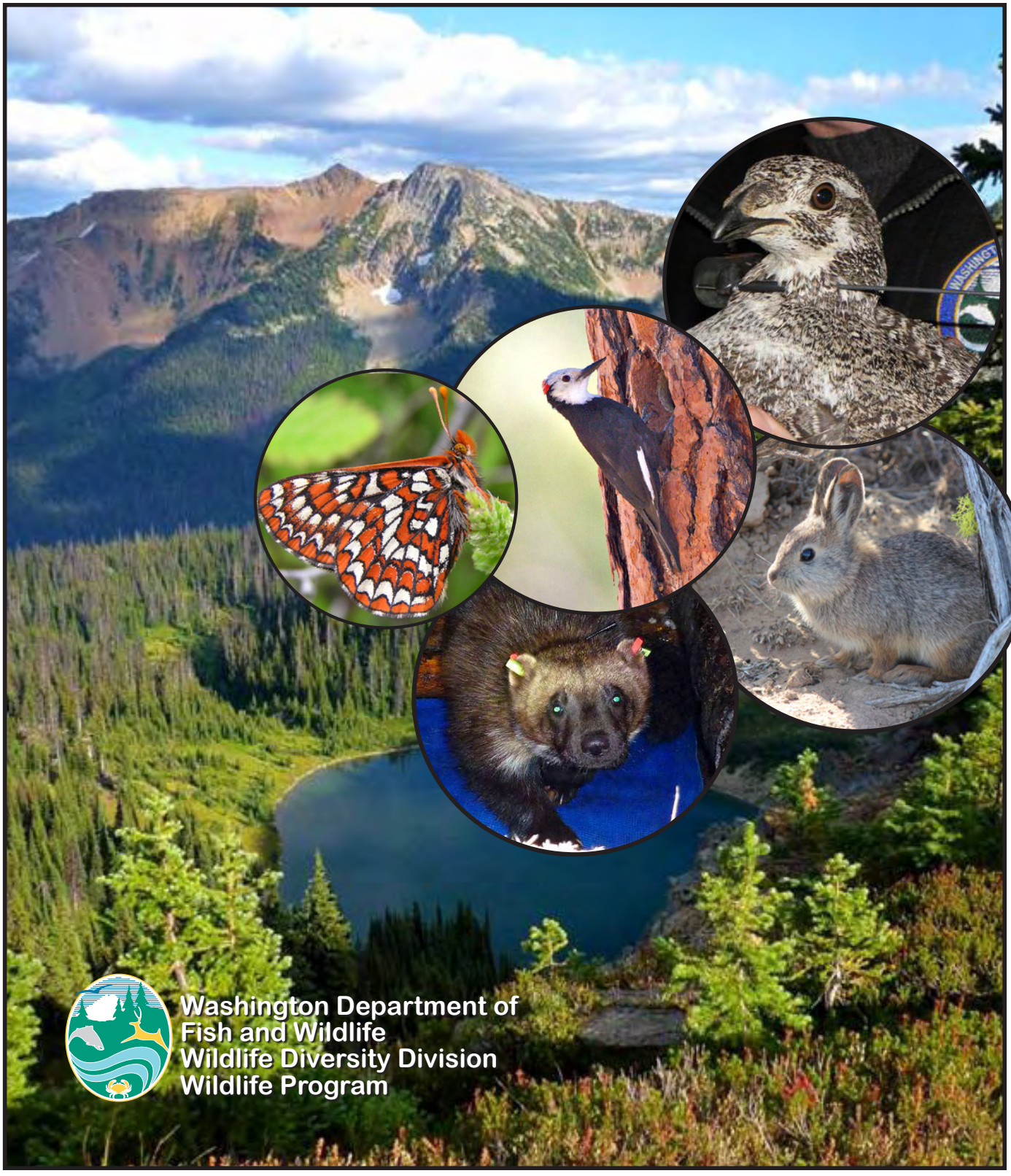
Threatened and Endangered Wildlife

STATE OF WASHINGTON **Annual Report 2012**



Washington Department of
Fish and Wildlife
Wildlife Diversity Division
Wildlife Program

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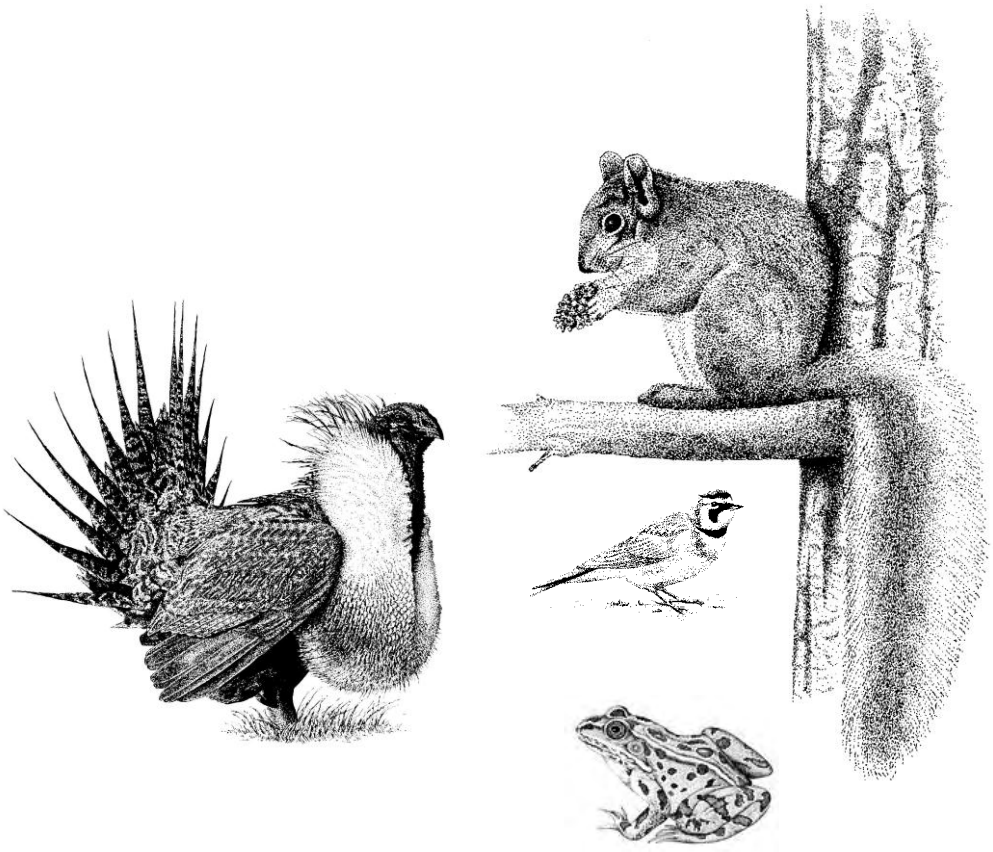
Cover photos by: *Joe Higbee (white-headed woodpecker), Betsy DeMay (pygmy rabbit), WDFW (greater sage-grouse in hand), Scott Fitkin (wolverine), Derek Stinson (Taylor's checkerspot), and Scott Fitkin (Pasayten Wilderness, background). Title page illustrations by Darrell Pruett.*

THREATENED AND ENDANGERED WILDLIFE IN WASHINGTON: 2012 ANNUAL REPORT



Washington Department of Fish and Wildlife
Listing and Recovery Section, Diversity Division, Wildlife Program
600 Capitol Way N
Olympia, Washington

2013

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ACKNOWLEDGMENTS

Species accounts were compiled by Derek Stinson, Gary Wiles, Gerald Hayes, Jeff Lewis, Lisa Hallock, Steve Desimone, and Joe Buchanan. Many other individuals took time from busy schedules to review species accounts or provide information or documents for this report, including WDFW district and assistant district wildlife biologists, research scientists, and people from other agencies. They include Harriet Allen, David Anderson, Hannah Anderson, Keith Aubry, Lynne Barre, Dana Base, Penny Becker, Scott Becker, Gary Bell, Gretchen Blatz, Joe Buchanan, Steve Desimone, Joe Engler, Greg Falxa, Howard Ferguson, Rich Finger, Scott Fitkin, John Fleckenstein, Eric Gardner, Joe Gaydos, Dawn Gedenberg, Gary Ivey, Lisa Hallock, Molly Hallock, Jeff Heinlen, Eric Holman, Steve Jeffries, Mary Linders, Mike Livingston, Russ Mullins, Travis Nelson, Heidi Newsome, Don Noviello, Brent Norberg, Gail Olson, Ann Potter, Scott Pearson, Leslie Robb, Elizabeth Rodrick, Ella Rowan, Lori Salzer, Chris Sato, Tammy Schmidt, Larry Schwitters, Michelle Tirhi, Laura Todd, Matt Vander Haegen, Jim Watson, and Kristin Wilkinson. Joe Higbee and Rod Gilbert allowed use of many photographs. David Speiser kindly allowed the use of his yellow-billed cuckoo photo.

DEDICATION

The 2012 report is dedicated to Harriet Allen on the occasion of her retirement from state service after over 30 years of hard work on behalf of threatened and endangered wildlife in Washington. Harriet led the Threatened and Endangered Species Section of the Wildlife Diversity Division for 25 years and is a veteran of some interesting times including listing of the Northern Spotted Owl, the recovery of our Bald Eagle population, and the development of the Wolf Conservation and Management Plan. Her guidance, enthusiasm, and sharp editor's eye will be missed.

INTRODUCTION

This report summarizes recent recovery actions for the 46 endangered, threatened, and sensitive wildlife species in Washington, with an emphasis on activities occurring in 2012. It also includes accounts for 26 of the 113 species that are candidates for listing as endangered, threatened, or sensitive. Species accounts include background information about the species in Washington and recent conservation activities including monitoring, management, and research. The state list of endangered, threatened, and sensitive species is found on pages 6-8. State listing procedures are defined in WAC 232-12-297; endangered species are classified under WAC 232-12-014; and threatened and sensitive species are designated under WAC 232-12-011 (Appendix A).

Conserving the wildlife of Washington is an immense job which the Washington Department of Fish and Wildlife cannot do alone. Numerous partners and cooperating agencies, tribes, organizations, zoos, companies, and landowners contributed time, money, and effort into conservation activities and are identified in the species accounts. The U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, National Park Service, Washington Department of Natural Resources, Washington State Department of Transportation, Washington State Parks, universities (particularly Washington State University, University of Washington, and The Evergreen State College), tribes, and conservation groups are important partners on many projects. The Woodland Park Zoo, Oregon Zoo, Northwest Trek, and Washington State Department of Corrections have become essential partners in several projects involving captive rearing and breeding of listed species. We apologize for any partner organizations that were not acknowledged. Wildlife conservation also benefits from the many people, too numerous to list, that volunteer their time, lands, and efforts to recover listed species.

In addition to the many partners who participate in recovery, grants and special funds are critical to implementing conservation efforts for listed species and their habitats. Special state funds include those from personalized license plates and the Orca-Endangered Species special background license plate. Funds for land acquisition and restoration have come from the Washington State Recreation and Conservation Office through its Washington Wildlife and Recreation Program and from U.S. Fish and Wildilfe Service Cooperative Endangered Species Conservation Funds (Section 6). Federal grants of particular importance include State Wildlife Grants, Cooperative Endangered Species Conservation Funds (Section 6), and Recovery Grants from the U.S. Fish and Wildlife Service. Additional funds have come from the Bonneville Power Administration and the Department of Defense through Army Compatible Use Buffer funds.

STATE LISTED AND CANDIDATE SPECIES

Species names in blue have accounts in this report. The Washington Fish and Wildlife Commission has classified the following 46 species as Endangered, Threatened, or Sensitive. The federal designation for these species is also listed below as follows: Federal Endangered (FE), Threatened (FT), Proposed Threatened (FPT), Candidate (FC), or Species of Concern (FSC).

STATE ENDANGERED SPECIES

A species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state. The 28 state Endangered species are designated in Washington Administrative Code 232-12-014.

MAMMALS (14)	
Pygmy Rabbit	FE
Sperm Whale	FE
Fin Whale	FE
Sei Whale	FE
Blue Whale	FE
Humpback Whale	FE
North Pacific Right Whale	FE
Killer Whale	FE*
(*Only the Southern Residents populations is federally listed)	-
Gray Wolf *(#Federally listed west of a north-south line following Highways 97, 17, and 395)*	FE#
Grizzly Bear	FT
Fisher	FC
Sea Otter	FSC
Columbian White-tailed Deer	FE
Woodland Caribou	FE

BIRDS (7)	
American White Pelican	-
Brown Pelican	FSC
Sandhill Crane	-
Upland Sandpiper	-
Snowy Plover	FT
Northern Spotted Owl	FT
Streaked Horned Lark	FC
REPTILES (2)	
Western Pond Turtle	FSC
Leatherback Sea Turtle	FE
AMPHIBIANS (2)	
Oregon Spotted Frog	FC
Northern Leopard Frog	FSC
INSECTS (3)	
Oregon Silverspot Butterfly	FT
Taylor's Checkerspot	FC
Mardon Skipper	FSC

STATE THREATENED SPECIES

A species native to the state of Washington that is likely to become endangered within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats. The 10 state Threatened species are designated in Washington Administrative Code 232-12-011.

MAMMALS (4)	
Western Gray Squirrel	FSC
Mazama Pocket Gopher	FC
Steller Sea Lion	FT
North American Lynx	FT
BIRDS (4)	
Greater Sage-Grouse	FC
Columbian Sharp-tailed Grouse	FSC
Ferruginous Hawk	FSC
Marbled Murrelet	FT
REPTILES (2)	
Green Sea Turtle	FT
Loggerhead Sea Turtle	FE

STATE SENSITIVE SPECIES

A species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats. The 8 state Sensitive species are designated in Washington Administrative Code 232-12-011.

MAMMALS (1)		**FISH (3)**	
Gray Whale	-	**Pygmy Whitefish**	FSC
BIRDS (3)		**Margined Sculpin**	FSC
Common Loon	-	**Olympic Mudminnow**	-
Bald Eagle	FSC	**AMPHIBIANS (1)**	
Peregrine Falcon	FSC	**Larch Mountain Salamander**	FSC

STATE CANDIDATE SPECIES

The Washington Department of Fish and Wildlife has designated the following 113 species as Candidates for listing as state Endangered, Threatened, or Sensitive in Washington. The Department reviews species for listing following procedures in Washington Administrative Code 232-12-297. The federal designation for these species is also listed below as follows: Federal Endangered (FE), Proposed Endangered (FPE), Threatened (FT), Proposed Threatened (FPT), Candidate (FC), or Species of Concern (FSC).

MAMMALS (13)	
Preble's Shrew	FSC
Merriam's Shrew	-
Townsend's Big-eared Bat	FSC
Keen's Myotis	-
White-tailed Jackrabbit	-
Black-tailed Jackrabbit	-
Gray-tailed Vole	-
Washington Ground Squirrel	FC
Townsend's Ground Squirrel	FSC
South of the Yakima River	
Olympic Marmot	-
Cascade Red Fox	-
Wolverine	FC
Pacific Harbor Porpoise	
BIRDS (23)	
Western and Clark's Grebes	-
Short-tailed Albatross	FE
Brandt's Cormorant	-
Northern Goshawk	FSC
Golden Eagle	-
Common Murre	-
Cassin's Auklet	FSC
Tufted Puffin	FSC
Yellow-billed Cuckoo	FC
Flammulated Owl	-
Burrowing Owl	FSC
Vaux's Swift	-
Lewis' Woodpecker	-
White-headed Woodpecker	-
Black-backed Woodpecker	-
Pileated Woodpecker	-
Loggerhead Shrike	FSC
Purple Martin	-
Slender-billed White-breasted Nuthatch	FSC
Sage Thrasher	-
Oregon Vesper Sparrow	FSC
Sage Sparrow	-
REPTILES and AMPHIBIANS (10)	
Sagebrush Lizard	FSC
Common Sharp-tailed Snake	FSC
California Mountain Kingsnake	-
Striped Whipsnake	-
Dunn's Salamander	-
Van Dyke's Salamander	FSC
Cascade Torrent Salamander	-
Western Toad	FSC
Columbia Spotted Frog	-
Rocky Mountain Tailed Frog	FSC

FISH (37)

Mountain Sucker	-
Lake Chub	-
Leopard Dace	-
Umatilla Dace	-
River Lamprey	FSC
Pacific Herring	FSC
Eulachon (Columbia R. Smelt)	FT
Pacific Cod, South & Central Puget Sound	FSC
Walleye Pollock, South Puget Sound	FSC
Pacific Hake (Whiting), GeorgiaBasin	FSC
Black Rockfish#	-
Brown Rockfish#	FSC
Copper Rockfish#	FSC
Quillback Rockfish#	FSC
Tiger Rockfish#	-
Bocaccio Rockfish#	FE
Canary Rockfish#	FT
Yelloweye Rockfish#	FT
Yellowtail Rockfish#	-
Greenstriped Rockfish#	-
Widow Rockfish#	-
Redstripe Rockfish#	-
China Rockfish#	-

#Puget Sound, the San Juan Islands, and the Strait of Juan de Fuca east of the Sekiu R.

Chinook Salmon	
Snake River Fall	FT
Snake R. Spring/Summer	FT
Puget Sound	FT
Upper Columbia Spring	FE
Lower Columbia	FT
Chum Salmon	
Hood Canal Summer (includes Strait of Juan de Fuca, not Puget Sound)	FT
Columbia River	FT
Sockeye Salmon	
Snake River	FE
Ozette Lake	FT
Steelhead	
Snake River	FT
Upper Columbia	FT
Middle Columbia	FT
Lower Columbia	FT
Bull Trout	FT

INSECTS (19)

Beller's Ground Beetle	FSC
Mann's Mollusk-eating Ground Beetle	-
Columbia River Tiger Beetle	-
Hatch's Click Beetle	FSC
Bog Idol Leaf Beetle	-
Columbia Clubtail (dragonfly)	FSC
Pacific Clubtail	-
Sand-verbena Moth	-
Yuma Skipper	-
Shepard's Parnassian	-
Makah Copper	FSC
Chinquapin Hairstreak	-
Johnson's Hairstreak	-
Juniper Hairstreak	-
Puget Blue	-
Valley Silverspot	FSC
Silver-bordered Fritillary	-
Great Arctic	-
Island Marble	FSC

MOLLUSKS (9)

Giant Columbia River Limpet	-
Columbia Pebblesnail	FSC
California Floater	FSC
Northern Abalone	FSC
Olympia Oyster	-
Columbia Oregonian (snail)	-
Poplar Oregonian (snail)	-
Dalles Sideband (snail)	-
Blue-gray Taildropper (slug)	-

OTHER INVERTEBRATES (2)

Giant Palouse Earthworm	-
Leschi's Millipede	-

SPECIES RECENTLY REMOVED from the STATE CANDIDATE SPECIES LIST

Merlin	-
Newcomb's Littorine Snail	-

Pygmy Rabbit

Brachylagus idahoensis

State Status: Endangered, 1990
Federal Status: Endangered, 2001 (Columbia Basin Distinct Population Segment)
Recovery Plans: Federal, 2012; State, 1995, updates 2001, 2003, 2011

Figure 1. Young pygmy rabbit born in an enclosure at Sagebrush Flats Wildlife Area in 2012 (*photo by Betsy DeMay*).

The pygmy rabbit is the smallest rabbit in North America (Figure 1). It is patchily distributed in the sagebrush-dominated areas of the Great Basin in portions of Oregon, California, Nevada, Utah, Idaho, Montana, and Wyoming. The Washington population has been isolated from the remainder of the species' range for at least 10,000 years and possibly as long as 40,000 to 115,000 years (Lyman 1991, Warheit 2001). Museum specimen records and reliable sight records show that pygmy rabbits formerly occupied sagebrush habitat in Benton, Adams, Grant, Lincoln, and Douglas counties (Figure 2). Paleontological evidence suggests that the species prehistorically had a broader distribution that also included Franklin, Kittitas, Chelan, Yakima, and Whitman counties (Lyman 2004).

The pygmy rabbit was listed as a threatened species in Washington in 1990 and was reclassified to endangered status in 1993 (WDFW 1993). A state recovery plan for the rabbit was written in 1995, with amendments in 2001, 2003, and 2011. The Columbia Basin pygmy rabbit distinct population segment was listed by the U.S. Fish and Wildlife Service as endangered in 2001. A federal recovery plan was recently completed (USFWS 2012).

Little was known about the distribution and status of pygmy rabbits in the state until WDFW conducted surveys between 1987 and 1990 (Dobler and Dixon 1990). At that time, they were found in six relatively small, isolated populations in Adams, Grant, Douglas, and Lincoln counties (WDFW 1995). Population sizes were never known, although the number of active burrows ranged from 10 – 590 at the six sites. Between 1997 and 2001 five of the six populations disappeared (Becker et al. 2011). Populations with the fewest active burrows generally disappeared first. Large-scale conversion and fragmentation of native shrub-steppe habitats, primarily to agriculture, likely played a primary role in the long-term decline of the Columbia Basin pygmy rabbit. However, once population numbers dropped below a

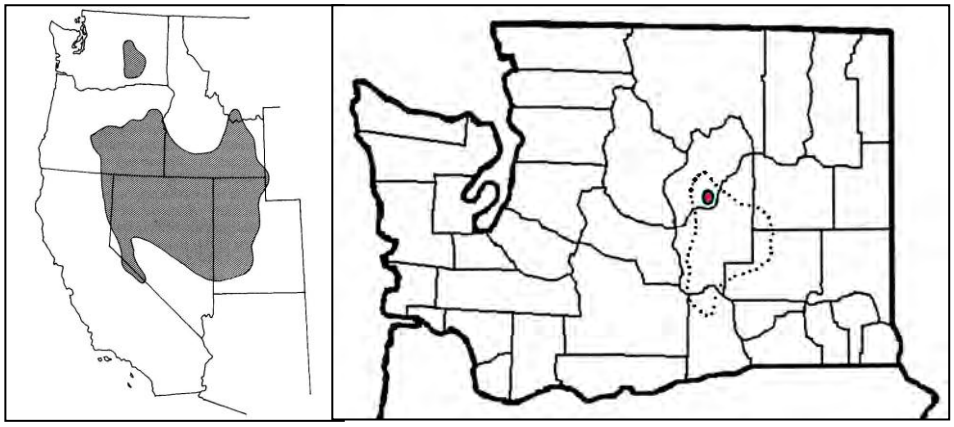

Figure 2. Historical range (right) and Columbia Basin Distinct Population Segment of the pygmy rabbit (*adapted from Green and Flinders 1980, USFWS 2012*).

certain threshold, a combination of other factors such as environmental events (e.g., extreme weather and fire), predation, disease, loss of genetic diversity, and inbreeding likely contributed to the extirpation of local populations. The population suffered a sudden large decline during the winter of 2000–2001, and by March 2001, rabbits remained only at Sagebrush Flat Wildlife Area. With so few Washington pygmy rabbits left in the wild, it was decided to capture 16 of the remaining rabbits in May 2001 to establish a captive population for future recovery efforts.

Captive breeding. A captive breeding program was initiated in 2001. The captive breeding program was a cooperative project involving WDFW (lead agency), Washington State University, Oregon Zoo, and Northwest Trek Wildlife Park. Although the Columbia Basin pygmy rabbits were not taxonomically separated from the remaining pygmy rabbits in the Great Basin, genetic studies prompted WDFW to manage the population to maintain its unique genetic characteristics. The Columbia Basin pygmy rabbit breeding program aimed to produce as many purebred animals as possible, but from the first breeding season, reproductive output was very poor, and the genetic diversity of the Columbia Basin founder population was found to be approximately half as diverse as the Idaho population (Warheit 2001). The low genetic diversity suggested that inbreeding depression was causing poor reproduction, skeletal deformities in the offspring, and increased susceptibility to disease (Elias 2004; Hays and Warheit 2007; USFWS 2012). Captive breeding was not producing sufficient numbers of rabbits for successful reintroduction. Although the original goal was to rear rabbits solely from Columbia Basin stock, that effort was unsuccessful. In 2003, the Washington pygmy rabbits were crossed with pygmy rabbits from the neighboring state of Idaho. The largest proportion of the 2010 population was 75% Columbia Basin genes.

Since genetic diversity was increased by intercrossing animals, reproduction has largely improved for captive pygmy rabbits. Unfortunately, while production of kits increased, the survival of kits decreased, with maternal neglect and disease the most common causes of mortality. High levels of disease occurrences continued to hamper attempts to increase the size of the captive population. As a result, recovery efforts transitioned from only captive breeding to also include field efforts with additional pygmy rabbits from other range states.

The transition from captive breeding in zoos to controlled propagation in large enclosures on release sites began in spring 2011 by reintroducing captive-reared individuals and their new offspring at Sagebrush Flats WLA. Washington State University ended their breeding program in June 2011, Northwest Trek Wildlife Park finished their efforts in October 2011, and Oregon Zoo sent all their captive pygmy rabbits fit for release to the wild in July 2012.

Reintroduction. Early recovery efforts also included experimental rearing and releasing of captive Idaho pygmy rabbits back into Idaho to test and improve methods. In 2002, 20 Idaho pygmy rabbits born in captivity were released in two groups at the Idaho National Environmental Engineering Laboratory near Idaho Falls, Idaho. Four of 20 rabbits survived to breeding season 2003. This was followed by a release of 20 Columbia Basin captive-bred rabbits into the wild at Sagebrush Flats Wildlife Area (WLA) in 2007. Rabbit survival using ‘hard release’ methods (without a transition period in an enclosure) was very low due to predation, despite removal of predators, especially weasels, at the release site. The reintroduction demonstrated that captive-reared Columbia Basin pygmy rabbits will breed in their first season of release in the wild.

Several steps are being taken to increase the likelihood of successfully re-establishing a pygmy rabbit population, including: 1) translocating wild pygmy rabbits to Washington from other states, 2) breeding pygmy rabbits in semi-wild conditions on the release site, and 3) releasing juvenile offspring of mixed lineage, and adult wild-caught pygmy rabbits from neighboring states.

Preparation of reintroduction sites at Sagebrush Flat included management activities designed to improve habitat conditions for pygmy rabbits, including restoration of old fields to increase shrub cover, construction of large enclosures and soft release enclosures, removal of unneeded fence posts to reduce raptor perches, placement of bird spikes on existing structures, signage to discourage unauthorized public access, weed control, and construction of fire breaks (USFWS 2012).

Figure 3. Pygmy rabbit kit being processed at Sagebrush Flats Wildlife Area in 2012.

Pygmy rabbits are vulnerable to a wide range of predators, so artificial burrows and augured holes are being used to protect rabbits from digging predators (i.e., badgers and coyotes) and raptors. In addition, predator control will be done intermittently throughout the reintroductions in the form of lethal and non-lethal hazing of raptors, and trapping of problem weasels, coyotes, and badgers as needed.

Large enclosures were also erected on Sagebrush Flat Wildlife Area and Domaier Unit to allow controlled breeding in semi-wild conditions. The large enclosures (approximately 10, 6 and 5 acres each) are structures that could be used throughout the reintroduction efforts. Inside the enclosures, artificial and natural burrows are available, netting covers burrow entrances to protect against raptor predation, and supplemental food is provided to ensure proper nutrition while in the enclosures.

Numbers and timing of additional releases of wild rabbits will depend upon ongoing assessments of program results and the availability of rabbits from neighboring states. Reintroductions at new locations will also depend on preparations of new areas (e.g. safe harbor agreements, construction of reintroduction infrastructure, habitat improvement) as well as the availability of wild rabbits.

Activities in 2012. In March 2012, a total of 23 rabbits were captured and moved from Nevada, and 24 were captured and moved from Utah. These rabbits, along with kits born in the enclosures, were weighed, sexed, sampled for DNA with an ear punch, and examined by a veterinarian to assess their overall health. Well over 150 kits were born in the enclosures at Sagebrush Flats WLA.

During May-July, 103 kits were released in 6 rounds, either in soft-release enclosures, or hard-released into prepared burrow sites in the wild. A proportion of the released kits had glue-on transmitters to monitor their dispersal and survival post-release. Half of the kits stayed near their release site, while the other half left the area immediately. One individual traveled more than 2 miles in 18 hours while others traveled intermediate distances. Tracking the very small transmitters with limited range is difficult. Flights tracked the rabbits to as far as 8 kilometers away, but distances dispersed have varied greatly with some individuals remaining very near release sites.

In July, the Oregon Zoo brought the remaining 11 adults and 5 kits to the large enclosures on Sagebrush Flat WLA, thus ending their role as a captive breeding center for pygmy rabbits. In November, a new 5 acre breeding enclosure was constructed on the Dormaier Unit of Sagebrush Flats WLA with the help of volunteers (Figure 4).

In December 2012 and January 2013, more than 2,400 acres of winter surveys were completed on or near Sagebrush Flat Wildlife Area. Approximately 110 active burrows were located and pellet samples collected from each. Genetic analyses of the fecal samples at the University of Idaho laboratory revealed that 38 rabbits released in the 2012 breeding season are using those burrows (37% of kits released).

Although some long distance dispersal events and trends in directionality were documented, a comparison of radio telemetry and genetics results showed that radio tracking of released kits yielded data that was less valuable than genetic sampling. Snow surveys paired with fecal genetics detected: 1) rabbits released without transmitters, 2) rabbits thought to have been preyed upon based on transmitter condition, 3) rabbits in a different location than last recorded based on transmitter location, and 4) rabbits that were missing after release even though they were fitted with transmitters.

Figure 4. Staff and volunteers constructed a 5-acre breeding enclosure on Dormaier Unit of Sagebrush Flat Wildlife Area, November 2012.

In addition, four pygmy rabbits were located that are the offspring of rabbits released in the 2011 breeding season. Parents of these individuals were located in February 2012 more than 1.8 km away from each other, yet still managed to find each other during the breeding season. Results showing a large number of rabbits in close proximity to each other are very encouraging because breeding will begin again in March 2013.

Figure 5. Pygmy rabbit observed in the release area during surveys in December 2012.

Federal recovery plan. The final federal recovery plan for the Columbia Basin distinct population segment of the pygmy rabbit was issued in December (USFWS 2012).

Partners and co-operators: U.S. Fish and Wildlife Service, Northwest Trek, Oregon Zoo, Washington State University, Oregon Department of Fish and Wildlife, Nevada Division of Wildlife, Utah Division of Wildlife Resources, Bureau of Land Management, University of Idaho (grants also from Association of Zoos and Aquariums and Riverbanks Zoo and Garden), and University of Idaho.

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Sperm Whale
(*Physeter macrocephalus*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 2010

Humpback Whale
(*Megaptera novaeangliae*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 1991

Blue Whale
(*Balaenoptera musculus*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 1998

Fin Whale
(*Balaenoptera physalus*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 2010

Sei Whale
(*Balaenoptera borealis*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 2011

North Pacific Right Whale
(*Eubalaena japonica*)
State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: None

Figures 1-4. From top: sperm whale *(by Arun Madisetti);* humpback whale *(by Robert Pitman);* humpback whale *(by Michael Richlen, NOAA Fisheries Service)*; fin whale *(by Michael Richlen, NOAA Fisheries).*

Populations of large whales were decimated by large-scale commercial whaling during the 19th and 20th centuries worldwide, including in the eastern North Pacific. The American Pacific Whaling Company operated a whaling station at Bay City, Washington, from 1911-1925, and six stations operated in British Columbia, with the last closing in 1967 (Table 1). Despite the end of most hunting by 1980, many populations have not yet recovered and are still considered depleted. All large whales off the U.S west coast are protected by the U.S. Marine Mammal Protection Act. Increasing levels of anthropogenic sound in the world's oceans is a concern for whales, particularly for deep-diving species like sperm whales. Drift gillnet fisheries and ship strikes are other sources of mortality that are very likely underestimated in their frequency (Douglas et al. 2008).

