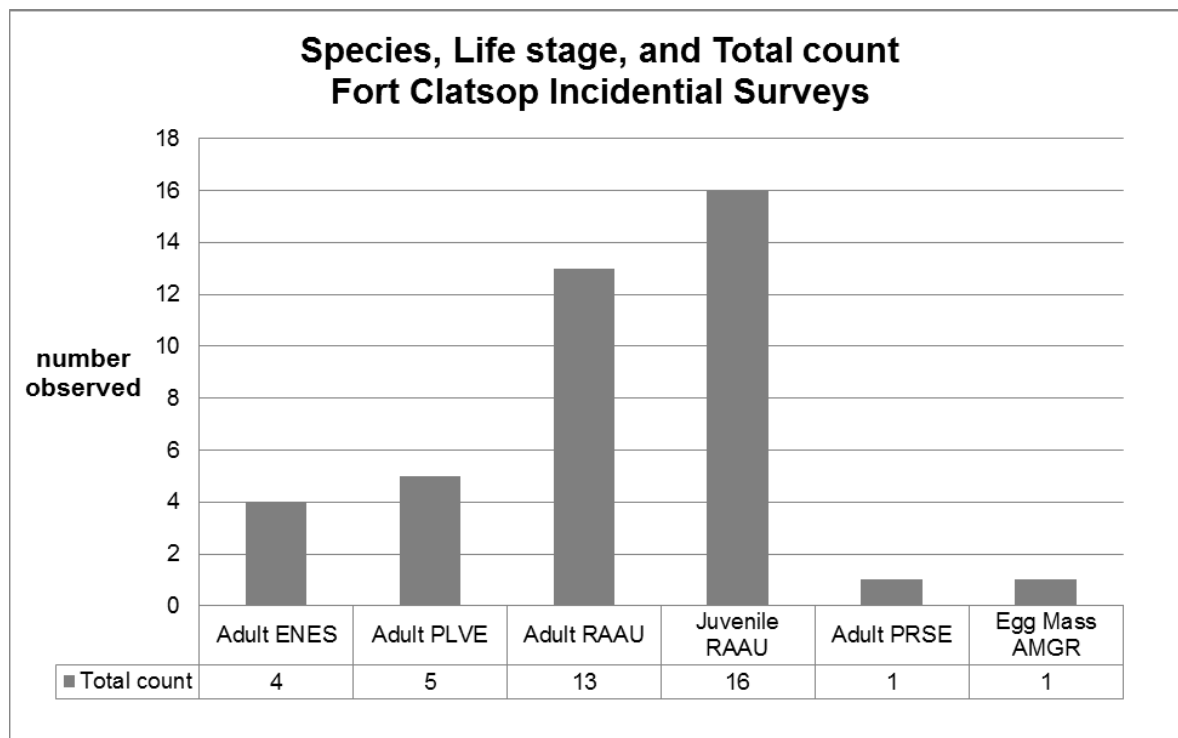


Figure 18. Results of incidental detections at Fort Clatsop unit. ENES = *Ensatina*; PLVE = western red-backed salamander; RAAU = northern red-legged frog; PSRE = northern Pacific treefrog; AMGR = northwestern salamander.

This report has had confidential information regarding park-sensitive species locations removed.

Table 9. Environmental Conditions for incidental survey sites.

Field Site	Location Description	Watershed	Date	Slope (%)	Aspect	Elevation (m)	Elevation (ft)	Air Temp. (C)	Precipitation	Wind
FC1	Maintenance Road to Burn Shed	Lower Lewis And Clark River	30-Apr-02	0	90	1.01	3.32	no data	Fog	Calm
FC5	Boundary Trail & Perkins Road	Lower Lewis And Clark River	1-May-02	20	360	14.35	47.09	11	Fog	Calm
FC7	Near Maintenance Yard	Lower Lewis And Clark River	1-May-02	10	135	3.99	13.09	10	Fog	Calm
FC8	Boundary Trail, Near Salamander Creek	Lower Lewis And Clark River	2-May-02	10	315	19.85	65.12	10	Mist	Calm
FC9	Boundary Trail & Perkin's Road	Lower Lewis And Clark River	2-May-02	13	360	15.20	49.88	10	Mist	Calm
FC10	Maintenance Road to Burn Shed	Lower Lewis And Clark River	2-May-02	0	360	3.00	9.85	11	Mist	Calm
FC12	old county road between clay pond & Iron spring	Lower Lewis And Clark River	2-May-02	0	180	8.93	29.30	9	Mist	Calm
FC13	Dike Between Canoe landing & S. Park Boundary	Lower Lewis And Clark River	2-May-02	0	360	0.08	0.25	10	Mist	Calm
FC16	Willow Thicket on Association Land (reed canary grass)	Lower Lewis And Clark River	7-May-02	0	no data	2.80	9.20	12	Dry	Calm
FC17	Willow Thicket on Association Land (ephemeral pool)	Lower Lewis And Clark River	7-May-02	0	no data	0.04	0.12	14	Dry	Calm
FC18	Dike east of burn shed	Lower Lewis And Clark River	7-May-02	0	no data	2.59	8.51	14	Dry	Calm
FC19	Small slough East of Historic spring	Lower Lewis And Clark River	7-May-02	0	no data	1.87	6.13	14	Dry	Calm
FC20	Forest between VC and overflow parking	Lower Lewis And Clark River	7-May-02	5	135	2.73	8.94	16	Dry	Calm
FC21	Wetland below Iron Spring	Lower Lewis And Clark River	7-May-02	30	180	2.62	8.60	12	Dry	Calm

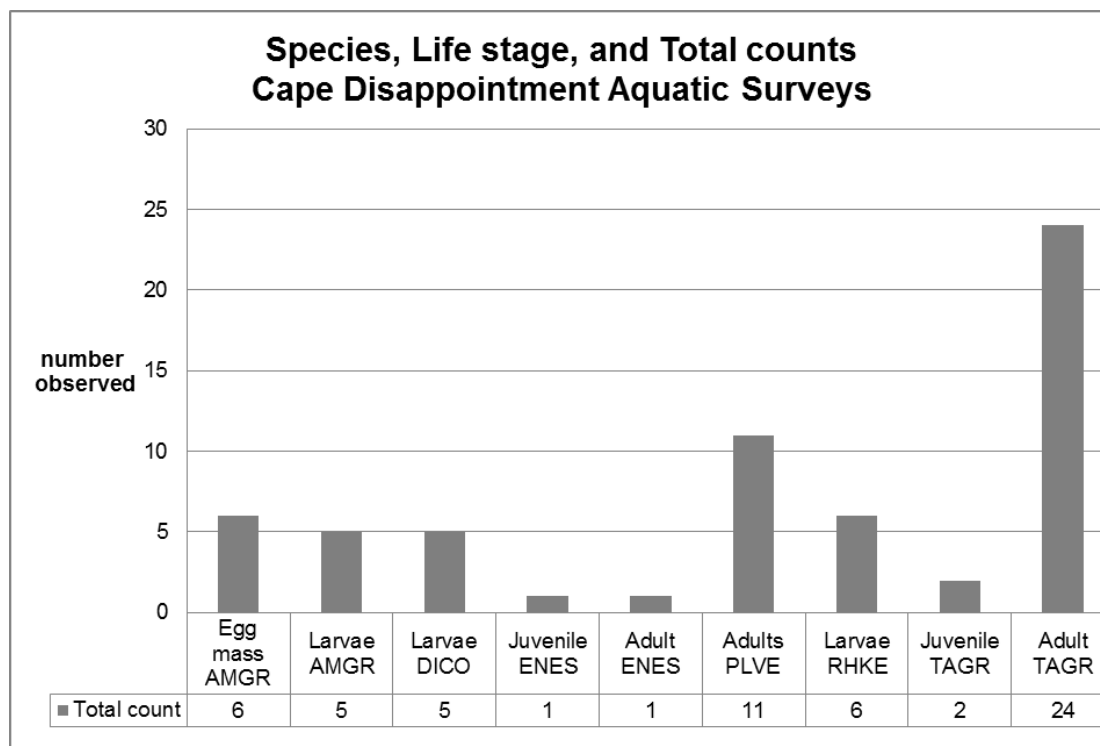


Figure 19. Results of Cape Disappointment unit aquatic surveys for salamander species. AMGR = northwestern salamander; DICO = Cope's giant salamander; ENES = Oregon Ensatina; PLVE = western red-backed salamander; RHKE = Columbia torrent salamander; TAGR = rough-skinned newt.

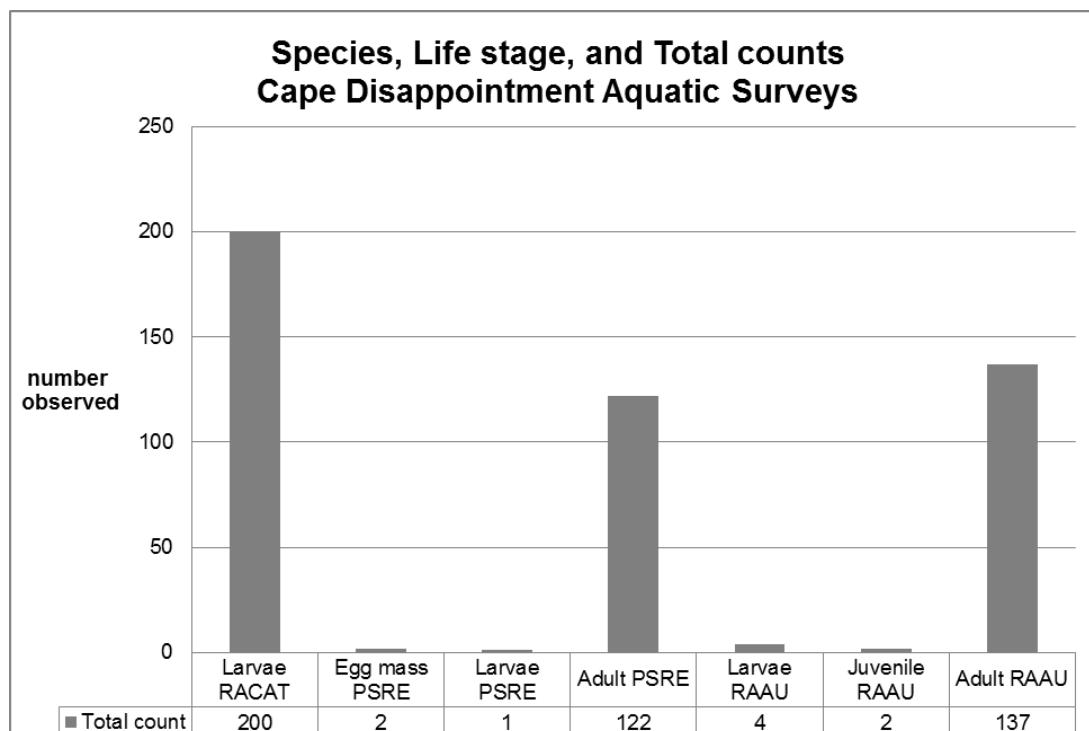


Figure 20. Results of Cape Disappointment unit Surveys for frog species. RACAT = American bullfrog; PSRE = Pacific treefrog; RAAU = northern red-legged frog.

This report has had confidential information regarding park-sensitive species locations removed.

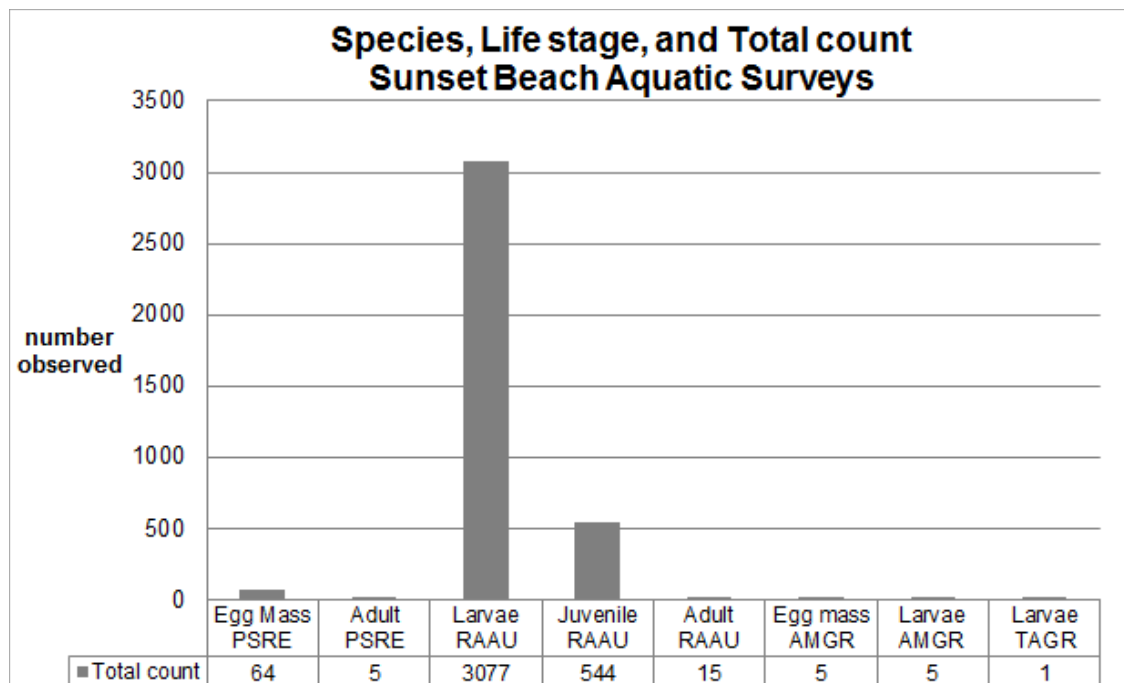


Figure 21. Results of Sunset Beach unit Surveys. PSRE = northern Pacific treefrog; RAAU = northern red-legged frog; AMGR = northwestern salamander; TAGR = rough-skinned newt.

This report has had confidential information regarding park-sensitive species locations removed.

Snout – vent lengths (SVL) were measured for animals when possible. Size by species and life stage are reported in Table 10 for all survey types.

Table 10. Maximum and minimum size for amphibian species and life stages (SVL= snout vent length).

Species	Lifestage	Minimum SVL (mm)	Maximum SVL (mm)	n
AMGR	larvae	<15	>35	5
AMGR	paedomorph	53	53	1
DICO	larvae	22	63	5
DITE	adult	65	82	2
DITE	larvae	22	65	26
ENES	adult	39	54	7
ENES	juvenile	18	32	3
PLDU	adult	38	62	14
PLDU	juvenile	33	33	1
PLVE	adult	33	52	57 ¹
PLVE	juvenile	14	32	9
PSRE	adult	<15	15-35	2
PSRE	juvenile	3	3	1
RAAU	adult	55	58	4 ²
RAAU	juvenile	15	35	4
RAAU	larvae	8	35	3 ³
RACAT	larvae	>35	>35	1
RHKE	adult	22	60	11
RHKE	larvae	14	38	12
RHKE	juvenile	15	35	2
TAGR	adult	35	55	8

¹Two listed as >35 mm

²Two listed as >35 mm

³One noted as 15-35 mm

Discussion

Northwestern Salamander (*Ambystoma gracile*)

Northwestern salamanders are found primarily west of the Cascade Crest from northern California through British Columbia to extreme southeastern Alaska (Jones et al. 2005). This salamander was detected at about 30% of all aquatic sites inventoried and was present in all three LEWI units. Embryo (all but 5 sites), larvae and paedomorph life stages were observed (Figures 22 and 23). Adult northwestern salamanders live in moist forests and partly wooded areas and breed in permanent ponds or stream backwaters in early to mid-spring (Corkran and Thoms 2006). Embryos take one to two months to develop and larvae may transform in their second year, or remain permanently aquatic (Hallock and McAllister 2005a). Breeding starts in late January through March. Egg masses were detected in beaver ponds (31%), ditches, lakes and ponds (both altered and natural), wetland meadow, and one egg mass in a small stream. Larvae were detected at only four sites (in natural ponds and beaver ponds). Egg masses were found mostly in muddy (53%) or silty (25%) substrates. Larvae were found mostly in muddy substrates (80%) and ranged in size from <15 mm to >35 mm. One paedomorph with an SVL of 53 mm was detected in a drainage ditch in the Fort Clatsop unit. Water temperature where embryos and larvae were detected (n=11) ranged from 7.2 to 12.8°C; pH ranged from 5.21 to 6.9; conductivity ranged from 86.8 to 250 uS/cm; and dissolved oxygen ranged from 5 mg/L to 11.2 mg/L.

Northwestern salamanders occurred mostly in association with northern red-legged frogs (38%), Pacific treefrog (31%), and rough-skinned newt (22%). Northwestern salamanders also occurred with American bullfrog (3%), Columbia torrent salamander (3%), and Dunn's salamander (3%). Size of northwestern salamander larvae ranged from <15 mm to >35 mm (n=5).

Northwestern salamanders remain common over many parts of their range and their current distribution appears to resemble their historical distribution, but undoubtedly populations have been lost as the Pacific Northwestern has been developed (Lanoo 2005). They have no national, regional or State conservation status. Much of the habitat identified as good in and surrounding LEWI in the 1850s is now noted as mostly fair, with some patches of good habitat (The Oregon Wildlife Explorer 2014).

Hallock and McCallister (2005a) report that land use activities that alter breeding habitat or access to breeding habitat can be detrimental to northwestern salamanders (e.g., tree removal, wetland drainage, land conversion and introduced fish).



Figure 22. Northwestern salamander (*Ambystoma gracile*) paedomorph found in a drainage ditch in Lewis and Clark National Historical Park.



Figure 23. Northwestern salamander (*Ambystoma gracile*) egg mass at LE19 in the Skipanon River watershed in the Fort Clatsop unit, Lewis and Clark National Historical Park.

Northern Pacific Treefrog (*Pseudacris regilla*)

Pacific treefrogs occur from central British Columbia to the southern tip of Baja California and from the Pacific Ocean east to western Montana, central Idaho, eastern Nevada, and northwestern Arizona (Jones et al. 2005). The northern Pacific treefrog was detected at 35% of all aquatic survey sites; only one adult was documented at one terrestrial survey site, and one incidental observation was documented (Figure 24). This species was present in all three LEWI units and all life stages were observed in this inventory. This species is the smallest frog in Oregon and is found in a variety of habitats including wetlands, woodlands, brush and disturbed areas (Cockran and Thomas 2006). It breeds in shallow quiet waters with submerged vegetation and will lay its eggs in almost any small body of water, including ephemeral ponds that may dry up before metamorphosis occurs (Nussbaum et al. 1983). Thirty-seven percent of northern Pacific treefrog sites at LEWI were beaver ponds, 27% were permanent but altered lakes or ponds, 27% were ditches, and two sites were diked areas of a river. Most sites where northern Pacific treefrogs were detected had muddy bottoms (62% of adults, 100% of larvae, and 65% of eggs). Water temperatures where embryos and tadpoles were detected (n=9) ranged from 8.4 to 13.0°C; pH ranged from 6.13 to 6.66; conductivity ranged from 100.2 uS/cm to 900 uS/cm; and dissolved oxygen ranged from 0.9 mg/L to 11.32 mg/L.

Breeding occurs with warm winter or early spring rains with most egg laying occurring in mid-February at lower elevations (Hallock and McAllister 2005d). Breeding may occur over a period of months. Eggs hatch in three to five weeks and larvae development typically takes 1 ½ to 2 ½ months to complete (Hallock and McAllister 2005b).

At sites where northern Pacific treefrog was detected, it occurred in association with northern red-legged frog (35%) rough-skinned newt (23%), and northwestern salamander (20%). Only one juvenile was measured (3 mm SVL) and two adults were observed (one noted as <15mm and one noted as 15-35 mm). The Oregon Wildlife Viewer notes that PSRE are excluded from ponds where bullfrogs are present (Oregon Wildlife Explorer 2014). However, we found northern Pacific treefrogs at all three sites where American bullfrog was detected. In enclosure experiments, the presence of bullfrog tadpoles resulted in a 16% reduction in the size of newly metamorphosed northern Pacific treefrogs but had no significant effect on survivorship (Kupferberg 1997).

Both larvae and adult northern Pacific treefrog were detected at Lake McKenzie in the Cape Disappointment unit. Adults were detected in a ditch near a pasture, and egg masses were observed in a ditch/stream in the Fort Clatsop unit.

Northern Pacific treefrogs are typically one of the most common amphibians, often exhibiting robust populations. Over most of its historic range, the treefrog is not declining and has not been targeted for conservation or recovery actions. This species has no national, regional or State conservation status. Historic habitat in the LEWI and surrounding area listed as good in the 1850s is now noted as fair with very patchy areas of good habitat.

Threats to northern Pacific treefrog include the introduction of fish or invasive amphibian species, such as American bullfrog, to breeding areas; pollutants; and chemical contaminants (Hallock and McAllister 2005b).



Figure 24. Northern Pacific treefrog (*Pseudacris regilla*) found at CD6 in the Cape Disappointment unit of Lewis and Clark National Historical Park.

Rough-skinned Newt (*Taricha granulosa*)

Rough-skinned newts are distributed in the coastal mountains from southeast Alaska, south to Santa Cruz County in California (Jones et al. 2005). Rough-skinned newts were detected in about 37% of all aquatic survey sites; one adult was documented during terrestrial site surveys (Figure 25). This species was present in all three units; adult, juvenile, and larvae life stages were observed in this inventory. They are most commonly found in mesic conifer or hardwood forests but may also occur in open valleys and farmland (Nussbaum et al. 1983). Adults are active year round and can be found in a variety of habitats such as coniferous forests, redwood forests, oak-woodland, farmlands, and grassland. Terrestrial animals spend much of their time underground in burrows, and also may be found beneath cover objects such as logs, bark, or boards (Nussbaum et al. 1983). Breeding habitats include lakes, ponds, roadside ditches, and slow-moving portions of streams and breeding begins in March but can be as late as July at low elevations (Nusbaum et al. 1983). Eggs hatch in 20 to 26 days; larvae typically metamorphose late in their first summer but may overwinter where growing seasons are short and metamorphoses occurs in their second summer (Nusbaum et al. 1983).

In this inventory, rough-skinned newt adults were found in natural and altered permanent lakes/ponds and rivers, and seasonal rivers, beaver ponds, wetland meadow and ditches. Bottom substrates where adult animals were detected were mostly mud (44%) and silt (42%). Juveniles were found at only one site, in cobble substrate. Larvae were found only in one site with bottom substrates of silt (50%), leaves (20%), grass (20%), and wood (10%). Water temperatures where embryos and larvae were detected (n=3), ranged from 9.7 to 10.2°C; pH ranged from 5.65 to 6.56; conductivity ranged from 91.3 uS/cm to 237.0 uS/cm; and dissolved oxygen ranged from 5.0 mg/L to 9.9 mg/L.

This report has had confidential information regarding park-sensitive species locations removed.

At all aquatic sites where rough-skinned newt was detected, it occurred in association with northern Pacific treefrog (30%), northwestern salamander (25%), Columbia torrent salamander (13%), and coastal giant salamander (7%). Rough-skinned newt was also found in association with terrestrial species including western red-backed salamanders (14%), Dunn's salamander (10%), and *Ensatina* (3%). Size of adult rough-skinned newts ranged from 35 mm to 55 mm SVL (n=8).

Hallock and McCallister (2005c) report rough-skinned newt as demonstrably widespread, abundant, and secure in the state of Washington. This species has no national, regional or State conservation status in Oregon or Washington. Historic habitat in LEWI and the surrounding area listed as good in the 1850s, is now noted as fair with very patchy areas of good habitat (Oregon Wildlife Explorer 2014).

In some areas, newts migrate in large groups to breeding ponds. If the migratory path crosses a road with heavy traffic, mortality can be high and could potentially threaten a local population (Hallock and McCallister 2005c).



Figure 25. Rough-skinned newt (*Taricha granulosa*) found at CD2 in a side tributary in the Cape Disappointment unit of Lewis and Clark National Historical Park.

Northern Red-legged Frog (*Rana aurora*)

Red-legged frog taxonomy is the subject of ongoing debate. Of the two subspecies recognized by Crother et al. (2008), *Rana aurora aurora* (northern red-legged frog) is the one that occurs in the Park. However, Pearl (2009) suggests that biochemical, ecological and life-history differences between northern red-legged frogs and California red-legged frogs (historically known as *Rana aurora draytonii*), support recognition of these taxa as distinct species. Hallock and McAllister (2009a) report that current research using genetic data has resulted in a systematic revision of red-legged frogs (Shaffer et al. 2004) revealing that not only are northern and California red-legged frogs valid species, northern red-legged frogs are more closely related to Cascades frogs than they are to California red-legged frogs.

Northern red-legged frogs are found in lower elevations in moist forested habitats with access to suitable breeding sites which includes vegetation suitable for egg mass attachment. Breeding sites can be permanent or temporary, with inundation usually necessary into June for successful metamorphosis (Nussbaum et al. 1983). Breeding is initiated when water temperatures exceed 6°C (42.8°F), generally in February or March (Nussbaum et al. 1983). Eggs hatch in about 30 to 40 days and metamorphosis occurs in about 11 to 16 weeks. Juveniles often remain around edges of breeding ponds for days to weeks before dispersing (Pearl 2009). Juvenile habitat includes moist, densely vegetated riparian micro habitats during the summer. Northern red-legged frogs may overwinter in terrestrial habitat (under ferns or in duff, under woody debris, and within streambanks) for at least part of the season, moving into water when conditions are colder; they remain active throughout the winter at low elevation sites when temperatures are above freezing (Hallock and McAllister 2009a). Larvae are grazers and can strongly influence the distribution of algae (periphyton) in some still-water habitats (Dickman 1968).

Northern red-legged frogs in this inventory were documented at 32 aquatic survey sites (all life stages) and three terrestrial survey sites (two juveniles and three adults), and were present in all three LEWI units (Figure 26). This species occurred in 50% of all aquatic survey sites, 60% of all terrestrial survey sites, and made up 57% of all the incidental observations. Of the northern red-legged frog lentic detections, 18% were found in natural and altered permanent lakes and ponds, and 7% in natural and altered seasonal lakes and ponds, 14% in beaver ponds, and 18% in palustrine wetland habitat. Of the lotic detections, 21% were permanent natural and altered streams, and other sites including ditches and a spring/seep. Incidental observations documented this species in an old wood pile and along the edge of a dike. Water temperatures where embryos and tadpoles were detected (n=14) ranged from 7.2 to 14.3°C; pH ranged from 5.27 to 6.9; conductivity ranged from 86.8 uS/cm to 250.0 uS/cm; dissolved oxygen ranged from 0.9 mg/L and 10.9 mg/L.

Northern red-legged frogs were observed in association with other aquatic lentic breeding species including northern Pacific treefrog (25%), northwestern salamander (21%), rough-skinned newt (20%) and American bullfrog (3%). They were also detected in lotic sites along with Columbia torrent salamander (5%), Coastal (2%) and Cope's (2%) giant salamanders, and at sites in association with terrestrial breeding species: Ensatina (5%), western red-backed salamander (9%), and Dunn's salamander (4%). Size of adults measured ranged from 35-58 mm SVL (n=4). Size of juveniles

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ranges from 15 mm to 35 mm SVL (n=5). We detected this species at 13 sites where fish were present. Negative interactions have been suggested between northern red-legged frogs and introduced bullfrogs and sport-fish in Oregon (Hayes and Jennings 1986, Kiesecker and Blaustein 1997, 1998).

The State of Oregon lists northern red-legged frog as vulnerable but not in the Coastal Range Ecoregion. However, the U.S. Fish and Wildlife lists the northern red-legged frog as a Species of Concern in Oregon (USFWS 2013). The Oregon Biodiversity Information Center (2013) notes this species as “List 4” which represents taxa which are of conservation concern but are not currently threatened or endangered. This includes taxa which are very rare but are currently secure, as well as taxa which are declining in numbers or habitat but are still too common to be proposed as threatened or endangered. While these taxa may not currently need the same active management attention as threatened or endangered taxa, they do require continued monitoring.

Limiting factors associated with this species in Oregon include loss of egg-laying habitat, predation and competition by invasive fish and bullfrogs. Data gaps include identification of overwintering habitat and lack of information on pollutants, ultraviolet radiation and parasites on populations. Another potential but least studied threat to red-legged frog populations is road mortality (Hallock and McAllister 2009a). Predation by introduced game-fish and American bullfrogs may represent important threats to northern red-legged frogs throughout their range (Hayes and Jennings 1986, Twedt 1993, Kiesecker and Blaustein 1997, 1998).



Figure 26. Northern red-legged frog (*Rana aurora*) found at a shallow spring/seep (CD2, on left) and at a beaver pond (LE8, on right) in Lewis and Clark National Historical Park.

American Bullfrog (*Lithobates catesbeianus*)



Figure 27. American bullfrog (*Lithobates catesbeiana*) tadpoles at Lake McKenzie in the Cape Disappointment unit (CD6, on left) and adult in a ditch in the Fort Clatsop unit (LE12, on right), Lewis and Clark National Historical Park.

American bullfrog was documented at two sites in the Fort Clatsop unit and one site in the Cape Disappointment unit. Adult, juvenile and tadpole life stages were observed in this inventory. American bullfrogs are native to the eastern United States and were introduced throughout the west since the early part of the 1900s (Hallock and McAllister 2009b). Bullfrogs were introduced into Oregon as early as the 1920s or 1930s (Nussbaum et al. 1983) and are now considered an invasive problematic species in Oregon (ODFW 2006) and Washington (Hallock and McAllister 2009b). American bullfrog juveniles and adults are found in permanent wetlands, ponds, lakes, sloughs and streams. Bullfrogs likely overwinter in permanent water bodies near sources of well-oxygenated water (Hallock and McAllister 2009b). They occasionally move to terrestrial sites at night and they will disperse over land, in mass, on warm rainy nights. Juvenile bullfrogs have also been observed in road puddles at some distance from aquatic habitat; puddles and other sources of temporary standing water may be important habitat features for dispersing individuals (Hallock and McAllister 2009b).