Table1. Number of whales processed historically at whaling stations in Bay City, Washington, and in British Columbia.

Species	Number whales processed	
	Washington[a] (1911-1925)	British Columbia[b] (1908 -1967)
Humpback whale	1,933	5,638
Fin whale	602	7,605
Sperm whale	120	6,158
Sei whale	21	4,002
Blue whale	13	1,398
Beaked whale spp.	8	41
North Pacific right whale	-	8
Total	2,698	24,850

[a]Scheffer and Slipp (1948)
[b]Gregr et al. (2000)

Sperm whale. Sperm whales in Washington belong to the California/Oregon/Washington stock. Numbers in this stock are estimated at 971 whales based on ship surveys conducted in 2005 and 2008 (Carretta et al. 2013). Estimates of stock size are variable among years, with this most recent estimate being lower than in the previous survey (1,233 whales for 1996 and 2001, combined; Carretta et al. 2013). However, survey data are inadequate for concluding that there has been a decline in the population. Mortality associated with drift gillnet fisheries and ship strikes appears to be low for this stock. Sperm whales are present in deeper waters off Washington in all seasons except winter (December-February) (Green et al. 1992).

Humpback whale. Population estimates for the entire North Pacific increased substantially from 1,200 whales in 1966 to about 18,000-20,000 whales by 2004-2006 (Calambokidis et al. 2008). Humpback whales feeding along the U.S. west coast comprise the California/Oregon/Washington stock. There is some mixing of individuals from this stock and a southern British Columbia stock in the waters off northern Washington, suggesting the presence of a third stock located in this specific area (Calambokidis et al. 2008, Carretta et al. 2013). The California/Oregon/Washington stock has a long-term growth rate of about 7.5% per year and was estimated to number at least 2,043 whales in 2007-2008 (Calambokidis 2009, Calambokidis et al. 2009). This stock mainly winters in coastal areas off Mexico and Central America (Calambokidis et al. 2000). During 2004-2008, 16 humpback whales (14 seriously injured, 2 killed) were recorded entangled in fishing gear and two others were killed by ship strikes in California, Oregon, and Washington (Carretta et al. 2013).

Most humpback whales occur off Washington from July to September (Green et al. 1992). Summer surveys during 1995-2002 found humpbacks to be the most common large whale off northern

Washington, with numbers increasing from about 100 to 200 whales during the study (Calambokidis et al. 2004). These estimates remain much lower than the historical population size before whaling. Humpback whales were common in the inner marine waters of Washington and British Columbia until the early 1900s, but were decimated by hunting and they remain rare visitors (Scheffer and Slipp 1948, Calambokidis and Steiger 1990). Notably, in 2012, a humpback was present in Hood Canal from late January through much of February (Orca Network, unpubl. data).

Blue whale. The Eastern North Pacific stock of blue whales includes animals found from the Gulf of Alaska to the eastern tropical Pacific. Waters off California are one of the most important feeding areas in summer and fall. Most of this stock is believed to migrate south to spend the winter and spring in high productivity areas off Baja California, in the Gulf of California, and off Costa Rica and Nicaragua. The best estimate of stock size is 2,497 whales during 2005-2008 (Carretta et al. 2013), with the current population trend unknown. Mortality associated with ship strikes has been relatively high off California in recent years, but no recent deaths from drift gillnet fisheries have been reported (Carretta et al. 2013). Blue whales are rarely sighted off the Washington coast, with just three reports in the last 50 years, including six seen on December 8, 2011 (Cascadia Research Collective, unpublished data). Four of these individuals were previously recorded off California. This species does not enter the state's inner waters.

Fin whale. Fin whales in Washington are part of the California/Oregon/Washington stock. Sightings and acoustic detections indicate this species is present off Oregon and Washington for most of the year (Douglas et al. 2008). The best estimate of stock size is 3,044 whales during 2005-2008, with the current population trend possibly increasing or stable (Carretta et al. 2013). Although fin whales appear more vulnerable to ship strikes along the U.S. west coast than other large whale species (Douglas et al. 2008), mortality and injury from ship strikes are considered relatively low for the stock (Carretta et al. 2013). Vessel collisions have been implicated in the deaths of at least seven fin whales found in Washington's waters since 2002 (Cascadia Research Collective, unpublished data). Many of these strikes probably took place outside of Washington. No recent deaths from drift gillnet fisheries have been reported for the stock (Carretta et al. 2013). Other potential threats to fin whale populations include noise from vessels, oil and gas activities, and military sonar and explosives; loss of prey resources due to climate and ecosystem change; and competition for prey with human fisheries (NMFS 2010). Sightings of fin whales in the state's inner marine waters are very rare.

Sei whale. Sei whales in Washington are part of the Eastern North Pacific stock, which extends west to longitude 180°. No population estimates or trend data exist for the stock (Carretta et al. 2013). Sei whales occur over deep waters and rarely appear off the U.S. west coast. Only nine confirmed sightings of sei whales were made in California, Oregon, and Washington waters during extensive ship and aerial surveys between 1989-2008 (Green et al. 1992, Carretta et al. 2013). The best estimate of abundance for California, Oregon, and Washington waters out to 300 nautical miles during 2005-2008 is 126 (CV=0.53) whales (Barlow and Forney 2007, Forney 2007, Barlow 2010). Reported losses to gillnetting and ship strikes are low along the U.S west coast, but are likely underreported. One ship strike death was reported in Washington in 2003. Other potential threats to sei whale populations include noise from vessels, oil and gas activities, and military sonar and explosives; and loss of prey resources associated with climate and ecosystem change (NMFS 2011).

North Pacific right whale. This species may be the most endangered large whale in the world (Allen and Angliss 2013). Historical whaling records indicate that it once ranged across the entire North Pacific north of 35°N and occasionally as far south as 20°N (Allen and Angliss 2013). Nearly all records of whales in the eastern North Pacific stock (which includes Washington) are now restricted to Alaskan waters, especially in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001, Allen and Angliss 2013). Current stock size and trend are not known, but the population is very small

(Allen and Angliss 2013). There are no records of fisheries or ship strike mortalities of whales in this stock, although ship strikes are an important cause of death for North Atlantic right whales (*E. glacialis*). The last sighting of a North Pacific right whale off Washington was in 1992 (Rowlett et al. 1994). A group of 2-3 individuals was observed off Three Arch Rocks in northern Oregon in 1994 (S. Reimer, pers. comm.).

Figure 5. North Pacific right whale (*by John Durban, NOAA*).

Monitoring and research. Survey efforts for each of these listed species are ongoing and are conducted by NOAA Fisheries and partner groups, such as Cascadia Research Collective. Updated stock assessments are regularly derived from survey results and include information on abundance, population trends, and mortality from fisheries, ship strikes, and other sources. Cascadia Research has recently begun survey efforts in collaboration with WDFW and Oregon Department of Fish and Wildlife to further investigate the occurrence of endangered large whales off Washington and Oregon. Some of this work includes satellite tagging of whales (e.g., Schorr et al. 2010). Sightings of all large whales in the inner waters of Washington are posted monthly by Orca Network (http://www.orcanetwork.org/sightings/map.html#recent).

Management of entanglements and ship strikes. NOAA Fisheries has expanded its efforts to document entanglements and ship strikes of all large whales in the eastern North Pacific. To better address the problem of entanglements, the agency has held disentanglement training sessions and cached disentanglement equipment at sites in Washington and elsewhere along the U.S. west coast.

Stranding responses. NOAA Fisheries Northwest Region coordinates responses to strandings of large whales through the Northwest Region Marine Mammal Stranding Network, which is comprised of cooperating scientific investigators, institutions, organizations, and state/federal fish and wildlife agencies. Stranding data are entered into a national database. In 2012, there were three strandings (two sperm whales, one humpback whale) involving these six species in Washington (NOAA Fisheries, unpublished data). Strandings of endangered large whales are rare in Washington and Oregon (Norman et al. 2004), with an average of 2-3 individuals per year for both states combined from 1999-2004 (NOAA Fisheries, unpublished data). Cascadia Research samples or necropsies many of these animals to determine cause of death, animal condition and health, and other traits.

Partners and cooperators: NOAA Fisheries, Cascadia Research Collective, Orca Network, Oregon Department of Fish and Wildlife, Olympic Coast National Marine Sanctuary, Makah Tribe, Dungeness National Wildlife Refuge, Olympic National Park, Center for Whale Research, Port Townsend Marine Science Center, Wolftown, Marine Science and Technology Center at Highline Community College, and local marine mammal stranding networks.

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Killer Whale

(*Orcinus orca*)

State Status: Endangered for all populations, 2004
Federal Status: Endangered for the southern resident population, 2006
Recovery Plans: Federal, 2008

Figure 1. Southern resident killer whales (*photo by NOAA Fisheries*).

Killer whales, or orcas, are an iconic member of Washington's marine ecosystems. Three populations of the whales, known as the southern residents, transients, and offshores, regularly occur in the state (Wiles 2004). A fourth population, the northern residents, enters the state's waters rarely. These populations are not known to interbreed and are therefore considered distinct from one another.

The southern resident population is comprised of three social groups identified as J, K, and L pods (NMFS 2008). It occurs primarily in U.S. and Canadian waters in and around the San Juan Islands, including Haro Strait, Boundary Passage, and the eastern portion of the Strait of Juan de Fuca, from late spring to fall. During the rest of the year, K and L pods spend most of their time along the outer coast and travel extensively to sites as far north as northern British Columbia and as far south as Monterey Bay in California. J pod tends to remain in the Georgia Basin throughout the year, making trips to the outer coast in the winter. Southern resident killer whales feed primarily on chinook salmon, chum salmon to a lesser extent, and occasionally on other fish and squid. The population is highly social, with the three pods having 40 (L), 25 (J), and 20 (K) members in July 2012. The basic social unit within pods is called the matriline, which is usually composed of a female, her sons and daughters, and offspring of her daughters. Members maintain extremely strong bonds and individuals seldom stray from the group for more than a few hours. Permanent dispersal of individuals away from southern resident matrilines has never been recorded.

Transients move greater distances and tend to have larger home ranges than resident whales. Animals observed in Washington have also been recorded in California and southeastern Alaska. The state's transients feed largely on harbor seals, but other marine mammals such as sea lions, porpoises, whales, and small numbers of seabirds are also taken. Transient matrilines are also led by adult females, with group size usually numbering less than 10 individuals. However, unlike residents, permanent dispersal of members from matrilines appears common.

Due to a scarcity of sightings, much less information is available on the biology of offshore killer whales. Observations usually occur more than 15 km (9 mi) offshore and have been made from southern California to Alaska, including rare visits to the Georgia Basin. Animals typically congregate in groups of 20-75 animals and are believed to feed primarily on sharks and other fish (Ford et al. 2011).

Sexually maturity in killer whales occurs at about 12-16 years of age. For animals that survive their first

six months, average life span is 50-60 years for females and 29 years for males. Maximum life span is estimated at 80-90 years for females and 50-60 years for males. Most births take place from October to March, but can happen during any month.

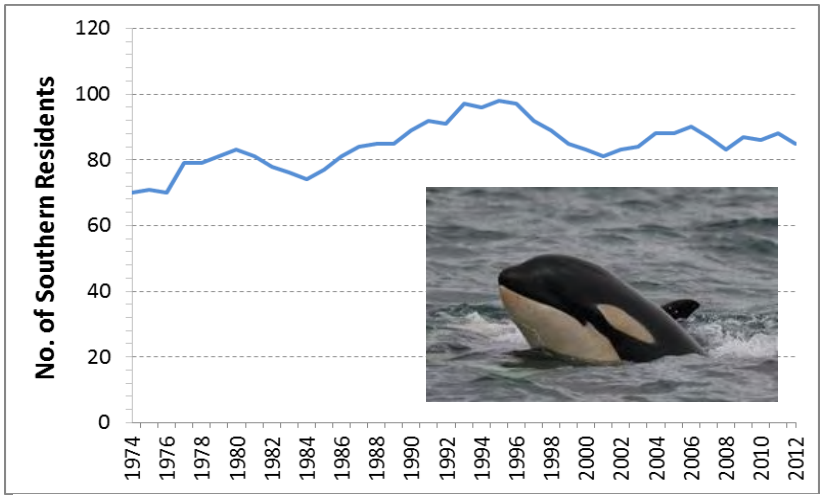

Figure 2. Population trend of southern resident killer whales, 1974-2012 (*photo by Robin Baird*).

Concern for Washington's killer whales focuses primarily on the southern residents (NMFS 2008). The population was heavily harvested for display in marine aquaria during the 1960s and early 1970s, when nearly 50 animals were captured. Census work began in 1974 and documented a total of 70 whales. The population generally increased in most years until 1995, when 98 animals were counted (Figure 2). It declined 17% from 1996-2001 to 81 whales and has since remained in the mid- to high 80s, with 85 individuals in July 2012. From July 1, 2011, to July 1, 2012, one birth (L119) and four deaths (J30, L5, L12, L112) occurred within the population.

Transients and offshore killer whales are thought to total at least 354 and 240 whales, respectively (Allen and Angliss 2013, Carretta et al. 2013), but only small portions of both populations normally occur in Washington at any one time. Trend information does not exist for these populations.

Killer whales in the Pacific Northwest face several important threats (NMFS 2008). Declines in chinook salmon have occurred during the past 150 years and may now be a limiting factor for the southern residents. Chemical contamination threatens both the southern residents and transients, despite the expansion of pollution controls in recent decades. Recent studies have found high levels of PCBs, DDTs, and PBDEs in both populations. Increased boat traffic, especially from commercial and recreational whale watchers, has caused greater underwater noise levels that may interfere with feeding and communication among the whales. The possibility of a major oil spill in the Georgia Basin (including Puget Sound) or along the outer coast is another threat.

Monitoring. Photo-identification work is continually conducted and the Center for Whale Research provides a complete annual count of the southern resident population and a record of recent births and deaths. Transients and offshores are also catalogued by this method, but efforts are much reduced.

Chinook salmon management. Chinook salmon are the main food of southern resident killer whales (Ford et al. 2010, Hanson et al. 2010). During 2011-2012, an expert science panel appointed by NOAA Fisheries and Fisheries and Oceans Canada evaluated whether chinook fisheries in Washington and elsewhere along the West Coast are having a negative effect on the southern resident population. The panel's final report (Hilborn et al. 2012) agreed with previous research linking southern resident survival rates to some indices of chinook salmon abundance, thus increases in chinook abundance would result in higher survival and population growth in the southern residents. However, there is considerable uncertainty about the nature of the relationships, meaning that reductions in chinook harvest would not necessarily result in equivalent increases in prey availability for the whales or their population growth.

Vessel impacts and regulations. NOAA Fisheries implemented new whale-watching regulations in 2011 that require most vessels to stay at least 200 yards from the whales and forbid vessels from intercepting the whales or parking in their path (www.bewhalewise.org). The state of Washington adopted a similar law in 2012 (http://wdfw.wa.gov/conservation/orca/). Both regulations are primarily enforced by WDFW through partial funding from NOAA Fisheries. The NOAA Fisheries Office of Law Enforcement also conducts patrols and coordinates with the U.S. Coast Guard to enforce the federal law. During 2012, WDFW conducted about a dozen dedicated patrols to enforce the whale-watching regulations, which was similar to the patrolling effort in 2011. During these patrols, several dozen warnings were given and six citations (including referrals to NOAA enforcement) were issued to boaters. Canada has not adopted a law similar to the U.S. and Washington regulations and continues to promote voluntary guidelines recommending vessels remain at least 100 m from the whales. The cross-border inconsistency in legal protection for the whales adds confusion for vessel operators and complicates enforcement efforts in U.S. waters.

Figure 3. Brochure for the revised *Be Whale Wise* viewing guidelines.

The Soundwatch Boater Education Program and Straitwatch continued to monitor boater compliance with the regulations in 2012, although both programs experienced reduced numbers of days on the water because of funding constraints. Soundwatch recorded an increase in vessel-whale incidents for the year, with the three most common infractions being vessels stopped within 200 yds of the whales (23% of all incidents), vessels parked in the paths (200-400 yds) of the whales (16%), and vessels motoring within 200 yds of the whales (14%) (Eisenhardt 2012). Private boaters committed 66% of all infractions.

Ayres et al. (2012) reported that levels of stress hormones in southern resident killer whales were correlated with changes in the availability of Fraser River chinook salmon, but not with greater vessel numbers. This suggests that reduced prey abundance has a greater physiological impact on the whale population than vessel traffic.

Marine pollution management. Undesirable levels of pollution and toxic chemical contamination remain a significant concern in Washington's inner marine waters (Puget Sound Partnership 2008, Norton et al. 2011). Land surface runoff and atmospheric deposition are the most important pathways into the environment for a variety of chemical pollutants that are potentially harmful to southern resident killer whales. Numerous efforts by governments, businesses, and citizens are underway to alleviate the problem, but expanded long-term programs are required. In combination, these efforts may lead to reduced loads of bioaccumulated contaminants in the whales. However, Alava et al. (2012) reported that the current guidelines for allowable polychlorinated biphenyl (PCB) levels in the marine environment (i.e., sediments and salmon) of British Columbia and Washington still greatly exceed those considered safe for southern resident whales. The Puget Sound Partnership has identified orcas as an indicator of the Puget Sound's health (http://www.psp.wa.gov/vitalsigns/orcas.php).

Oil spill prevention and response. State and federal agencies, industry, tribes, and other stakeholders continue their work to protect Washington's natural resources (including killer whales) from oil spills. In

2010, a rescue tug was permanently deployed at Neah Bay with funding provided by the commercial shipping industry under a new state law. Presence of the tug greatly reduces the threat of oil spills in killer whale habitat near the western end of the Strait of Juan de Fuca. Response planning, participation in oil spill drills, and outreach are ongoing. Among the many activities done in 2012 were the completion of a protocol to haze killer whales away from oil spills (NMFS 2012a) and preparation for an experimental test of the use of oikumi pipes as a hazing device to be conducted in 2013.

Research. A number of research projects involving the southern residents have been recently completed or are underway (NOAA Fisheries Service 2011). These include studies of diet and foraging behavior; health (i.e., physiology, energetics, stress, disease, and contaminant loads); whether chinook salmon abundance is a limiting factor; impacts from vessels; population monitoring and structure; seasonal distribution; and habitat use. A sampling of studies published on southern resident killer whales in 2012 included Alava et al. (2012), Ayres et al. (2012), Foster et al. (2012), and Mongillo et al. (2012).

Key research beginning in 2012 included the placement of satellite tags on two southern residents by NOAA Fisheries staff (http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/2011-2012blog.cfm). J26 was tracked for just three days in February before its transmitter was lost. During this time, the whale traveled from the western Strait of Juan de Fuca to an area 30-80 km west of Cape Flattery. K25 was tagged on December 29 and moved from Vashon Island to the mouth of the Strait of Juan de Fuca during the three days before the end of 2012. Tracking of this individual continued into 2013.

Federal listing status. In 2011, NOAA Fisheries completed a 5-year review concluding that the southern residents should remain listed as endangered (NMFS 2011). However, in August 2012, NOAA Fisheries was petitioned to delist the southern resident distinct population segment (DPS), based on information suggesting it may not be distinct from other killer whale populations (NMFS 2012b). In response, NOAA Fisheries has initiated a new status review, with a final determination to be made by August 2013.

Strandings. A dead killer whale identified as L112, a 3-year-old southern resident female, washed ashore near Long Beach in February 2012. A necropsy revealed that the whale experienced extensive blunt trauma in the head, neck, and right side of the body, but the cause of death has not yet been determined.

Outreach. Numerous outreach efforts are underway. A few of these include the Soundwatch Boater Education Program, which promotes responsible boating and kayaking practices near the southern residents. Work continues on The Whale Trail, which is a series of sites in Washington and southern British Columbia where the public can watch for killer whales and other marine wildlife from shore (Figure 3). Thirty-two sites have been placed thus far in city, county, and state parks; on tribal lands; and on Washington ferries. The environmental education program Killer Whale Tales is operated by a non-profit and provides storytelling, lectures, and hands-on classroom exercises about killer whales for school children. The Seattle Aquarium and The Whale Museum also conduct educational programs and have exhibits on killer whales. NOAA Fisheries' Northwest Regional Office has developed five classroom lesson plans on killer whales for grades 9-12 that are available at http://www.nwr.noaa.gov/education/killer_whale_recovery_unit.html. Another non-profit, Orca Network, continues to post online sightings of killer whales and information about the species.

Partners and cooperators: NOAA Fisheries, Fisheries and Oceans Canada, Center for Whale Research, The Whale Museum, Orca Network, Seattle Aquarium, Puget Sound Partnership, Washington State Department of Ecology, U.S. Coast Guard, University of Washington, Olympic Coast National Maine Sanctuary, Cascadia Research Collective, Straitwatch, Cetus Research and Conservation Society, Pacific Whale Watch Association, Marine Resources Committee of San Juan County, Vancouver Aquarium,

SeaDoc Society, Portland State University, University of British Columbia, Parks Canada, Georgia Strait Alliance, Washington Environmental Council, and Coast Watch Society.

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Gray Wolf

(*Canis lupus*)

State Status: Endangered, 1980
Federal Status: Endangered in the western two-thirds of Washington, 1973; delisted in the eastern third of Washington, 2011
Conservation and Management Plan: State, 2011

Figure 1. A member of the Teanaway Pack, 2012 (*photo by WDFW*).

Wolves are highly social and live in packs containing a breeding male and female, pups from the current year and previous years, and sometimes other individuals. Typical pack size in the northern U.S. Rockies is 5-10 animals (Mitchell et al. 2008). Packs defend territories that typically average about 200-400 mi^2. A single litter averaging 4-6 pups is produced annually and is born in April. Diet is comprised primarily of large ungulates and in Washington includes mainly elk, deer, and moose. Wolves are habitat generalists and can occupy almost any habitat where adequate prey is available and human-caused mortality is limited. Humans are the most frequent cause of death in most areas of North America, with legal harvest, lethal control to reduce livestock depredations, and illegal killing being the main sources (Murray et al. 2010, Smith et al. 2010, USFWS et al. 2013). Lethal control and illegal killing have occurred in Washington since 2007. As top-level predators, wolves influence the abundance and behavior of their prey and other predators, which in turn can affect vegetation patterns, occurrence of other wildlife, and other ecological processes (e.g., Hebblewhite and Smith 2010).

Wolves were formerly common throughout most of Washington, but declined rapidly from being aggressively killed during the expansion of ranching and farming between 1850 and 1900. They were eliminated as a breeding species from the state by the 1930s. Reliable reports of wolves began increasing in Washington by 2002 due in part to the recovery of wolf populations in Idaho, Montana, and Wyoming. The state's first fully documented wolf pack in many years was confirmed in Okanogan County in 2008, and the population has continued to expand since then. In December 2011, the Washington Fish and Wildlife Commission formally adopted the Wolf Conservation and Management Plan for Washington (Wiles et al. 2011) to guide recovery and management of gray wolves as they recolonize Washington.

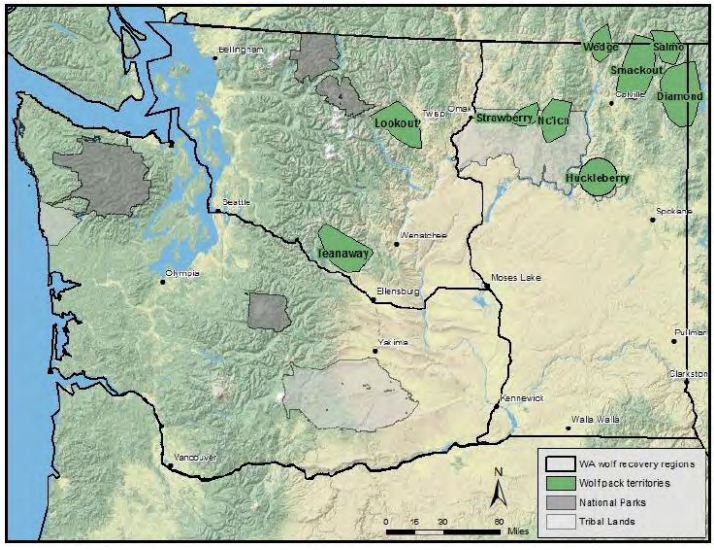

Figure 2. Wolf recovery regions in Washington and the locations of known packs in 2012.

Population monitoring. Wolf monitoring activities occur year-round to determine numbers, distribution, and breeding success of wolf packs in the state. WDFW and partners conducted extensive efforts in 2012 to confirm wolf packs in the state, including on-the-ground investigation of wolf sighting reports, deployment of remote trail cameras to follow up on sighting reports, and surveying roads and trails for tracks and other wolf sign. WDFW and biologists from the Colville Confederated Tribes (CCT) captured nine wolves from six packs in 2012 and eight were radio-collared (Becker et al. 2013).

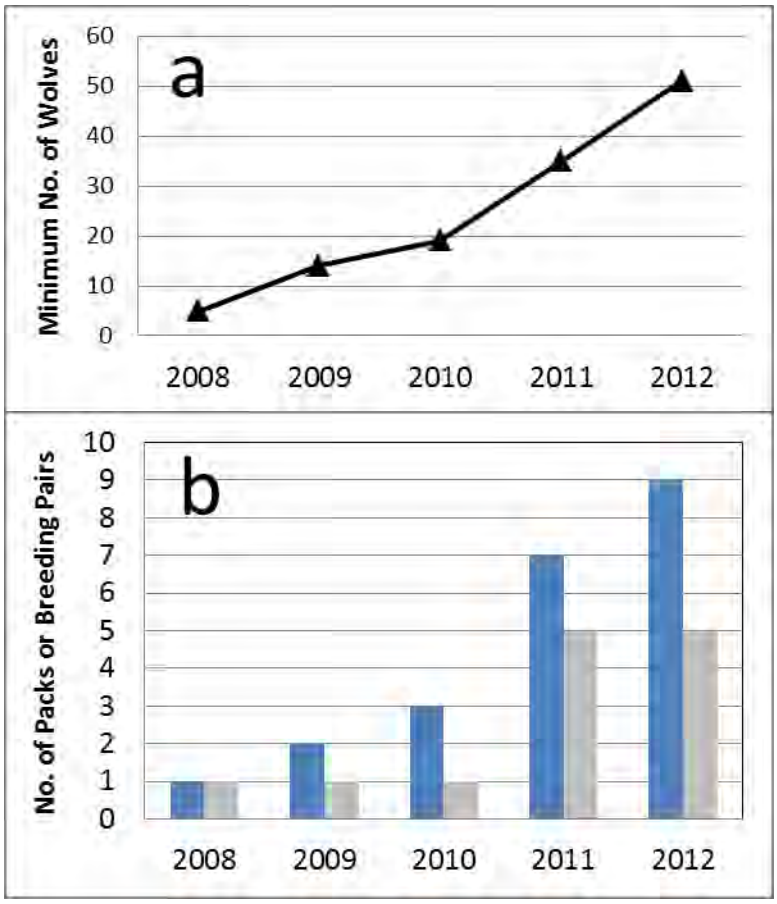

Figure 3. Number of wolves and packs in Washington, 2008-2012: (a) minimum number of wolves, and (b) numbers of documented wolf packs (blue) and successful breeding pairs (gray).

Washington's wolf population increased from a minimum of 35 wolves in seven known packs in 2011 to a minimum of 51 known wolves in nine known packs (including five breeding pairs) in 2012 (Figures 2 and 3, Table 1; Becker et al. 2013). The number of successful breeding pairs remained at 5 in 2011 and 2012. Successful breeding pairs are those with a breeding male and female with at least two pups that survive to 31 December. In 2012, these included the Diamond, Huckleberry, Nc'icn, Smackout, and Teanaway packs. Nine wolves are known to have died in Washington during 2012, with causes of mortality including agency control (n = 7), other human-caused (n = 1), and unknown (n = 1) (Becker et al. 2013). An additional two wolves from Washington packs were legally harvested in Idaho and British Columbia during the year.

Management. In 2012, potential livestock depredations in Washington were investigated by WDFW with some assistance by deputies from local county sheriff's departments (Becker et al. 2013). Personnel from WDFW classified possible depredations as confirmed, probable, confirmed non-wild wolf, unconfirmed depredation, non-depredation, or unconfirmed cause of death based on criteria outlined in Wiles et al. (2011). Confirmed livestock mortalities caused by wolves in the state included seven calves and one sheep (Table 2; Becker et al. 2013). Investigators also confirmed six calves and two sheep injured by wolves, and an additional four injured calves as probable wolf depredations. This was the first year since 2007 that wolves were responsible for any livestock mortalities in Washington. Three of the nine known packs in Washington were involved in at least one confirmed livestock injury or mortality in 2012.

One goal of the Wolf Conservation and Management Plan for Washington is to manage wolf-livestock conflicts in a way that minimizes livestock losses while at the same time ensuring the long-term recovery

of a sustainable wolf population. Techniques that may be used to minimize livestock depredations include both non-lethal and lethal control of depredating wolves. WDFW and livestock producers can implement non-lethal and preventative control measures any time they deem necessary throughout Washington. WDFW has full management authority for wolves in the Eastern Washington recovery area (Figure 2) and, under state law RCW 77.12.240, can implement lethal measures to control depredating wolves when it is deemed necessary to stop chronic livestock depredations. However, in the western two-thirds of Washington, where wolves remain federally endangered, WDFW must consult with the U.S. Fish and Wildlife Service to ensure that any management actions being considered are consistent with federal law prior to implementation.

Table 1. Minimum number of wolves and breeding pair status of each pack in the three wolf recovery regions in Washington.

Recovery region/pack	Minimum no. of wolves	Successful breeding pair
Eastern Washington		
Diamond	10	Yes
Huckleberry	8	Yes
Nc'icn	6	Yes
Salmo	2	No
Smackout	12	Yes
Strawberry	3	No
Wedge	2	No
Northern Cascades		
Lookout	2	No
Teanaway	6	Yes
S Cascades & NW Coast	-	-
Statewide Total	51	5

In 2012, livestock producers and WDFW implemented numerous non-lethal and preventative control measures in an effort to minimize livestock injuries and mortalities caused by wolves (Becker et al. 2013). These measures included the use of fladry and electrified fladry, radio-activated guard (RAG) boxes, hazing wolves from livestock, increased operator presence around range livestock, range riders, daily text messaging of wolf locations to livestock producers and range riders, and removal of injured and/or dead livestock from grazing sites. WDFW lethally removed seven members of the Wedge Pack after the pack became involved in chronic livestock depredation.

Table 2. Confirmed wolf-caused livestock deaths and injuries in Washington in 2012 (Becker et al. 2013).

	Deaths	Injuries
Cattle	7	6
Sheep	1	2
Dogs	0	0
Other livestock	0	0
Total	8	8

Under state law and the provisions of the Wolf Conservation and Management Plan for Washington, WDFW may issue a "caught in the act" permit to livestock producers and their authorized employees to lethally remove wolves in the act of attacking livestock (defined as biting, wounding, or killing) on private land and public grazing allotments they own or lease after a documented depredation. These permits cannot be issued in the western two-thirds of the state where wolves remain federally listed. As provided for in the Wolf Conservation and Management Plan, WDFW issued two caught-in-the-act permits to livestock producers and no wolves were taken with those permits (Becker et al. 2013). WDFW paid $1,595 to compensate livestock producers who had animals killed or injured by wolves during 2012.