American bullfrog was observed in association with northern Pacific treefrog (37%), rough-skinned newt (25%), northern red-legged frog (25%), and northwestern salamander (13%) in aquatic surveys. Larvae measured (only one) was noted as >35mm.

American bullfrog was documented at one altered stream (LE24) and one drainage ditch (LE12) in the Fort Clatsop unit and at Lake McKenzie in the Cape Disappointment unit (CD6) (Figure 27). Adults were detected in bottom substrate of mud, juveniles were detected in silt substrate, and larvae were detected in bottom substrate consisted of mostly leaves. Water temperatures where tadpoles were detected (n=1) was 13°C, pH was 6.65, conductivity was 208 uS/cm, and dissolved oxygen concentration was 7.4 mg/L.

Adult bullfrogs are voracious, opportunistic predators (Schwalbe and Rosen 1988) that employ a sit-and-wait approach and will readily attack any live animal smaller than themselves, including

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conspecifics and other frogs (Bury and Whelan 1984). American bullfrog is a controlled species in Oregon and Washington and can be legally harvested year-round in Oregon (ODFW 2006), and in Washington (WAC 232-12-619). Bullfrog observations in Oregon should be reported to ODFW (ODFW 2006). We recommend monitoring of this invasive species at known and potential sites.

Columbia Torrent Salamander (*Rhyacotriton kezeri*)



Figure 28. Columbia torrent salamander (*Rhyacotriton kezeri*) near a site [location removed] in the Fort Clatsop unit of Lewis and Clark National Historical Park.

Columbia torrent salamander was detected in both Oregon (Fort Clatsop unit) and Washington (Cape Disappointment) at ten aquatic survey sites, and one adult was documented at one terrestrial survey site. Adults, juveniles, and larval life stages were observed in this inventory. Larvae are fully aquatic. Columbia torrent salamanders are distributed throughout the Coast Range ecoregion from sea level to the highest points in coastal northwestern Oregon and southwestern Washington (Jones et al. 2005). The species was not described until the early 1990's (Good and Wake 1992), have not been studied extensively, and few nest sites have been observed but eggs are likely laid in low-flow headwater habitats Russell (2004), occurring in relatively inaccessible, cryptic locations. Stable, slow-flow stream microhabitats with loose gravel and cobble, open interstices, and reduced levels of fine

sediments are preferred habitat (Hayes and Quinn 2005). Stebbins and Lowe (1951) reported microenvironment of *Rhyacotriton* is characteristically cold, permanent streams with small water-washed or moss-covered rocks (usually rock rubble) in and along running water, seeps and small, trickling tributary streams with rocks of small dimensions. Stebbins and Lowe (1951) also generalized about the vegetation typical of streams where *Rhyacotriton* are found that provide a cool, wet microenvironment with good leaf canopy (especially during summer), abundant understory vegetation, moss and thick leaf mat on stream banks. Hallock and McCallister (2005d), report that this species inhabit relatively cold, permanent streams (usually occurring in stream segments that are shallow, slow flowing and have gravel or rock rubble with low levels of silt), seepages and waterfall splash zones, typically in areas with a thick canopy cover. During rainy wet periods, individuals may be found in wet terrestrial forest settings away from streams or seepages (Hallock and McCallister 2005d). In this inventory, Columbia torrent salamander was detected in permanent natural streams (18%), permanent altered streams (9%), seasonal natural (18%) and seasonal altered (55%) streams (Figure 28). Juveniles were found mostly in silt substrate (50%) followed by cobble (20%), mud (20%), and wood (10%). Larvae were detected in silt (40%), cobble (30%), bedrock (25%), and wood (5%). Adults were found in silt substrate (53%), cobble (33%), mud (7%), grass (5%) and wood (2%). Water temperatures where larvae and adults were detected (n=10) ranged from 9.0 to 10.3°C, pH ranged from 5.29 to 7.12, conductivity ranged from 94.0 uS/cm to 411.0 uS/cm, and dissolved oxygen concentrations ranged from 9.8 mg/L to 14.5 mg/L.

Except for the egg stage, little information on life history exists for Columbia torrent salamanders. However, data from closely related species of *Rhyacotriton* (Nussbaum and Tait 1977) suggest that Columbia torrent salamanders probably remain larvae for a relatively long period (>2 yr), and that metamorphosis can occur at almost any time, but a majority of individuals appear to metamorphose in late summer to early autumn (Nussbaum and Tait 1977). Based on data for other *Rhyacotriton* (Nussbaum and Tait 1977), this species may have a moderately long lifespan (>10 yr).

Jones et al. (2005) reports that co-occurrence with other species is relatively infrequent. However, in this inventory, Columbia torrent salamander was detected in association with western red-backed salamander (24%), Dunn's salamander (20%), coastal giant salamander (16%), rough-skinned newt (16%), *Ensatina* (8%), red-legged frog (8%), Cope's giant salamander (4%), and northwestern salamander (4%). Size of Columbia torrent salamander adults ranged from 22 mm to 60 mm SVL (n=11). Size of juveniles ranged from 15 mm-35 mm (n=2). Size of larvae ranged from 14 mm to 38 mm (n=8).

Columbia torrent salamanders have state Sensitive status in both Oregon and Washington and are listed as a Federal Species of Concern. In Washington they are listed as S3 (Rare or uncommon, typically 21 to 100 occurrences). In Oregon, this species is listed as Sensitive –Vulnerable, species are facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the state but could become so with continued or increased threats to populations and/or habitats. The Oregon Conservation Strategy (ODFW 2006) notes data gaps on distribution and responses to management activities. Hallock and McCallister (2005d) recommend studies of habitat affinities for larval and adult salamanders,

This report has had confidential information regarding park-sensitive species locations removed.

especially egg-laying habitat, on the effects of roads and logging on population persistence, and addressing the seasonal movement patterns, especially the recolonization abilities of this species.

The Oregon Conservation Strategy (ODFW 2006) recommends maintaining stream buffers for cool water temperatures and water clarity and minimizing disturbance in known suitable habitat. We recommend additional surveys and monitoring of existing populations in LEWI.

Cope's Giant Salamander (*Dicamptodon copei*)

Cope's giant salamander was detected at only two sites, both in the Cape Disappointment unit. *D. copei* was first described by Nussbaum 1970) and was previously not distinguished from *D. ensatus*. Recent genetic studies (Daugherty et al. 1983, Good 1989) have supported the recognition of these forms as separate species. This species is the smallest of the *Dicamptodon* species. Nussbaum et al. (1983) report that Cope's giant salamanders have a complex and highly variable pattern of life history with some individuals reproducing in larval form while some localities only terrestrial adults reproduce, and at other localities a high percentage of the breeding population is paedogenetic. Jones et al. (2005) notes that there has been little research on this species since it was first described in 1970 but they report that metamorphosis in some populations is not as rare as previously believed, and the degree of sympatry with coastal giant salamanders is high in some areas. Jones and Bury (2005) report Cope's giant salamanders as occurring from western Washington and extreme northwestern Oregon, including the Cascades, Olympic Peninsula, and in Oregon confined to the vicinity of the Columbia River Gorge, however, Jones et al. (2005) reports that the range of this species is not completely known and that it does occur in Clatsop County.

Cope's giant salamander and coastal giant salamander are phenotypically similar when young and therefore difficult to distinguish, especially for larvae <50 mm snout-vent length (Hallock and McCallister 2009c). Previous to this inventory park staff believed any giant salamander species present in the area of the park were Cope's (David Ek, personal communication). However, this inventory detected only five Cope's giant salamanders at two sites, both in the Cape Disappointment unit, across the Columbia River in Washington, as confirmed through genetic testing (Storfer 2005). Only the larval life stage was detected in this inventory. Generally, this species is found in its larval or paedomorphic life stage (Jones et al. 2005).

Nusbaum et al. (1983) note Cope's giant salamanders are normally restricted to streams and seepages in moist coniferous forests with water temperatures that usually range from 8 to 14°C, and are seldom higher than 18°C but may also occasionally occur in clear, cold mountain lakes and ponds. Petranksa (1998) reports that individuals may be found under rocks and woody debris. Cope's larvae in this inventory were detected only in a permanent stream in bottom substrates of 40% bedrock, 36% cobble, and 24% silt. Water temperatures where larvae were detected (n=2) ranged from 9.8 to 10.2°C, pH ranged from 5.96 to 6.25, conductivity ranged from 217 uS/cm to 411 uS/cm, and dissolved oxygen concentrations ranged from 9.8 to 9.9 mg/L.

Size of Cope's giant salamander larvae ranged from 22 mm to 63mm SVL (n=5). Jones et al. (2005) report that larvae usually become paedomorphic adults at 665–75 mm SVL.

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In Washington this species is listed as State Monitor and S3 (Rare or uncommon in the state, typically 21 to 100 occurrences) as well as S4 (Widespread, abundant, and apparently secure in state, with many occurrences, but the taxon is of long-term concern; usually more than 100 occurrences). Local declines and extirpations may have occurred but have not been documented. The main concerns for this species have to do with protection of stream integrity, mainly land uses that elevate stream temperatures and contribute to erosion and increased sedimentation (Hallock and McCallister 2009c). In Oregon, Cope's giant salamander is listed as Sensitive–Vulnerable, species are facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the state but could become so with continued or increased threats to populations and/or habitats. The Oregon Conservation Strategy (ODFW 2006) notes information gaps including reproduction (parental care, number of clutches /female/year) and frequency of naturally occurring terrestrial individuals. Conservation actions include maintaining stream buffers for cool water temperatures and water clarity, prevention of sedimentation, and replacement of culverts to remove barriers in continuous, natural streambed and streambank habitats. We recommend additional searches for Cope's giant salamander within the Oregon units of LEWI.

Coastal Giant Salamander (*Dicamptodon tenebrosus*)



Figure 29. Coastal giant salamander (*Dicamptodon tenebrosus*) at a seasonal stream (LE3) in the Fort Clatsop unit, Lewis and Clark National Historical Park.

This report has had confidential information regarding park-sensitive species locations removed.

On the basis of genetic differentiation, coastal giant salamander is now recognized as a species distinct from the California giant salamander (*Dicamptodon ensatus*) (Good 1989). Coastal giant salamander (also formerly known as Pacific giant salamander) is the largest salamander in the Pacific northwest and in North America, and one of the largest terrestrial salamanders in the world (Petranka 1998). Coastal giant salamander was detected at nine sites in this inventory, only in the Fort Clatsop unit, and confirmed through genetic analysis (Storfer 2005). As noted above for Cope's giant salamander, larvae of the two species, <50 mm snout-vent length, are difficult to distinguish, (Hallock and McCallister 2009c). Terrestrial adults can reach 190 mm SVL (Jones et al. 2005). In this inventory, size of coastal giant salamander larvae ranged from 22 mm to 65 mm SVL (n=26). Size of adults ranged from 65 mm to 82 mm SVL (n=2).

Jones et al. (2005) report that this species occur in moist forests, where adults seek refuge under rocks, logs, root channels, and mammal burrows and larvae and paedomorphs are found primarily in lotic waters from headwaters to rivers and in lentic habitats as well and the highest abundances and diversity of sizes is found along partially shaded and adequately buffered streams. Within stream diversity includes both a range of coarse substrate sizes from boulders to pebbles with little fine sediment, and a good mix of pools riffles, and runs (Jones et al. 2005). In this inventory, adults were observed near permanent altered streams and larvae were observed in both permanent and seasonal altered streams with bottom substrates of mostly silt (62%), cobble (19%), wood (14%), and mud (5%) (Figure 29). Water temperatures where larvae were detected (n=9) ranged from 8.5 to 9.7°C, pH ranged from 6.46 to 7.02, conductivity ranged from 95 uS/cm to 156.4 uS/cm, and dissolved oxygen concentrations ranged from 9.5 mg/L to 13.2 mg/L. Nussbaum and Clothier (1973) reported that paedomorphosis is typical in perennially aquatic sites (large streams, rivers, lakes, and ponds), while small streams that may dry up tend to harbor predominantly metamorphic populations. No paedomorphs were observed in this inventory.

Coastal giant salamander adults (n=2) were detected in association with western red-backed salamander, Dunn's salamander, *Ensatina*, and northern Pacific treefrog. Larvae (n=9) were observed in association with Columbia torrent salamander (40%), rough-skinned newt (20%), and northern red-legged frog (10%), and with no other species (30%).

No indication of declines or increases in the historical distribution of coastal giant salamanders has been documented, but there has been some fragmentation within their range resulting from habitat alterations, mostly due to forestry practices, and this species seems to be more resilient than other stream-associated amphibians in the coastal Northwest and are likely to persist in streams that are moderately disturbed (Jones and Welsh 2005).

Ensatina (*Ensatina eschscholtzii*)



Figure 30. *Ensatina (Ensatina eschscholtzii)* found in a coniferous forest (site CD4) in Lewis and Clark National Historical Park.

Crother et al. (2008) reports that the taxonomy of *Ensatina* is complex and still being debated and as many as 11 or more species have been suggested. *Ensatinas* have the widest distribution of any West Coast plethodontid, ranging from northern Baja, Mexico, to the central coast of British Columbia and Vancouver Island, Canada (Kuchta and Parks 2005). Crothers recognizes seven subspecies including *Ensatina eschscholtzii oregonensis*. Nussbaum et al. (1983) and Jones et al. (2005) report that the Oregon *Ensatina (Ensatina eschscholtzii oregonensis)* as the subspecies that occurs in Washington and northwestern Oregon.

Ensatinas are mainly found in coniferous and deciduous forests (Jones et al. 2005), and are surface active during spring and fall when temperatures are cooler and the ground is damp from rain or snow melt and in warmer and drier conditions, they retreat underground (Nussbaum et al. 1983). Breeding is terrestrial. They require moist microhabitats but do not enter water. Hallock and McCallister (2005e) report *Ensatina* inhabiting forests stands of all ages and appear to be more abundant in higher

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rainfall areas in western Washington. *Ensatina* are found under decaying logs, leaf litter, bark and rocks and even backyard woodpiles (Jones et al. 2005).

Ensatina (*Ensatina eschscholtzii*) was detected in the Fort Clatsop unit at two sites in terrestrial surveys, two sites in aquatic surveys, and four incidental surveys. *Ensatina* was also detected at two sites in the Cape Disappointment unit aquatic surveys (Figure 30). In all surveys combined, *Ensatina* was found in association with western red-backed salamander (30%), Columbia torrent salamander (15%), northern red-legged frog (15%), Dunn's salamander (10%), coastal giant salamander (10%), Pacific giant salamander (10%), rough-skinned newt (5%), and northern Pacific treefrog (5%). Size of adults ranged from 39 mm to 54 mm SVL (n=7). The size of the juvenile was 18 mm to 32 mm SVL. (n=3).