The Colville Confederated Tribes established a regulated wolf hunt on its lands for tribal members only beginning in November 2012 (Becker et al. 2013). A harvest quota of three wolves was set for three of seven tribal wolf management zones (total quota = 9 wolves). No hunting was allowed in the remaining four management zones and no trapping of wolves was allowed in any zone. No wolves had been harvested by 31 December 2012. No regulated public harvest occurred in Washington outside of the Colville Indian Reservation in 2012.

Outreach. Extensive outreach with livestock, hunting, conservation groups, and the public was conducted during 2012 and WDFW staff gave numerous talks about wolves and wolf management. WDFW sponsored several depredation training workshops for personnel from various agencies during the year. The Grizzly Bear Outreach Project produced and distributed a brochure titled *Identify Washington's Wolves*, which is intended to help the public distinguish wolves and their sign from coyotes and dogs.

Partners and cooperators: U.S. Fish and Wildlife Service, U.S. Forest Service, Colville Confederated Tribes, Conservation Northwest, National Park Service, U.S. Department of Agriculture Wildlife Services, Washington State University, Seattle City Light, Western Transportation Institute, American Forest Resources, Stimson Lumber Company, Broughton Land Company, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, British Columbia Ministry of Environment, Grizzly Bear Outreach Project (now Western Wildlife Outreach), Wolf Haven International, and Burke Museum.

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Grizzly Bear

(*Ursus arctos horribilis*)

State Status: Endangered, 1980
Federal Status: Threatened, 1975 (Selkirk and North Cascades Distinct Population Segments, 'warranted but precluded' from listing as Endangered)
Recovery Plans: Federal, 1993, 1997

Figure 1. Grizzly bear.

Grizzly bears can be distinguished from black bears by longer, curved claws, humped shoulders, and a face that appears to be concave (Craighead and Mitchell 1982). Their coloring ranges from blond to deep brown or black, with the differences now thought to be due primarily to variation in regional diet and climate. In the lower 48 states, the average weight of grizzly bears is generally 250-350 lb for females and 400-600 pounds for males (Craighead and Mitchell 1982). Grizzly bears are long-lived mammals, potentially living to be about 25 years old (LeFranc et al. 1987).

Although adult grizzly bears are normally solitary, home ranges of adult bears frequently overlap and they are not considered territorial (Schwartz et al. 2003). Grizzly bears enter dens in October or November for 4-6 months of hibernation. In preparation for hibernation, bears increase their food intake dramatically (Craighead and Mitchell 1982). Grizzlies must consume foods rich in protein and carbohydrates to build up fat reserves to survive denning and post-denning periods (Rode and Robbins 2000). Grizzly bears are opportunistic omnivores with high diet variability among individuals, seasons, and years. Grizzlies will consume almost any food available including living or dead mammals or fish, insects, and garbage (Mattson et al. 1991a, 1991b, Schwartz et al. 2003). In areas where animal matter is less available, berries, grasses, roots, bulbs, tubers, seeds, and fungi may be important in meeting protein requirements (LeFranc et al. 1987, Schwartz et al. 2003).

Prior to the arrival of Europeans, grizzly bears occupied much of the western half of the contiguous U.S., central Mexico, western Canada, and most of Alaska. By the 1930s, grizzlies had been eliminated from all but 2% of their historical range in the 48 contiguous states (USFWS 1993). Grizzly bears occurred in most of Washington, historically, except on the Olympic Peninsula and the lowlands below the west slope of the Cascades (Almack et al. 1993). Hudson Bay Company records list a large number of grizzly hides shipped from posts in Washington (e.g. 3,477 from Fort Colville, which was near Kettle Falls 1827–1859), but these trading posts received furs from a wider area that included the southeast corner of British Columbia, northern Idaho, and Montana west of the Continental Divide, as well as northeastern Washington (Hudson's

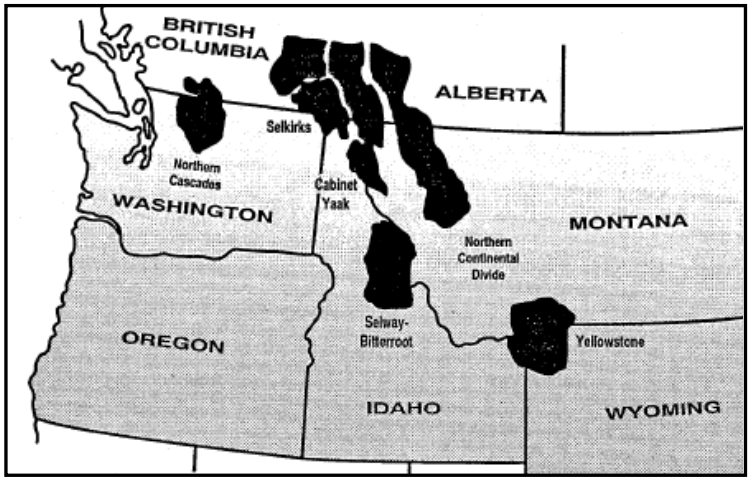

Figure 2. Grizzly bear ecosystems in the coterminous United States (USFWS 1993).

Bay Company Archives, Winnepeg; Mackie 1997:250).

In 2012, photographs of four different grizzly bears were obtained from remote cameras in an area of northern Stevens County known as "the Wedge'; photos included a sow and two cubs. In response, WDFW staff coordinated with relevant staff from other agencies having management jurisdiction, posted bear awareness signs at campgrounds and other suitable locations in the Wedge, and contacted spring black bear hunters. A total of 30 hair samples were obtained from wire hair snags in the area and submitted to USFWS for DNA analysis.

***Selkirk Mountains Ecosystem*.** Proctor et al. (2012) estimated a population size of 88 grizzly bears in the Selkirk Ecosystem (30 in the U.S., 58 in Canada) using DNA-based population surveys and other data. The estimate for the U.S. portion is based on expert opinion; the Idaho Department of Fish and Game is working on a more scientifically rigorous estimate population (USFWS 2011). Wakkinen and Kasworm (2004) estimated this population is slowly increasing at a rate of 1.9% annually (95% CI=0.922-1.098) (Table 1).

Table 1. Estimated grizzly bear population size and population growth rate by recovery zone (modified from USFWS 2011).

Recovery Zone	Population estimate	Trend (% change/yr)
Greater Yellowstone Area	582	+4.7%
Northern Continental Divide	765	+3%
Cabinet-Yaak	42	–3.8%
Selkirk	80	+1.9%
North Cascades	~6[a]	unknown
Bitterroot	0	-

[a] Romain-Bondi et al. (2004)

***North Cascades Ecosystem*.** An assessment by Almack et al. (1993) concluded that adequate habitat exists in the North Cascades of Washington to support a population of grizzly bears. Based on expert opinion and a database of sightings, the population in the North Cascades Ecosystem was estimated to be fewer than 20 animals (USFWS 2011). The population in adjacent B.C. is estimated to be less than 25 grizzly bears (North Cascades GBRT 2004). Romain-Bondi et al. (2004) used DNA hair-snare sampling and catch per unit effort to estimate relative density and population size of grizzly bear population in the North Cascade Ecosystem. During 5,304 trap nights over 3 years (1998-2000), one grizzly bear was detected in the BC portion of the North Cascades, a much lower detection rate than in seven other populations. Using a model, they estimated a grizzly bear density in the North Cascades Ecosystem of 0.15 bears/100 km^2, and a mean population estimate of 6 bears (Romain-Bondi et al. 2004).

During 2010-2012, the North Cascade Ecosystem was surveyed using barbed wire DNA hair corrals and cameras (USFWS 2011). During 2010, 191 hair corrals were placed in North Cascades National Park and

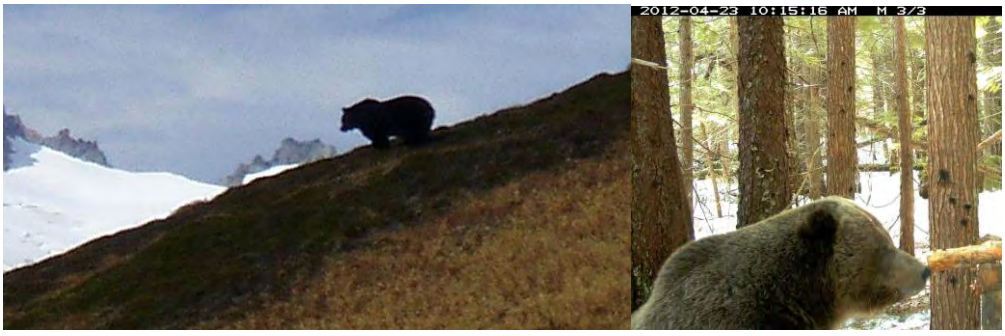

Figure 3. Grizzly bears photographed in the North Cascades of Washington in 2010, left (*photo by Joe Sebille*), and of British Columbia in 2012, right.

adjacent national forests. No grizzlies were detected during surveys, but a hiker photographed a lone grizzly bear in the Upper Cascade River drainage south of North Cascades National Park in October 2010 (Figure 3). This is the first time a grizzly bear has been documented in the American portion of the North Cascades since 1996. During the three years, 2,500 hair samples have been retrieved; 2012 samples are still being analyzed, but no grizzlies have been detected from these samples which covered perhaps 25-30% of the North Cascades. A remote camera set by colleagues photographed a grizzly in the British Columbia portion of the North Cascades in 2012 (Figure 3).

Limiting factors. Proctor et al. (2012) studied the fragmentation of grizzly bear populations in western Canada and the northern United States using genetic and telemetry data. They also related movement rates of male and female grizzlies to highway traffic, settlement, and human caused grizzly bear mortality. They reported that settled mountain valleys and major highways near the Canada-US border area resulted in fragmentation of populations and several small bear populations had male-only immigration. Females grizzlies reduced their movement rates dramatically when settlement increased to >20% of the fracture zone. Small grizzly populations are not viable over the long term without female connectivity (Proctor et al. 2012).

Factors affecting grizzly bear recovery in the Selkirk Mountains Ecosystem include human disturbance, particularly, a lack of food storage orders, human-caused mortality, small population size, and population fragmentation that resulted in genetic isolation (USFWS 2011). Although the Selkirk population may be slowly increasing (Wakkinen and Kasworm 2004), high levels of human-caused mortality and inadequate regulatory mechanisms in B.C. and the U.S. still threaten this population. Wakkinen and Kasworm (2004) reported that 80% of known grizzly mortalities (n=40) in the Selkirk Ecosystem were human-caused.

Factors affecting grizzly bear recovery in the North Cascades recovery zone include very small population size, human disturbance, and population fragmentation resulting in genetic isolation (USFWS 2011). There are no data regarding population size, trend, survival, and reproductive rates for grizzlies in the North Cascades in Washington. The likely isolation of the population in B.C. from other populations limits the chance of natural recovery given the small population size.

Conservation activities. In response to petitions received, the U.S. Fish and Wildlife Service determined that uplisting the North Cascades and Selkirk grizzly bear distinct population segments from threatened to endangered status was warranted but precluded by higher priority actions (USFWS 1998, 1999).

WDFW worked with partners in 2010 and 2011 to conduct hair snare sampling for grizzly bears in the North Cascades and Selkirks. The Grizzly Bear Outreach Project (now Western Wildlife Outreach) has been working in local communities to improve understanding and appreciation of grizzly bears in Washington and Idaho (Morgan et al. 2004). A similar effort has been underway in the North Cascades in B.C. (Davis 2008)

Partners and cooperators: U.S. Fish and Wildlife Service, U.S. Forest Service, National Park Service-North Cascades National Park, Grizzly Bear Outreach Project, Idaho Fish and Game, British Columbia Ministry of Forests, Lands, and Natural Resource Operations, Washington State University, Conservation Northwest.

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Fisher

(*Pekania pennanti*)

State Status: Endangered, 1998
Federal Status: Candidate, 2004
Recovery Plans: State, 2006

The fisher is a large, dark brown member of the weasel family, about the size of a large house cat (Figure 1). Fishers generally eat small mammals (mice, voles, shrews, mountain beavers, and squirrels), snowshoe hares, ungulate carrion, birds, and insects. They also occasionally prey on beavers, muskrat, and porcupines.

Figure 1. Fisher released on the Olympic Peninsula (*photo by Jessica Hoffman*).

The fisher was listed as endangered in Washington in 1998 (Lewis and Stinson 1998), and as a federal candidate species in its west coast range in 2004 (USFWS 2004). Historically, fishers occurred throughout the forested habitats of western Washington, northeastern Washington and the Blue Mountains of southeastern Washington (Lewis et al. 2012). Fishers were extirpated from Washington by the mid-1900s as the result of historical overharvest, incidental capture, predator control campaigns, and loss and fragmentation of mature low and mid-elevation coniferous forests. Despite 70 years of protection, fishers did not recover in Washington. No fishers were detected during extensive carnivore surveys in the 1990s, and the fisher was listed as a state endangered species in Washington. Following the listing, WDFW developed a fisher reintroduction feasibility assessment (Lewis and Hayes 2004), a fisher recovery plan (Hayes and Lewis 2006), and an implementation plan for a fisher reintroduction in Olympic National Park (Lewis 2006). The reestablishment of self-sustaining fisher populations in three recovery areas, (Olympic Peninsula and the North and South Cascades) are essential goals of the fisher recovery plan.

Olympic fisher reintroduction project. To restore fishers to Washington, WDFW, Olympic National Park, Conservation Northwest, British Columbia Ministry of the Environment, and other partners, initiated a reintroduction effort to capture and translocate fishers from central British Columbia to Olympic National Park over three years.

A total of 90 fishers (50 females, 40 males) were released at 21 locations in Olympic National Park from 2008 to 2010 (Figure 2).

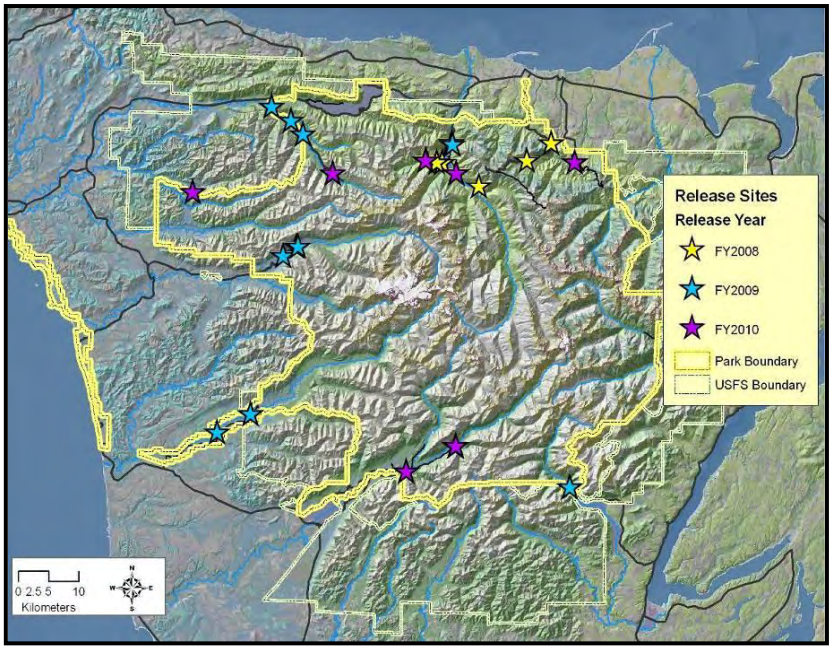

Figure 2. Release locations for fishers (n=90) in Olympic National Park in 2008 (yellow stars), 2009 (blue stars), and 2010 (purple stars).

Figure 3. Automated camera photo of a female moving a kit from its natal den in Olympic National Forest, April 2011.

Each fisher was equipped with a radio-transmitter to allow project biologists to track their movements, assess survival, detect where and when a fisher established a home range, and to determine if females gave birth to kits. Fishers were tracked primarily from the air because of the limited access and rugged nature of Olympic National Park and surrounding area, and the limited power of the radio-transmitters. Ground telemetry and remote cameras were used to confirm that a female was occupying a den and caring for kits (Figure 3). Ground telemetry was also used to recover collars that were transmitting a mortality signal, which indicated that a fisher had died or that its collar had come off.

While monitoring released fishers for four years, biologists located the dens of seven females; litter sizes ranged from 1-4 kits. First year survival varied by release-year cohort; those released in year 1 had the highest survival rates (85-94%) as compared to those released in year 2 (33-65%) and in year 3 (52-78%). Male survival rates were greater than those of females. Of the 35 fishers recovered, 14 (40%) were killed by a predator, seven (20%) were killed by a vehicle strike, 7 (20%) died of unknown causes, 4 (11%) died of an unknown cause but possibly by a predator, 2 (6%) drowned, and 1 (3%) died after it was caught and escaped from a trap. Initial findings from survival analyses indicated that release-year (whether it was released in year 1, 2, or 3), sex, age, and the duration of time spent in captivity prior to release, were factors that influenced the survival of released fishers.

Fishers moved extensively after being released but most fishers established a home range by the end of

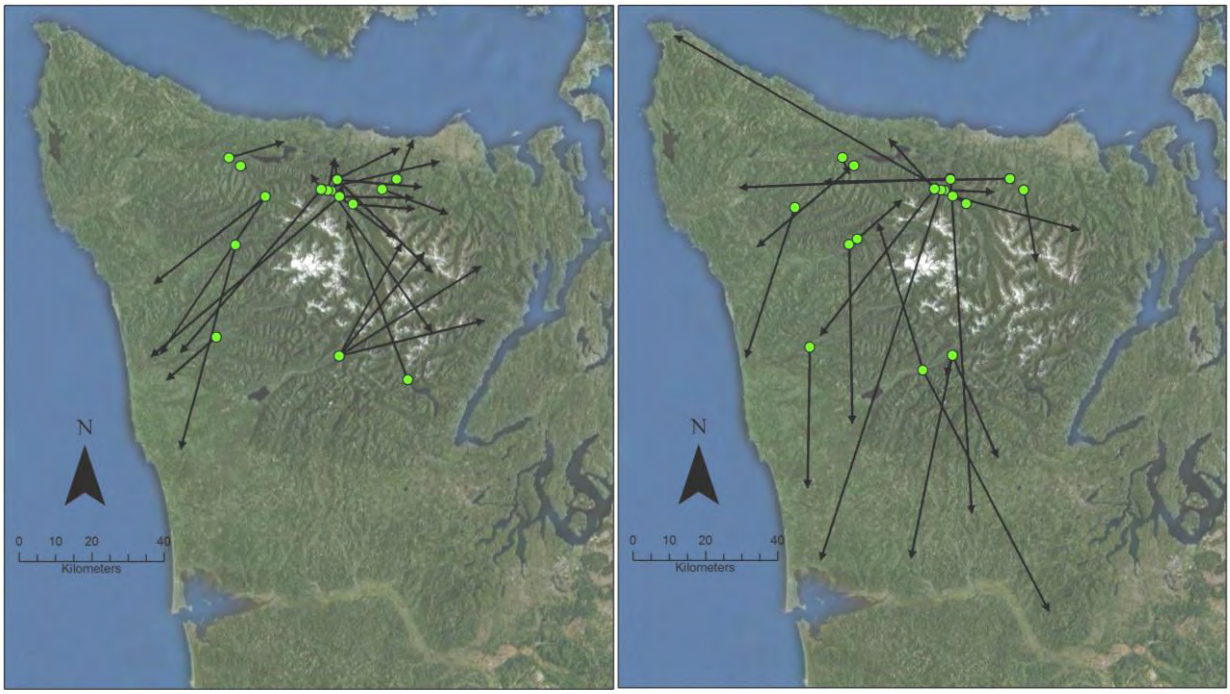

Figure 4. Arrows illustrating straight-line distances from release sites to the center of home ranges of 27 females (left) and 21 males (right) on the Olympic Peninsula, 2008-2011.

their first summer (Figure 4; Lewis et al. 2012). Males moved greater distances from a release site to a home range than females, and females initiated home ranges over a longer period of time compared to males. Fishers established home ranges in a variety of managed (e.g., Washington DNR lands, private timber company lands, tribal lands, Olympic National Forest) and unmanaged landscapes (Olympic National Park, wilderness areas in Olympic National Forest) (Figure 5). Initial findings of home range analyses indicate that fishers released on the Olympic Peninsula used home ranges that were the largest (females; mean: 63.5 $\pm$ 39.2[SE] km^2) or among the largest (males; mean: 128.3 $\pm$ 66.9[SE] km^2) reported for the species (Lewis et al 2012).

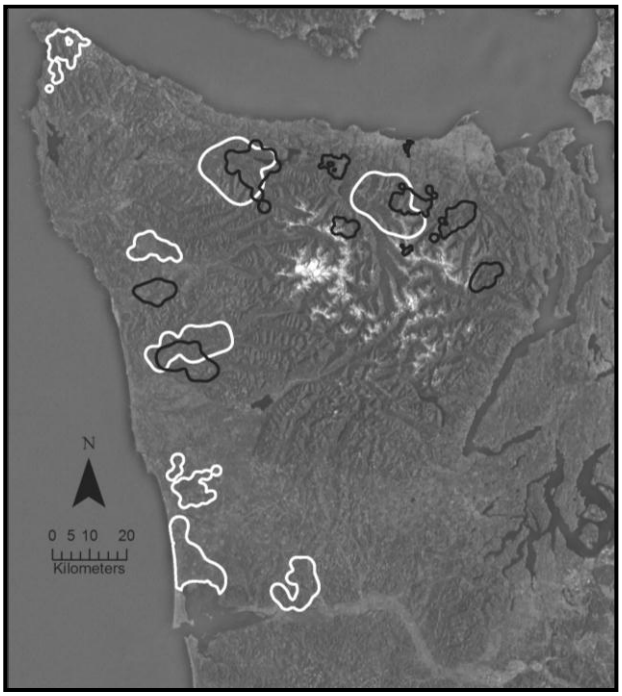

Figure 5. Home ranges (95% fixed-kernel contours) of 8 male (white) and 10 female (black) fishers on the Olympic Peninsula from 2008–2012 (not all home ranges are shown).

Monitoring has been successful in tracking the reintroduced population. A photograph of a fisher at remote camera station in the Duckabush River watershed (Figure 6; March 2013), recoveries of 2 individuals killed by cars on State Highway 101 near Port Angeles (April and May 2013), and numerous other unconfirmed sightings indicate that fishers are persisting within the Olympic Recovery Area. The success of the reintroduction project at reestablishing a self-sustaining population will be determined by long-term monitoring to assess fisher occupancy and population growth throughout the Olympic Recovery Area. Continued monitoring through 2015 by Olympic National park and partners, will use hair-snare and camera stations placed throughout the Olympic Peninsula to detect fishers. Detection data collected at these stations will be used to determine the location, size, persistence and genetic characteristics of fisher populations that now occur on the Olympic Peninsula, and will indicate if the reintroduction was successful.

Figure 6. Automated camera photo of fisher in the Duckabush River watershed, March 2013.

Cascades fisher reintroduction project. Recovery criteria require that fisher populations be established in the Cascade Recovery Area, as well as the Olympic Recovery Area for the fisher to be down-listed from endangered to threatened or sensitive (Hayes and Lewis 2006). WDFW, National Park Service (NPS), and the US Forest Service are now planning for a reintroduction effort in

the Cascade Recovery Area. Information from the Olympic fisher reintroduction is being used to shape the reintroduction process for the Cascades to increase the likelihood of success. WDFW will be working with the NPS in 2013-2014 to conduct a NEPA analysis for the proposed fisher reintroduction in the Cascades and WDFW is developing an implementation plan for the reintroduction. WDFW biologists are also coordinating with the British Columbia Ministry of Environmental to continue our cooperative efforts to translocate fishers from central B.C. to the Washington Cascades as well as seeking funding and support to initiate a Cascades reintroduction project in fall 2014.

Partners and cooperators: Olympic, North Cascades, and Mt. Rainier National Parks and the National Park Service; U.S. Geological Survey; U.S. Fish and Wildlife Service; Conservation Northwest; U.S. Forest Service; British Columbia Ministry of Environment; British Columbia Trappers Association; Doris Duke Foundation; Makah Tribe, Lower-Elwha Klallam Tribe; Quinault Tribe; Washington Department of Natural Resources; Washington's National Park Fund; Seattle City Light; University of Washington; Wildlife Conservation Society.

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Sea Otter

(*Enhydra lutris*)

State Status: Endangered, 1981
Federal Status: Species of concern
Recovery Plans: State, 2004

Figure 1. Sea otter (*photo by USFWS*).

Sea otters are among the largest members of the weasel family, but are the smallest marine mammals in the North Pacific. The species is known for its luxuriantly thick pelage, which is the densest of all mammals. Sea otters inhabit nearshore waters up to 20 fathoms deep and seldom venture more than 1-2 km from land. They typically inhabit rocky habitats with kelp beds, but also occur at lower densities in soft-sediment areas without kelp. Kelp is generally considered an important part of habitat and is used for foraging and resting.

Sea otters capture prey from the sea bottom, then carry it to the surface for handling and feeding. A variety of prey is eaten, especially in areas inhabited for long periods. In recently occupied areas, sea otters tend to exhaust one type of food (e.g., sea urchins, various crustaceans, or mollusks) before switching to another (Estes et al. 1982, Riedman and Estes 1990, Laidre and Jameson 2006). In Washington, prey include urchins, clams, mussels, crabs, snails, and chitons (Bowlby et al. 1988, Laidre and Jameson 2006). Predation on urchins gives sea otters a fundamental role in maintaining the structure of nearshore marine ecosystems in many areas (Estes and Duggins 1995, Kvitek et al. 1998). Removal of urchins promotes the growth of kelp and kelp-associated communities.

The species once lived along most of the North Pacific coasts from California to Japan, but was extirpated from most of its range by the early 1900s by the fur trade (Kenyon 1969). In Washington, sea otters historically occurred in estuarine and sandy habitats from the Columbia River to Pt. Grenville, along the rocky outer Olympic Peninsula coast, and into the Strait of Juan de Fuca, but with few reaching the San Juan Islands and Discovery Bay, and none present in Puget Sound (Scheffer 1940, Kenyon 1969). The species was extirpated from the state by about 1910 (Scheffer 1940, Kenyon 1969).

Sea otters were reintroduced to Washington in 1969 and 1970, when 59 animals were translocated from Amchitka Island, Alaska (Lance et al. 2004). The population has grown by 7.6% per year since 1991 to 1,105 animals in 2012 (Jameson and Jeffries 2013). However, overall population growth has slowed since 2008 and the northern population segment may be reaching carrying capacity. At present, otters occur primarily in rocky habitats along the Olympic Peninsula coast from Destruction Island northward to Tatoosh Island. Colonization of the western Strait of Juan de Fuca has not yet occurred despite the presence of groups of animals using the area during fall and winter months until 2000 (Laidre et al. 2009). A state recovery plan for the otter was written in 2004 (Lance et al. 2004).

Sea otters in Washington face a number of potential threats (Lance et al. 2004). These include oil spills, contaminants, disease, marine biotoxins, entanglement in fishing nets, loss of kelp habitat, and reduced genetic diversity.

Figure 2. Sea otters at Destruction Island, Washington (*photo by Joe Evenson, WDFW*).

Monitoring. Washington's sea otter population is surveyed annually in July through a combination of aerial and ground counts along the entire outer coast and eastward into the Strait of Juan de Fuca to Tongue Point. The 2012 survey was made on 9-13 July and produced a total count of 1,105 sea otters (Figure 3; Jameson and Jeffries 2013). A high of 29 pups was counted, with a pup to independent otter ratio of 2.7:100. The single largest concentration (562) of sea otters was at Destruction Island. The southernmost otters were observed near Cape Elizabeth and Willoughby Rock and the northernmost otters were seen at Tatoosh Island. No otters were sighted in the Strait of Juan de Fuca. The distribution pattern of Washington's sea otter population has gradually changed in recent years with an increasing and larger proportion of the population now occurring south of La Push. In 2012, 73% of the population was south of La Push and 27% was north.

Annual surveys do not extend east of Tongue Point, although credible sightings of scattered individual sea otters have come from the San Juan Islands and Puget Sound in recent years.

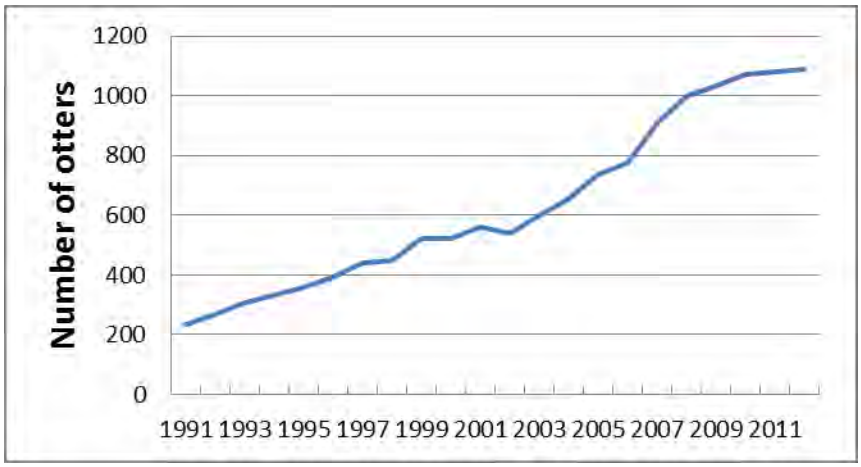

Figure 3. Growth of the sea otter population in Washington, showing the 3-year running average of counts, 1989-2012.

No groups of multiple animals have been noted in these areas, thus the small number of sea otters in this region does not add significantly to the state's total population. In 2012, one individual was reported in south Puget Sound.

Strandings. A total of 32 sea otter strandings occurred in Washington in 2012, with 19 of these reported from south of LaPush and 13 north of LaPush. Necropsies were performed on 15 of the 18 recovered otters by the U.S. Fish and Wildlife Service's National Wildlife Health Center in Madison, Wisconsin, and by WDFW's Lakewood office.

Oil spill prevention and response. State and federal agencies, industry, tribes, and other stakeholders continue efforts to protect Washington's natural resources (including sea otters) from oil spills. Response planning and participation in oil spill drills are ongoing. In 2010, a rescue tug was permanently deployed at Neah Bay with funding provided by the commercial shipping industry as required by a recent state law. Presence of the tug greatly reduces the threat of oil spills throughout the sea otter's current range in Washington. An oil spill response handbook specific to seas otters provides guidance on the preferred methods for locating, recovering, and rehabilitating sea otters injured by contact with oil during an oil spill (WDFW 2009).

Partners and cooperators: U.S. Fish and Wildlife Service, Olympic Coast National Marine Sanctuary, Makah Tribal Fisheries, Quinault Indian Nation, The Seattle Aquarium, Point Defiance Zoo and Aquarium.

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Columbian White-tailed Deer

(*Odocoileus virginianus leucurus*)

State Status: Endangered, 1980
Federal Status: Endangered (1967; Columbia River Distinct Population Segment-2003)
Recovery Plans: Federal, 1983

Figure 1. Columbian white-tailed deer (*photo by Joseph V. Higbee*).

White-tailed deer are generally distinguished from mule or black-tailed deer by their longer tail that is brown rather than black on the dorsal surface, and in adult males, antlers with prongs arising from a single main beam. The Columbian white-tail is a large subspecies with antlers narrowly spreading and curving steeply upward (Figure 1). In a study in western Oregon, Columbian white-tailed and black-tailed deer had similar diets but maintained spatial separation during most seasons and tended to avoid each other (Whitney et al. 2011). The Columbia River population evolved as a riparian species, occupying the floodplain while black-tailed deer inhabited the forested foothills above the floodplain (Gavin 1984). Habitat changes over time affected the riparian habitat, and urban and agricultural areas now limit population expansion. Columbian white-tailed deer were once found in a contiguous area in southwestern Washington and western Oregon (Figure 2), but now exist in two distinct, geographically isolated populations: in Douglas County, Oregon, and along the lower Columbia River (USFWS 1983). The Douglas County population in Oregon recently achieved recovery objectives and was delisted from the federal Endangered Species Act in 2003 (USFWS 2003). The Columbia River population is found on islands in the Columbia and adjacent areas of Clark, Cowlitz, Pacific, Skamania, and Wahkiakum Counties, Washington, and Clatsop, Columbia, and Multnomah Counties, Oregon (Figure 3).

Figure 2. Historical range of the Columbian white-tailed deer (USFWS 1983).

Population status. Recovery objectives for the Columbia River population are to have a minimum of 400 deer, with at least three subpopulations of 50 or more individuals in secure habitat (USFWS 1983). Secure habitat is that which is free from adverse human activities. Currently, two subpopulations of ≥50 individuals qualify as secure, the Julia Butler Hansen National Wildlife Refuge (JBH) mainland unit and Tenasillahe Island. Two additional subpopulations of at least 50 individuals exist (USFWS and WDFW 2011) at Westport, Oregon, and Puget Island, Washington, but these occur predominately on private ownership that is not considered secure habitat.

The JBH mainland subpopulation has experienced a significant decrease in size since a peak of an estimated 500 deer in 1986 and 1987. The drop was initially welcomed, as the population probably exceeded the refuge's carrying capacity. Numbers subsequently fell below the desired goal of 125 deer, to a low of 59 in 2007. Current total numbers of the Columbia River population are estimated at roughly 582 deer (Table 1). Overall, the population still needs to attain a third subpopulation of ≥50 to reach recovery plan goals. However, compounding factors, including high predation on fawns, vehicle

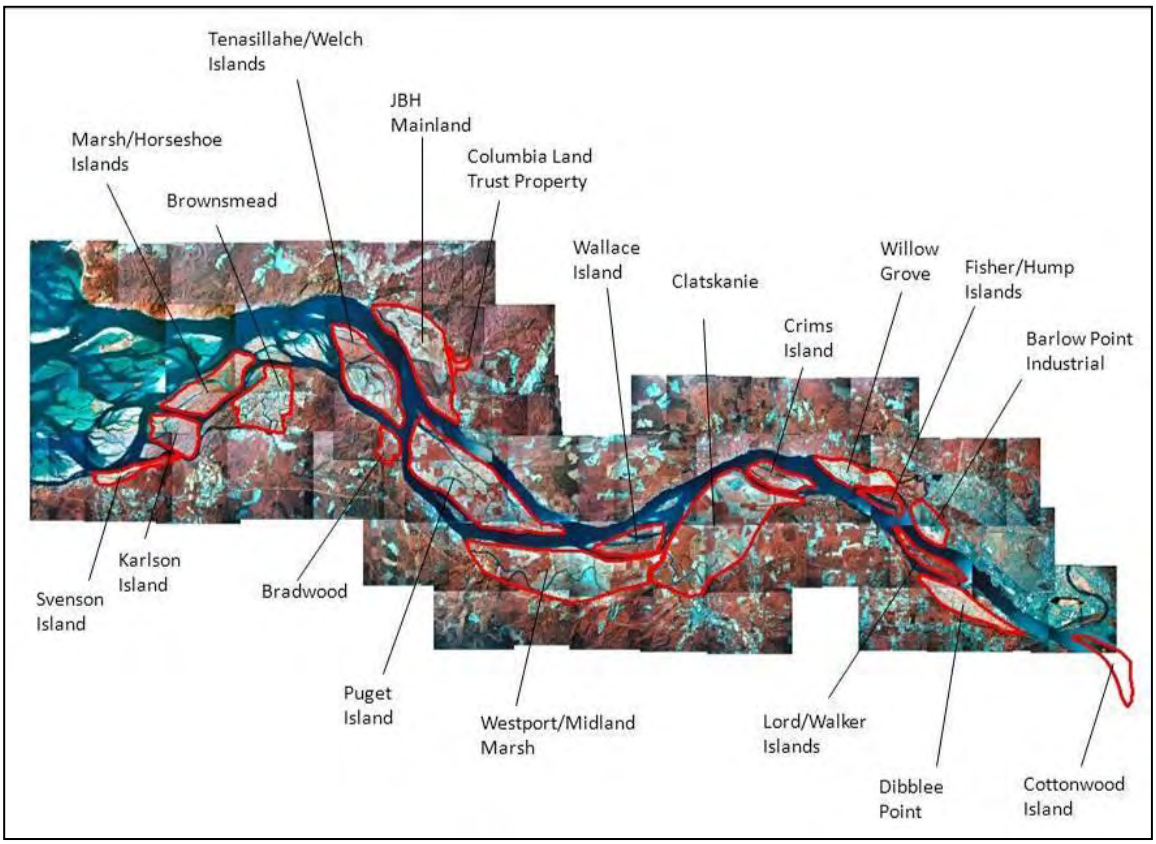

Figure 3. Current range of the Columbian white-tailed deer along the lower Columbia River (USFWS and WDFW 2011).

collisions, disease, flooding events, and hybridization with black-tailed deer, affect the population and have continued to limit recovery (Clark et al 2010, USFWS and WDFW 2011).

Translocations. Recovery actions have involved securing habitat through acquisitions, translocations to augment existing populations and establish new populations, and habitat enhancement on the JBH. The USFWS identified a series of islands near Longview, Washington, for a third secure subpopulation. These islands include Fisher (225 ac), Hump (100 ac), Lord (500 ac), and Walker (109 ac). A total of 66 deer have been translocated there to date. Since translocation, these islands have supported 10–14 animals, with the most current estimate at 10. Sixty-one deer were translocated to Crims Island between 1999-2006 (Table 2). This site has supported between 8 and 33 deer since 2000, with the 2011 estimate at 18 animals. The upper estuary islands (Lord/Walker, Fisher/Hump, and Crims) have so far failed to

Table 1. Most recent estimates of Columbia River subpopulations of Columbian white-tailed deer.

Site	Population estimate	Year of estimate
Julia Butler Hansen NWR mainland[a]	72±32	2012
Tenasillahe Island	91±48	2012
Wallace Island/	22	2011
Crims Island	18	2011
Lord/Walker and Fisher/Hump islands	10	2011
Puget Island	171	2011
Westport	132	2010
Willow Grove	18	2011
Clatskanie Flats	21	2010
Dibblee and Longview Industrial	24	2011
Cottonwood Island	3	2011
Total	~582	

[a]Includes Hunting and Price islands.

maintain the target population of 50 deer. In 2010, the Cowlitz Indian Tribe moved 15 deer to Cottonwood Island, an area also listed in the Recovery Plan as a potential relocation site (USFWS 1983, Cowlitz Tribe of Indians 2010).

In 2006, translocation efforts began to augment the declining JBH mainland subpopulation. Deer were relocated from Puget Island in 2006, Westport, Oregon, in 2009, and Tenasillahe Island and Roseburg, Oregon, in 2010. Consistent coyote predation and significant flooding events in 1996, 2006, and 2009 have been partially implicated in the decline of the JBH mainland subpopulation, which currently supports about 83 deer. Of these translocation efforts, Tenasillahe, Crims, and the JBH mainland have shown the most success (Table 2). The USFWS is also actively restoring refuge habitat to establish cover and provide forage for deer.

Table 2. Summary of land acquisitions and translocation activity for secured Columbian white-tailed deer habitat.

Site Name	Acres	Year Secured	Translocations	
			Year	No. of deer
Julia Butler Hanson NWR mainland[a]	2,823	1972	2006	5
			2009	20
			2010	8
Tenasillahe Island	1,919	1972	1986	19
			1987	19
			1988	21
Crims Island	730	1999	1999	27
			2000	29
			2006	5
Lord/Walker Island	609		2003	16
			2004	8
			2006	9
Fisher/Hump Island	325		2003	12
			2004	11
			2006	10
Cottonwood Island	650		2010	15
Wallace Island/Westport	725	1995	NA	
Willow Grove	304	2008	NA	
Nelson Creek	423	2008-2011	NA	
Total	**8,508**			**234**

[a]Includes Hunting and Price islands.

In March 2011, it was learned that the Steamboat Slough Road dike that prevents tidal flooding on the JBH refuge mainland unit was eroding and in danger of failing. Regular flooding would be expected to substantially reduce the Columbian white-tailed deer numbers present. In 2012, USFWS proposed to translocate up to 50 Columbian white-tailed deer from JBH mainland to Ridgefield NWR (Figure 4, *after Lit. Cited*), and 15 Columbian white-tailed deer from Puget Island to Cottonwood Island during Jan-April 2013 (USFWS 2012).

Partners and cooperators: USFWS-Julia Butler Hansen National Wildlife Refuge, Cowlitz Tribe of Indians, Oregon Department of Fish and Wildlife, Oregon State University.

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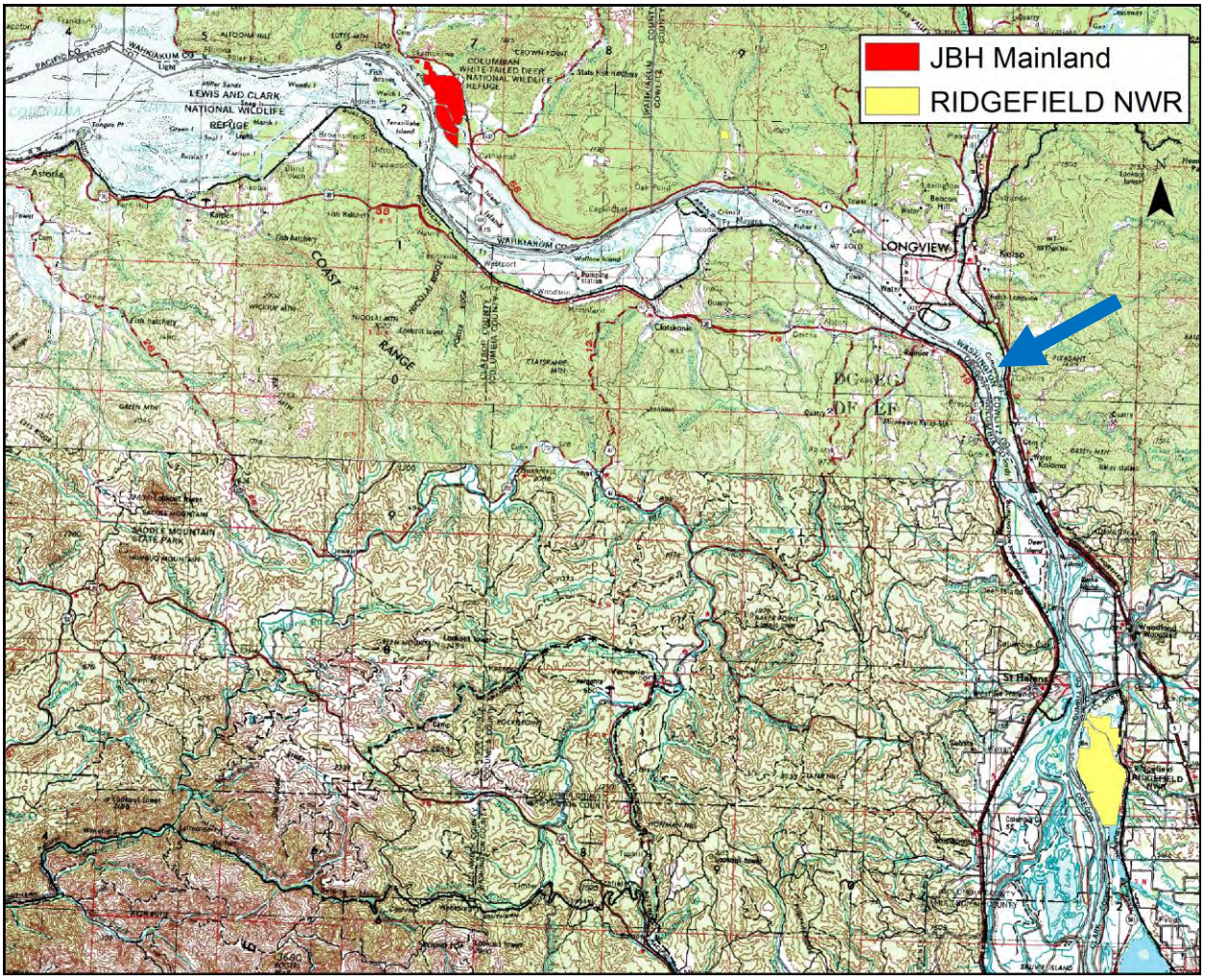
Figure 4. Location of Julia Butler Hanson NWR Mainland Unit, Cottonwood Island (arrow), and Ridgefield NWR.



Woodland Caribou

(*Rangifer tarandus caribou*)

State Status: Endangered, 1982
Federal Status: Endangered, 1984
Recovery Plans: Federal, 1994

Figure 1. Woodland caribou.

Woodland caribou in southeastern British Columbia, northeastern Washington, and northern Idaho are a unique ecotype of caribou distinguished from other woodland caribou by their winter diet consisting almost exclusively of arboreal lichens. This trait allows them to inhabit the deep snow areas in the Selkirk Mountains above 4,000 ft, and these caribou are often referred to as "mountain caribou".

Selkirk Mountain woodland caribou are medium-sized members of the deer family with males weighing up to 600 pounds and females 300 pounds. Caribou are distinguished from other members of the deer family by their large concave hooves, which allow them to walk snowshoe-style across deep snow. They also have distinctive antlers, which both sexes drop annually. Males possess larger antlers with one or two brow tines called "shovels" that extend over the face.

The mountain caribou population has been divided into 18 subpopulations (Wittmer et al. 2005), with the South Selkirk animals comprising the southern-most subpopulation and the only one that extends into the United States. Unlike the barren ground caribou that form large aggregations, woodland caribou form relatively small groups. Herd size ranges from single females during calving up to ~25 animals during late winter; small groups of 2-5 animals are typical during spring and summer.

Population status. Historically, woodland caribou ranged throughout much of Canada, and the northeastern, north-central, and northwestern U.S. The southern limit of woodland caribou range has contracted considerably since the 1800s due to overhunting, cutting of old growth forests, and a northward range expansion of the white-tailed deer. White tailed deer are hosts to a parasitic meningeal worm, *Elaphostrongylus tenuis*, that is fatal to woodland caribou. Mountain caribou historically ranged as far south as the Salmon River in Idaho (Figure 2). In the 1950s, the Selkirk population was estimated

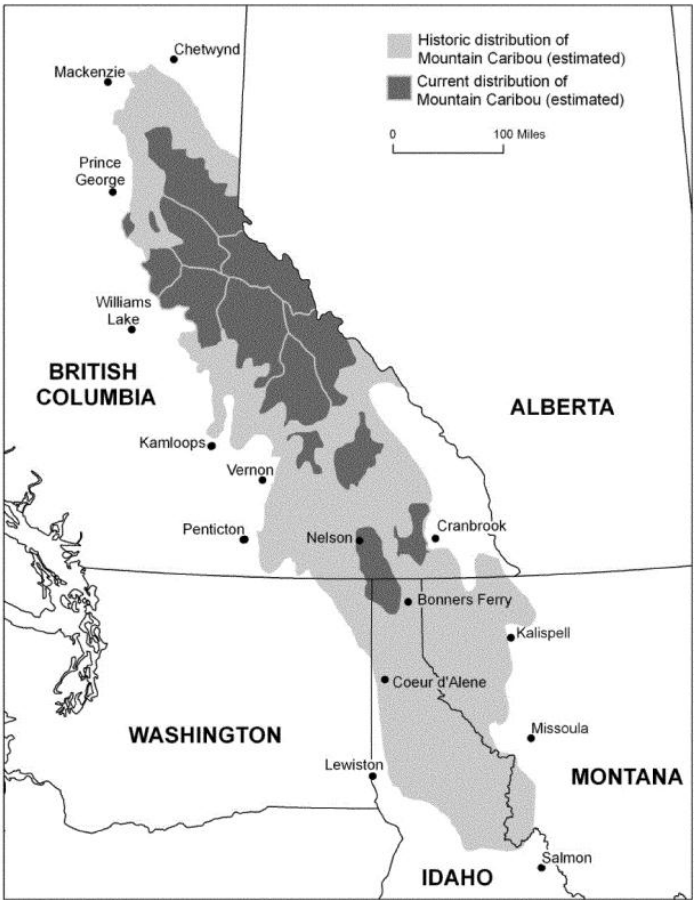


Figure 2. Historical and current range of mountain caribou (USFWS 2011).

at 100 animals. The last confirmed report of a caribou in Montana occurred in 1958. Since the 1960s, they have been restricted to the Selkirk Mountains of northeastern Washington, northern Idaho, and southeastern British Columbia. By the early 1980s this population had declined to 25-30 individuals.

Wakkinen et al. (1996) developed a census technique for the mountain caribou that has been used in recent years. This involves a 2-stage sampling effort: a "pre-census" fixed wing flight to determine caribou distribution and a "census" flight using a helicopter to count and classify individuals. The South Selkirks contained a minimum of 27 caribou in 2012, with 4 of these observed in the U.S., down from 36 in 2011 and 43 in 2010. Recruitment in the South Selkirks continued to be low (7%), with only 3 calves observed (Table 1; Degroot and Wakkinen 2012).

Habitat and limiting factors. Mountain caribou habitat is defined as old-growth forests of Engelmann spruce/subalpine fir and western redcedar/western hemlock, generally more than 100–150 years old. These forests support abundant arboreal lichens on which mountain caribou forage for up to 6 months of the year (Rominger 1995). The fall and early winter diet consists largely of dried grasses, sedges, huckleberry leaves, willow and dwarf birch tips, and arboreal lichens (Rominger and Oldemeyer 1989, Rominger et al. 1996).

Mountain caribou populations have been adversely affected by predation and habitat change as a result of timber harvest, fire, human settlement, roads and reservoirs. Mountain caribou avoid predators by spreading out over large areas of their high elevations habitat (USFWS 1994). In winter, predators follow deer, elk and moose to lower elevations, leaving the subalpine forests to caribou. In summer, when other ungulates and predators are more common in the high country, mountain caribou are relatively rare and spread out, which makes them infrequent prey of bears, wolves, and cougars (Wittmer 2004, 2007).

Table 1. Winter census, South Selkirk woodland caribou, 2002-2010 (DeGroot and Wakkinen 2012).

Year	Total (U.S.)
2002	34 (2)
2003	41[a] (1)
2004	33 (3)
2005	35[b] (2)
2006	34-38 (1)
2007	43-44 (2)
2008[c]	46 (3)
2009[c]	46 (3)
2010[c]	43 (2)
2011[c]	36 (0)
2012[c]	27 (4)

[a] Likely some double counting and therefore not a reliable count.
[b] Not a complete census, must be considered a minimum count.
[c] Combination fixed wing/helicopter survey.

A shift in the predator-prey dynamics within the range of mountain caribou has been hypothesized as a major factor in the decline of mountain caribou (Rettie and Messier 1998, Wittmer et al. 2005). Timber harvest and fire result in the creation of young forest and edge habitat suitable for deer, elk, and moose. The higher densities of other ungulates in turn support higher predator densities leading to increased predation on adult female caribou (Wittmer et al. 2007). Wittmer et al. (2005) found predation to be the primary cause of mortality in 11 of 13 subpopulations and predation predominantly occurred during summer. Potential management actions to address high predation include managing for lower numbers of predators or their alternate prey, or managing habitat for the same result (Mountain Caribou Science Team 2005).

In a literature review, Mitchell and Hamilton (2007) reported that some research suggests that snowmobiles can displace caribou from winter habitat and have contributed to the caribou decline in British Columbia, while other literature suggests that the effects are unknown or pose little threat to the population (Wilson and Hamilton 2003, Seip et al. 2007). Compared to predation and the direct and indirect effects of habitat change, current levels of disturbance are considered a less significant (although additive) threat to the viability of mountain caribou (Mountain Caribou Science Team 2005).

Conservation activities. The USFWS Selkirk Mountain Woodland Caribou Recovery Plan was developed in 1985 and updated in 1994, and a BC Recovery Strategy was written in 2002 (USFWS1994, Mountain Caribou Technical Advisory Committee 2002). As part of the recovery plan, caribou were translocated from British Columbia to Washington to establish caribou in the western portion of the Selkirk Ecosystem (Almack 1998). Between 1996 and 1998, 43 animals were translocated; 32 in Washington and 11 just north of the border in B.C. Unfortunately, the augmentation effort coincided with a high mountain lion population in the Selkirk ecosystem, and mortality from predation and other causes was high (>50%; USFWS 2011).

A previous herd augmentation effort led by Idaho Fish and Game involved transplanting caribou from healthy populations in British Columbia to Idaho. A total of 60 caribou were transplanted: 24 in 1987; 24 in 1988; and 12 in 1990. Although neither the 1987-1990, nor the 1996-1998 1998 augmentations resulted in a long-term improvement in caribou distribution, the effort succeeded in maintaining and enhancing the number of caribou in the population as a whole.

In May 2011, some caribou habitat areas near Revelstoke, BC were closed to snowmobiles. In November 2011, the USFWS proposed designating critical habitat for the Selkirk woodland caribou in Boundary and Bonner counties in Idaho, and Pend Oreille County in Washington; the final rule was published in November 2012 (USFWS 2012). The rule designates 30,010 ac of national forest lands at or above 5,000 ft elevation as critical habitat.

Figure 3. Woodland caribou observed during aerial surveys in the southern Selkirk Mountains (from DeGroot and Wakkinen 2012).

In May 2012, a petition was filed by the Pacific Legal Foundation, representing Bonner County, Idaho, and the Idaho State Snowmobile Association, requesting that the southern Selkirk population be removed from federal listing on the grounds that it is not a listable entity. In response, the USFWS published a 90-day finding indicating that they would conduct a 12 month status review (USFWS 2012b).

Climate change. Climate change will likely alter the distribution and abundance of suitable caribou habitat, and will also change snow depths and persistence, which affect the seasonal movements of mountain caribou. The potential effects of climate change depend on the interaction, not only of seasonal temperatures and snowfall patterns, but also occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Although there is considerable uncertainty about the future effects of climate change, warmer and drier conditions generally favor deer, elk and moose, exacerbating changes in habitat and predation of caribou.

Partners and cooperators: U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, U.S.

Forest Service Colville National Forest, British Columbia Ministry of Environment, Fish and Wildlife Compensation Program-Columbia Basin, University of British Columbia, Washington State University.

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American White Pelican

(*Pelecanus erythrorhynchos*)

State Status: Endangered, 1981
Federal Status: None
Recovery Plans: None

Figure 1. American white pelican (*photo by Joe Higbee)*.

American white pelicans breed primarily on isolated islands in freshwater lakes and rivers, and forage in shallow areas of inland marshes, lakes, and rivers (Figure 1). White pelicans are known for their cooperative foraging in coordinated swimming groups that encircle fish (Evans and Knopf 1993). Unlike brown pelicans, they do not dive. White pelicans were persecuted in the past because they were seen as competitors for fish, even though studies clearly showed that they seldom preyed on the same fish sought by people. Nevertheless, people shot pelicans, clubbed young, and broke eggs. American white pelicans feed largely on nongame or "rough" fish, amphibians, and crustaceans (Evans and Knopf 1993); many of these are small schooling fish, but larger bottom fish, salamanders, and crayfish are also eaten. Foraging for small fish occurs in shallow (less than 8 ft) marshes, rivers, and lake margins in summer, and shallow coastal marine waters in winter. Foraging areas can be 30 miles or more from breeding colonies.

The pelicans nesting at the colony in Washington are not consuming large numbers of juvenile salmonids, based on the relatively small numbers of smolt PIT tags detected on the colony (Roby and Collis 2012). Non-breeding white pelicans on the Columbia and Snake rivers are sometimes observed foraging below hydroelectric dams and may be foraging on out-migrating juvenile salmonids, but their impact on salmonid smolts is not well understood.

Rangewide population trend. The total population of breeding adult white pelicans was estimated to be about 30,000 in 1933, but surveys in Canada were believed incomplete (Keith 2005). The number of known breeding colonies increased from 43 in the 1960s, to 55 in 1980, while breeding adults tallied appeared to increase from 63,000 to 109,000 (Keith 2005). The increase was likely partly an artifact of more complete surveys. King and Anderson (2005) reported that the North American population of white pelicans doubled between about 1980 and 2000. They estimated that breeding birds totaled about 134,000 for 1998-2001. More recent Breeding Bird Survey data for the United States, the most reliable dataset, indicated an annual increase of about 6.6% between 1966-2009 (Figure 2; Sauer et al 2011).

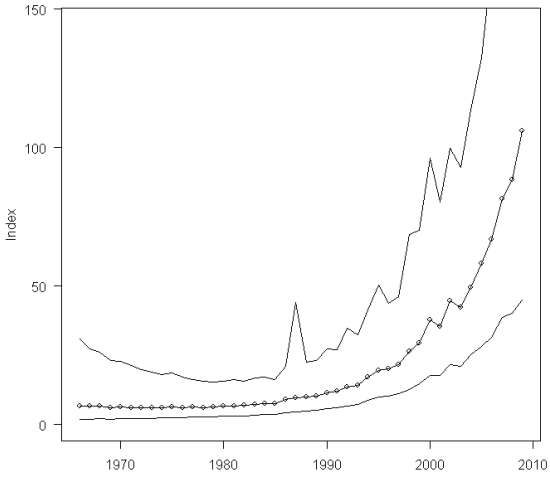

Figure 2. Breeding Bird Survey trend index for white pelicans in the United States, 1966-2009 (Sauer et al. 2009).

The western population of pelicans, which includes all pelicans known to breed west of the continental divide and the pelicans within the colonies at Yellowstone National Park, Wyoming and Canyon Ferry Lake and Arod Lake, Montana, includes 19 breeding colonies in 8 States and British Columbia (Pacific Flyway Council 2012). Based on the most recent data, the western population of white pelicans is estimated at 45,996 breeding adults.

Washington population status. Historically, American white pelicans occurred and likely bred in eastern Washington on inland waters such as Sprague and Moses Lakes (Dawson and Bowles 1909 Jewett et al. 1953). The first published record of nesting is from 1926 at Moses Lake, Grant County, a colony that was occupied for several years. From 1926 through 1994 there were no published records of American white pelicans breeding in Washington and it is not clear when or if they continued to nest (Ackerman 1994). In 1994, a breeding colony was established on Crescent Island, which was constructed for nesting birds in the Columbia River, Walla Walla County in 1985 (Ackerman 1994, 1997). In 1997, pelicans began nesting on nearby Badger Island, which is a part of McNary National Wildlife Refuge. Since that time, the colony has grown to over 1,000 breeding pairs and there is little use of Crescent Island. A mean of 2,083 adult white pelicans were counted in the aerial photos in May 2012, down from 2,228 in 2011 (Figure 3; Roby and Collis 2012).

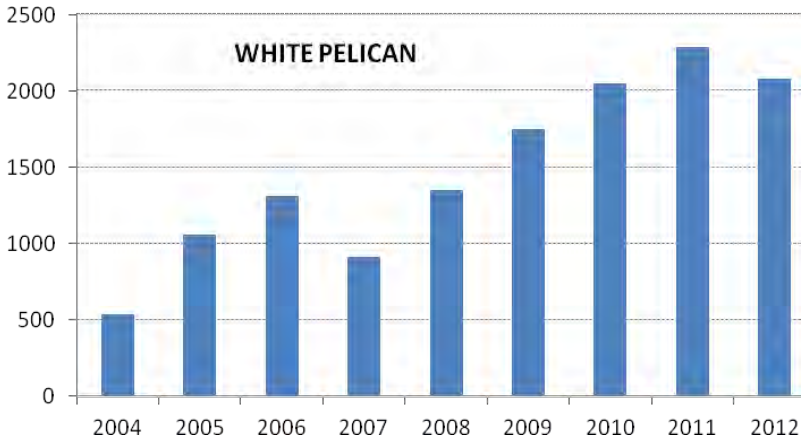

Figure 3. Numbers of American white pelicans counted in aerial photographs of Badger Island, during the 2004-2012 breeding seasons (D. Lyons, Oregon State University).

The first nesting record of white pelicans in the Columbia River estuary occurred at Miller Sands Spit, Oregon, in 2010. In July 2011, an on-colony survey on Miller Sands, Oregon, indicated a colony size of about 97 breeding pairs (Roby and Collis 2011). In July 2012, an aerial survey counted 427 adults and 79 chicks, and 71 were later banded with alpha-numeric legbands (http://www.birdresearchnw.org). In September, the nesting area on Miller Sands was covered with dredged material by the Army Corp of Engineers, so it is uncertain where they will nest in 2014. White pelicans also nested in significant numbers at Malheur Lake, Oregon, in 2012 for the first time in many years.

Inland waters of eastern Washington also support significant numbers of non-breeding white pelicans year-round, especially along the Columbia River from The Dalles to Chief Joseph Pool. Numbers of these pelicans vary greatly during the summer, with peaks of up to 2,000 birds observed in the Potholes region of the Columbia Basin during late summer. Wintering concentrations, ranging from 40-300 birds, occur along the Columbia River from the mouth of the Walla Walla River to Priest Rapids. Parts of eastern Washington may be important in sustaining non-breeding summer residents and birds that have dispersed from breeding grounds in adjacent states and provinces. Aerial surveys conducted in May 2006 detected up to 513 pelicans along the Columbia and Snake rivers.

Conservation. Although the U.S. population of white pelicans has recovered substantially, populations remain somewhat vulnerable to habitat degradation, contaminants, disturbance, and shooting. Many

wetlands in the arid West are affected by insecticides, fertilizers, and other agricultural pollutants. White pelicans have died of poisoning from endrin, dieldrin, and toxaphene, but not from DDT or its breakdown products (Keith 2005). Large die-offs of pelicans in recent decades have been linked to toxaphene poisoning, an insecticide carried into marshes in waste irrigation water. Residues of DDE, a breakdown product of the DDT, remain in sediments. It is not known if white pelicans suffered negative effects on reproduction as did the brown pelicans which suffered from eggshell thinning.

About 8,000 white pelicans died of botulism at Salton Sea, California in 1996 (Keith 2005). Water diversion and draining of wetlands for agriculture, along with recreational boating, have destroyed or degraded many traditional feeding, breeding, and loafing areas. Water level fluctuations can flood nesting colonies or expose a land bridge to nesting islands allowing access by predators such as coyotes and red foxes. White pelicans are highly sensitive to human disturbance in nesting colonies, particularly during courtship and early incubation, which cause desertions (Evans and Knopf 1993).

The Pacific Flyway Council (2012) developed a framework for managing American white pelicans in the Pacific Flyway. Guidance was needed for agencies and locations dealing with pelican predation on fish of conservation concern, such as Yellowstone cutthroat trout in southern Idaho, Lahontan cutthroat in Nevada, and Eagle Lake Rainbows and federally listed suckers in California.

Partners and cooperators: Bird Research Northwest (Oregon State University, USGS, and Real Time Research, Inc), Yakama Nation, USFWS-McNary NWR.

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Brown Pelican

(*Pelecanus occidentalis*)

State Status: Endangered, 1980
Federal Status: Species of concern
Recovery Plans: None

Brown pelicans seen in Washington belong to the California subspecies, *Pelecanus occidentalis californicus*. They nest on islands in the Gulf of California and along the coast of Baja California to the Channel Islands National Park in southern California. In California, they feed primarily on Pacific mackerel, Pacific sardines, and northern anchovies (USFWS 2009).