In terrestrial surveys, *Ensatina* was found mostly under decaying wood in mixed forest with 80-100% overstory cover. Overstory vegetation included Sitka spruce, western hemlock, red alder. Understory vegetation included salmonberry, western sword fern, trillium, azalea, deer fern, false lily of the valley, huckleberry, lady fern, and salal.

Ensatina are common and appear to be well distributed throughout their historic range in Washington (Hallock and McAllister 2005e) and occur throughout most of western Oregon (Nussbaum et al. 1983). They have no national, regional, or State conservation status. Patchy, good to fair habitat exists in LEWI today in what was considered contiguous good habitat in the 1850's (ODFW 2005).

Western Red-backed Salamander (*Plethodon vehiculum*)



Figure 31. Western red-backed salamander (*Plethodon vehiculum*), Cape Disappointment unit (both photos CD2), Lewis and Clark National Historical Park.

Western red-backed salamander distribution extends from southwestern British Columbia through western Washington to southwestern Oregon (Jones et al. 2005). Western red-backed salamander was detected only in the Fort Clatsop and Cape Disappointment units at 21 sites (Figure 31). This species is entirely terrestrial and eggs hatch into miniature versions of adults (Jones et al. 2005). Bury

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(2005) notes that western red-backed salamander occur across all forest stand ages and are common in Douglas fir and other mixed forests throughout their range.

In terrestrial surveys we detected western red-backed salamander under decaying wood near streams and seeps in mixed forest overstory with canopy cover from 60% to 100%. Overstory vegetation included western hemlock, Sitka spruce, red alder, and Douglas fir. Understory vegetation included huckleberry, sword fern, deer fern, lady fern, salal, vine maple, salmonberry, skunk cabbage, and red elderberry. Western red-backed salamanders were observed in association with Dunn's salamander, *Ensatina*, northern red-legged frog, northern Pacific treefrog, rough-skinned newt, and Columbia torrent salamander at terrestrial survey sites (n=4), and with Columbia torrent salamander, coastal and Cope's giant salamanders, northern red-legged frog, northern Pacific treefrog, rough-skinned newt, Dunn's salamander, and *Ensatina* at aquatic survey sites (n=14). Three incidental observations of western red-backed salamander were also recorded.

Adult males mature at about 38 to 53 mm SVL and females mature at about 44 to 58 mm SVL (Nussbaum et al. 1983). Newly hatched young are about 15 mm SVL (Jones et al. 2005). In this inventory, size of adults ranged from 33 mm to 52 mm SVL (n=57). Size of juveniles ranged from 14 mm to 32 mm SVL (n=9). Juveniles grow about 10 mm SVL annually for their first 3 years (Nussbaum et al. 1983).

Western red-backed salamander has no national, regional or State conservation status. This is a widespread species that occurs in a variety of habitats and appears not to be declining at the present time (Bury 2005).

Dunn's Salamander (*Plethodon dunni*)



Figure 32. Dunn's salamander (*Plethodon dunni*) at site [location removed], Fort Clatsop unit, Lewis and Clark National Historical Park.

Dunn's salamanders are the largest of the northwestern *Plethodon* species and are distributed west of the Cascade Range crest, from extreme northwestern California to southern Washington (Jones et al. 2005). We detected Dunn's salamander only in the Fort Clatsop unit in Oregon. Dunn's salamander is associated with rocks in cool, moist forested environments, often within a few meters of small streams; however they have also been observed upslope, away from stream channels (Jones et al. 2005). Typically, they occupy the splash zone, where they can be found in bank gravel, under rocks, and under woody debris, and they also occupy moist talus (Hallock and McCallister 2005f). In this inventory, we detected Dunn's salamander near streams and seeps in or under decaying wood in mixed forest overstory with canopy cover from 60% to 100% (Figure 32). One juvenile was detected in stream cobble. Overstory vegetation included western hemlock, Sitka spruce, red alder, and Douglas fir. Understory vegetation included huckleberry, sword fern, deer fern, lady fern, salal, vine maple, salmonberry, skunk cabbage, and red elderberry.

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Jones et al. (2005) report that Dunn's salamander often occur along streams inhabited by torrent salamander and Pacific giant salamander species and seems to have complementary streamside distributions with western red-backed salamander. In this inventory Dunn's salamander was found in association with western red-backed salamander, rough-skinned newt, northern red-legged frog, and Columbia torrent salamander at terrestrial survey sites (n=2). They were also observed in association with these species at aquatic survey sites along with Ensatina, northwestern salamander, coastal giant salamander, and northern Pacific treefrog.

Dunn's salamander is one of the larger woodland salamanders with males ranging as high as 67 mm SVL and female adults up to 75mm SVL. In this inventory, size of adult Dunn's salamanders ranged from 38mm to 62mm SVL (n=14). Jones et al. (2005) report size of hatchlings at 16 mm SVL and hatchlings can be found at the surface after fall rains in October and November. In this inventory, one juvenile was measured at 33mm SVL.

Dunn's salamander is listed as State Critical in Washington but has no national, or State conservation status in Oregon. This is a fairly widespread species in Oregon, but it appears to require wet rocky substrate and often is most abundant along streamside habitat. There is no clear evidence to indicate declines in populations, but they are absent or reduced in clearcut forests in western Oregon (Bury 2005b). Riparian corridors are clearly important and should receive continued scrutiny and removal of large woody debris from streams and terrestrial habitats may also be detrimental (Hallock and McCallister (2005f). More information is needed on population dynamics and life history; better descriptions of habitat associations, egg-laying habitat characteristics, and information on forestry practices and the importance of large woody debris is also needed (Hallock and McCallister 2005f). Jones et al. (2005) report that removal of tree cover adjacent to streams may cause a temperature increase that is harmful to this species. We recommend additional surveys and monitoring of known sites be conducted. When conducting surveys, care should be taken to replace cover objects after exposing an animal.

Threats

In western North America, a disturbingly large percentage of native amphibians have suffered severe declines and local extinctions even in our most pristine and remote reserves (Lanoo 2005). Direct declines have been attributed to habitat decline and the spread of invasive species (Liss et al. 1995, Pearl et al. 2004, Adams and Pearl 2007, Ryan et al. 2014). Widespread stressors threaten amphibian populations including deposition of air-borne chemical pollution (Bridges 1997, Bridges 2000, Bridges 1999a, Bridges 1999b, Relyea and Mills 2001, Boone and Semlitsch 2002, Blaustein and Johnson 2003, Blaustein et al. 2003, Christin et al. 2003, Daszak et al. 2003, Gendron et al. 2003), water pollution (Säfholm et al. 2014, Berrill et al. 1994, Marco et al. 2009, Sadinski et al. 2014), diseases (Pearl et al. 2009, Pounds et al. 2006, Johnson et al. 2006, Hayes et al. 2010, Berger et al. 1998, Skerratt et al. 2007, Fisher et al. 2009, Briggs et al. 2010, Gray et al. 2009, Sessions and Ruth 1990, Johnson et al. 1999, 2002, Schotthoefer et al. 2003, Blaustein et al. 1994, USGS 2011, IUCN 2005, NPS 2009), and global climate change (Lawler and Mathias 2007, Carey and Alexander 2003, Beebee 1999, Lind 2008, Ryan et al. 2014), in addition to having direct effects on amphibian survival, reproduction, and growth, may also act by reducing immune system functioning and thereby facilitate the emergence of infectious diseases (Daszak et al. 2003).

Human development projects can directly or indirectly alter amphibian habitat. Wetlands are important habitat for many amphibians and reptiles and should be protected from development or alteration. Trail- and road-stream crossing structures (such as culverts) can alter natural water courses and habitat, and act as passage barriers for aquatic species. Care should be taken when planning to place structures at a trail- and road-stream crossings, and when cleaning or replacing culverts which are often inhabited by native frogs. Trail- and road-stream crossing structures that maintain natural watercourses and habitat are most suitable. Frogs and salamanders also are often found breeding in roadside ditches, and so the cleaning of roadside ditches should be delayed until after native tadpoles have metamorphosed and moved from the ditch habitat.

Vehicle travel along roads can have a profound effect on anuran species well beyond 1000 m from the road, and most anurans are likely to have reduced abundances near roads. The noise and barrier effect of very high nighttime traffic volumes can also lead to negative effects of roads even on species that are relatively unaffected by direct road mortality (Eigenbrod et al. 2009). A synthesis of the effects of roads on the abundance of many amphibians and other species was conducted by Fahrig and Rytwinski (2009) who found scientific evidence of population effects of roads and traffic strong enough to merit routine consideration of mitigation of these effects on all road construction and maintenance projects.

Summary

Parkwide, the northern red-legged frog was the most dominant amphibian species at Lewis and Clark National Historical Park, followed by western red-backed salamanders, northern Pacific tree frogs, rough-skinned newts, and northwestern salamanders.

Ten of the 15 expected species were documented in Lewis and Clark National Historical Park, and one additional species that we did not expect was documented (*Dicamptodon tenebrosus*) (Table 11). Seven new species that had not been previously verified were documented in this inventory. Aquatic breeding, native, lentic species detected in Lewis and Clark National Historical Park were the northwestern salamander, rough-skinned newt, northern Pacific treefrog, and northern red-legged frog. Aquatic breeding, lotic species documented were the Columbia torrent salamander, Cope's giant salamander, and Pacific giant salamander; terrestrial breeding species documented were Ensatina, western red-back salamander, and Dunn's salamander. Fish were present in 28% of the aquatic survey sites (n=16).

One non-native species, American bullfrog, was documented during the inventory. The northern red-legged frog is the only federal special status species detected. However, neither Oregon nor Washington State list this as a special status species in the area of Lewis and Clark National Historical Park. NatureServe (2014) reports State-wide status of northern red-legged frog in Oregon as "Vulnerable" and Washington as "Secure."

The Oregon spotted frog is listed as threatened under the Endangered Species Act and State Critical in Oregon and Washington. Historically, Oregon spotted frog was found in Multnomah, Clackamas, Marion, Linn, Benton, Jackson, Lane, Wasco, Deschutes, and Klamath counties in Oregon (USFWS 2014), but was not detected in this inventory. Currently, this species is only known to occur in Wasco, Deschutes, Klamath, Jackson, and Lane counties (USFWS 2013).

Two species were not detected that should be present in the area: the long-toed salamander and western toad. A type specimen of the long-toed salamander was collected at Astoria, Oregon, located across Young's Bay from Fort Clatsop (Baird 1949). This species occurred historically in the area of the park and good to fair habitat exists throughout the park today. The Oregon Wildlife Explorer (2014) identifies long-toed salamanders as occurring in both the Lower Lewis and Clark and Skipanon River watersheds. Additional searches should be conducted in potential breeding areas during early spring (seasonal or permanent ponds, shallow edges of lakes and streams, palustrine wetlands).

There is anecdotal evidence of western toad sightings in the Fort Clatsop unit, but there are no recent confirmable observations although good to fair habitat exists throughout the park. Western toads are a federal species of concern, are listed by the Oregon Division of Fish and Wildlife (ODFW 2006) as "vulnerable," not in imminent danger of being listed as threatened or endangered but could become so, and are listed as "critical" in Washington. Additional targeted habitat searches should be conducted in typical breeding areas during early spring in lakes, ponds, marshes, and wet meadows.

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The Van Dyke's salamander, listed as a federal Species of Concern and "critical" in Washington, has not been documented in Oregon, but we included it in this survey as recommended by local amphibian experts. The nearest known population exists near Highway 4 in Washington, across the Columbia River, north of Lewis and Clark National Historical Park (IUCN 2004).

The clouded salamander, another species listed as "vulnerable" in Oregon, is also listed as occurring in Clatsop County (OSU Oregon Wildlife explorer 2014) but was not found in this inventory.

Historic maps suggest this species was found only southeast of the park within Clatsop County in moist coniferous forests, at edges and clearings and recently cut or burned areas, in association with stumps or decaying logs with intact bark and large, coarse, woody debris, as well as rock outcrops or talus.

Table 11. Amphibian species documented in Lewis and Clark National Historical Park, and their status. T = federal threatened status; ** = federal species of concern; SC= State critical; SE= State Endangered (Washington); SV= State vulnerable; SM= State Monitor (Washington); Category; # = introduced species.

Genus and Species	Common Name	Code	Special Status Species ¹	Non-native Species
Terrestrial Breeding Species				
Caudata — salamanders				
Ensatinas				
<i>Ensatina eschscholtzii oregonensis</i>	Oregon Ensatina	ENES		
Woodland salamanders				
<i>Plethodon vehiculum</i>	Western red-backed salamander	PLVE		
<i>Plethodon dunni</i>	Dunn's salamander	PLDU	SC (WA)	
Aquatic Breeding Species				
Caudata — salamanders				
Mole salamanders				
<i>Ambystoma gracile</i>	Northwestern salamander	AMGR		
Pacific newts				
<i>Taricha granulosa</i>	Rough-skinned newt	TAGR		
Pacific giant salamanders				
<i>Dicamptodon tenebrosus</i>	Coastal Giant Salamander	DITE		
<i>Dicamptodon copei</i>	Cope's giant salamander	DICO	SV, SM	
Torrent salamanders				
<i>Rhyacotriton kezeri</i>	Columbia torrent salamander	RHKE	SV	
Anurans				
Brown frogs				
<i>Rana aurora</i>	Northern red-legged frog	RAAU	** ²	
American water frogs				
<i>Lithobates catesbeianus</i> (formerly <i>Rana catesbeiana</i>) ²	American bullfrog	RACAT		#
Chorus frogs				
<i>Pseudacris regilla</i>	Northern Pacific treefrog	PSRE		

¹ ODFW 2008, USFWS 2013, WDFW 2014.

² U.S. Fish and Wildlife Service. 2013.

<http://www.fws.gov/oregonfwo/Species/Data/Default.asp#Reptiles And Amphibians>

This report has had confidential information regarding park-sensitive species locations removed.

Although land use and introduction of non-native species has altered the Park as compared to what was present in the 1800s, a mosaic of prairie, forest, herbaceous, shrubland, and wetland habitats are still present among the Park units (Kagan et al. 2012). Amphibians were found in a diversity of habitats including diked areas; beaver ponds; ditches; altered lakes, ponds, streams and rivers, both permanent and seasonal; springs and seeps; in moist areas adjacent to or along streams; in forested areas in or under moist, decayed wood; and even in fence piles or wood left from park maintenance activities.

Given the limited time involved in conducting this inventory, diversity and amount of amphibian habitat existing within the Park, and threats associated with amphibian species present in the park, additional surveys and long-term monitoring should be conducted. In particular, additional surveys should be conducted in the 77 acres of former pasture that the park has restored to tidal wetland and in the lands acquired since the 2005 survey – the Dismal Nitch unit in Washington and the Yeon Unit south of Sunset Beach.

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Appendix A: Amphibian Survey Protocols and Datasheets

LEWI Aquatic Amphibian Survey Protocols and Datasheets.

CONTENTS

Materials

Procedures

Water Sample Collection

Survey Form Field Definitions

Species List and Codes

ARMI Survey Form 2001

This survey protocol was initially designed for use in the North Coast and Cascades Network (NCCN) Amphibian Inventory for lentic habitat. All lentic habitats at LEWI were surveyed using this protocol. In 2002, all aquatic lentic habitats were surveyed with this protocol (including ponds, lakes, streams, wetland complexes, ditches with surface water). In 2005 aquatic surveys included searches of these aquatic habitats along with seeps, springs, and the terrestrial areas surrounding the surface waters. Searches of terrestrial areas included field crews visually searching for amphibians over the entire area surrounding the surface water bodies, searching along and within streambanks as well as looking under loose wood, bark, or rock habitat in the upland areas.

Aquatic: each wetland will be sampled for amphibians, a variety of habitat variables measured, and water samples collected for analysis in a lab. It is important that standardized methods be used to collect these data, so that they are comparable among wetlands within the Network.

Field crews will have read all appropriate SOPs prior to starting field work. Sampling procedures will be checked by an experienced staff member (e.g., subproject lead) prior to sending novice samplers out into the field.

MATERIALS

1. map of study area - indicating location of wetland patches to be characterized
2. data notebook – blank datasheets copied on waterproof paper (sample datasheet attached)
3. thermometer - for measuring air and water temperatures
4. GPS - for determining wetland location and area
5. dipnets - net mesh suitable for capturing small amphibian larvae
6. pH meter - for characterizing H⁺ ion content
7. TDS/conductivity meter - for characterizing aquatic conductivity
8. DO meter or BOD bottles
9. water sample containers - 120ml and 250ml plastic bottles

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10. voucher specimen vials 1/2 filled with formalin
11. waders and wading shoes
12. ruler- to measure amphibian lengths

PROCEDURES

Survey Techniques:

*Note: Although all of the tasks below need to be completed at each wetland, the specific order of completion is not critical. If amphibian sampling will stir up too much sediment to get clean water samples, these sensitive tasks should be completed first. Otherwise it is up to the discretion of the team to determine which tasks to complete in what order.

Datasheet Management:

Upon arrival at each wetland to be sampled begin a new data sheet. If multiple discrete bodies of water are encountered when the crew approaches a site, fill out a separate form for each. If ponds are not discrete (are connected with channels or are part of a wet meadow) cover the area as a single site on one sheet.

Mapping:

1. Draw a map of the wetland perimeter (use box on page 2 of data sheet)
 - be sure to orient drawing to North arrow on map
 - use codes to indicate approximately where each survey activity is conducted (e.g., water Samples, Temperature, GPS)
2. Include details of habitat on map (where large concentrations of emergent veg occur, overhanging veg, etc.)

GPS Location:

1. Find location along the shoreline where the GPS unit receives a strong signal, indicate location on map.
 2. Log points at that location for 1-2 minutes (use UTM NAD27 format)
 - a. Record the UTM Zone, coordinate locations, and the estimate of error (EPE preferably <5m) on the data sheet.
 - b. Record the filename as it was saved.
- do not record elevation from the GPS, it is not very accurate. Determine elevation from topography map.

Amphibian Surveys:

1. These surveys generally are conducted by teams of 2 individuals and can be conducted at the same time as the aquatic habitat characterizations or separately (depending on crew size).

- a. Record all stages of development observed for each species (see attached species list)
- b. Walk the perimeter of the wetland, stopping every 10 meters, or at 20 evenly spaced stations, to scan for embryos and larvae. One person wades, the other walks on shore.
- c. At each of the stations, look for amphibians and make dipnet sweeps to capture individuals to ensure definitive species identification (*Only continue dipnetting while potentially occurring species remain undetected). Release identified specimens at the point of capture. If moveable cover items are present move them to see if larvae are hiding beneath them. Identify any embryos or larvae to species, or if not possible preserve a voucher specimen in a labeled vial of 10% buffered formalin.
- d. Vegetated areas and other habitats likely to harbor embryos and larvae will also be intermittently sampled using dipnets
- e. Once evidence of current breeding activity for a species is detected (i.e., embryos, tadpoles, or metamorphs from the current breeding season) and recorded, searches for that species/stage should cease (to conserve time).
- f. If one or more species remain undetected following a complete circuit of the wetland, other habitats where they are likely to occur (e.g., vegetated areas away from the shoreline) should be searched prior to declaring them absent.

2. Each team should collect voucher specimens (generally a single larva of each species present) at 10% of the ponds located in each randomly chosen watershed. Sufficient information will be recorded on the labels and data sheets such that it can be determined where the sample was collected and what species are represented. A subsample (about 10 of a stage per species) of amphibians will be measured and a few individuals will be collected as vouchers and for the health and disease survey (see the Animal Collection SOP).

3. Each species detected will be recorded on a separate line on the datasheet. The species name (or a set abbreviation) will be recorded and if a voucher was preserved “Y” will be circled. Counts or estimates of individuals will also be recorded. If the numbers of larvae are too high to count, the field crew will estimate the numbers of individuals seen. For egg masses, if they are distinct they will be counted. If masses can’t be counted, the number of eggs seen at the site will also be estimated (for example, a crew member can count all the eggs/larvae found within a square quarter-meter and extrapolate to estimate the total number observed). Also note any frog or toad species heard calling, and/or metamorphosed amphibians incidentally encountered around the area of the wetland.

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Aquatic Habitat Characterization:

1. Estimate the percent of the surface area with floating (reaching the surface) or emergent aquatic vegetation.
2. Estimate the percent of the pond bottom made up by each of the substrate categories.

Fish Presence/Absence:

While characterizing habitat and surveying for amphibians watch for any evidence of the presence of fish.

- a. Watch for fish in shallows and rising to feed on the surface
- b. If not yet detected, search 30 meters up inlet and outlet streams where fish may be more visible.
- c. If present indicate species, if determined, on the Species list of the datasheet.

Water Quality Characterization:

1. Record air temperature (in the shade and 1 m above ground) and water temp (in the sun and 10 cm below the surface) in Celsius.
2. pH and conductivity measurements.
 - a. Calibrate both meters at the beginning of each day. Calibrate pH meter using pH 4 and 7 stock buffers. Measure the check solution to see if is accurate.
 - b. Rinse cup 3 times with site water, collect sample of water in cup, insert pH meter and follow procedures for measuring pH.
 - c. Rinse cup 3 times with site water, collect new sample, insert conductivity meter and allow equilibrating, recording reading. If meter does not stabilize after 2 minutes record the low and high range of the current readings.
 - d. Store pH and conductivity meters as required by the manufacturer and the MORA QA/QC protocol.
 - e. If a raft is used, take DO and Temperature profiles beginning at the surface. If a shoreline sample is taken, follow Mount Rainier National Park QA/QC protocols for using the DO meter or collecting a sample in a BOD bottle.
 - f. Collect a sample (see below) to analyze for ANC (alkalinity).

Notes:

1. The remaining space on the data sheets should be used to record any additional notes.

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2. Team members are encouraged to write extensive notes about features of each site not encompassed by the required data fields. Notes can also explain that data which may look weird are actually correct. For example if the pH readings never stabilized this would be a good place to note this fact. The notes will help those of us who are not there understand the collected data, the conditions at that site, how difficult it was to get to that site, etc.

3. Think of the notes as a journal to record anything.

Data Management:

1. Prior to leaving each site one crew member (preferably one who was not recording data) will check over the datasheet to make sure that all fields have been filled (data or NA), that all recorded data is clearly legible, and that the reported data do not have any obvious errors.

2. Once the data is checked the crew member should initial the 'Field Checked'

WATER SAMPLE COLLECTION

1. When collecting water samples avoid areas of dense aquatic or overhanging vegetation.

Collect samples as far from shore as practical from a depth of 25 cm (10 in) where possible.

Avoid inclusion of surface film and suspended sediments or organic material. Sampling is to be done first and/or in an area not disturbed by other sampling procedures.

2. Collect water in 1 L plastic bottle in the area of amphibian habitat. Take care not to introduce surface "scum" into the bottle. Avoid stirring up the pond bottom. If filtering is required, filter the sample immediately at the site.

3. Label with site name, date, time, data sheet number, and other pertinent information. Store sample bottles on ice in cooler.

SURVEY FORM FIELD DEFINITIONS

Date - Write the date as month, day, year (e.g. 11 Aug, 1993). The three letter abbreviation for the month is less ambiguous and more readily recognized than 8-11-93.

Begin Time - Record the time that the survey began, not the arrival time at the locality.

End Time - Record the time when the survey ended, not time you finished taking notes and gathering up equipment.

Search Minutes - This is the total time (in minutes) spent searching for amphibians multiplied by the number of active observers. Do not include time spent processing specimens, recording notes, or taking photographs. If two or more people spend differing amounts of time searching, use the average time.

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Site ID – A unique identifier for the site represented by the data sheet. In ONP we are using the naming convention of 2 letters designating what major drainage the site is in followed by a number. No spaces or dashes between the letters or numbers. If a new pond is found by one already named, the new pond can be named with the name of the nearby pond followed by an “a”, then “b” for a 2nd new pond, etc. Example: Eagle Lakes in the Lyre drainage or named LY1, LY2, LY3.

Observers - Enter the initials of the observers present.

Sentinel Site – Circle NO. There are no sentinel sites in this inventory.

Location - This is a description that would allow someone not familiar with the area to find the pond again. For example: 200m NE of Lake Constance. Also, it is a good place to put the name of a lake if it has an official name (Hidden Lake). Use mapped landmarks that are not likely to change. Some localities are difficult to describe and the UTM coordinates will be the most descriptive, but a narrative description is important to confirm the general location.

State - Enter state name.

County - Enter county name.

Ownership – Indicate land ownership

Index Area - Many sites will be in designated index areas. If so, enter the name of the area.

Sample Unit (HUC #) - Index areas will be broken down into sample units, in our case these are 6th field watersheds.

UTM Zone - Enter the zone number, which in the continental United States ranges from 10 on the west coast to 19 in the east. UTM zones are always indicated in the lower left corner of USGS topographic maps.

UTM Coordinates - This is a pair of numbers that are x and y coordinates. In North America, the two numbers are northings and eastings. Location of each site will be recorded using a hand held GPS unit in the field. If area surveyed is more than 1 km of a creek, stream, or river, enter the UTM coordinates for both the beginning and ending location. For lakes and ponds, enter the coordinates for the edge of the water if using a GPS or from the center of the water body if obtaining the coordinates from a USGS 7.5' topographic map.

Datum (Database only) - This refers to the base map projection. The datum is always indicated in the lower left corner of USGS topographic maps. If using a GPS unit to get UTM coordinates, check the GPS setup menu to see which datum is being used. UTM coordinates are generally associated with either the 1927 North American datum or 1983 North American datum. Latitude/longitude coordinates are usually given in reference to the WGS84 datum. Using the wrong datum can result in significant positional errors.

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Error – error estimate of Garmin 12XL GPS unit (preferably this is less than 5m).

GPS File – the name of the saved waypoint marking the location of a wetland.

Elevation - This should be taken from a 7.5' topographic map (or ArcGIS data) since elevations from GPS units are not sufficiently accurate. Make sure to indicate the elevational units.

Species Present At Site – All amphibians and a selected group of other organisms will be recorded in these fields including garter snakes, some invertebrates, and fish. Each species is recorded in one line.

Amphibians - Indicate the number of adults, paedomorphs (rarely seen and difficult to determine—adult amphibians but in aquatic physical form permanently), juveniles, larvae, eggs and egg masses observed for each amphibian species at a site. Adults and juveniles can typically be counted, but it is often necessary to estimate the number of anuran and salamander larvae. Circle E if estimated or C if all the larvae or egg masses were actually counted. Note that this is not an estimate of the total number that might occur at the survey site, but the actual number of individuals seen during the survey. Some amphibian larvae do not metamorphose within one year. If size classes can be clearly distinguished, record a count for each size-class. If the number of egg masses can be counted then do so and record as EM, #, C. If the egg masses cannot be separated then estimate the number of eggs or egg masses and record as E or EM, #, E.

Fish Species - List the kinds of fish observed. If fish cannot be identified to the species level, use the lowest taxonomic level possible, e.g. families: salmonidae, centrarchidae, cyprinidae.

Garter Snakes - Indicate if any were seen and list species if able to identify.

Inverts - Indicate if certain predatory invertebrates were detected.

Method – Record how the animals were identified. Were they captured and held in a hand for close inspection (H), see from a distance but not held (V), or heard calling only (A).

* Remember to record other interesting/unusual species sightings in the notes section on the back of the datasheet.

Physical and Chemical Environment

Weather - Circle one of the choices: clear overcast, rain, snow.

Wind - Circle one of the choices: calm, light, gusty, strong.

Beaver Sign – Use only one code, choosing the strongest indicator for your location (1=see beaver, 2=hear beaver, 3=lodge, 4=current dam, 5=old dam, 6=cuttings).

pH - Record pH.

This report has had confidential information regarding park-sensitive species locations removed.

Air Temperature (°C) - Measure the air temperature in the shade at approximately 1 meter off the ground.

Water Temperature (°C) - Measure the water temperature near the surface either in the vicinity of any amphibians that are located, or approximately 0.5 meter out from the edge of the water. Since temperature can be quite variable in standing water, try to select a location that is representative of the site.

Conductivity - Measure with meter.

Color - Indicate if water appears to be clear or stained (i.e. from leaf tannins)

Turbidity - Is the water clear or cloudy?

Site Description

Habitat Origin - Circle one of the choices: natural, man-made, or man altered.

Drainage - Circle one of the choices: permanent, seasonal. If uncertain, consult a 7.5' USGS topographic map. Seasonal streams are generally indicated with a broken blue line and seasonal ponds/lakes are hatched.

Description - Circle only one of the choices: lake/pond, river/stream, ditch, spring/seep, meadow/wetland, oxbow/backwater, beaver pond.

Shallows - Indicate the percent of the total site area that is <0.5 m deep.

Average Site Width (m) - This is the average width of the aquatic habitat.

Average Site Length (m) – Estimate the average length of the site.

Maximum Depth (m) - Circle one of the choices: <1.0, 1.0-2.0, >2.0

Percent of site edge searched: Estimate how much of entire site edge was searched.

Emergent/Floating Vegetation - Indicate the percent cover for emergent/floating vegetation for the entire site.