Figure. 1. Brown pelican *(photo taken in Florida by D. Stinson)*

Brown pelicans are sensitive to bioaccumulation of the pesticide DDT which causes reproductive failure by altering calcium metabolism and thinning eggshells. California brown pelicans declined drastically in the 20th century as a result of DDT contamination, particularly off the coast of Los Angeles where a manufacturing plant discharged DDT residues into the sewage system for many years (Shields 2002). Pollution and perhaps persecution by fishermen adversely affected pelicans. By the 1960s, even single birds in Washington were noteworthy (Wahl 2005). The brown pelican was listed as endangered by the USFWS under the Endangered Species Act in 1970.

The brown pelican recovered after the banning of most uses of DDT and the cleanup of DDT and derivatives from sediments off the California coast. The species began to reoccupy the Washington part of its non-breeding range in the early 1980s (Wahl and Tweit 2000). Since 1985, the California subspecies has exceeded a recovery objective of at least 3,000 breeding pairs during all but 2 years (1990, 1992), and has exceeded 6,000 pairs for 10 of the last 15 years. The brown pelican was removed from the federal Endangered Species List in 2009 (USFWS 2009).

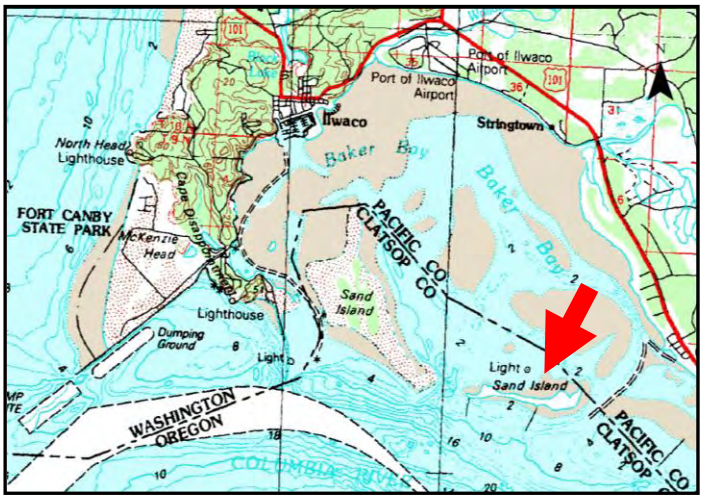

Figure 2. Location of East Sand Island.

Brown pelicans now occur in substantial numbers (7,000–10,000) in Washington's outer coastal waters, mainly from late April through October (Wahl 2005). Small numbers occur in the Strait of Juan de Fuca and Puget Sound. East Sand Island in the Columbia River estuary is the largest known post-breeding nighttime roost site for California brown pelicans (Figure 2). In 2012, weekly counts of brown pelicans roosting on East Sand Island peaked at 10,570 on 22 July; counts peaked at about 14,224 in 2011, 11,500 in 2010, and over 16,000 in 2009, the highest count ever recorded for the island (birdresearchnw.org). Brown pelicans feed primarily on schooling marine forage fishes which are abundant near East Sand Island (Emmett et al. 2006). The absence of salmon PIT tags in a sample plot suggests that brown pelicans roosting on East Sand Island are not feeding on salmon smolts (Roby and

Collis 2012).

The species may be proposed for de-listing in Washington in 2013. Brown pelicans are protected from 'take' by federal law (Migratory Bird Treaty Act), and would remain protected by state law (as 'protected wildlife') if delisted.

Partners and cooperators: U. S. Fish and Wildlife Service.

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Sandhill Crane

(*Grus canadensis*)

State Status: Endangered, 1981
Federal Status: None
Recovery Plans: State, 2002

Figure 1. Sandhill crane (*photo by Joseph V. Higbee*).

Three subspecies of sandhill crane occur in Washington: a small number of greater sandhills (*G. c. tabida*) breed in Klickitat and Yakima Counties; about 23,000 lesser sandhills (*G. c. canadensis*) stop in eastern Washington during migration; and 3,000-4,000 Canadian sandhills ([*G. c. rowani*] and possibly some lessers and greaters) stop on lower Columbia River bottomlands (Engler et al. 2003), the only major stopover site between northern breeding areas and wintering sites in California. In recent years, up to 1,000 sandhills have wintered on lower Columbia bottomlands, primarily at Ridgefield National Wildlife Refuge (NWR), Washington, Sauvie Island Wildlife Area, Oregon, and surrounding areas (Littlefield and Ivey 2002). Most of the cranes seen in Washington winter in California.

The greater sandhill cranes that breed in Washington are part of the Central Valley Population, so called because they winter in California's Central Valley. Other members of this population nest in Oregon, California, Nevada, and interior British Columbia. The lesser sandhill cranes are of the Pacific Flyway Population that stop in Washington during migration between their breeding grounds in Alaska and wintering areas in California.

Historically, sandhill cranes bred in the south-central, northeastern and southeastern regions of Washington, and the southern Puget Sound basin. Crane numbers were severely reduced due to widespread habitat destruction and unregulated hunting which continued until passage of the federal Migratory Bird Treaty Act in 1916. The species was extirpated as a breeder from the state after 1941 when the last nest was documented at Signal Peak, Yakima County, in south-central Washington (Littlefield and Ivey 2002, Jewett et al. 1953). After an absence of 31 years, they were found summering in the Glenwood Valley on Conboy Lake National Wildlife Refuge, Klickitat County in 1972, but it was not until 1979 that nesting was confirmed. The Conboy Lake NWR provides nesting habitat for most (~80%) of the cranes breeding in Washington.

In 2012, a total of 27 breeding pairs were monitored representing the entire known Washington State breeding population of sandhill cranes (Table 1). A total of 10 juveniles (colts) were banded, of which 8 survived to fledge. An additional 2 colts that were not banded also fledged later in the season bringing the total juvenile (colt) production in 2012 to 10 birds. The total summer population of greater sandhills in Washington was around 80 birds (not including young of the year).

Figure 2. Sandhill crane nesting habitat in Klickitat County, Washington.

Since 1996, crane colts at Conboy Lake NWR have been captured at approximately 8 weeks of age, one

Table 1. Greater sandhill crane breeding pairs and production in Washington, 1995-2012 (Stocking et al. 2008, USFWS-Conboy NWR, and WDFW data).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Population estimate[a]	22	26	34	39	40	47	50	50	49	53	60	60	62	62	-	82	80	-
Breeding pairs	8	10	15	14	16	15	16	13	18	19	18	19	23	23	23	30	30[b]	27[b]
Pairs, nest unconf[b]	3	3	-	3	2	4	4	7	3	1[d]	7	5	2	-	-	-	-	-
Subadult (non-breeders) on-refuge[e]	0	0	4	5	4	9	10	10	7	15	10	12	12	14	[f]	[f]	[f]	-
Young produced[g]	1	3	5	5	5	6	0	2	6	5	5	7	6	5	[f]	[f]	[f]	10[b]
Recruitment	4.5	11.5	16.7	14.7	13.9	16.2	0.0	5.0	14.3	13.2	10.0	14.6	12.0	12.0	[f]	[f]	[f]	-

[a]Data includes confirmed pairs, unconfirmed pairs, and sub-adults but does not include young fledged that year.
[b] Does not include data from Yakama Nation which have had 3-5 pairs since 2005.
[c]Territorial pairs without confirmed nesting data
[d]Unable to confirm 2 traditional pairs at Deer Creek and Panakanic Valley based on limited surveys.
[e]"on-refuge" refers to cranes nesting within the Glenwood Valley
[f] Data not yet available
[g] this number reflects young known or suspected of joining the fall migration
[h]Recruitment = no. fledged young / no. of breeding adults + fledged young X 100 (excludes subadults).

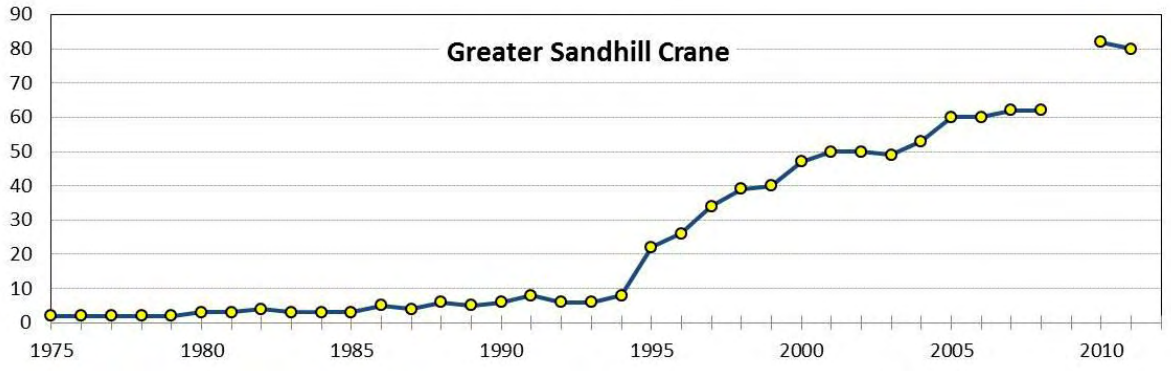

Figure 3. Population estimate of greater sandhill cranes in Washington, 1975-2012.

week before fledging, and have been color-banded with unique two-color combinations that allow identification of individual cranes. Cranes also have nested at 1 or 2 sites on the Yakama Indian Reservation, and have been observed in several other eastern Washington locations during the breeding season in recent years (e.g., central Cascades, Mount Spokane, Okanogan).

A stable population of cranes typically has a recruitment rate of 7-9%, while a growing population has a recruitment rate of ≥10% (Littlefield and Ivey 2002). Using those figures, the Washington population has been growing slowly since monitoring began (Stocking et al. 2008). Nesting surveys are conducted in cooperation with the USFWS staff at Conboy National Wildlife Refuge. A combination of ground and aerial surveys were conducted from April through August of each year (2010-2012) to monitor nesting pairs and juvenile (colt) production.

Use of Washington habitats during migration. The subspecies composition of sandhill cranes which stage and winter along the Lower Columbia River in northwest Oregon and southwest Washington is uncertain, but may include all 3 forms using the Pacific Flyway: lesser, Canadian, and greater. During 2001-02, Ivey et al. (2005) attached satellite transmitters to 6 cranes to ascertain locations of their breeding areas, migration corridors and wintering sites. They reported that these cranes appear to be the intermediate Canadian form (*rowani*), and the staging counts of cranes along the Lower Columbia River may represent the entire population. They breed along the coast of British Columbia and southeast Alaska and some winter in Washington, while others stop during migration en-route to wintering areas in California. Genetic analyses of samples taken indicate that these *rowani* are distinct from the lesser and greater subspecies in the Pacific Flyway (Hayes et al. *in prep*). Ivey et al. (2005) recommended that they be managed as a unique population due to their limited numbers, distinct coastal migration route, and habitat issues at breeding, staging, and wintering areas.

As the Washington sandhill crane breeding population expands, cranes may re-occupy long vacant sites. Sandhill cranes were observed at a new location on the Gifford Pinchot National Forest in 2012 (Figure 4), and additional surveys will take place in 2013 to document any nesting attempts.

Conservation. A state recovery plan was completed in 2002 (Littlefield and Ivey 2002), with the goals of restoring a healthy breeding population of cranes and to maintain the flocks that winter or stop in Washington. Recovery objectives include a breeding population of ≥65 pairs, with at least 15 of these at sites outside the Glenwood Valley. The greater sandhill crane breeding population in Washington has continued to grow slowly. Several factors can affect Washington's sandhill cranes, particularly on private lands including water availability and management, and incompatible grazing and haying practices. For the migrant cranes, habitat on the lower Columbia bottomlands between Vancouver and Woodland is threatened with industrial development, conversion of agricultural lands to incompatible uses, and crane use is affected by disturbance by hunters and other recreationists. Wind energy project development may affect migrant lesser sandhills in eastern Washington by occasional collision mortalities, and the potential for habitat loss.

Figure 4. Meadow in Gifford Pinchot National Forest where cranes were observed in 2012.

Partners and cooperators: U.S. Fish and Wildlife Service, Conboy Lake NWR, Ridgefield NWR, Yakama Nation, U.S. Forest

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Upland Sandpiper

(*Bartramia longicauda*)

Figure 1. Upland sandpiper

State Status: Endangered, 1981 (possibly extirpated)
Federal Status: None
Recovery Plans: State, 1995

The upland sandpiper may be extirpated as a breeding species in Washington. It is a medium-sized sandpiper that nests on grassland in North America, and winters on the pampas of South America. There are scattered historical breeding records for eastern Washington, it may have never been abundant, and apparently was rare throughout the 20th century in Washington. Habitat loss to development, grazing, and invasive knapweeds all may have contributed to the species' extirpation from the state. A few birds nested in the Spokane Valley during the 1950s-1990s (McAllister 1995), with the last nesting record in 1993. The last sighting of an upland sandpiper in Spokane County was 2004. It is also apparently gone from Idaho (Mlodinow 2005).

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Snowy Plover

(*Charadrius nivosus*)

State Status: Endangered, 1995
Federal Status: Threatened, 1993
Recovery Plans: Federal, 2007; State, 1995

Figure 1. Western snowy plover (*photo by Gregg Thompson*).

The Pacific coast population of the snowy plover breeds from Midway Beach, Washington, south to Bahia Magdalena, Baja California, Mexico. The snowy plover winters mainly in coastal areas from southern Washington to Central America (Page et al. 1995).

The Pacific coast population of the snowy plover breeds primarily above the high tide line on coastal beaches. Less common nesting habitats include bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars. In winter, snowy plovers are found on many of the beaches used for nesting as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats. Habitat degradation caused by human disturbance, building development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations have resulted in a decline in active nesting areas and in the size of the breeding and wintering populations (USFWS 2007). Human activity on beaches, such as walking, jogging, walking pets, operating off-road vehicles, and horseback riding, during the plover breeding season can inadvertently cause destruction of eggs and chicks.

A range-wide breeding season survey in 2012 tallied 1,855 adult western snowy plovers along the U.S. Pacific Coast. Prior to 1970, the coastal population was thought to have nested at more than 50 locations along the coast. Today, only 28 major nesting areas remain.

Historically, five areas supported nesting plovers in Washington (Figure 2; Richardson 1995), but that number has slowly declined to just 2 or 3 areas since 2009 (Table 1). Causes of reduced nest success and local population declines in Washington include predators eating plover eggs, disturbance by recreational activities, and habitat degradation from shoreline modification and dune stabilization (i.e., spread of non-native and invasive beachgrasses; Richardson 1995).

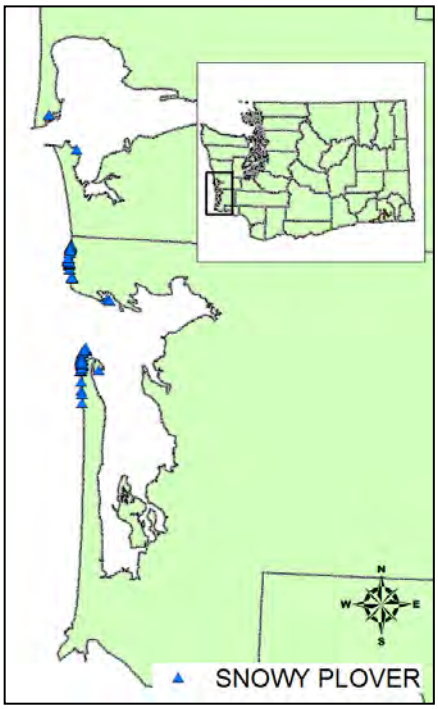

Figure 2. Snowy plover nesting areas in Washington, 2000-2012.

Population monitoring. WDFW, U.S. Fish and Wildlife Service, and Oregon Department of Fish and Wildlife coordinate their monitoring efforts to provide the information needed to assess recovery progress and to assess the effectiveness of conservation actions. This coordinated effort was initiated in 2006 although state-specific monitoring was initiated years before.

Table 1. Mean counts (95% CI) of breeding adults at four nesting sites in Washington, 2006-2011 (Pearson et al. 2013).

Site	2006	2007	2008	2009	2010	2011	2012
Damon Point	1 (0-2)	0	0	0	0	0	-
Graveyard	2 (-1-5)	2(-1-4)	1(0-2)	0	0	0	2 (0-3)
Midway Beach	21(14-28)	18(14-21)	14(10-19)	15(13-17)	14(11-18)	19(8-30)	14 (5-23)
Leadbetter Pt.	35(26-45)	25(20-30)	32(23-40)	17(10-24)	21(17-26)	12(6-19)	18 (6-29)
Total	59(48-70)	44(36-53)	47(33-60)	31(23-39)	36(33-38)	31(15-47)	33 (15-52)

During 2012, 31 surveys were conducted on 8 sites to assess occupancy or count the number of nesting adults. Snowy plovers were found nesting only on Leadbetter Point, Midway Beach, and Graveyard Spit. The adult breeding population estimate for Washington in 2012 was 33 birds (Table 1).

Population modeling indicates that productivity of at least 1 chick fledged per breeding male per year is needed for a stable population and productivity of 1.2 or more chicks fledged per breeding male should increase population size at a moderate pace (Nur et al. 1999). In 2012, the average number of young fledged per adult male in Washington was 0.68 (range 0.46–0.94). The only year during 2006–2012 when productivity was adequate to maintain the Washington population was 2011 when 1.7 (95% CI = 0.9–2.7) young fledged per adult male (Pearson et al. 2013).

Since 2006, the mean population has declined about 4 birds per year, although the population has been stable for the last 4 years (Figure 3). The population decline in Washington would likely be greater without immigration. Many birds banded in Oregon and northern California, are observed at Leadbetter and Midway Beach indicating that birds are moving into Washington. Oregon's plover population is larger and increasing and has had higher fledging success (≥ 1.0; Lauten et al. 2012), which apparently result in immigration of Oregon birds into Washington.

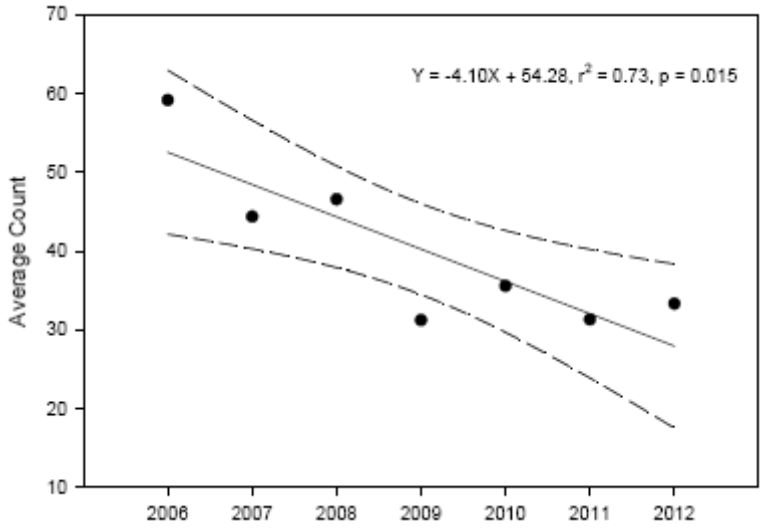

Figure 3. Trend (95% CI) of average yearly count of adult plovers for all Washington sites, 2006 – 2012 (Pearson et al. 2013).

During the 2012 nesting season, the probability of nest survivorship was 26% at Midway Beach and 17% at Leadbetter (Pearson et al. 2013). Of 47 nests found, 15 hatched (32%); predation caused 60% of nest failures. Thirteen nests were protected by exclosures, and 10 of these hatched, while only 5 of 34 unexclosed nests hatched. Although exclosures appeared to increase nest success, there is some evidence that exclosures may increase adult predation as noted in 2008 (Lauten et al. 2004, Pearson et al. 2009a, 2009b). The percent of nests surviving from egg laying through hatching was 21% (including exclosed and unexclosed). Common ravens (*Corvus corax*), the only identified nests predator, were responsible for 9 nest failures in 2012.

Recent conservation actions. In 2012, WDFW biologists put nest exclosures around 3 nests on Midway Beach, and 10 nests on Refuge and State Park lands at Leadbetter Point. Willapa National Wildlife Refuge continued to collect data on nest predators that occurred in and adjacent to plover nesting areas at Leadbetter Point.

A number of the management actions that occurred in 2012 involved minimizing some human activities near active Snowy Plover nesting sites during the nesting season. Human disturbance during the nesting season is well known to cause reduced hatching success and chick survival in snowy plovers (Warriner et al. 1986, Ruhlen et. al. 2003). Disturbances to wintering Snowy Plovers are 16 times higher at a public beach than at a protected beach. Human disturbance negatively affects hatching rates and chick survival for various plover species (Flemming et al. 1988, Buick and Paton 1989, Dowling and Weston 1999).

In 2012, nesting areas above the wet sand were again closed to all human use on Grayland and South Beach State Parks and on National Wildlife Refuge and State Park lands at Leadbetter Point. These closures involved about 7.5 miles of nesting habitat at Leadbetter Point and 1 mile of habitat at Midway/Grayland Beach. The lower beach adjacent to the ocean in both areas remained open to the public. The Midway Beach Road access, which cuts through the center of the highest use area for plover nesting on this beach, has been closed each nesting season since 2009 and has resulted in much less disturbance of plovers in this area. At Leadbetter Point, temporary symbolic fencing was installed along access trails at Long Beach by U.S. Fish and Wildlife Service staff to direct people toward the wet sand and away from plover nesting habitat. Area closures are facilitated through the placement of signs notifying the public to stay out and through increased patrolling. Symbolic fencing was used on State Park land at Midway/Grayland Beach at 5 specific high-intrusion locations along the posted sign line. Rope was used more as a reinforcement alert to the public not to enter the closed area. This method was very successful in reducing the number of human intrusions into the posted nesting area. There are two dog restriction signs at trail junctions and trailheads on the Leadbetter Point Refuge lands and there is a "Share the Beach" sign posted at Grayland Beach State Park and on the Refuge trails at Leadbetter Point.

As in previous years, WDFW, Washington State Parks, and U.S. Fish and Wildlife Service again coordinated enforcement activities during razor clam dig days in 2012 to reduce the amount of human activity in active nesting areas at Leadbetter Point and Midway/Grayland Beach. In addition, USFWS provided funding for two portable toilets that were placed on the Refuge beaches during razor clam days. These toilets were successful in reducing the number of human intrusions into the posted nesting area. The refuge received favorable public response to this action. Also, fireworks were prohibited on beaches where State Parks and U.S. Fish and Wildlife Service (USFWS) are the upland land owners.

Also in 2012, Willapa National Wildlife Refuge produced and distributed a revised outreach brochure informing the public about Snowy Plover conservation and habitat restoration actions at Leadbetter Point.

Habitat restoration. In 2012, the U.S. Fish and Wildlife Service added 15 ac to the habitat restoration area (HRA) at Leadbetter Point, which now totals over 250 acres. Oyster shell was added to approximately 62 acres. The non-native beachgrass control included aerial and hand spraying 110 acres in the south central portion of the HRA. The north end of the shelled area in the HRA was harrowed to redistribute shells and bulldozed to remove beachgrass. No habitat restoration work was conducted on State Parks lands at Leadbetter Point or Midway Beach in 2012.

Critical habitat. In 2012, the U.S. Fish and Wildlife Service designated approximately 24,527 acres of coastal habitat in Washington, Oregon and California as critical habitat for the Pacific Coast population of the western snowy plover (USFWS 2012). The designation revises the Service's 2005 critical habitat designation for the species. Designated critical habitat includes coastal beach-dune ecosystem habitat along the Pacific Coast essential to the survival and recovery of the plover. A total of 60 units were

designated, with 4 of those units in Washington totaling 6,077 acres. These included Copalis Spit (WA1), Damon Point (WA2), Midway Beach and Shoalwater/Graveyard Spit (WA3), and Leadbetter Point and Gunpowder Sands (WA4).

Critical habitat identifies geographic areas containing features essential for the conservation of a threatened or endangered species, and which may require special management considerations or protection. Designation of critical habitat does not affect land ownership and has no impact on private landowners taking actions on their land that do not require federal funding or permits. It is used to notify federal agencies of areas that must be given special consideration when they are planning, implementing, or funding activities that may affect designated critical habitat.

Partners and cooperators: U.S. Fish and Wildlife Service (Willapa National Wildlife Refuge and the Washington State office), Oregon Department of Fish and Wildlife, Oregon Biodiversity Information Center, Washington State Parks, Shoalwater Tribe.

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Northern Spotted Owl

(*Strix occidentalis caurina*)

State Status: Endangered, 1988
Federal Status: Threatened, 1990
Recovery Plans: Federal 2008, 2011

Figure 1. Northern spotted owl in the Olympic Mountains (*photo by Rod Gilbert*).

The northern spotted owl is one of three spotted owl subspecies found in North America. A species with dark eyes and no ear tufts (Figure 1), the spotted owl is about 18 inches from head to tip of tail and has a wingspan of about 41 inches. Females are slightly larger than males (Gutiérrez et al. 1995). Most of its feathers are a moderate shade of brown, with light-colored "spots" on the head, back, wings, and belly. Horizontal brown bands across buff-colored feathers on the belly help to distinguish this species from the closely-related barred owl (*S. varia*) which has vertical bars on the belly.

The spotted owl is distributed from extreme southwestern British Columbia south to central coastal California. In Washington, it is found throughout much of the Olympic Peninsula, on both slopes of the Cascade Range and, rarely, in remnant patches of mature or structurally complex forest in the Puget Trough and southwestern Washington (Figure 2). It is found at elevations from near sea level on the Olympic Peninsula to about 1,555 m (5,100 feet) in the Cascade Range. All parts of its range are characterized by the presence of coniferous forest.

Spotted owls are strongly associated with structurally complex forest. Such forests are generally old growth, but the owls also use mature and some younger-aged forests. Sites as young as 50 years that contain remnant large-diameter trees or snags that survived, or were created by, a previous disturbance (e.g. fire, wind storm, or, in some cases, timber harvest) are sometimes used (Gutiérrez et al. 1995, Courtney et al. 2004). Forests used by spotted owls in the eastern Cascade Range tend to be younger than forests used elsewhere in Washington, and owls in those areas nest in abandoned northern goshawk

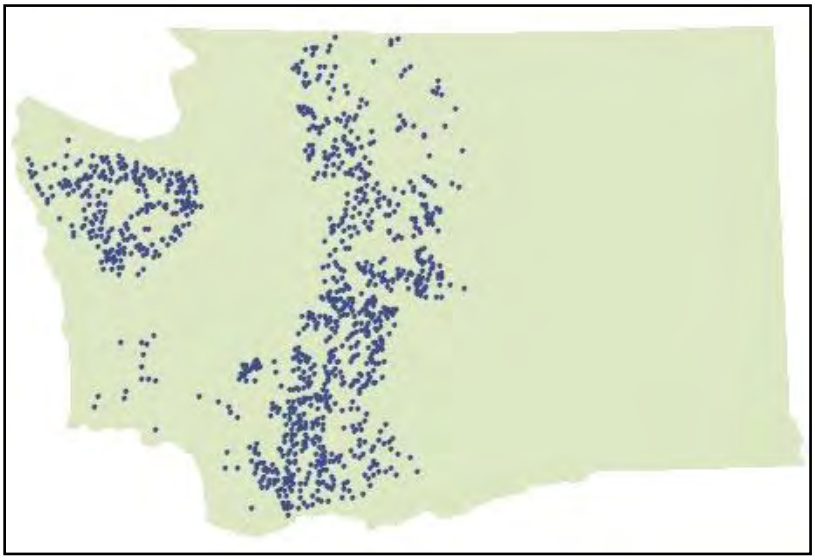

Figure 2. Cumulative distribution of 1,070 known spotted owl site centers in Washington from 1976 to 2011. The number of currently occupied sites is unknown.

(*Accipiter gentilis*) nests or clumps of branches infected by mistletoe (Buchanan et al. 1993), in contrast to the typical use of snags and cavity trees elsewhere in the state.

The most important habitats support all spotted owl life requisites, whereas some of them provide only certain resources, such as prey, and not others, such as nest sites. Spotted owls in Washington have the largest home ranges in the species' range (up to 27,679 acres), with substantial amounts of habitat used to hunt for prey (Forsman et al. 2005). Spotted owls primarily prey on small mammals; the most important prey species in Washington is the northern flying squirrel (*Glaucomys sabrinus*) and various other small mammals are also taken (Forsman et al. 2001).

WDFW maintains a database of spotted owl sites in the state. There were 1,070 territorial sites known to have been occupied by spotted owls in at least one year between 1976 and 2011 (Figure 2); results from recent demographic research (Forsman et al. 2011) suggested that many of these sites are no longer occupied. Information contained in the database was collected over many years by researchers, state and federal agencies, the wood products industry, tribes, and environmental groups. Some sites have not been monitored for many years (>15 years) and others have been impacted by disturbance events (e.g. fire, timber harvest) to the extent that they may no longer be used by spotted owls. As is true throughout its range, the absolute size of the spotted owl population in Washington is not known.

In contrast to knowledge of population size, there is information on the spotted owl population trend in Washington. Demography research projects were initiated in Washington in the 1980s in four large landscapes: the vicinity of Cle Elum in the eastern Cascades, a larger area of the eastern Cascade Range, the Olympic Peninsula, and Mt. Rainier and vicinity (Anthony et al. 2006). The larger eastern Cascade Range project was discontinued, but the others are ongoing. Results from the four studies have demonstrated population declines through 2004 (Anthony et al. 2006). The most recent analysis for the three Washington study populations through 2008 indicated declines of 4.3 to 7.1% (Forsman et al. 2011; Figure 3). Population declines have also been documented in parts of Oregon and California (Forsman et al. 2011), and the species is nearly extirpated in British Columbia (Fenger et al. 2007; I. Blackburn, pers. comm.).

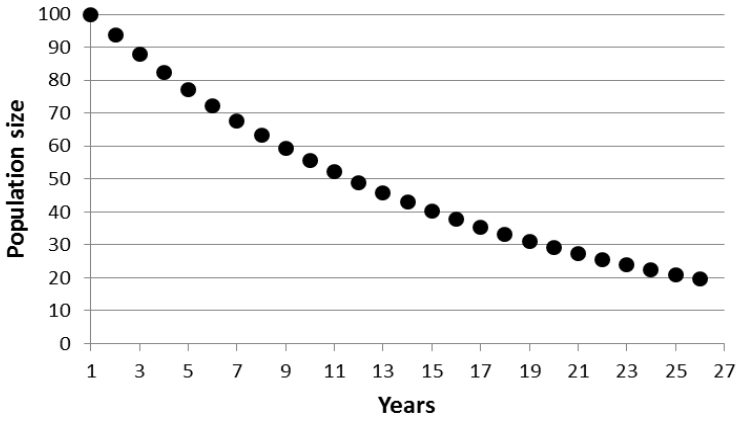

Figure 3. Representation of the estimated annual population decline of -6.3% documented for spotted owls for the Cle Elum study area. Similar changes have been documented at two other active demographic study areas in Washington.

Habitat loss. The two most important limiting factors affecting spotted owls in Washington are habitat loss and competition with barred owls (Courtney et al. 2004). Habitat loss has occurred as a result of forest conversion, timber harvest, fire, windthrow, insect outbreak and disease. The eruption of Mount St. Helens also destroyed large areas of forest that was probably spotted owl habitat. Substantial areas of forest, particularly in the lowlands of western Washington, were intensively managed over the last century, especially following the development of modern clear cut harvest methods after World War II. Much of the lowland area remains in forest, but large areas have also been converted to urban and suburban environments that do not provide habitat for spotted owls. Habitat loss from timber harvest has continued both in lowland and mid-elevation areas on public and private industrial forest lands (e.g. Pierce et al. 2005).