Substrate and Veg Cover – In many cases, the field site will be too large to sample as a single station so stations can be placed roughly every 10 meters or up to 20 evenly spaced stations as the crew surveys the site. Typically, a site needs to be subsampled if the entire pond from the shore cannot be seen (15m X15m). Each station (or transect) consists of a 2 meter portion of the shoreline and 3 meters out from the shore into the pond making a rectangle of area to be surveyed. Estimate the percent cover (to the nearest 10%) provided by emergent or floating vegetation for each station. At each station circle the most dominant substrate (circle only one): boulder/bedrock, cobble, mud/silt, sand/gravel, leaves/grass, downed wood.

This report has had confidential information regarding park-sensitive species locations removed.

Field Checked – A team member will initial this box after making a final check of the datasheet before leaving the field site.

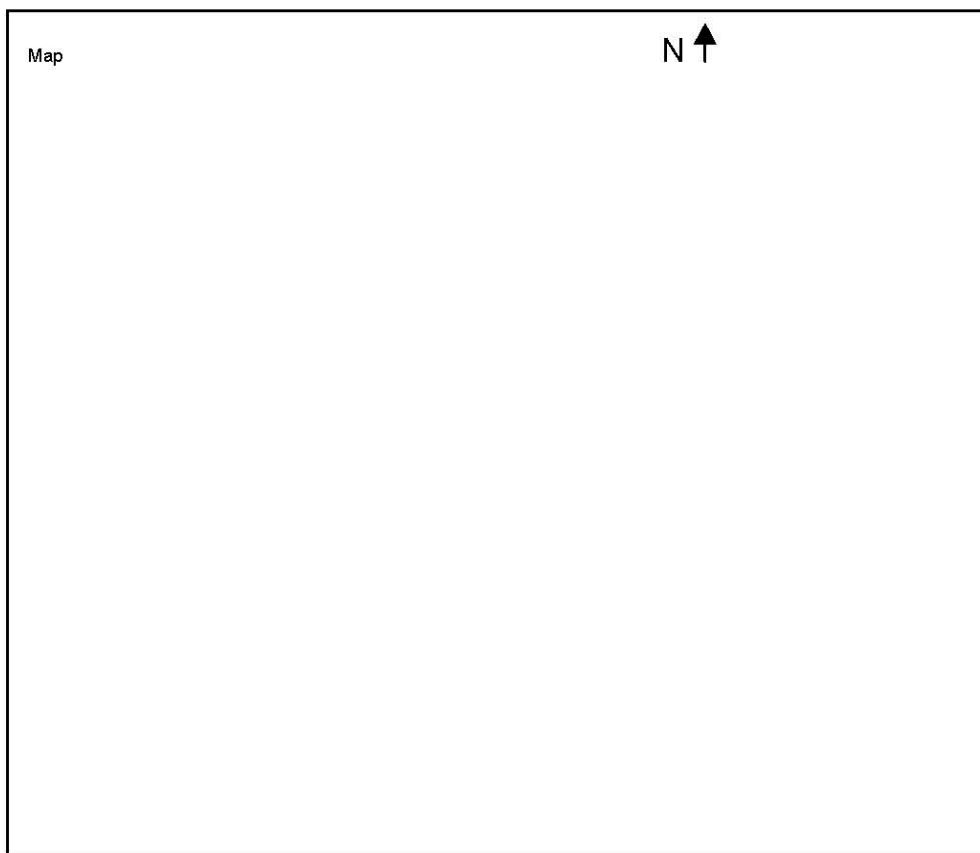
Entered – Check box when data have been entered into database

Field QA _____ Entered By _____

Page 1

SITE LOCATION:													
Index ID			Site ID				Drain-age						
State	WA		Co.				Owner-ship			Senti-nel?	Y N		
UTM Zone	10				E				N	Error (m)			
Elev.			m ft	GPS File				HUC #					
Loca-tion													
SITE VISIT:													
Date			Visit #			Crew							
Start Time			End Time				Search Minutes (minutes times # of surveyors)						
Weather	Clear Overcast Rain Snow		WIND	Calm Light Gusty Strong		Air Temp			Water Temp				
pH			Conductivity			Water Sample: 120-ml FCC (filtered, brown)	Y N		Water Sample: 250-ml RU (unfilter, white)	Y N			
POND (all measurements in meters):													
Length			Width			Max Depth	<1 1-2 >2		% Shallow (<0.5m)				
Color	Clear Stained		Turbid-ity	Clear Cloudy		% Emergent Veg Cover			% of Site edge Searched				
Wetland Type	Lake/Pond Meadow/Wetland Ditch Beaver-pond River/Stream Spring/Seep Oxbow/Backwater						Perman-ance	Permanent Seasonal					
Site Origin	Natural Man-Made Altered				Beaver Sign	See Beaver Hear Beaver Lodge Current Dam Old Dam Cuttings							

Figure A-1. Aquatic amphibian inventory data sheets.



Mark Locations: S = water samples, T = temperature, G = GPS location
Sketch emergent vegetation using dotted lines.

Dominant Substrate & Percent Veg Cover (up to 20 transects per site)					
% Cover					
Substrate	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W
% Cover					
Substrate	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W
% Cover					
Substrate	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W
% Cover					
Substrate	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W	B D C G S M L W

B: Bedrock D: Boulder C: Cobble G: Grass L: Leaves M: Mud S: Silt W: Wood

Figure A-1. Aquatic amphibian inventory data sheets (continued).

This report has had confidential information regarding park-sensitive species locations removed.

Page 3

[illegible]

Life Stage: Egg, **EM** Egg Mass, Larval, Juvenile, Paedomorph, Adult.
E / C: Is the "count" number Estimated or precisely Counted.
SVL Range (for larvae only): <15mm, **15-35mm**, >35mm
Method: Hand Collected (catch and see), Visual (see from a distance only),
Aural (heard calling only).

NOTES:

Figure A-1. Aquatic amphibian inventory data sheets (continued).

Appendix 1

Table 6-Scientific and common names of amphibians and reptiles found in the Pacific Northwest west of the Cascade Range from northern California to British Columbia

Scientific name ^a	4-letter code	Common name ^a
Amphibia, order Urodela (salamanders):		
Family Ambystomatidae-		
<i>Ambystoma gracile</i>	AMGR	Northwestern salamander
<i>A. macrodactylum</i>	AMMA	Long-toed salamander
Family Dicamptodontidae-		
<i>Dicamptodon copei</i>	DICO	Cope's giant salamander
<i>D. ensatus</i>	DIEN	California giant salamander
<i>D. tenebrosus</i>	DITE	Pacific giant salamander
<i>Rhyacotriton olmpicus</i>	RHOL	Olympic salamander
Family Plethodontidae-		
<i>Aneides ferreus</i>	ANFE	Clouded salamander
<i>A. flavipunctatus</i>	ANFL	Black salamander
<i>A. lugubris</i>	ANLU	Arboreal salamander
<i>Batrachoseps attenuatus</i>	BAAT	California slender salamander
<i>B. wrighti</i>	BAWR	Oregon slender salamander
<i>Plethodon dunni</i>	PLDU	Dunn's salamander
<i>P. elongatus</i>	PLEL	Del Norte salamander (includes <i>P. stormi</i>)
<i>P. larseilli</i>	PLLA	Larch Mountain salamander
<i>P. vandykei</i>	PLVA	Van Dyke's Salamander
<i>P. vehiculum</i>	PLVE	Western red-backed salamander
Family Salamandridae-		
<i>Taricha granulosa</i>	TAGR	Rough-skinned newt
<i>T. rivularis</i>	TARI	Red-bellied newt
<i>T. torosa</i>	TATO	California newt
Amphibia, order Anura (frogs and toads):		
Family Leiopelmatidae, <i>Ascaphus truei</i>	ASTR	Tailed frog
Family Bufonidae, <i>Bufo boreas</i>	BUBO	Western toad
Family Hylidae, <i>Hyla regilla</i>	HYRE	Pacific treefrog
Family Ranidae-		
<i>Rana aurora</i>	RAAU	Red-legged frog
<i>R. boylei</i>	RABO	Foothill yellow-legged frog
<i>R. cascadae</i>	RACA	Cascades frog
<i>R. catesbeiana</i>	RACT	Bullfrog (introduced)
<i>R. clamitans</i>	RACL	Green frog (introduced)
<i>R. pretiosa</i>	RAPR	Spotted frog
Reptilia, order Chelonia (turtles):		
Family Emydidae-		
<i>Chrysemys picta</i>	CHPI	Painted turtle
<i>Clemmys marmorata</i>	CLMA	Western pond turtle
Reptilia, order Squamata (lizards and snakes):		
Family Anguillidae-		
<i>Gerrhonotus coeruleus</i>	GECO	Northern alligator lizard
<i>G. multicarinatus</i>	GEMU	Southern alligator lizard
Family Iguanidae-		
<i>Phrynosoma douglassii</i>	PHDO	Short-horned lizard
<i>Sceloporus graciosus</i>	SCGR	Sagebrush lizard
<i>S. occidentalis</i>	SCOC	Western fence lizard
Family Scincidae, <i>Eumeces skiltonianus</i>	EUSK	Western skink
Family Boidae, <i>Charina bottae</i>	CHBO	Rubber boa
Family Colubridae-		
<i>Coluber constrictor</i>	COCA	Racer
<i>Contia tenuis</i>	COTE	Sharptail snake
<i>Diadophis punctatus</i>	DIPU	Ringneck snake
<i>Lampropeltis getulus</i>	LAGE	Common king snake
<i>L. zonata</i>	LAZO	California mountain kingsnake
<i>Masticophis taeniatus</i>	MATE	Striped whipsnake
<i>Pituophis melanoleucus</i>	PIME	Gopher snake
<i>Thamnophis couchi</i>	THCO	Sierra garter snake
<i>T. elegans</i>	THEL	Western terrestrial garter snake
<i>T. ordinoides</i>	THOR	Northwestern garter snake
<i>T. sirtalis</i>	THSI	Common garter snake
Family Crotalidae, <i>Crotalus viridis</i>	CRVI	Western rattlesnake

^a Scientific and common names follow Banks and others (1987).
Sources: Nussbaum and others (1983) and Stebbins (1985).

Figure A-2. Scientific and common names of amphibians and reptiles found in the Pacific Northwest (Corn and Bury 1990).

LEWI Terrestrial Amphibian Survey Protocols and Datasheets.

This survey protocol was used only in 2002 in the former Fort Clatsop National Memorial, now part of the Fort Clatsop unit of Lewis and Clark National Historical Park.

Site Selection

We will survey all appropriate habitat for which a safe and legal access route can be found. National Wetland Inventory maps, USGS topographical maps, and Vegetation or Forest Inventory maps will be used to locate appropriate habitat. Availability of maps varies for each park. NWI maps in ArcView files are available at:

X:\ArcGIS\Data\Shapefiles\Network\wetlands

Boundaries of the NCCN parks are located at:

X:\ArcGIS\Data\Shapefiles\Network\boundaries

Safety precludes sampling areas that are located on slopes >34 degrees.

On a topographic map or aerial photo of the study area, determine the number of 30 minute searches (plots) to use in appropriate habitat, assuming a 30m radius for each plot. The center of each 30 min. search plot should be at least 75 m from any forest edge (if possible). Also determine the path to follow between searches, with compass headings and approximate distances. Record the outlines of the plots on the air photo or map overlay.

Field Habitat Measurements

The following measurements are to be recorded from the plot center:

- Primary forest association series
- Canopy cover to the nearest 20%
- Slope
- Aspect
- Presence of streams, seeps, or talus
- Record the relative cover of each overstory species present – these numbers add to 100%. Include any deciduous trees present
- For each of the size class categories record the percent of stems from each tree species. Should sum to 100% going across columns
- Record the absolute cover of understory components for the 3 most important (dominant) species in each category using the 6 cover categories listed
- Record the percent cover of grasses, mosses, and L.O. debris

This report has had confidential information regarding park-sensitive species locations removed.

CWD: For each 30m plot, mark 4 evenly distributed lines, radiating from the plot center to the plot edge. Record the distance (cm) that the line is in contact with down wood and record the decay class for each object (Figure A-3).

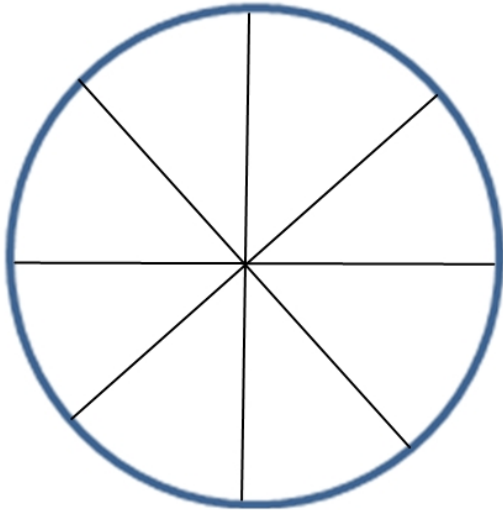


Figure A-3. 30m plot with 8 transects for recording coarse woody debris. (Note: Data recorded for only 4 transects in this study as CWD data collection was time consuming and limited the amount of time available for amphibian searches).

Field Amphibian Surveys

Each plot will be searched for 30 worker-minutes during daylight (>1 hr after sunrise and before sunset). Search time was doubled or tripled in some cases if amphibian habitat was spatially complex. A search consists of workers methodically visually searching for amphibians over the entire area of the plot and looking under as much loose wood, bark, or rock that can be lifted and restored to a condition similar to its original state. Workers should not tear apart decayed logs or completely dig up talus or piles of decaying wood. For example, a worker encountering a heavily decayed log that is still largely intact should attempt to move and replace pieces of decayed wood. It is permissible to break apart a small portion of the log (up to 10%) in this process.

Night time surveys, using a spotlight, should be conducted to verify absence of species expected that were not observed during daytime searches of sites.

Field Quality Assurance

After each survey, the field leader will review the data forms for completeness and accuracy and then initial the top of the form in the space provided.

This report has had confidential information regarding park-sensitive species locations removed.

Field QA: _____ Entered by: _____ Survey ID#: _____

Page 1

Cluster #			Stand			Drainage		
Crew					Verification Plot?	Y N		
PDOP			Date					
Uncorrected UTM Coord.			File		Corrected UTM Coord.			
N	E	N			E			
Forest								
Tot. Cov. (near. 20%)			Slope:			Aspect:		
Stream:	Y	N	Seep:	Y	N	Talus:	Y	N
Canopy cover and stem density by size class.								
Species	%Cov	1(0-23)	2(23-53)	3(53-81)	4(81-122)	5(>122)		
All Stems								
Record absolute cover of understory components for the 3 most important species in each category. Use cover classes of <1, 1-5, 6-25, 26-50, 51-75, 76-100%.								
Category	Sp1	%Cov	Sp2	%Cov	Sp3	%Cov		
Ust. Conifer								
Ust. Decid.								
Shrubs								
Ferns								
Forbs								
Total Cover of	Grasses:		Mosses:		L.O.Debris:			

Figure A-4. Terrestrial amphibian inventory data sheets.