Fire and wind events have destroyed or altered spotted owl habitat in areas throughout the range of the species. In Washington, one of the most significant wind events was a 1921 cyclone (Mass and Dotson 2010), now locally referred to as the "21 blow." That event impacted many thousands of acres of forest in the western parts of the Olympic Peninsula. Impacts ranged from very minor to areas of complete blowdown; present-day patches of 90-year old forest with residual older trees are the result of partial impacts and these patches generally function as spotted owl habitat.

Habitat loss from fire has occurred in both western and eastern Washington. Two fires in Olympic National Park burned spotted owl habitat in the last two decades. Several fires in the southern and central parts of the eastern Cascade Range have burned habitat in about 20 spotted owl territories since 1994 (e.g. Bevis et al. 1997, Gaines et al. 1997). The intensity and impact of these fires appears to have been exacerbated by the effects of decades of fire suppression in the dry forest landscape (Spies et al. 2009; see Hanson et al. 2009 for a different perspective). Insect outbreaks can also impact spotted owl habitat. A large ongoing outbreak of spruce budworm in the eastern Cascade Range affected large patches of spotted owl habitat in and near the Teanaway River Basin in Kittitas County.

Competition with barred owls. The barred owl has recently expanded its range into the Pacific Northwest and northern California and is now found throughout most of the northern spotted owl's range (Dark et al. 1998). Barred owls first entered the Pacific Northwest in Washington and they are believed to be more common here than in other parts of the northern spotted owl range. The greatest spotted owl population declines have been reported from Washington and northern Oregon, and rates of negative population change were generally lower in southern through Oregon and northern California (Forsman et al. 2011). The gradient of spotted owl population decline from north to south appears to coincide with a regional gradient in barred owl abundance.

In contrast to spotted owls, barred owls are habitat and prey generalists, use smaller home ranges, have greater dispersal ability, and appear to have greater reproductive rates (Mazur and James 2000). Barred owls also appear to be behaviorally dominant over spotted owls (Courtney et al. 2004, Wiens et al. 2011). When barred owls first entered the range of the spotted owl they were more often found in forested valleys and areas near water (J. Buchanan, pers. obs.), which is consistent with their use of habitat in eastern North America (Mazur and James 2000). In the decades since their arrival, the species has moved into other, dryer and upslope forests (Gremel 2005, J. Buchanan, pers. obs.), although some upslope areas appear not to be used at present (Singleton et al. 2010, B. Pearson, personal communication).

Surveys. Surveys are conducted for purposes such as demography research and assessment of occupancy by owls in or near proposed timber harvests. Two recent investigations provide insight into aspects of survey methods. Kroll et al. (2010) found that spotted owl vocalization rates were lower at sites where barred owls were present than at sites where barred owls had not been detected. This information was used to inform changes to the U.S. Fish and Wildlife Service survey protocol. In addition, Wasser et al. (2012) used specially trained dogs to search for spotted owls and found that the dogs' ability to correctly distinguish between spotted owl and barred owl pellets increased the probability of detecting spotted owls by about 30% compared to standard survey methods based on broadcasts of owl vocalizations. This study has the potential to dramatically improve survey efficiency, particularly at sites where spotted owl response rates to traditional survey efforts are low.

Climate change. Climate change may affect spotted owl habitat in the future. A recent overview indicates that species composition and forest productivity of Washington forests will change, as will the size and severity of fires and the prevalence of insects and disease problems (Littell et al. 2009). Depending on the magnitude of these changes, habitat or prey of spotted owls might be influenced. Proactive dry forest management in the eastern Cascade Range that reverses some of the effects of historical fire suppression, should moderate some of these concerns in that portion of the owl's range

(Franklin et al. 2008). A new initiative lead by investigators from the U.S. Geological Service Northwest Climate Science Center and other partners will evaluate potential effects of climate and land management on future vegetation structure and how these changes might influence spotted owls in coastal Washington. WDFW is providing technical support for this project.

Addressing threats to spotted owls. A 2008 federal recovery plan for the northern spotted owl was revised in 2011 (U.S. Fish and Wildlife Service 2011). The revised plan recommends achieving recovery of the spotted owl through: 1) the retention of more occupied and high-quality habitat; 2) active management using ecological forestry techniques, both inside and outside of reserves; 3) increased conservation of spotted owls on state and private lands; and 4) the removal of barred owls in areas with spotted owls. It also recommends retaining a reserve network of habitat while the Service utilizes a habitat model to develop and propose a new critical habitat network for the spotted owl.

In May 2012, the U.S. Fish and Wildlife Service released two proposals related to northern spotted owl recovery. These are: 1) a proposed revised critical habitat designation for the spotted owl (U.S. Fish and Wildlife Service 2012a); which was subsequently implemented; and 2) a draft environmental impact statement on experimental removal of encroaching barred owls from certain portions of spotted owl habitat (U.S. Fish and Wildlife Service 2012b). The removal experiment has yet to be implemented.

Other initiatives to address habitat threats include the formation of a Dry Forest Working Group convened by the Service to address fire risk to spotted owl habitat in dry forest landscapes. The Washington Forest Practices Board convened a Northern Spotted Owl Implementation Team to recommend incentives for private landowners to provide spotted owl habitat and assist with other conservation efforts. A technical team that reports to the Northern Spotted Owl Implementation Team was also formed to identify potential landscapes where incentives might be optimized, from both ecological and economic perspectives. WDFW participates on both of these teams.

State and private timber entities have developed habitat conservation plans for spotted owls in Washington; most of these plans have been in place for a decade or more (Buchanan and Swedeen 2005). In addition, two industrial forest management companies have developed Safe Harbor Agreements since 2009.

Partners and cooperators: Common Futures, Conservation Biology Institute, Earth Economics, EcoTrust, EcoNorthwest, Institute for Natural Resources, National Park Service, Oregon State University, Portland State University, Raedeke Associates, Seattle Audubon Society, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, University of Washington, Washington Department of Natural Resources, Washington Forest Law Center, Washington Forest Protection Association and member companies, Yakama Indian Nation.

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Streaked Horned Lark

(*Eremophila alpestris strigata*)

State Status: Endangered, 2006
Federal Status: Candidate, 2001
Recovery Plans: None

Figure 1. Banded streaked horned lark at Damon Point (*photo by David Maloney*).

The streaked horned lark is a rare endemic subspecies found only in western Washington and Oregon. It is perhaps the most distinct subspecies of the horned lark, a small common ground-dwelling passerine that prefers open grassland habitat (Beason 1995, Rogers 2000, Stinson 2005). In Washington, the streaked horned lark nests on grasslands and sparsely vegetated areas at airports, sandy islands and coastal spits; Oregon nesting areas include fallow agricultural fields in the Willamette Valley. The streaked horned lark was once abundant on Puget Sound prairies, but has become increasingly rare with the decline in habitat and is now restricted to a few large open grassland sites in Washington. Genetic data indicate that the subspecies is unique, isolated, and has little genetic diversity (Drovetski et al. 2005).

Historically, streaked horned larks bred from southern British Columbia, through the Puget Trough in Washington and in the Willamette and Rogue River Valleys in Oregon (Rogers 2000, Stinson 2005) (Figure 2). The breeding range of the lark has contracted over time with extirpation from former breeding sites in northern Puget trough, southern British Columbia, the Washington Coast north of Grays Harbor, and the Rogue River Valley of Oregon (Rogers 2000, Beauchesne and Cooper 2003, Stinson 2005). More than 90% of the original grasslands have been lost in the south Puget Sound region as a result of development, and the incursion of trees, shrubs, and non-native invasive species, such as Scotch broom (*Cytisus scoparius*) (Chappell et al. 2001, Foster and Shaff 2003). In addition to state and federal listing status in the U.S., the streaked horned lark is listed as endangered under the Species at Risk Act in Canada (Beauchesne and Cooper 2003).

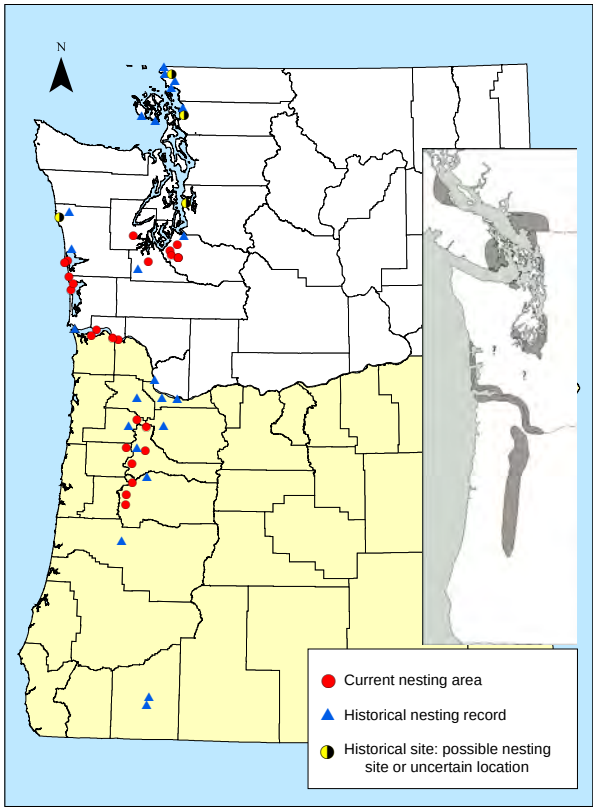

Figure 2. Historical and current breeding locations of the streaked horned lark in Washington and Oregon, and (inset) hypothesized historical breeding range (Stinson 2005).

Population estimates indicate that there are probably fewer than 1,000 streaked horned larks remaining, with about 330 birds breeding in Washington and 440 in Oregon (Pearson and Altman 2005). Pearson and Altman (2005) cautioned that these estimates combined data from

separate efforts over a time period of 8 years. The streaked horned lark is currently known to breed at 13 locations in Washington: 6 inland sites, 4 coastal sites, and 3 Columbia River sites. Population estimates based on winter surveys produced estimates of about 500-600 in 2004-2005 (Pearson and Altman 2005).

U.S. Fish and Wildlife Service Listing proposed rule. In October 2012, the USFWS proposed to list the Streaked Horned lark as Threatened under the Endangered Species Act (USFWS 2012). The proposed rule also would designate critical habitat.

Figure 3. Fledgling streaked horned lark on Brown Island (*photo by Mark Hopey*).

Population monitoring. Three new probable breeding sites were discovered in 2012, including 2 along the Columbia River (Kalama and Sand Island Marine Park near St. Helens, Oregon) and on Johns River Island, on the Washington Coast. A standardized monitoring protocol was developed and is in use by WDFW and partners. Most sites were visited 3 times during the breeding season, and the total of high counts totaled 196 in Washington in 2012 (Table 1).

Table 1. High count of Streaked Horned Larks during May-July surveys in Washington, 2010–2012.

Location	Washington region	County	2010	2011	2012
Whites Is./Brown Is. (off E tip Puget Is.)	Columbia	Wahkiakum	32	24	30
Rice Island (Washington and Oregon)	Columbia	Wahkiakum	14	24	24
Kalama (Steelscape)	Columbia	Cowlitz	-	-	2
Leadbetter Point	Coast	Pacific	-	20	13
Midway Beach	Coast	Pacific	-	-	2
Damon Point	Coast	Grays Harbor	-	6	4
Johns River Island	Coast	Grays Harbor	-	-	2
Olympia Airport	Inland	Thurston	47	41	46
13th Division Prairie, Fort Lewis	Inland	Pierce	3	6	18
Gray Field, Fort Lewis	Inland	Pierce	29	25	18
91st Division Prairie, Range 74	Inland	Pierce	12	9	4
McChord Air Force Base	Inland	Pierce	26	18	17
Shelton Airport	Inland	Mason	15	11	16
Total			178	184	196

Demographic studies. Camfield et al. (2011) monitored 257 streaked horned lark nests on seven sites in Washington and banded 58 adults (26 females, 32 males) and 88 juveniles. They developed a demographic model to estimate population trends and to identify the parameter and life stage that would be the most important targets for management. They reported that streaked horned larks in Washington were declining rapidly and that local breeding sites were not sustainable without immigration. In addition, although there are no data on range-wide population trends for streaked horned larks, territory mapping data from four sites in the Puget lowlands indicated that the number of territories had decreased 45% over 3 years from 77 territories in 2004, to 42 in 2007 (S. F. Pearson, unpubl. data). They concluded that the highest priority for management was to increase adult survival, followed by improvement of

juvenile survival and fecundity. Horned Larks are the most commonly reported species involved in collisions with Air Force aircraft, and represent almost 13% of all reported strikes (BASH 2009), but it isn't known how often streaked horned larks are struck by aircraft. Streaked horned larks nest at five airports in Washington and one in Oregon. If collisions are an important mortality factor, improving nesting habitat away from active runways where suitable habitat is available, may reduce collisions and improve adult survival.

Research by Oregon State University has been ongoing for 4-5 years to understand juvenile lark movement, survivorship, and habitat use in the Willamette Valley. Telemetry of large chicks was initiated in 2012. This work will continue in 2013 (R. Moore, pers. comm.).

Figure 4. Streaked horned lark nest on Midway Beach (*photo by C.Sundstrom*).

Nest exclosure trials. During 2009-2010, WDFW, and the USFWS-Willapa National Wildlife Refuge tested the efficacy of wire nest exclosures to reduce predation for improving fledging success, without increasing predation on adults. The nest exclosure design used did not improve nest success, because lower rates of predation were offset by nest abandonment (Pearson et al. 2012). Nest abandonment was probably caused by American Kestrels (*Falco sparverius*) perching on the exclosure and predation of adults at exclosed nests at the Corvallis Airport study site. Modified designs that preclude perching by raptors may be tested in 2013.

Genetic augmentation on Joint Base Lewis-McChord. Anderson (2010) reported that streaked horned lark at 13th Division Prairie on Joint Base Lewis-McChord had significantly lower values in all measures of reproductive success when compared to both a guild of ground nesting birds and savannah sparrows (*Passerculus sandwichensis)*. Streaked horned lark's low egg hatching rate of 44% suggested that inbreeding depression was playing a role in the decline of larks at 13th Division Prairie. A project was initiated in 2011 to address the issue of inbreeding and low hatching rate, by moving eggs from Willamette Valley in Oregon to nests on 13th Division; the plan involves moving eggs from five lark nests in 2011, and again in 2012. The project requires the donor and recipient nests be at the approximate same stage of incubation; it takes advantage of intensive nest monitoring being done during a study in Oregon (Randy Moore, pers. comm.). In 2011, 4 clutches of 3 eggs were moved; 11 of the 12 translocated eggs hatched, and 3 of 4, 3-egg clutches fledged a total of 5 or 7 young.

In 2012, no egg-clutches were translocated to Puget Sound nests from Oregon due to significantly high nest failure at the Corvallis airport (floods and then mass predation) and a mismatch of timing of clutch incubation (Wolf 2012). One Oregon translocated nestling returned to 13th Division Prairie as an adult male, but did not breed successfully with a female in 2012. No other banded birds that originated from Corvallis translocated clutches were observed at other lark nesting sites (i.e., McChord Airfield, Gray Army Airfield, JBLM Range 76, Olympia and Shelton airports). This bird returned to 13th Division in 2013, and if it successfully reproduces, it may provide the needed improvement in genetic diversity of the local population to improve fitness and reduced extinction risk. Subsequent monitoring will determine whether the male or other translocated birds return to breed (Wolf 2012).

Habitat restoration and management. In 2004-2005, Pearson et al. (2005) tested the effect of controlled burns on larks. Lark abundance was significantly higher on burned plots compared to controls ($p = 0.10$)

in the breeding season following the burn. Burned plots had significantly less thatch, forbs and total vegetation, with more moss/lichen and open groud; there was no differences in the percent cover of annual or perennial grasses (Pearson et al. 2005).

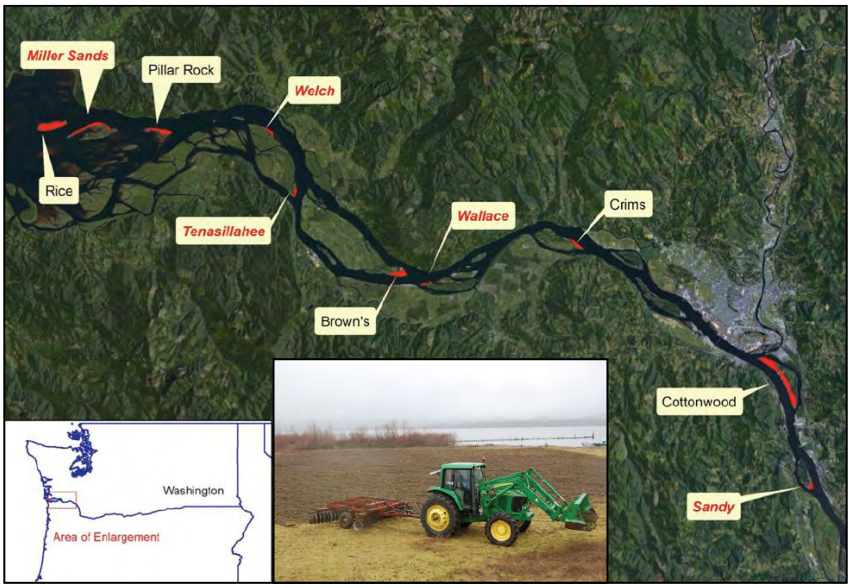

Figure 5. Island sites in the lower Columbia River used in the habitat management study; sites in red are restoration trial sites (from Anderson 2011).

The Center for Natural Land Management and U.S. Army Corps of Engineers conducted management experiments during 2009-2011 on dredged material islands in the lower Columbia River to test methods of maintaining sparse vegetation for streaked horned lark nesting habitat. A tractor was used to till treatment plots to create the open habitat condition used by larks; plots were tilled with 1 pass, 2 passes, or with alternating tilled and untilled strips. After treatments, larks used all the treated plots and none of the control/untreated plots (Anderson 2011).

Willapa NWR removed introduced beachgrass (*Ammophila* spp.) from a Habitat Restoration Area that has been expanded to 250 ac; originally intended to provide nesting habitat for snowy plover, the area also has provided nesting sites for larks. WDFW and volunteers treated five 1-ac plots at Leadbetter State Park to remove beachgrass to create nesting habitat for plovers during 2007-2009, but to-date these plots have not been used for nesting by either species.

Scotch broom control and prairie restoration is an ongoing activity on Joint Base Lewis-McChord, and a large prescribed burn was conducted on 13th Division Prairie in 2012 that may improve and increase nesting area for larks there.

A guide for managing agricultural lands to benefit Streaked Horned Larks was completed in 2011, with a grant from the Department of Defense Legacy Program (Moore 2011).

Conspecific attraction study. In 2012, a two-year research study was initiated to examine the feasibility of attracting Streaked Horned-larks to nearby sites through the use of using recordings of their calls and three-dimensional Streaked Horned-lark decoys. Study sites are at Joint Base Lewis-McChord and the St. John's Landfill in Portland, Oregon. The study is being done by Center for Natural Lands Management and Evergreen State College.

Working Group. A range-wide interagency streaked horned lark working group meets at least annually to identify and prioritize conservation actions for the streaked horned lark. In March 2011, The Nature Conservancy, with support from USFWS and a Department of Defense Legacy grant, hosted the *Streaked Horned Lark and Pacific Northwest Airports: A Collaborative Workshop* that brought together interested parties to explore opportunities for conserving the streaked horned lark without impacting aircraft safety.

Partners and cooperators: U.S. Fish and Wildlife Service, Center for Natural Lands Management,

Department of Defense, Joint Base Lewis-McChord, Oregon Dept Fish and Wildlife, Oregon State University, Willapa National Wildlife Refuge, and Washington State Parks.

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Western Pond Turtle

(*Actinemys marmorata*,
formerly *Clemmys marmorata*)

State Status: Endangered, 1993
Federal Status: Species of concern
Recovery Plans: State, 1999

Figure 1. Adult female western pond turtle with an attached radio transmitter and identifying number for population monitoring (*photo by Melissa Reitz*).

The western pond turtle inhabits slow moving streams, lakes, ponds and wetlands. It is generally brown, olive or black on top and yellow and brown underneath (Figure 1). It is one of two turtle species native to Washington; the painted turtle (*Chrysemys picta*) is more brightly colored with yellow stripes on the head and bright red markings on the underside. Other non-native species, often liberated pets, occur in many sites. The pond slider (*Trachemys scripta*) is the most common of these. Particularly old sliders can be confused with western pond turtles. For descriptions, see the Washington Herp Atlas at: http://www1.dnr.wa.gov/nhp/refdesk/herp/speciesmain.html

The western pond turtle once ranged from the Puget Sound lowlands through western Oregon and California to Baja California. Historical declines of this species resulted from commercial exploitation for food, alteration and loss of habitat, and introduced predators such as bullfrogs and large-mouth bass. Western pond turtles were essentially extirpated in the Puget lowlands by the 1980s. By the mid-1990s, they were found in only two small populations totaling about 150 turtles in Skamania and Klickitat counties. The western pond turtle has declined throughout its range, but is still locally common in parts of California and Oregon. Recovery in Washington will require long-term efforts because the turtles grow slowly, requiring up to 10 years to produce their first offspring.

Survival of hatchlings in the wild was believed to be near zero based on the lack of recruitment to larger size classes (Hays et al. 1999). To address the high mortality rate of small hatchlings in the wild, especially due to predation by bullfrogs, a head-start program was initiated with Woodland Park Zoo, and later with the Oregon Zoo (Vander Haegen et al. 2009). A captive breeding program was also started at the Woodland Park Zoo to build a population of turtles for release into suitable habitat in the Puget Sound area. Wild hatchling head-starts are reared with hatchlings produced from captive breeding (Figures 2). Unlike wild turtles, zoo-reared turtles are fed throughout the winter in a controlled environment, so by their summer release, the 10-month-olds are about the size of 3-year-old turtles in the wild. The young turtles are released at established

Figure 2. Head-started western pond turtles ready for release, and young turtle (inset) at Woodland Park Zoo (*photos by D. Stinson and Woodland Park Zoo*).

sites to augment populations or to establish additional populations. Head-starting is an interim recovery strategy until efficient and reliable means of bullfrog control (possibly a combination of gigging, trapping, egg mass removal) are developed and implemented at occupied sites. Head-started turtles reproduced in the wild for the first time in 2001. The captive breeding program was ended in 2010.

The recovery plan objectives are to have 7 populations greater than 200 individuals each that are sustained by natural recruitment of juveniles, with 4 populations in the Columbia Gorge and 3 in Puget Sound (Hays et al. 1999). As of 2011, two introduced populations occur in Puget Sound (one in Mason County and one in Pierce County), and two reintroduced populations and two natural populations occur in the Columbia Gorge. These populations do not yet meet the needed size, age distribution, and natural recruitment required for down-listing and recovery.

Columbia Gorge recovery actions. In 1992, WDFW began acquiring land in Klickitat County that hosted the largest turtle population remaining in the state; it is now managed as part of the Klickitat Wildlife Area. In 2002-2003, the U.S. Forest Service acquired over 200 acres of western pond turtle habitat at the Skamania County site that contains the second largest population in the state. Improvements for the benefit of the turtles have been ongoing at both sites.

Table 1. Western pond turtles released at recovery sites in Washington, 1991-2012.

Recovery region/Population	Number Released			
	1991-2010	2011	2012	Total
Columbia Gorge				
Klickitat	530	0	0	530
Bergen	266	11	25	302
Pierce NWR	321	9	13	343
Beacon Rock	127	20	35	182
Puget Sound				
Pierce County	195	19	24	238
Mason County	196	26	48	270
Total	1,635	85	145	1,865

The first reintroduction site for western pond turtles in the Columbia River Gorge was on Pierce National Wildlife Refuge in western Skamania County. The goal was to establish the third of four populations needed to recover the pond turtle in the Gorge. A total of 343 turtles have been released at this location since 2000 (Table 1). From 2000 to 2004, telemetry was used to document survival and mortality of 68 head-started turtles released at the refuge (Vander Haegen et al. 2009). Survival estimates for first year and older turtles ranged from 86% to 97%, with no differences among age classes. Subadult turtles released at ≥90 mm carapace length apparently avoided predation by bullfrogs. High annual survival and nesting by head-started turtles was indicative of successful recruitment.

A second reintroduction in the Columbia River Gorge began in September of 2007 with a release of turtles at ponds in Beacon Rock State Park in Skamania County. As of 2012, 182 head-started juvenile turtles have been released (Table 1; Holman and Anderson 2013).

The western pond turtle program in the Columbia Gorge continues to make progress. Since recovery efforts began in 1991, 1,357 head-started turtles have been released into suitable habitat within their historical range in the Gorge (Holman and Anderson 2013). The populations were estimated using mark-recapture at Bergen (86) and Pierce (41) in 2011, and Sondino (246) in 2012 (Holman and

Figure 3. Western pond turtle hatchling (*photo by Eric Holman*).

Anderson 2013). Turtles now occupy 4 distinct locations, with sexually mature males and females present at 3 of the sites. A significant milestone was documentation of nesting by pond turtles at Pierce National Wildlife Refuge in 2010 (Holman et al. 2012). Control of bullfrogs and habitat enhancement efforts are ongoing at Gorge sites. In 2011, a total of 525 frogs or tadpoles and three bullfrog egg masses were removed; 6 bullfrog egg masses were removed at Sondino in 2012 (Holman et al. 2012, Holman and Anderson 2013).

South Puget Sound recovery actions. The first western pond turtle population re-established in the South Puget Sound region was at an excavated pond complex in Pierce County (Figure 4). This site is a 12-acre compound that includes a 3-acre wetland mitigation site constructed by Pierce County Public Works in 1994. Turtles from the Woodland Park Zoo were first released in the summer 1996, with a total of 238 turtles released by December 2012 (Table 1). Survival and growth of head-started juveniles has been high compared to that reported in wild populations. The first hatchlings from wild nests were produced in 2001.

A habitat enhancement project funded by the Wildlife Habitat Incentive Program was completed at the Pierce County site in 2008-2009 and included control of Himalayan blackberries and the addition of 1,000 cubic yards of topsoil. This project improved the habitat condition of the nest hill. Meeting the recovery objective of having a population of >200 turtles may require creating an additional pond complex using an existing spring-fed seep. This could double the population and take advantage of a more desirable south-facing hill for nesting. In 2012, 6 basking logs, donated by Weyerhaeuser, along with 4 from Scatter Creek Wildlife Area, were installed at the turtle ponds at the Pierce County site.

Figure 4. Western pond turtles basking at Pierce County site (*photo by Mike Walker*).

Reestablishment of a second population of western pond turtles in the Puget Sound region began in 2005 at a shallow 20-acre warm water pond in Mason County. The site is relatively secluded, but close to additional wetland complexes that may allow the turtle population to expand. The project required habitat enhancement, translocation of turtles, and monitoring survival and nesting activity so eggs could be collected for head-starting. To create and maintain habitat, logs were cut from downed trees and anchored throughout the pond to provide basking sites. Nesting habitat was provided by clearing the nest hill. Removal and control of scotch broom and blackberry has been ongoing.

Figure 5. Western pond turtle nest at the reintroduction site in Mason County (*photo by Bryan Murphie*).

The first reintroduction effort in 2005 began with the relocation

of 22 turtles from the Pierce County recovery site and the release of 21 turtles from Woodland Park Zoo. In 2012, 48 head-started turtles were released, bringing the total number of released turtles to 270 (Table 1). Annual survival has been high, with the probability of surviving from 2005–2012 estimated at 96%. Growth in all age classes has been good, suggesting ample food resources. The number of nests has increased from 1 in 2006 to 6 in both 2010 and 2011, and 5 in 2012. No hatchlings were produced at the site through 2010, so in 2011, all 43 eggs were removed and transported to incubators at the Woodland Park Zoo. The 43 eggs produced 36 hatchlings. In 2012, 39 eggs were collected; of these 5 were broken in the nest, 14 hatched at Woodland Park Zoo, and 9 were still in incubation as of December 2012.

Observations from 2010 suggested that the rock content of the soil at potential nesting sites made it difficult for females to excavate nests. There were occasions where turtles laid their eggs above ground or in the water, and struggles were apparent with the long hours turtles spent on land, the numerous scrapes and test holes dug, and the large number of broken eggs recovered. When turtles were successful in excavating a proper cavity they were unable to form a compact nest plug and filled in their nest cavities with whatever rocks and loose soil they could find, breaking numerous eggs in the process. In 2012, 10 cubic yards of a sandy soil mix was hauled in to provide more suitable nesting habitat. Predation of turtles by river otters and bald eagles was observed in 2011; none was observed in 2012, but both otters and eagles were observed.

Pond turtle workshop. WDFW staff and cooperators from the Woodland Park Zoo captive rearing and reintroduction program participated in a Population and Habitat Viability Assessment for the western pond turtle for 3 days in November 2012. The workshop was made possible by a grant from the International Union for Conservation of Nature (IUCN) to the Woodland Park Zoo. Experts in population viability analysis of rare and endangered species from IUCN led the workshop; a report of the results of the exercise will be available in 2013.

Partners and cooperators: Bonneville Power Administration, Woodland Park Zoo, Oregon Zoo, Pierce County Public Works, Pierce College-Veterinary Technology Program, Washington State Parks and Recreation Commission, USDA Forest Service Scenic Area, Washington Department of Natural Resources, Larch Mountain Correctional Facility, U.S. Fish & Wildlife Service, Pierce National Wildlife Refuge, Clark College, Skamania County Weed Control, Skamania County Forest Youth Success Program, Frank and Kate Slavens, and Weyerhaeuser.

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Leatherback Sea Turtle

(Dermochelys coriacea)

State Status: Endangered, 1981
Federal Status: Endangered, 1970
Recovery Plans: Federal, 1992

Figure 1. Leatherback sea turtle hatchling (*photo by Scott Benson, NMFS-Southwest Fisheries Science Center*).

The leatherback sea turtle (Figure 1) is the sole member of the family Dermochelyidae; all other sea turtles belong to the Cheloniidae. The leatherback is the largest, deepest diving, and most migratory and wide ranging of the sea turtles (Figure 2). Adult leatherbacks reach 4-8 feet in length and weigh 500 to 2,000 pounds. The leatherback is the only sea turtle that lacks a hard, bony shell. Its shell is composed of a mosaic of small bones covered by firm, rubbery skin. A leatherback's top shell (carapace) has seven longitudinal ridges and tapers to a blunt point. The skin is predominantly black with varying degrees of pale spotting. The front flippers are proportionally longer than in other sea turtles. The ridged carapace and large flippers are characteristics that make the leatherback uniquely equipped for long distance foraging migrations. Leatherbacks also display several physiological and behavioral traits that enable them to inhabit colder water than other sea turtles.

Leatherback turtle nesting grounds are located around the world in tropical regions, with the largest remaining nesting areas found on the coasts of northern South America and West Africa. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support small nesting colonies, but represent the most significant nesting activity within the U.S. In the Pacific Ocean, significant nesting aggregations occur primarily in Mexico, Costa Rica, Indonesia, the Solomon Islands, and Papua New Guinea.

Females lay clutches of about 100 eggs on sandy tropical and subtropical beaches, and may nest several times during a nesting season, typically at 8-12 day intervals. The distribution and developmental habitats of juvenile leatherbacks are poorly known. Individuals smaller than 100 cm carapace length have only been observed in waters 26°C or warmer (Eckert 2002).

Leatherback turtles forage in both pelagic (open ocean) and productive coastal waters. They prey mainly on jellyfish and consume 20-30% of their body weight daily (NMFS 2009). Although leatherbacks are capable of deep diving, most of their time is spent at or near the surface.

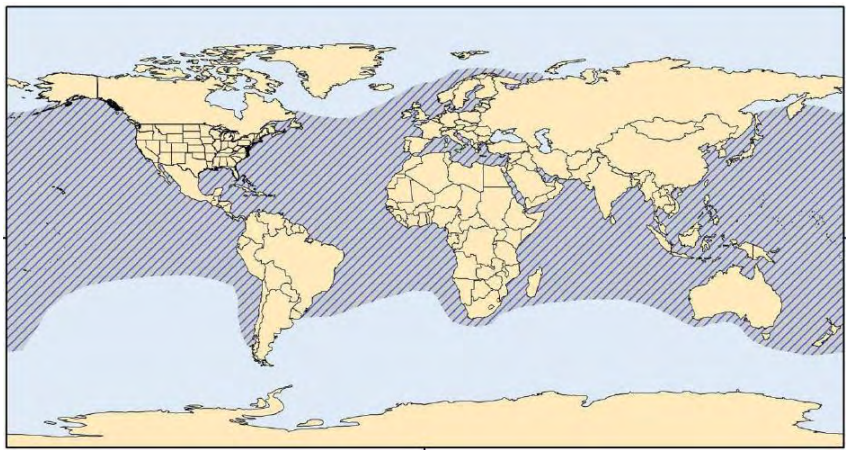

Figure 2. Range of leatherback sea turtles (*from NMFS*).

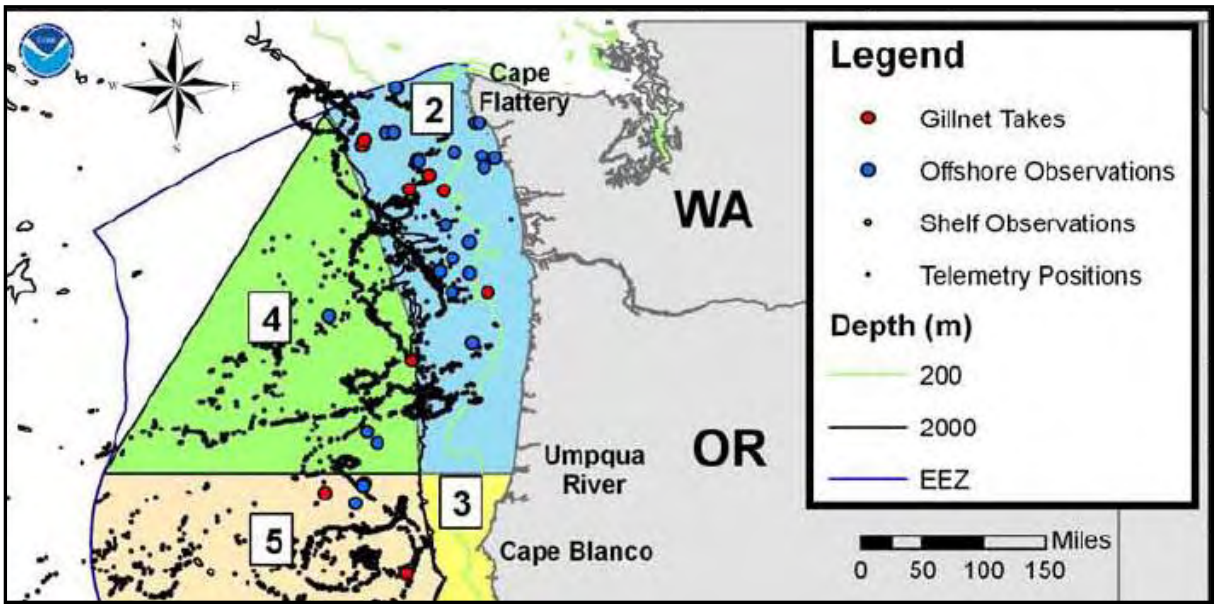

Figure 3. Observations, telemetry data, and gillnet captures of leatherback sea turtles off Washington and Oregon (NMFS 2009). Additional telemetry locations appear in Benson et al. (2011).

Leatherback turtles occur worldwide in tropical and temperate oceans, with a few adults sighted as far north as the Gulf of Alaska and northern Europe (Figure 2). After nesting, females migrate from tropical waters to more temperate latitudes. Leatherbacks regularly occur off the coasts of Washington (especially off the Columbia River mouth), Oregon, and California during the summer and fall when large aggregations of jellyfish form, particularly brown sea nettle (*Chrysaora fuscescens*) and moon jellies (*Aurelia labiata*) (Figure 3; Bowlby et al. 1994, NMFS 2009, 2012, Benson et al. 2011). Recent satellite telemetry has shown that some of the animals visiting Washington have their nesting sites in western New Guinea, and therefore have transited the entire Pacific Basin (Benson et al. 2011).

Pacific leatherback populations are generally smaller than those in the Atlantic, and most Pacific nesting populations have declined more than 80% (Sarti Martinez 2000). In other areas of the species' range, observed declines in nesting populations are not as severe and some populations are increasing or stable. Nesting trends on U.S. beaches have been increasing in recent years.

Conservation. Leatherback turtles face threats at their nesting beaches and at sea. The greatest causes of decline and the continuing primary threats to leatherbacks worldwide are human harvest and incidental capture in fishing gear (NMFS and USFWS 1998). Harvest of eggs and adults occurs on nesting beaches, whereas juveniles and adults are harvested on feeding grounds. In some areas, illegal egg harvest has removed more than 95% of the clutches (Sarti Martinez 2000). Incidental capture primarily occurs in gillnets, but also in trawls, traps and pots, longlines, and dredges. Together these threats are serious ongoing sources of mortality that adversely affect the species' recovery. Oceanic pollution, particularly plastics, is another cause of mortality (Sarti Martinez 2000). Leatherbacks commonly ingest plastic bags, balloons, and other plastic debris, which are probably mistaken as jellyfish. These forms of plastic can cause partial or even complete obstruction of the gastrointestinal tract. In one recent study, 138 of 408 necropsied leatherbacks contained plastic objects, with 12 having sufficient plastic to block the passage of food and likely cause death (Mrosovsky et al. 2009). Climate change is an additional threat because of potential decreases in egg and hatchling survival at nesting beaches (Santidrián Tomillo et al. 2012).

Because leatherbacks are highly pelagic and make long migrations, they come into contact with people of

many nations. Therefore, conservation efforts in one country may be jeopardized by activities in another. Protecting leatherbacks in U.S. waters and on U.S. nesting beaches alone is therefore not sufficient to ensure the continued existence of the species. The species is protected by various international treaties and agreements, and national laws. It is listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), which prohibits international trade of this species. The U.S. is also a party of the Inter-American Convention for the Protection and Conservation of Sea Turtles, which is the only international treaty dedicated exclusively to marine turtles.

Figure 4. Adult leatherback (*photo by Scott Benson, NMFS, Southwest Fisheries Science Center*)

In the U.S., NOAA Fisheries (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have joint management authority for leatherback turtles, with NMFS having the lead in the marine environment and the USFWS having the lead at nesting beaches. Both agencies, and a number of state agencies, have promulgated regulations to eliminate or reduce threats to sea turtles. NMFS enacts measures to reduce sea turtle interactions with fisheries through regulations and permits under the ESA and Magnuson-Stevens Fishery Conservation and Management Act. Since the early 1990s, it has implemented conservation measures including turtle exclusion devices in trawl fisheries, large circle hooks in longline fisheries, time and area closures for gillnets, and modifications to pound net leaders.

In 2012, NMFS designated critical habitat for leatherback sea turtles in two nearshore areas serving as important feeding sites off the U.S. West Coast, including the waters 0-80 m deep off Washington extending to the 2,000 m depth contour (Figure 5; NMFS 2012). Waters west of this area were not included because of the reduced availability of prey. Strandings of this species are very rare in Washington (Bowlby et al. 1994), with none recorded from 2002-2012 (K. Wilkinson and L. Todd, unpublished data).

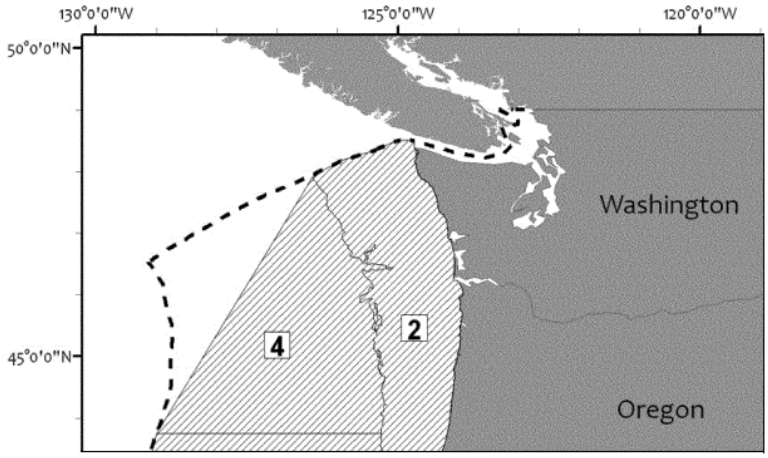

Figure 5. The area of critical habitat off Washington and Oregon (Area 2) designated for leatherback sea turtles by NMFS in 2012 (NMFS 2012). Area 4 was not classified as critical habitat. The dashed line represents the U.S. exclusive economic zone (EEZ).

Partners and cooperators:
National Marine Fisheries Service, U.S. Fish and Wildlife Service.

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Oregon Spotted Frog

(*Rana pretiosa*)

State Status: Endangered, 1997
Federal Status: Candidate, 1997
Recovery Plans: State, 2013 (Draft)

Figure 1. Oregon spotted frog female (*photo by Kelly McAllister*).

The Oregon spotted frog is a medium-sized aquatic frog endemic to the Pacific Northwest (Figure 1). Historically, it was distributed from southwestern British Columbia, Canada to northeastern California (Cushman and Pearl 2007). Today it is known from about 46 occupied locations in British Columbia, Washington and Oregon (USFWS 2011, Bohannon et al. 2012). In 1997, the U.S. Fish and Wildlife Service concluded that federal listing of the Oregon spotted frog as Endangered or Threatened was warranted but precluded from listing by other higher priority species (USFWS 2010).

Museum specimens and substantiated accounts indicate Oregon spotted frogs were found in both the Puget Trough and East Cascades. The most significant factor contributing to the decline of Oregon spotted frogs is the loss and alteration of wetland habitat. Oregon spotted frogs have life history traits, habitat requirements, and population characteristics that make them vulnerable to such loss and limit their distribution. The species persists in only six Washington locations (Figure 2). Conboy Lake had the

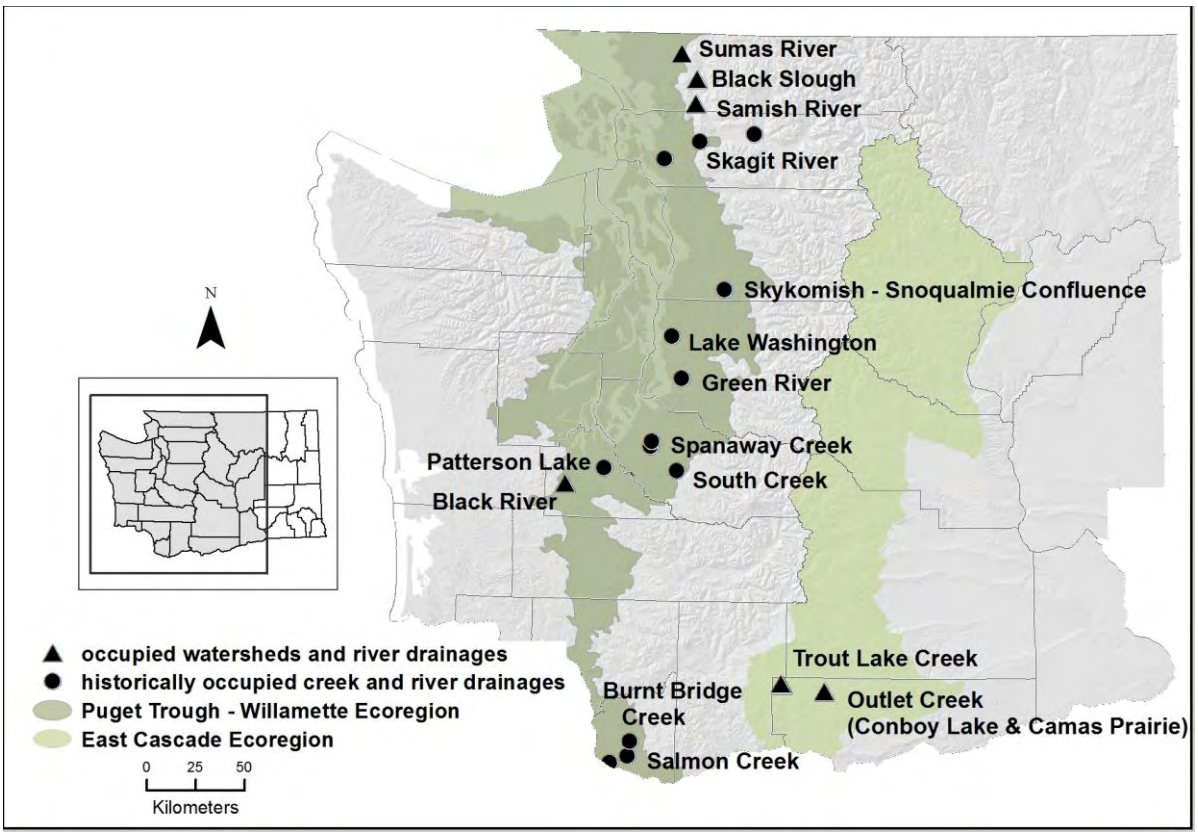

Figure 2. Washington drainages documented to have been occupied by Oregon spotted frogs.

largest population in Washington until 2012, but has undergone a >86% decline in egg mass production since 1998. Hydrological issues will determine whether or not this population recovers to 1990s levels.

***Species inventory and monitoring*.** Several agencies, land owners, zoos, conservation groups, and volunteers coordinate with WDFW on annual egg mass censuses in Washington. In 2011, WDFW, with financial support from USFWS, initiated egg mass surveys in Whatcom and Skagit counties and found two new isolated breeding populations on private lands in the South Fork Nooksack (Black Slough) and near the headwaters of the Samish River near the town of Acme, areas that were not historically known to host the species. In 2012, five additional breeding areas were found on the Samish River, and a third breeding area was found along Black Slough. Also in 2012, a previously unknown population was found on a privately owned dairy farm near the town of Nooksack on an unnamed tributary of the Sumas River; surveys recorded a total of 45 Oregon spotted frog egg masses.

Population estimates are based on annual censuses of egg masses. These assume one egg mass per adult female per year and one male breeding with each female. Surveys of all known breeding areas in 2012 found a total of 3,684 egg masses, which corresponds to a total population estimate of 7,368 breeding adults for Washington (Table 1).

Table 1. Population census results for the six known Oregon spotted frog locations in Washington, 2012.

Population Sites	County	Egg masses	Population estimate of breeding adults
Black River	Thurston	874	1,748
Trout Lake	Klickitat	1,062	2,124
Conboy Lake[1]	Klickitat	977	1,954
Black Slough	Whatcom	116	232
Samish River	Whatcom	610	1,220
Sumas River	Whatcom	45	90
Total		**3,684**	**7,368**

[1]Census results based on survey of Conboy Lake National Wildlife Refuge and one site on private land.

Conservation planning. The Washington Oregon Spotted Frog Working Group was formed in 2008 to coordinate and advise on recovery activities. It includes biologists from state and federal agencies, Port Blakely Tree Farms, Joint Base Lewis-McChord, The Nature Conservancy, Evergreen State College, Cedar Creek Correctional Facility, and members of the Northwest Zoo and Aquarium Alliance including staff from Point Defiance Zoo and Aquarium, Woodland Park Zoo, Northwest Trek, and Oregon Zoo. The working group contributed to the development of a draft state recovery plan for the Oregon spotted frog (Hallock 2013).

Dailman Lake reintroduction project. A reintroduction project was started at Dailman Lake on Joint Base Lewis-McChord Military Reservation in Pierce County in 2008. The captive rearing project is a cooperative project involving WDFW, Cedar Creek Correctional Facility, Evergreen State College, Oregon Zoo, Northwest Trek, Woodland Park Zoo, Joint Base Lewis-McChord, and Point Defiance Zoo and Aquarium. Rearing facilities at Woodland Park Zoo, Northwest Trek, and Oregon Zoo receive eggs taken from wild populations in Thurston and Klickitat counties in early spring. In addition, Cedar Creek inmates raised frogs in 2009-2011 as part of a partnership between Evergreen State College and the Washington Department of Corrections' Sustainable Prison Project, which allows prisoners to participate in science-based conservation projects. The tadpoles were captive raised until metamorphosis and then

released in the fall of each year. As of November 2012, about 5,490 frogs were released. Biologists from Joint Base Lewis-McChord and WDFW monitor the released frogs and survey for egg masses in the spring. The only evidence of breeding by the reintroduced population was found in April 2011 when three verified Oregon spotted frog egg masses and eleven egg masses suspected to be Oregon spotted frogs were found by WDFW and JBLM biologists. Eleven embryos from both the confirmed and unconfirmed egg masses were collected for genetic verification and confirmed to be Oregon spotted frog. In 2012, no eggs resembling those of Oregon spotted frog were found by WDFW and JBLM biologists. The project will be evaluated in 2013 to determine if additional releases should continue.

Protection, enhancement and management of habitat. Several properties are managed for Oregon spotted frogs, with most efforts focused on control of reed canarygrass in breeding areas. These include the Trout Lake Natural Area Preserve in Klickitat County, which was established in 1996 primarily for the protection of Oregon spotted frogs. Conboy Lake National Wildlife Refuge manages water and controls reed canarygrass to benefit Oregon spotted frogs. WDFW acquired the West Rocky Prairie Wildlife Area in 2006. Nisqually National Wildlife Refuge acquired occupied habitat on Dempsey Creek and the floodplains of the Black River. The Center for Natural Lands Management owns property on Mima Creek, which they are restoring for possible Oregon spotted frog colonization or translocation with funding from USFWS and the Natural Resources Conservation Service. Habitat enhancement is also taking place on private lands at the Salmon Creek site with support from WDFW and USFWS.

Research to facilitate and enhance recovery. A number of research projects pertaining to Oregon spotted frogs have been conducted in the past few years. In 2009, WDFW and WDNR initiated experiments on control of reed canarygrass at Beaver Creek and Trout Lake. In 2009, Port Blakely Tree Farms began investigating cattle grazing impacts to oviposition sites using fencing exclosures to evaluate pre- and post-grazing changes. Also in 2009, a study was initiated to determine the species' sensitivity to the chytrid fungal pathogen (Padgett-Flohr and Hayes 2011). In 2010, the Washington Department of Ecology funded the University of Washington to investigate the potential effects of exposure to the herbicide-surfactant combination Imazapyr-Agridex on juvenile Oregon spotted frogs. In related work, WDFW began a study in 2010 of amphibian phenology at Beaver Creek to determine which life stages would be exposed if herbicides were used to control reed canarygrass. WDFW is currently seeking funding to extend these tests. Oregon Zoo, WDFW, and Kyle Tidwell compared the anti-predator behavior of Oregon spotted frogs from Black River and Conboy Lake National Wildlife Refuge from 2009-2011.

Partners and cooperators: Port Blakely Tree Farms, Washington Department of Natural Resources' Natural Areas and Natural Heritage Programs, Washington Department of Transportation, U.S. Fish and Wildlife Service, Nisqually and Conboy National Wildlife Refuges, Department of Defense-Joint Base Lewis-McChord Military Reservation, U.S. Forest Service-Gifford-Pinchot National Forest, The Nature Conservancy, Northwest Trek , Woodland Park Zoo, Oregon Zoo, Cedar Creek Correctional Facility, Evergreen State College, Point Defiance Zoo and Aquarium, and, Capitol Land Trust, Mountain View Conservation and Breeding Center.

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Northern Leopard Frog

(*Lithobates pipiens*)

State Status: Endangered, 1999
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Northern leopard frog. Individuals can have a green or brown background color, but oval spots surrounded by a halo are typical (*photo by Steve Germaine*).

The northern leopard frog (Figure 1) is one of the most widely distributed amphibians in North America. Recently, however, declines in the populations of this species have been reported from throughout its range. The species was petitioned in 2009 for listing under the Endangered Species Act, but a status review determined that listing throughout their range was not warranted (USFWS 2011).

The northern leopard frog has been called the "meadow frog" for its summertime movements away from natal ponds. A wide variety of habitats are inhabited, even hay fields and grassy woodlands, although this may not be true of leopard frogs in much of the arid West. Leopard frogs require permanent deep water for overwintering, in proximity to seasonal ponds and wetlands for breeding.

Museum records indicate that leopard frogs inhabited at least 18 general areas in eastern Washington, many of these along the Columbia River and its major tributaries (Figure 2; McAllister et al. 1999). Investigations during 2002-2005 indicated that the species was found in only two areas in the state: in ponds at the Potholes Reservoir and Gloyd Seeps units of the Columbia Basin Wildlife Area in Grant County (Figure 2). The Gloyd Seeps population was near extirpation and was last detected in 2004 (Germaine and Hays 2007, 2009). Recent surveys confirm that the Potholes population is the only remaining population. Intensive survey efforts have determined that leopard frogs are negatively associated with the presence of bullfrogs, carp, and non-native predatory fish. In 2012, one of the key ponds was found to have been invaded by large bullfrogs.

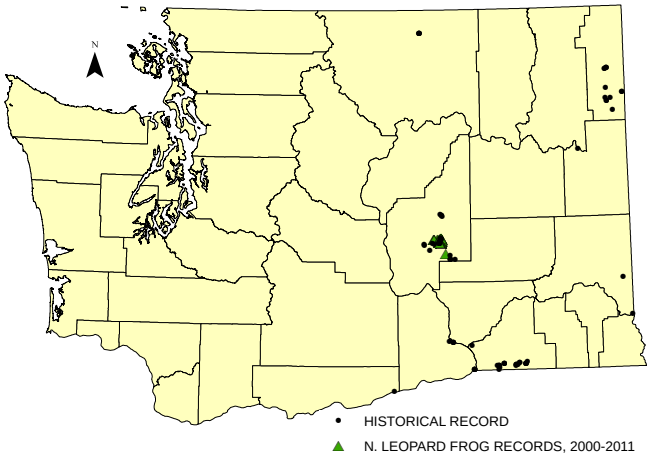

Figure 2. Historical and recent records of northern leopard frogs in Washington.

Factors affecting the species. Several factors likely contributed to the decline of leopard frogs in Washington (McAllister et al. 1999). The increasing spread of bullfrogs, which prey on leopard frogs and other amphibians, is a major problem. Introduced fish are also known to eat amphibians and are thought to cause significant declines in leopard frog populations. Agricultural chemicals have been implicated in the decline of amphibians in other areas and may affect leopard frog populations in Washington. Rotenone used to control unwanted fish can kill leopard frog tadpoles.

Habitat-related changes have caused declines of leopard frogs elsewhere in North America, and are possible problems in Washington. Expansion of native cattails and bulrush, and non-native phragmites,

reed canarygrass, and purple loosestrife can render breeding habitats unsuitable. Land use changes, irrigation projects, and development have contributed to changes in the hydrology of many areas, potentially affecting amphibians through rapid changes in water levels during critical embryonic and larval periods. Vehicles on roads can be a significant source of mortality as leopard frogs move from breeding to summer and overwintering habitats (Merrell 1977). Disease, particularly chytrid fungus, may also have contributed to the decline in Washington.

Conservation activities. In 2012, Washington State University discontinued a captive rearing program due to disease issues and lack of staff to adequately operate the facility. A graduate research project was initiated to develop methods to estimate population size within the subunits of the Northern Leopard Frog Management Area using mark recapture via photography (individuals have unique spot patterns) (Figure 3).

Figure 3. Northern leopard frog photo for mark-recapture study (*photo by R.Saylor, WSU*).

Partners and cooperators: U.S. Fish and Wildlife Service, Washington State University, Bureau of Reclamation.

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Oregon Silverspot Butterfly

(Speyeria zerene hyppolyta)

State Status: Endangered, 1993 (extirpated)
Federal Status: Threatened, 1980
Recovery Plans: Federal, 2001

Figure 1. An Oregon silverspot nectaring on pearly everlasting (*photo by Gary Falxa, USFWS*).

The Oregon silverspot butterfly is a small, darkly marked coastal subspecies of the zerene fritillary, a widespread butterfly species in montane western North America (Figure 1). The historical range of the subspecies extends from Westport, Grays Harbor County, Washington, south to Del Norte County, California (USFWS 2001). Within its range, the butterfly is known to have been extirpated from at least 11 colonies (2 in Washington, 8 in Oregon, and 1 in California). Currently, Oregon silverspot butterfly populations occur at six sites (5 in Oregon, 1 in California). In Washington, the population on the Long Beach Peninsula was last documented in 1991 and is presumed extirpated (WDW 1993). A population at Westport disappeared sometime prior to 1982 (D. Hays, pers. comm.).

Habitat and limiting factors. The Oregon silverspot occupies three types of grasslands: coastal salt spray meadows, stabilized dunes, and montane meadows. The butterfly's primary larval host plant is the hookedspur violet (*Viola adunca*) (Figure 2). Important adult nectar plants include common yarrow (*Achillea millefolium*), western pearly everlasting (*Anaphalis margaritacea*), Canada goldenrod (*Solidago canadensis*), and Douglas aster (*Symphyotrichum subspicatus* var. *subspicatus*). Soil conditions, wind, salt spray, and fire regimes historically maintained low, open grasslands within the species' range by suppressing encroaching trees and shrubs. Invasion by exotic species, natural succession, fire suppression, and land development have resulted in loss and modification of the species' habitat and the open meadow habitat has gradually been invaded by shrubs and trees. Management is needed to maintain sufficient habitat to sustain the species, curtail vegetative succession, and reduce other threats to the species and/or its habitat. Coastal sites are also under intense pressure from development and recreation. Much habitat has been destroyed by residential and commercial development. Other factors affecting silverspots include off-road vehicles, grazing, erosion, road kill, and pesticides.

Conservation activities. In Washington, WDFW and partners are gradually restoring suitable habitat. Habitat restoration and active management to maintain grassland is ongoing on the Long Beach Peninsula and Tarlat slough on the Willapa Bay National Wildlife Refuge, although no butterflies currently occupy these sites. The 30-acre Oregon Silverspot Butterfly Recovery unit of Johns River Wildlife Area, near the west side of Loomis Lake in Pacific County, provides some of the last remaining salt-spray meadows, including hookspur violets. Approximately 3 acres were cleared of trees in 2010–2011 to expand existing meadows. In addition, meadows are annually mowed to reduce encroachment by shrubs and small trees. The U.S. Fish and Wildlife Service is currently funding the production of native seed for habitat restoration efforts in southwest Washington and northeast Oregon. 2011 was

Figure 2. Hookedspur violet, larval host of Oregon silverspots (*photo by Gary Falxa, USFWS*).

the first year of direct seeding from the seed production efforts.

Augmentation and reintroduction will be essential for the recovery of this species. A captive-rearing program designed to maintain genetic variability in the population and increase the likelihood of its natural recovery was initiated in 1999 by The Nature Conservancy, Oregon Zoo, and Woodland Park Zoo. Pupated larvae are returned to Cascade Head and two other sites on the Oregon Coast, where they emerge as adult butterflies.

Partners and cooperators: U.S. Fish and Wildlife Service, Oregon Zoo, Woodland park Zoo, Institute for Applied Ecology, Xerces Society, North Coast Land Conservancy, Willapa Bay National Wildlife Refuge.

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Taylor's Checkerspot
(*Euphydryas editha taylori*)

State Status: Endangered, 2006
Federal Status: Candidate, 2001
Recovery Plans: None

Figure 1. Taylor's checkerspot (*photo by D. Stinson*)

Taylor's checkerspot, a subspecies of Edith's checkerspot, is a medium-sized butterfly with a striking checkered pattern of orange to brick red, black and cream (Figure 1). It was historically found on grassland habitats from southeastern Vancouver Island, British Columbia, through the southern Willamette Valley in Oregon. This included over 40 known locations in Washington from the San Juan Islands south to the Cowlitz River in Lewis County (Stinson 2005). They were once so numerous that Dornfeld (1980) described Willamette Valley meadows as "fairly swarming" with checkerspots. The subspecies is now restricted to a small scattering of about seven populations in Washington, one population in British Columbia, and two populations in Oregon. Sites occupied by Taylor's checkerspot included balds, coastal bluffs, and estuarine grasslands along the Strait of Juan de Fuca in Clallam County as well as prairies and balds in Thurston, Mason, Pierce, and Lewis counties. The subspecies became a candidate for listing under the federal Endangered Species Act in 2001 (USFWS 2001).

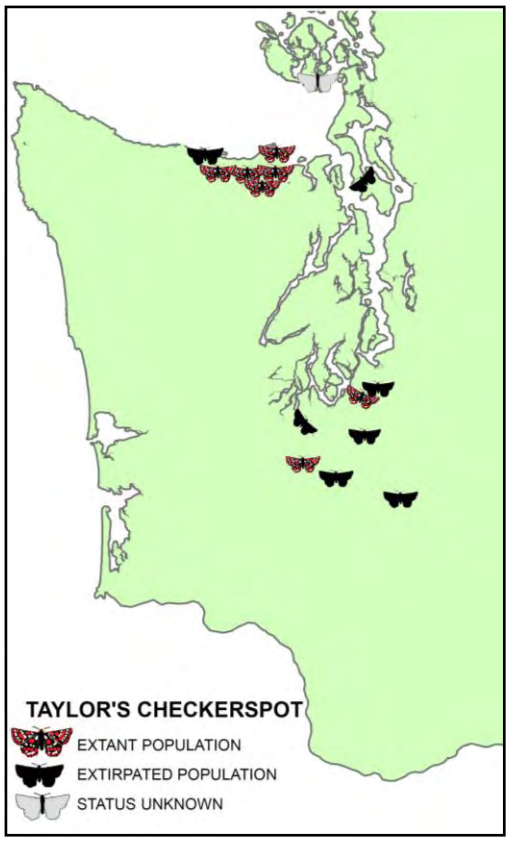

Figure 2. Extant and extirpated populations of Taylor's checkerspot in Washington (some sites have been aggregated with a single symbol).

Females emerge in the spring and lay eggs on host plants of the family Scrophulariaceae, which are often specific to sites (or populations); these include harsh paintbrush (*Castilleja hispida*; Figure 3), marsh speedwell (*Veronica scutellata)*, American brooklime *(V. beccabunga*), and non-natives including plantains (*Plantago lanceolata*, Figure 4, and *P. major*) and thyme-leaved speedwell (*V. serpyllifolia ssp. serpyllifolia*). When the caterpillars emerge, they depend on these primary host species for food until early summer, when they enter an inactive diapause stage. Emerging from diapause in late winter, the caterpillars feed more broadly on the primary hosts and other post-diapause food plants that may be available, including sea blush (*Plectritis congesta*), blue-eyed Marys (*Collinsia parviflora* and *C. grandiflora*), and dwarf owl-clover (*Triphysaria pusilla*).