Page 2

A-18

Herp Sp.	Sex	Stage	SVL(mm)	UL	LL	MB	Hab
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
	M F U	E L J A P U					
Habitats: D1-3 = Wood of decay classes 1-3; R=Rock; S=Stream/seep; O=other.							

Figure A-4. Terrestrial amphibian inventory data sheets (continued).

This report has had confidential information regarding park-sensitive species locations removed.

Appendix B: Amphibian Survey Locations for All Sites by Species, Life Stage and Total Count

[* Sensitive species locations removed]

Site ID	Date	UTM E NAD 83	UTM N NAD 83	Species	Stage	Count
*				DICO	L	3
*				DICO	L	2
*				RHKE	L	2
*				RHKE	L	4
*				PLDU	2	A
*				PLDU	4	J
*				RHKE	2	A
*				RHKE	L	6
*				PLDU	6	A
*				PLDU	A	3
*				PLDU	A	1
*				RHKE	J	7
*				RHKE	A	1
*				RHKE	L	1
*				PLDU	A	1
*				RHKE	A	1
*				PLDU	A	1
*				RHKE	L	2
*				RHKE	A	3
*				RHKE	A	1
*				RHKE	J	8
*				PLDU	A	2
*				RHKE	L	2
*				RHKE	A	4
*				PLDU	A	4
*				RHKE	A	1
CD1	18-Apr-05	417719	5126748	AMGR	EM	1
CD1	18-Apr-05	417719	5126748	PSRE	A	15
CD1	18-Apr-05	417719	5126748	PSRE	EM	2
CD1	18-Apr-05	417719	5126748	RAAU	J	50
CD1	18-Apr-05	417719	5126748	RAAU	L	3000
CD1	18-Apr-05	417719	5126748	TAGR	A	2
CD2	19-Apr-05	418804	5127300	RAAU	J	4
CD3	19-Apr-05	418687	5127268	PLVE	A	4
CD3	19-Apr-05	418687	5127268	RAAU	J	15
CD3	19-Apr-05	418687	5127268	RAAU	A	10
CD3	19-Apr-05	418687	5127268	TAGR	J	2
CD4	19-Apr-05	417720	5127476	ENES	J	1
CD4	19-Apr-05	417720	5127476	ENES	A	1

This report has had confidential information regarding park-sensitive species locations removed.

Site ID	Date	UTM E NAD 83	UTM N NAD 83	Species	Stage	Count
CD4	19-Apr-05	417720	5127476	PLVE	A	4
CD4	19-Apr-05	417720	5127476	RAAU	A	5
CD4	19-Apr-05	417720	5127476	RAAU	J	150
CD5	19-Apr-05	418245	5127392	PLVE	A	3
CD5	19-Apr-05	418245	5127392	RAAU	J	300
CD5	19-Apr-05	418245	5127392	TAGR	A	1
CD6	20-Apr-05	418111	5126101	PSRE	A	100
CD6	20-Apr-05	418111	5126101	PSRE	L	1
CD6	20-Apr-05	418111	5126101	RACAT	L	200
CD6	20-Apr-05	418111	5126101	TAGR	A	7
CD7	20-Apr-05	418060	5128600	AMGR	L	5
CD7	20-Apr-05	418060	5128600	AMGR	EM	5
CD7	20-Apr-05	418060	5128600	PSRE	A	6
CD7	20-Apr-05	418060	5128600	RAAU	L	2
CD7	20-Apr-05	418060	5128600	RAAU	A	8
CD7	20-Apr-05	418060	5128600	TAGR	A	6
CD8	20-Apr-05	418454	5126322	PSRE	A	1
CD8	20-Apr-05	418454	5126322	RAAU	J	16
CD8	20-Apr-05	418454	5126322	RAAU	L	75
CD8	20-Apr-05	418454	5126322	TAGR	A	9
CD10	21-Apr-05	417926	5128159	RAAU	J	1
CD10	21-Apr-05	417926	5128159	TAGR	A	1
FC1	4/30/2002	432344	5109254	ENES	A	2
FC1	4/30/2002	432344	5109254	RAAU	A	1
FC2	30-Apr-02	432512	5109018	AMGR	EM	3
FC2	30-Apr-02	432512	5109018	AMGR	P	1
FC2	30-Apr-02	432512	5109018	PSRE	EM	5
FC2	30-Apr-02	432512	5109018	PSRE	J	100
FC2	30-Apr-02	432512	5109018	RAAU	L	1000
FC2	30-Apr-02	432512	5109018	RAAU	A	3
FC3	01-May-02	431764	5109396	ENES	2	J
FC3	01-May-02	431764	5109396	PLVE	4	A
FC3	01-May-02	431764	5109396	TAGR	2	A
FC4	01-May-02	431866	5109403	ENES	2	J
FC4	01-May-02	431866	5109403	PLVE	4	A
FC5	5/1/2002	431709	5109190	PLVE	A	1
FC6	01-May-02	432162	5109372	RAAU	2	A
FC7	5/1/2002	432195	5109422	PLVE	A	2
FC8	5/2/2002	431731	5109312	ENES	A	1
FC9	5/2/2002	431706	5109168	PLVE	A	2
FC10	5/2/2002	432359	5109482	ENES	A	1
FC11	02-May-02	431894	5109183	ENES	2	A
FC11	02-May-02	431894	5109183	PLVE	30	A

This report has had confidential information regarding park-sensitive species locations removed.

Site ID	Date	UTM E NAD 83	UTM N NAD 83	Species	Stage	Count
FC11	02-May-02	431894	5109183	PLVE	6	J
FC11	02-May-02	431894	5109183	RAAU	2	A
FC12	5/2/2002	431814	5109112	RAAU	A	1
FC13	5/2/2002	432235	5108838	AMGR	EM	1
FC13	5/2/2002	432235	5108838	PSRE	A	1
FC14	07-May-02	431953	5109146	AMGR	EM	5
FC14	07-May-02	431953	5109146	RAAU	A	1
FC15	07-May-02	432476	5109607	AMGR	L	4
FC15	07-May-02	432476	5109607	RAAU	L	50
FC16	5/7/2002	432445	5109488	RAAU	J	3
FC17	5/7/2002	432466	5109431	RAAU	A	1
FC17	5/7/2002	432466	5109431	RAAU	J	13
FC18	5/7/2002	432431	5109231	RAAU	A	1
FC19	5/7/2002	432364	5109225	RAAU	A	3
FC20	5/7/2002	432032	5109190	RAAU	A	4
FC21	5/7/2002	432019	5109010	RAAU	A	2
FC23	08-May-02	431924	5108905	PLVE	A	1
FC23	08-May-02	431924	5108905	RAAU	J	8
FC23	08-May-02	431924	5108905	RAAU	A	1
FC23	09-May-02	431924	5108905	PLVE	6	A
FC23	09-May-02	431924	5108905	PLVE	6	J
FC23	09-May-02	431924	5108905	PSRE	2	A
FC23	09-May-02	431924	5108905	RAAU	8	A
FC23	09-May-02	431924	5108905	RAAU	4	J
LE1	29-Mar-05	431412	5108690	NONE		
LE2	29-Mar-05	431281	5108803	DITE	A	1
LE2	29-Mar-05	431281	5108803	ENES	J	1
LE2	29-Mar-05	431281	5108803	PLVE	J	1
LE2	29-Mar-05	431281	5108803	PSRE	A	1
LE3	29-Mar-05	431226	5108667	DITE	A	2
LE3	29-Mar-05	431226	5108667	PLVE	J	1
LE3	29-Mar-05	431226	5108667	PLVE	A	2
LE4	29-Mar-05	431316	5109547	DITE	L	1
LE4	29-Mar-05	431316	5109547	PLVE	A	1
LE5	30-Mar-05	430604	5109091	NONE		
LE6	30-Mar-05	430689	5109001	TAGR	A	1
LE7	30-Mar-05	430941	5109657	DITE	L	1
LE7	30-Mar-05	430941	5109657	PLVE	A	3
LE8	30-Mar-05	429535	5108106	AMGR	EM	3
LE8	30-Mar-05	429535	5108106	PSRE	A	1
LE8	30-Mar-05	429535	5108106	RAAU	A	1
LE8	30-Mar-05	429535	5108106	RAAU	J	1
LE8	30-Mar-05	429535	5108106	TAGR	A	9

This report has had confidential information regarding park-sensitive species locations removed.

Site ID	Date	UTM E NAD 83	UTM N NAD 83	Species	Stage	Count
LE9	30-Mar-05	429402	5108182	NONE		
LE10	31-Mar-05	430593	5108525	DITE	L	1
LE10	31-Mar-05	430593	5108525	ENES	A	1
LE10	31-Mar-05	430593	5108525	PLVE	J	1
LE10	31-Mar-05	430593	5108525	PLVE	A	3
LE11	31-Mar-05	430514	5108342	DITE	L	3
LE11	31-Mar-05	430514	5108342	PLVE	A	1
LE11	31-Mar-05	430514	5108342	TAGR	A	3
LE12	04-Apr-05	431996	5108568	AMGR	EM	5
LE12	04-Apr-05	431996	5108568	PSRE	A	2
LE12	04-Apr-05	431996	5108568	RAAU	EM	16
LE12	04-Apr-05	431996	5108568	RACAT	J	1
LE12	04-Apr-05	431996	5108568	TAGR	A	9
LE12	04-Apr-05	431996	5108568	TAGR	L	1
LE13	04-Apr-05	431760	5108382	AMGR	EM	3
LE13	04-Apr-05	431760	5108382	RAAU	EM	2
LE13	04-Apr-05	431760	5108382	RAAU	A	1
LE13	04-Apr-05	431760	5108382	TAGR	A	13
LE14	05-Apr-05	430866	5108339	DITE	L	3
LE14	05-Apr-05	430866	5108339	PLVE	A	5
LE15	05-Apr-05	430825	5108217	DITE	L	3
LE15	05-Apr-05	430825	5108217	TAGR	A	1
LE16	05-Apr-05	430009	5108806	PLVE	A	4
LE16	05-Apr-05	430009	5108806	TAGR	A	1
LE17	05-Apr-05	430119	5108812	DITE	L	6
LE18	06-Apr-05	430038	5108490	DITE	L	3
LE18	06-Apr-05	430038	5108490	RAAU	J	1
LE19	06-Apr-05	429881	5108571	AMGR	EM	13
LE19	06-Apr-05	429881	5108571	AMGR	L	2
LE19	06-Apr-05	429881	5108571	PSRE	A	3
LE19	06-Apr-05	429881	5108571	RAAU	A	4
LE19	06-Apr-05	429881	5108571	RAAU	EM	11
LE19	06-Apr-05	429881	5108571	RAAU	L	42
LE19	06-Apr-05	429881	5108571	TAGR	A	74
LE20	07-Apr-05	429814	5108382	DITE	L	5
LE20	07-Apr-05	429814	5108382	PLVE	A	1
LE21	07-Apr-05	429582	5108246	PLVE	A	4
LE22	11-Apr-05	431952	5109239	AMGR	EM	3
LE23	11-Apr-05	432292	5107574	PSRE	EM	1
LE23	11-Apr-05	432292	5107574	TAGR	A	2
LE24	11-Apr-05	432231	5107908	PSRE	EM	3
LE24	11-Apr-05	432231	5107908	RAAU	L	1500
LE24	11-Apr-05	432231	5107908	RAAU	EM	4

This report has had confidential information regarding park-sensitive species locations removed.

Site ID	Date	UTM E NAD 83	UTM N NAD 83	Species	Stage	Count
LE24	11-Apr-05	432231	5107908	RACAT	A	1
LE25	12-Apr-05	432520	5107668	RAAU	L	80
LE25	12-Apr-05	432520	5107668	AMGR	EM	2
LE25	12-Apr-05	432520	5107668	PSRE	A	2
LE25	12-Apr-05	432520	5107668	PSRE	EM	22
LE25	12-Apr-05	432520	5107668	RAAU	A	5
LE26	12-Apr-05	427638	5105460	AMGR	EM	3
LE26	12-Apr-05	427638	5105460	AMGR	L	3
LE26	12-Apr-05	427638	5105460	PSRE	A	1
LE26	12-Apr-05	427638	5105460	PSRE	EM	52
LE26	12-Apr-05	427638	5105460	RAAU	J	2
LE26	12-Apr-05	427638	5105460	RAAU	L	40
LE26	12-Apr-05	427638	5105460	TAGR	L	1
LE27	13-Apr-05	432415	5109795	NONE		
LE28	13-Apr-05	427670	5105578	AMGR	EM	2
LE28	13-Apr-05	427670	5105578	AMGR	L	2
LE28	13-Apr-05	427670	5105578	PSRE	EM	10
LE28	13-Apr-05	427670	5105578	RAAU	A	4
LE28	13-Apr-05	427670	5105578	RAAU	L	35
LE29	13-Apr-05	427542	5106009	PSRE	A	4
LE29	13-Apr-05	427542	5106009	PSRE	EM	2
LE29	13-Apr-05	427542	5106009	RAAU	L	62
LE30	14-Apr-05	431875	5109801	AMGR	EM	14
LE30	14-Apr-05	431875	5109801	PSRE	A	3
LE30	14-Apr-05	431875	5109801	RAAU	L	125
LE30	14-Apr-05	431875	5109801	RAAU	EM	24

This report has had confidential information regarding park-sensitive species locations removed.

Appendix C: Environmental Conditions and Habitat Characteristics of Amphibian Survey Sites

This report has had confidential information regarding park-sensitive species locations removed.

Table C-1. Environmental conditions and water quality for aquatic surface waters.

Field Site ID	Water Quality_Event Date/Time	Weather	Wind	Air Temp (C)	Water Temp (C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Max Depth (m)	Shallow Area (% of total site area <0.5 m deep)	Color	Turbidity	Emergent Vegetation (% cover)
CD1	2005-Apr-18_13:00:00	Clear	Gusty	12	12.8	6.14	250	7.3	>2	20	Stained	Clear	90
CD2	2005-Apr-19_08:15:00	Overcast	Calm	10	11.3	6.35	280	8.9	<1	100	Clear	Clear	0
CD3	2005-Apr-19_08:45:00	Clear	Calm	10	9.7	6.56	230	9.9	<1	100	Clear	Clear	0
CD4	2005-Apr-19_11:00:00	Clear	Calm	14	10.2	6.25	217	9.9	<1	100	Clear	Clear	0
CD5	2005-Apr-19_14:45:00	Clear	Gusty	14	10.2	6.17	203	10.3	<1	100	Clear	Clear	0
CD6	2005-Apr-20_08:00:00	Overcast	Calm	12	13.0	6.65	208	7.4	>2	20	Stained	Clear	10
CD7	2005-Apr-20_12:15:00	Overcast	Light	10	11.4	6.33	194	7.6	>2	30	Clear	Clear	70
CD8	2005-Apr-20_14:30:00	Overcast	Gusty	12	14.3		208	8.0	>2	20	Stained	Clear	20
CD9	2005-Apr-21_08:10:00	Overcast	Calm	11	9.8	5.96	411	9.8	<1	100	Clear	Clear	0
CD10	2005-Apr-21_11:00:00	Overcast	Calm	11	10.3	6.71	239	11.1	<1	100	Clear	Clear	0
FC2	2002-Apr-30_15:50	Overcast	Calm	14	12.0	6.66	250	0.9	<1	100	Stained	Clear	40
FC14	2002-May-07_09:50	Overcast	Calm	9	7.0	5.76	40	12.5	<1	100	Clear	Clear	30
FC15	2002-May-07_09:00	Overcast	Calm	10	11.0	5.27	140		<1	100	Stained	Clear	0
FC22	2002-May-08_09:30	Overcast	Calm	10	9.0	5.29		14.5	<1	100	Clear	Clear	0
FC23	2002-May-08_12:30	Clear	Calm	12	10.0	6.52	60	10.0	<1	100	Clear	Clear	0
FC24	2002-May-09_08:30	Clear	Calm	9	11.0	5.97	50	9.5	<1	100	Clear	Clear	0
LE1	2005-Mar-29_09:15:00	Rain	Light	8	9.2	6.13	91	12.9	<1	100	Clear	Clear	0
LE2	2005-Mar-29_12:50:00	Rain	Light	9	9.1	5.96	95	12.3	<1	100	Clear	Clear	0
LE3	2005-Mar-29_10:45:00	Overcast	Light	9	8.3	6.80	82	13.6	<1	100	Clear	Clear	0
LE4	2005-Mar-29_15:15:00	Rain	Light	10	9.3	6.46	95	13.2	1-2	90	Clear	Cloudy	40
LE5	2005-Mar-30_09:00:00	Overcast	Calm	10	8.5	6.40	106	13.0	<1	100	Clear	Clear	0
LE6	2005-Mar-30_09:55:00	Overcast	Calm	10	8.9	6.73	105	10.4	<1	100	Clear	Clear	0
LE7	2005-Mar-30_11:40:00	Overcast	Calm	12	9.5	6.66	125	11.3	<1	100	Clear	Clear	0
LE8	2005-Mar-30_15:00:00	Clear	Calm	13	10.0	6.60	137	11.2	>2	80	Clear	Clear	50
LE9	2005-Mar-30_16:15:00	Overcast	Calm	11	10.2	6.03	158	9.2	<1	100	Clear	Clear	0
LE10	2005-Mar-31_08:45:00	Overcast	Light	8	9.5	6.98	156	11.4	<1	100	Clear	Clear	0
LE11	2005-Mar-31_10:30:00	Clear	Calm	10	9.5	6.91	150	9.5	<1	100	Clear	Clear	0
LE12	2005-Apr-04_11:00:00	Clear	Calm	9	10.2	5.65	91	5.0	1-2	80	Clear	Clear	80
LE13	2005-Apr-04_13:15:00	Clear	Calm	9	9.0	6.40	94	10.9	>2	80	Clear	Clear	20
LE14	2005-Apr-05_09:30:00	Rain	Light	6	9.3	6.90	116	11.6	<1	100	Clear	Clear	0
LE15	2005-Apr-05_12:30:00	Rain	Light	12	8.5	6.95	111	11.7	<1	100	Clear	Clear	0
LE16	2005-Apr-05_14:00:00	Clear	Calm	12	9.6	7.12	157	11.3	<1	100	Clear	Clear	0
LE17	2005-Apr-05_16:00:00	Rain	Gusty	12	9.3	7.02	156	11.2	<1	100	Clear	Clear	0
LE18	2005-Apr-06_10:00:00	Clear	Calm	11	9.5	6.54	118	10.2	<1	100	Clear	Clear	0
LE19	2005-Apr-06_12:20:00	Overcast	Calm	12	10.0	6.90	129	10.8	>2	80	Clear	Clear	80
LE20	2005-Apr-07_08:20:00	Rain	Light	11	9.7	6.99	144	10.88	<1	100	Clear	Clear	0
LE21	2005-Apr-07_10:35:00	Rain	Light	10	9.4	6.58	141	10.67	<1	100	Clear	Clear	0

This report has had confidential information regarding park-sensitive species locations removed.

Field Site ID	Water Quality_Event Date/Time	Weather	Wind	Air Temp (C)	Water Temp (C)	pH	Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	Max Depth (m)	Shallow Area (% of total site area <0.5 m deep)	Color	Turbidity	Emergent Vegetation (% cover)
LE22	2005-Apr-11_12:50:00	Overcast	Gusty	10	8.5	5.21	102	8.2	<1	100	Clear	Clear	50
LE23	2005-Apr-11_14:00:00	Rain	Light	10	12.4	6.41	900	11.32	1-2	60	Stained	Cloudy	10
LE24	2005-Apr-11_15:10:00	Overcast	Light	11	12.0	6.20	100	9.57	<1	60	Clear	Clear	70
LE25	2005-Apr-12_09:20:00	Rain	Gusty	8	8.4	6.13	199	8.03	1-2	80	Stained	Clear	90
LE26	2005-Apr-12_14:00:00	Clear	Gusty	10	10.0	6.53	237	9.4	1-2	50	Clear	Clear	50
LE27	2005-Apr-13_08:30:00	Overcast	Calm	8	7.5	5.62	126	8.6	1-2	50	Stained	Cloudy	80
LE28	2005-Apr-13_11:00:00	Overcast	Light	11	9.7	6.59	210	6.3	>2	30	Stained	Clear	10
LE29	2005-Apr-13_13:15:00	Rain	Gusty	10	11.8	6.66	220	8.1	>2	10	Stained	Clear	10
LE30	2005-Apr-14_09:00:00	Rain	Light	9	7.2	6.83	87	7.5	1-2	85	Stained	Clear	85

This report has had confidential information regarding park-sensitive species locations removed.

Table C-2. Habitat characteristics of aquatic sites.

Site ID	Date	Length (m)	Width (m)	Maximum Depth (m)	Emergent Vegetation Cover (%)	Wetland Type	Permanence	Site Origin
CD1	18-Apr-05	1000	1000	>2	90	Meadow/Wetland	Permanent	Natural
CD2	19-Apr-05	30	0.1	<1	0	Spring/Seep	Permanent	Natural
CD3	19-Apr-05	60	0.3	<1	0	River/Stream	Permanent	Natural
CD4	19-Apr-05	60	0.3	<1	0	River/Stream	Permanent	Natural
CD5	19-Apr-05	300	0.5	<1	0	River/Stream	Permanent	Natural
CD6	20-Apr-05	300	200	>2	10	Lake/Pond	Permanent	Altered
CD7	20-Apr-05	300	200	>2	70	Beaver Pond	Permanent	Natural
CD8	20-Apr-05	500	140	>2	20	Lake/Pond	Permanent	Altered
CD9	21-Apr-05	50	0.2	<1	0	River/Stream	Permanent	Natural
CD10	21-Apr-05	30	0.1	<1	0	River/Stream	Seasonal	Natural
FC2	30-Apr-02	60	4	<1	40	Ditch	Seasonal	Man-Made
FC14	7-May-02	20	4	<1	30	Lake/Pond	Seasonal	Man-Made
FC15	7-May-02	20	10	<1	0	Lake/Pond	Seasonal	Natural
FC22	8-May-02	100	1	<1	0	River/Stream	Permanent	Natural
FC23	8-May-02	200	1	<1	0	River/Stream	Permanent	Altered
FC24	9-May-02	15	1	<1	0	Spring/Seep	Permanent	Natural
LE1	29-Mar-05	30	0.3	<1	0	River/Stream	Seasonal	Altered
LE2	29-Mar-05	40	0.2	<1	0	River/Stream	Permanent	Altered
LE3	29-Mar-05	40	0.2	<1	0	River/Stream	Permanent	Altered
LE4	29-Mar-05	4	40	1-2	40	River/Stream	Permanent	Altered
LE5	30-Mar-05	30	0.1	<1	0	River/Stream	Seasonal	Altered
LE6	30-Mar-05	40	0.2	<1	0	River/Stream	Seasonal	Altered
LE7	30-Mar-05	40	0.1	<1	0	River/Stream	Seasonal	Altered
LE8	30-Mar-05	80	30	>2	50	Beaver Pond	Permanent	Altered
LE9	30-Mar-05	40	0.2	<1	0	River/Stream	Permanent	Altered
LE10	31-Mar-05	40	0.1	<1	0	River/Stream	Seasonal	Altered
LE11	31-Mar-05	50	0.3	<1	0	River/Stream	Permanent	Altered
LE12	4-Apr-05	300	1	1-2	80	Ditch	Permanent	Man-Made
LE13	4-Apr-05	300	1.5	>2	20	River/Stream	Permanent	Altered
LE14	5-Apr-05	0.2	40	<1	0	River/Stream	Seasonal	Altered
LE15	5-Apr-05	40	0.1	<1	0	River/Stream	Seasonal	Altered
LE16	5-Apr-05	40	0.1	<1	0	River/Stream	Seasonal	Altered
LE17	5-Apr-05	40	0.3	<1	0	River/Stream	Seasonal	Altered
LE18	6-Apr-05	40	0.2	<1	0	River/Stream	Seasonal	Altered

This report has had confidential information regarding park-sensitive species locations removed.

Site ID	Date	Length (m)	Width (m)	Maximum Depth (m)	Emergent Vegetation Cover (%)	Wetland Type	Permanence	Site Origin
LE19	6-Apr-05	500	70	>2	80	Beaver Pond	Permanent	Altered
LE20	7-Apr-05	50	0.1	<1	0	River/Stream	Seasonal	Altered
LE21	7-Apr-05	30	0.1	<1	0	River/Stream	Seasonal	Altered
LE22	11-Apr-05	30	8	<1	50	Lake/Pond	Permanent	Man-Made
LE23	11-Apr-05	30	5	1-2	10	Lake/Pond	Permanent	Man-Made
LE24	11-Apr-05	40	10	<1	70	River/Stream	Seasonal	Man-Made
LE25	12-Apr-05	400	100	1-2	90	Meadow/Wetland/Ditch	Permanent	Altered
LE26	12-Apr-05	100	300	1-2	50	Lake/Pond	Permanent	Natural
LE27	13-Apr-05	30	20	1-2	80	Meadow/Wetland	Permanent	Natural
LE28	13-Apr-05	100	100	>2	10	Lake/Pond	Permanent	Natural
LE29	13-Apr-05	400	100	>2	10	Lake/Pond	Permanent	Natural
LE30	14-Apr-05	300	100	1-2	85	Beaver Pond	Permanent	Altered

This report has had confidential information regarding park-sensitive species locations removed.

Table C-3. Habitat decay class descriptors.

Log characteristics	Log Decay Class				
	1	2	3	4	5
Bark	intact	intact	trace	absent	absent
Twigs <3cm (1.18in)	present	absent	absent	absent	absent
Texture	intact	intact to partly soft	hard, large pieces	small, soft, blocky pieces	soft and powdery
Shape	round	round	round	round to oval	oval
Color of wood	original color	original color	original color to faded	light brown to faded brown or yellowish	faded to light yellow or gray
Portion of log on ground	log elevated on support points	log elevated on support points but sagging slightly	log is sagging near ground	all of log on ground	all of log o ground

This report has had confidential information regarding park-sensitive species locations removed.

Table C-4. Habitat characteristics of terrestrial survey sites including slope, aspect, and species documented and cover objects, forest type, percent overstory vegetation, and general habitat type (stream, seep, talus) [sensitive species removed].

Date	Site ID	Slope (%)	Aspect	Species Code	Stage	Count	Cover Object	Forest Type	% Overstory Cover	Stream	Seep	Talus
02-May-02	FC11	5	WSW	ENES	A	1	Wood D3	Mixed	100	N	N	N
02-May-02	FC11	5	WSW	PLVE	A	11	Wood D2	Mixed	100	N	N	N
02-May-02	FC11	5	WSW	PLVE	A	2	Wood D3	Mixed	100	N	N	N
02-May-02	FC11	5	WSW	PLVE	A	1	Wood D1	Mixed	100	N	N	N
02-May-02	FC11	5	WSW	PLVE	J	3	Wood D2	Mixed	100	N	N	N
02-May-02	FC11	5	WSW	RAAU	A	1	Wood D2	Mixed	100	N	N	N
09-May-02	FC23		SE	PLVE	A	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PLVE	A	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PLVE	A	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PLVE	J	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PLVE	J	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PLVE	J	1	Wood D3	Mixed	60	Y	Y	N
09-May-02	FC23		SE	PSRE	A	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	A	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	A	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	A	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	A	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	J	1	Other	Mixed	60	Y	Y	N
09-May-02	FC23		SE	RAAU	J	1	Other	Mixed	60	Y	Y	N
05-May-02	FC3	20	NW	PLVE	A	1	Wood D3	Mixed	100	Y	N	N
05-May-02	FC3	20	NW	PLVE	A	1	Wood D3	Mixed	100	Y	N	N
05-May-02	FC3	20	NW	TAGR	A	1	Wood D3	Mixed	100	Y	N	N

This report has had confidential information regarding park-sensitive species locations removed.

Date	Site ID	Slope (%)	Aspect	Species Code	Stage	Count	Cover Object	Forest Type	% Overstory Cover	Stream	Seep	Talus
02-May-02	FC4	0	N	ENES	J	1	Wood D3	Mixed	80	N	N	N
01-May-02	FC4	0	N	PLVE	A	2	Wood D3	Mixed	80	N	N	N
01-May-02	FC6	10	SE	RAAU	A	1	O	Mixed	100	N	Y	N

This report has had confidential information regarding park-sensitive species locations removed.

Table C-5. Habitat characteristics of incidental survey sites.

Site ID	Location Description	Species Code	Stage	Count	SVL(mm)	Cover Object	Habitat Description
FC1	Maintenance Road to Burn Shed	ENES	A	1	48	Wood D2	Old wood piles
FC1	Maintenance Road to Burn shed	ENES	A	1	49	Wood D3	Old wood piles
FC1	Maintenance Road to Burn shed	RAAU	A	1	45	Wood D3	Old wood piles
FC5	Boundary Trail & Perkins Road	PLVE	A	1	39	Wood D2	Old wood piles
FC7	Near Maintenance Yard	PLVE	A	1	33	Other	Bark pile
FC7	Near Maintenance Yard	PLVE	A	1	46	Other	Bark pile
FC8	Boundary Trail, Near Salamander Creek	ENES	A	1	54	Wood D5	Snag/bark pile
FC9	Boundary Trail & Perkin's Road	PLVE	A	1	42	Wood D2	Sawed logs on side of trail
FC9	Boundary Trail & Perkins Road	PLVE	A	1	36	Wood D2	Under cut log on side of trail
FC10	Maintenance Road to Burn Shed	ENES	A	1	53	Wood D2	Fence post piles
FC12	Old county road between Clay Pit and Iron Spring	RAAU	A	1		Other	False lily of the valley patch

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National Park Service
U.S. Department of the Interior



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