The decline of Taylor's checkerspot in Washington has accompanied the loss of prairie and grassland habitats. As with other grassland-dependent species, forest encroachment together with invasion by non-native grass and forb species have degraded checkerspot habitat (Stinson 2005, Schultz et al. 2011). Severns and Warren (2008) describe loss of

Figures 3,4. Host species fed on by Taylor's checkerspot larvae: introduced plantain (*Plantago lanceolata*), left; and harsh paintbrush (*Castilleja hispida*), right (*photos by D. Stinson*).

habitat in a 0.5 ha occupied patch resulting from invasive grass, and suggest that invasive grasses led to extinction of other historically sites. Extensive habitat management, including herbicide, mowing, prescribed burning, and nectar and host-plant enhancement, is needed to restore the larval food and nectar plants required for the species' survival. Several occupied sites are on public lands, but are affected by recreation, military training, wildfires, and habitat degradation by exotic plants. The survival of the subspecies requires protecting and maintaining grassland habitat at existing sites, restoring habitat on degraded historical prairie, and reintroducting butterflies to establish additional populations.

Planning. An Interim Conservation Strategy is being prepared by WDFW and is expected to be completed in 2013. The purpose of the document is to direct conservation actions until a more complete recovery plan can be developed. In addition, an Action Plan is updated annually by the Taylor's checkerspot Working Group to prioritize a list of short-term (2-3 year) conservation actions needed to secure the species status. Current conservation actions include developing statistically robust monitoring methods, monitoring extant populations and recently occupied sites, and conducting surveys to locate additional extant sites.

WDFW is also working with Olympic National Forest to develop checkerspot management plans for occupied sites on Forest Service lands, and habitat management efforts for one site were initiated in 2011. WDNR and WDFW completed a management plan in 2011 for four Taylor's checkerspot sites on lands managed by WDNR in Clallam County. The plan includes site-specific management to minimize and mitigate the potential impacts to checkerspots and their habitat from timber harvest, silviculture, road maintenance, fire management, public use, and other activities.

Site specific restoration plans that outline tasks and actions that will develop suitable habitat for Taylor's checkerspot (as well as Mardon skipper, streaked horned lark and Mazama pocket gopher) are being developed by a team of land managers, with input from species specialists (Dunn 2011). To date, final plans have been developed for Scatter Creek Wildlife Area, Tenalquot Prairie Preserve, Mima Mounds NAP, Rocky Prairie NAP, Bald Hill NAP, and Wolf Haven and a draft plan has been developed for West Rocky Prairie Wildlife Area. An early draft plan is being developed for Glacial Heritage Preserve.

Status and listing. In October 2012, the USFWS published a proposed rule to list the Taylor's checkerspot as endangered under the federal Endangered Species Act; the proposed rule would also designate 6,000 ac of critical habitat (USFWS 2012). A final rule is expected in September 2013.

Captive propagation and reintroduction. A major part of WDFW's recovery program for Taylor's checkerspot involves captive propagation and translocation to re-establish additional populations on Puget Sound prairies (Linders 2011, 2012). The objective of this project is to establish at least three populations on three sites in the next decade. The Oregon Zoo has developed captive propagation techniques (Barclay et al. 2009). A second captive-rearing facility, Mission Creek Corrections Center for Women, began rearing Taylor's checkerspot in 2012 as part of the Sustainability in Prisons Project, operated via The Evergreen State College. The captive rearing institutions have demonstrated high degree of success rearing larvae, mating adults and producing eggs. Two sites have received multiple releases of Taylor's checkerspot caterpillars (larvae) and/or adult butterflies since 2009 (Figure 5-8). **C**aptive rearing and reintroduction combined with intensive habitat management has met with preliminary success. Larval releases have consistently produced adult butterflies with normal foraging, basking, mating, and ovipositioning behaviors. After two years of release, one site produced densities comparable to the extant Puget lowland site; no new releases have occurred since 2011 and numbers remain promising. Numbers at a second release site have not increased yet, but the site produces and retains a small population of adults.

In 2012, two new sites were selected for reintroduction from a suite of historic and potential sites within the known range of Taylor's checkerspot in South Puget Sound. A total of 2,540 postdiapause larvae were released in March, and 133 adults were released from captivity in May 2012, bringing the total to more than 15,000 larvae and 500 adults released since the program was initiated.

Figures 5-8. Taylor's checkerspot eggs, larvae, pupae, and captive-reared adult released in Washington (*photos, left to right, by M. Linders, Rod Gilbert, Rod Gilbert, and M. Linders*).

Each reintroduction site is expected to require multiple years of release followed by 5 years of monitoring to confirm population establishment. Long-term monitoring goals to measure progress toward population establishment were developed in 2012 based on population data from an extant site. Other project cooperators include US Fish and Wildlife Service, Joint Base Lewis-McChord, the Center for Natural Lands Management (CNLM), and WDNR-Natural Heritage Program.

Genetics project. A cooperative genetic research project involving the U.S. Forest Service, U.S. Fish and Wildlife Service, WDFW, and Washington State University-Vancouver was initiated in 2011 to investigate the genetic health, structure, and phylogenetic relationships of Taylor's checkerspot populations. Molecular markers will be used to assess genetic diversity and population structure across the range of the species and to determine if any of the disjunct populations should be designated as separate subspecies. Results are anticipated in 2013.

Habitat enhancement. Butterfly conservation is usually best accomplished through habitat preservation, in part, because their numbers cannot be readily managed (New et al. 1995). In order to enhance habitat at occupied and reintroduction sites, techniques for establishing host plants, controlling weeds, and controlling shrubs are being developed and tested, and routine maintenance of prairie vegetation, such as

prescribed burns and control of Scotch broom are ongoing at several sites on public lands. In 2011, WDFW completed a three-year project that enhanced occupied checkerspot habitat on state and private lands in Clallam County (Hays 2011). This WDFW/USFWS partnership included controlling exotic vegetation, establishing nectar plants, and removing trees and shrubs to maintain meadows and protect larval food plants.

Figure 9. Enhanced Taylor's checkerspot habitat on Joint Base Lewis-McChord.

To enhance and increase habitat for Taylor's checkerspot on the Bald Hill Natural Area Preserve, WDNR-Natural Heritage Program has been conducting various treatments since 2007 (Wilderman and Davenport 2011). Actions included conifer removal on several acres, shrub control on 3 acres, treatment of orchard grass on 1 acre, and direct seeding and planting of plugs of several plant species important for Taylor's checkerspot in 2010 and 2011.

Habitat restoration to support reintroduction of Taylor's checkerspot is a primary goal of the *Unoccupied Butterfly Habitat Enhancement* project funded by the Joint Base Lewis McChord ACUB Program, with additional funding from the US Fish and Wildlife Service (Dunn and Fimbel 2012). Many formerly occupied prairie sites do not currently support appropriate habitat and non-native grasses and forbs have established dense populations. The goal of the project is to efficiently restore a habitat condition adequate for Taylor's checkerspot reintroduction within identified management units on Glacial Heritage Preserve, Tenalquot Prairie, West Rocky and Scatter Creek Wildlife Areas, Mima Mounds and Rocky Prairie NAPs, and Wolf Haven International. A team of land managers has been implementing prescribed fire, weed control treatments and enhancing habitat through seeding and planting at these sites; from 2008-2011, they enhanced targeted sites with >250,000 seedlings and 110 kg of seed. During fall 2012, CNLM staff, volunteers, and Americorps, planted more than 66,000 seedling plugs and over 50 pounds of native seed on Thurston County prairies; and similar amounts on JBLM prairies in preparation for upcoming Taylor's checkerspot reintroductions (Fig. 9). Funding from JBLM's Fish and Wildlife program supports complementary restoration efforts on JBLM prairies, including Ranges 76 and 50, Training Areas 7S, 14, 15 and Johnson Prairie. CNLM produces about 200,000 seedlings per year for these efforts. The scale and success of restoration on JBLM prairies is significant and several of these sites offer prime opportunities for reintroduction.

Research. Research into oviposition preference by Taylor's checkerspot is occurring at the Mission Creek captive rearing facility under the guidance of a graduate student from The Evergreen State College. Initial results indicate that females prefer to oviposit on the natives, harsh paintbrush (*Castilleja hispida*) and golden paintbrush (*C. levisecta*) equally over the non-native English plantain (*Plantago lanceolata*). Golden paintbrush is a federally threatened species which USFWS has been aggressively restoring across numerous historic locales throughout the Puget Trough and in Oregon. Severns and Grosboll (2011) investigated patterns of reproduction and habitat use in four populations of Taylor's checkerspot in Washington to identify and quantify habitat conditions that are associated with, as well as, conditions that discourage butterfly oviposition. Identification of reproductive habitat and characterization of the conditions will aid site-specific management, habitat restoration, assessment of reintroduction site suitability. Understanding patterns of pre-diapause host plant use is important because only the presence of pre-diapause plants will result in colonization. Bennett et al. (2011) reported observations of patrolling

and perching, and evidence of mate-guarding behavior in Taylor's checkerspot at sites in Oregon and Washington. Dunwiddie and Bakker (2011) review recent efforts in restoration of the Willamette Valley-Puget Trough-Georgia basin prairie and oak-dominated habitats.

Russell and Schultz (2010) and LaBar and Schultz (2012) investigated the effects of grass-specific herbicides on butterflies using Puget blues (*Icaricia (Plebejus) icarioides blackmorei* Barnes and McDunnough) and Cabbage whites (*Pieris rapae*) as a model species. Herbicides are an essential tool in restoring habitat for Taylor's checkerspot.

A review and strategy document is in preparation by experts in butterfly conservation and will be completed in 2013. Recommendations for research and monitoring were completed in 2012 (Weiss 2013).

Taylor's Checkerspot Working Group. The Center for Natural Land Management coordinates annual meetings of a range-wide interagency Taylor's checkerspot working group aimed at information exchange, cooperative conservation and promotion and prioritization of recovery actions.

Acquisition. In 2012, a 152 ac site in Clallam County occupied by Taylor's checkerspot was acquired for conservation, and will initially be managed by CNLM.

Partners and cooperators: Oregon Zoo, Evergreen State College Sustainable Prisons Project, Mission Creek Corrections Center for Women (Washington Department of Corrections), U.S. Fish and Wildlife Service, Joint Base Lewis-McChord, Center for Natural Lands Management, U. S. Forest Service-Olympic National Forest, U.S. Natural Resources Conservation Service, Xerces Society, U.S. Forest Service-Genetics Lab, Washington State University-Vancouver, Washington Department of Natural Resources, Weyerhaeuser, Thurston County, Wolf Haven International, University of Washington.

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Mardon Skipper

(*Polites mardon*)

State status: Endangered, 1999
Federal status: Species of concern
Recovery plans: None

Figure 1. Mardon skipper (*photo by Rod Gilbert*).

The Mardon skipper butterfly is a small (<1"), tawny-orange butterfly (Figure 1) dependent upon grassland habitats dominated by native grass species. Skippers are small butterflies that get their name from their fast erratic flight; they can be recognized because when perched, they hold their front and hind winds at different angles. The larvae of grass skippers in the subfamily Hesperiinae feed on grasses and sedges (Pyle 2002). Mardon skippers exist in four disjunct areas in Washington, Oregon and California. In Washington, the majority of sites are in the southern Cascades, but a few populations occur on south Puget Sound prairies.

Population status. In 1999, the Mardon skipper was known from a total of 14 sites in Washington, Oregon and California (Potter et al. 1999). By 2011, many additional sites had been discovered in Washington, primarily in the south Cascades (Table 1), while the number of occupied sites in the southern Puget Sound region was reduced to 4. Minimum abundance estimates in 2009 for the north and south units of Scatter Creek Wildlife Area were 84–360 and 399–1,286 individuals, respectively (Potter and Olson 2012). Populations are also patchily distributed in the Artillery Impact Area (AIA) at Joint Base Lewis-McChord and are roughly estimated to be 200-400 butterflies (Schultz et al. 2011).

The current known range in the Washington Cascades extends from the Rimrock Lake area along Highway 12 south to Glenwood and east to the Simcoe Mountains north of Goldendale. A total of 108 occupied sites were known from federal, tribal, and private lands in this portion of the state in 2011 (Table 1; USFWS 2012). Many of these sites have modest numbers of Mardon skippers (less than 50 individuals), and may be satellites of larger populations; a few host populations of hundreds, and at least two sites may support >1,000 individuals. Sites are typically isolated small meadows surrounded by miles of forest, with no apparent connectivity for dispersal between local populations (Kerwin and Huff 2007); skippers may not recolonize a site unless the distance between sites is less than 1 mi (USFWS 2010).

Table 1. Numbers of known occupied sites and populations or site clusters of Mardon skippers in Washington, 2000-2011 (USFWS 2012).

Location	Number of occupied sites	Number of populations (site clusters)
South Puget Sound	4	4
Southern Washington Cascades		
Okanogan-Wenatchee NF	36	15
Gifford Pinchot NF	43	13
Yakama Nation	23	11
Glenwood-Goldendale	6	4
Total	111 sites	46 populations

Habitat. In the south Puget Sound region, the species is found in open, glacial outwash grasslands with abundant Roemer's fescue (*Festuca roemeri*) interspersed with early blue violet (*Viola adunca*) (Potter et al. 1999). On these prairies, adults feed on nectar from a variety of herbaceous plants. Early blue violet and common vetch (*Vicia sativa*) are strongly preferred as nectar sources and Scotch broom (*Cytisus scoparius*) is strongly avoided (Hays et al. 2000). Nectaring has also been observed on common camas (*Camassia quamash*), prairie lupine (*Lupinus lepidus*), fine-leaved desert parsley (*Lomatium utriculatum*), western buttercup (*Ranunculus occidentalis*), sea blush (*Plectritis congesta*), and yarrow (*Achillea millefolium*).

Plant species used by Mardon skippers for oviposition and larval food vary per location (Beyer 2009, Beyer and Schultz 2010). On South Puget prairies, Mardon skippers oviposit on Roemer's fescue almost exclusively, indicating a strong association with this grass species (Henry 2010). In the Cascades, oviposition is known on 23 different plant species, but Mardon skippers are selective for certain grass species in different meadows (Beyer and Schultz 2010). The most frequently used oviposition plants include Idaho fescue (*Festuca idahoensis*), Kentucky bluegrass (*Poa pratensis*), timber oatgrass (*Danthonia intermedia*), long-stolen sedge (*Carex inops*), and red fescue (*Festuca rubra*). One-spiked oatgrass (*Danthonia unispicta*) appears to be an important grass species at sites on Wenatchee National Forest. Females have been observed ovipositing on this species (Henry 2010), and higher densities of adult butterflies are commonly associated with patches of *D. unispicta* (St. Hilaire et al. 2009). The variety of identified oviposition plants suggests that females may not always oviposit on specific host plants, but within a community of possible species that can be used by the larvae (Beyer and Black 2007).

Figure 2. Meadow in Cascades occupied by Mardon skippers (*photo by Xerces Society*).

Threats. Open grassland habitat in the south Puget Sound region has declined dramatically in the past 150 years due to agricultural and residential development, fire suppression, livestock grazing, and introduction of exotic plant species. Invasion by Scotch broom (*Cytisus scoparius*) and tall oatgrass (*Arrhenatherum elatius*) is a major threat. As a result of fire suppression, conifers have encroached into native grasslands, reducing both habitat for skippers and connectivity between grassland habitats. Management efforts to control invasive plants and maintain grasslands (prescribed fire, mowing, and herbicides), can also result in direct mortality of Mardon skippers. In the Cascades, intensive grazing is an ongoing issue at many Mardon skipper sites resulting in the loss of adult nectar sources, larval food plants, and presumably some direct mortality to butterfly larvae. Other threats include the unregulated use of off-road vehicles at several sites, pesticide applications (Btk), logging road construction, and military training and recreational activities in the south Puget Sound sites.

Current conservation actions. WDFW has been developing and testing survey methods to estimate numbers of Mardon skippers. Distance sampling has proven effective for monitoring the species at Scatter Creek Wildlife Area (Potter and Olson 2012). In 2012, WDFW continued research to understand oviposition habitat on Puget prairies; 27 oviposition locations were observed on JBLM and Scatter Creek (Beyer 2012).

WDFW is conducting intensive habitat restoration at the Scatter Creek Wildlife Area to protect and enhance Mardon skipper populations. Ongoing efforts include prescribed fire, direct seeding of native species, mowing, and herbicide control of Scotch broom and exotic grasses and forbs. WDFW is also

restoring once-occupied habitat at West Rocky Prairie Wildlife Area, and is working with WDNR to restore and evaluate habitat at Mima Mounds Natural Area Preserve for reintroduction. Ongoing habitat management efforts are funded by grants from the Recreation and Conservation Office and Joint Base Lewis-McChord, Army Compatible Use Buffer program.

WDFW and the Oregon Zoo have been attempting to develop rearing methods for Mardon skippers that could be used to produce large numbers of skippers in captivity, but these efforts have not been successful to date (Schultz et al. 2011).

In 2012, the USFWS published a 12-month finding on a petition to list the Mardon skipper under the Endangered Species Act. They found listing was not warranted because the increased survey effort from 2000-2011 dramatically increased the number of known sites, predominantly on National Forests.

Partners and cooperators: Forest Service/BLM Interagency Special Status Species Program, U.S. Fish and Wildlife Service, Xerces Society, Center for Natural Lands Management, Recreation and Conservation Office, Joint Base Lewis-McChord, Gifford Pinchot National Forest, Wenatchee-Okanogan National Forest, Washington Department of Natural Resources, Oregon Zoo.

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Figure 3. Mardon skipper (*photo by Tom Kogut*).

Western Gray Squirrel

(*Sciurus griseus*)

State Status: Threatened, 1993
Federal Status: Species of concern
Recovery Plans: State, 2007

Figure 1. Western gray squirrels (*photos by Joseph V. Higbee*)

The western gray squirrel is the largest native tree squirrel in Washington. They are dark gray with pure white underparts, and have large ears and a large tail that is as long as the body (Figure 1). Similar species include the eastern gray (*S. carolinensis*) and fox (*S. niger*) squirrels. Adult eastern gray squirrels are about 20% smaller, typically have pale gray dorsal pelage with a brown to reddish wash, and the ears and tail are shorter (Linders and Stinson 2007). Adult fox squirrels are similar in size to western gray squirrels, but have a rufous or cinnamon belly and short ears (http://wdfw.wa.gov/conservation/gray_squirrel/index.html). Western gray squirrels range from north-central Washington southward through the western half of Oregon to southern California (Carraway and Verts 1994).

Arboreal and generally solitary in their habits, western gray squirrels mostly forage on the ground, but rarely stray far from trees. They use stick nests for resting and sleeping, and females use cavity nests for parturition and rearing of young. Pine nuts, acorns, seeds, green vegetation, hypogeous fungi (truffles and false truffles), and fruit are the main components of the western gray squirrel diet.

Historically, western gray squirrels were more widespread in Washington, but currently occur only in three geographically isolated populations: (1) Pierce County in the Puget Trough; (2) Klickitat, Yakima, and Skamania counties in the southeastern foothills of the Cascades; and (3) Chelan and Okanogan counties in north-central Washington (Figure 2; Linders and Stinson 2007). They inhabit transitional forests of mature Oregon white oak, ponderosa pine, Douglas-fir, and various riparian tree species (Linders and Stinson 2007). Habitat quality in Washington is assumed to be relatively poor compared to other parts of the species' range due to the lower number of oak species and degradation of pine and oak habitats. The cumulative effects of land conversion, logging, sheep grazing, and fire suppression largely eliminated the open-grown stands of mature and old growth pine and have

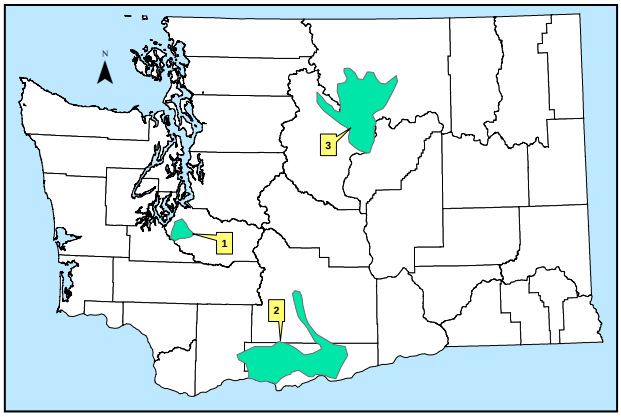

Figure 2. Current range of western gray squirrels in Washington (Linders and Stinson 2007).

degraded oak woodlands (Linders and Stinson 2007). The most recent population estimate for Washington was between 468 and 1,400 squirrels, based on data gathered from 1994 to 2005 (Linders and Stinson 2007). Population size can fluctuate dramatically with disease and changes in food supply.

Surveys. Hair-snare tubes, first used for detecting western gray squirrels on Joint Base Lewis-McChord (Fimbel 2004a), are a technique being increasingly used to delineate squirrel distribution, particularly where densities are low near the edge of the species' range. WDFW, the Pacific Biodiversity Institute, and the University of Washington have conducted tube surveys in Okanogan and Chelan counties since 2007. These efforts, which included a citizen science project, have expanded the known range of western gray squirrels in both the Okanogan and Methow watersheds (Pacific Biodiversity Institute 2012).

Despite significant forest changes over the last 40 years, squirrel habitat still exists in Chelan County and warrants surveys to document current squirrel distribution. In 2010, 56 hair snag bait tubes were distributed in 4 drainages of suitable habitat along the south shore of Lake Chelan in Wenatchee National Forest. Hair samples tentatively identified as western gray squirrels indicated the presence of this species in several drainages that were not known to be occupied (Gallie 2010). Prior to this effort, most western gray squirrels in Chelan County (outside of the Stehekin Valley) were only known to occur in low elevation areas (<1,000 ft), along developed areas with stands of domesticated walnut and other deciduous trees. In 2011, tubes were placed at 50 sites in 5 drainages on the south shore of Lake Chelan. Twenty-four hair samples were collected, 5 of which were possibly from western gray squirrels. These determinations await confirmation. WDFW also initiated tube surveys in the Nile valley in Yakima County in 2011.

In Chelan County in 2012, 37 hair-snag tubes were placed to document current distribution of western gray squirrels. Tubes were placed at 18 sites on the North Shore of Lake Chelan, two other routes were in the Entiat Valley. No positive detections were made.

Hair-snag tubes were deployed in the Okanogan watershed to document the northern extent of western gray squirrel distribution in Washington. All hairs were checked but no positive western gray squirrel detections were found.

WDFW coordinated with Pacific Biodiversity Institute in the Methow which was in its third year of having volunteers run hair-snag tubes throughout private and public lands in the Methow watershed. In 2011, they recorded 629 observations at 101 hair tube sample locations. There were five population centers in the seventeen sample locations containing western gray squirrel hairs (Pacific Biodiversity Institute 2012). Two of these locations were new sightings, located more than 500 meters from a previously known site. In 2012, volunteers deployed hair tubes at 186 sample locations from French Creek to Early Winters, the Chewuch River, Twisp River and a number of tributaries;

Figure 3. Juvenile western gray squirrels (*photo by Matt Vander Haegen*)

western gray squirrel hairs were captured at 10 sites, four of these sites were new. The other six sites were located in a cluster where gray squirrels had been discovered earlier. More information about their project can be found at: http://www.pacificbio.org/initiatives/wgs/squirrel-news.html .

Conservation actions and research. WDFW completed a state recovery plan for western gray squirrels in 2007 (Linders and Stinson 2007) and updated its Priority Habitat and Species Management Recommendations for the species in 2010. Where forest practices occur in suitable habitat, voluntary guidelines have been developed to protect nest trees and large, mast-producing trees, and maintain the needed canopy closure and connectivity (Linders et al. 2010). Research has been conducted on all three populations in the state by WDFW and partners.

Klickitat research. In 1998–1999, home range and habitat use by western gray squirrels was studied on the Klickitat Wildlife Area in Klickitat County by a University of Washington graduate student (Linders 2000, Linders et al. 2004). WDFW expanded the research in 2000 to include a site on private timberlands. From 2000–2005, 149 individual squirrels were captured and ear-tagged or equipped with radio transmitters. Radio-tracked squirrels were used to evaluate reproductive success, home range, movement, juvenile dispersal and survivorship. Mark-recapture methods on a 78–ha grid were used to estimate population densities (Vander Haegen et al. 2005). WDFW also conducted a preliminary investigation evaluating the effects of timber management on western gray squirrels in 1999–2000 (Vander Haegen et al. 2004).

Okanogan region research. During 2003-2005, Gregory (2005) studied selection of nest sites and nest trees by radio-collared squirrels in Okanogan County. Movements and total home-range estimates in the study area were significantly larger than estimates reported for populations in California, Oregon, and south-central Washington. Nest sites with high selection probability by squirrels had greater basal area, larger mean dbh, and higher richness of tree species than control sites (Gregory et al. 2010)

Stuart (2012) studied distribution, life history, and response to fire fuel treatments in the North Cascades during 2008-2011, using live trapping, telemetry, and genetic sampling. Squirrels used fuel treated and wildfire areas within their home ranges disproportionately, and found no evidence that fuels treatment negatively affected western gray squirrel diet or habitat at the home range scale. However, nesting areas had characteristics that can decrease with fuel reductions, such as large trees, dwarf mistletoe, high canopy cover, and connectivity; she suggested that fuels treatments should retain patches of large trees with mistletoe, and connectivity to protect nesting habitat (Stuart 2012).

Genetic analysis suggested that population of western gray squirrels in the North Cascades of 500-1,000 individuals (Stuart 2012). Female home range sizes in her Stehekin and Squaw Creek study sites were smaller than those in Black Canyon reported by Gregory et al (2010). The population size estimate and home range size information suggest that the North Cascades may provide better habitat and support a somewhat larger population than previously assumed. The Stehekin population, although small, did not have significantly lower levels of heterozygosity and allelic richness than the Methow Valley. Genetic data indicated immigration from the Methow Valley to Stehekin. The one-way movements and higher mortalities at Stehekin suggested it might be a sink population (Stuart 2012). One male squirrel moved 37 km.

Puget Trough research. An intensive study of western gray squirrel ecology on Joint Base Lewis-McChord was initiated by WDFW in 2006. Research on the resident squirrel population has focused on quantifying population parameters including survival, causes of mortality, productivity, and resource selection. This information will be critical for assessing why the Puget Trough population has contracted over the last few decades and for focusing recovery efforts. Since October 2006, 142 resident squirrels have been captured and radio-tagged, with >18,000 telemetry locations recorded for 124 animals. Mean

survival of 82 resident squirrels was about 63%, similar to that observed in Klickitat County (Vander Haegen and Orth 2011).

A companion study investigating potential competition between eastern and western gray squirrels was initiated by a University of Washington graduate student in 2007. Johnston (2013) tracked eastern and western gray squirrels with radio-telemetry for four years to investigate resource use and interactions between species on Joint Base Lewis-McChord. Following a monitoring period of 1-2 years, eastern gray squirrels were experimentally removed from two sites. Dietary overlap for most food resources was high between eastern and western gray squirrels but they did not share space and had little overlap in their use of habitat types. Western gray squirrels were found primarily in coniferous uplands with little understory vegetation, whereas eastern gray squirrels were in riparian areas with deciduous trees and dense understory. Few western gray squirrels moved into areas formerly occupied by eastern gray squirrels, and he found no increases in body mass, fecundity, or survival for western gray squirrels. He concluded that coexistence of eastern and western gray squirrels appears possible where distinctly different upland and riparian habitats occur in an area (Johnston 2013).

Puget Trough augmentation. The Puget Trough population of western gray squirrel faces the greatest extinction risk in Washington (Linders and Stinson 2007). Available evidence in about 2000 suggested that the population had declined dramatically since the early 1990s, when numbers were already small, and might be dangerously low (Bayrakci et al. 2001). Causes for the decline likely include habitat loss, habitat alteration, and increased mortality related to vehicle traffic (Ryan and Carey 1995). In 2007, WDFW and Joint Base Lewis-McChord initiated a cooperative plan to augment the western gray squirrel population on the base with the goal of increasing the population's size, its genetic diversity, and its area of occupation (Vander Haegen et al. 2007). From 2007–2011, a total of 83 western gray squirrels from Klickitat and Okanogan counties and from Hood River and Wasco Counties, Oregon, were released on the base (Figure 4). Translocated animals were radio-collared and tracked as part of the ongoing ecology study on Joint Base Lewis-McChord. Survival of translocated squirrels has been equivalent to that of resident animals and numerous translocated females have produced

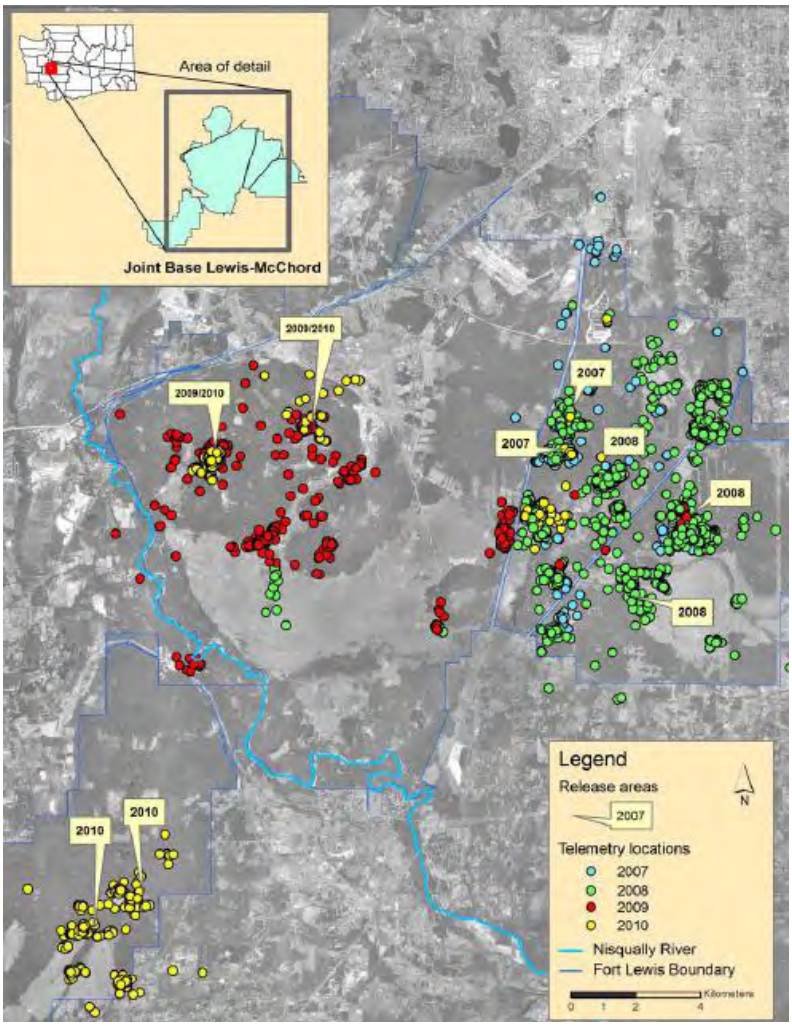

Figure 4. Telemetry locations for western gray squirrels translocated to JBLM, 2007-2010 (Vander Haegen et al. 2011).

young (Vander Haegen and Orth 2011). The augmentation project and ecology study will be completed in 2012, but additional translocations to the Puget Trough population are planned as funds are available.

Oregon white oak research. The USDA Forest Service, Pacific Northwest Research Station, in cooperation with the Fort Lewis Forestry Program, initiated a study of the response of Oregon white oak to release from overtopping by Douglas-fir and to different methods of planting oaks (Devine and Harrington 2004). Preliminary results suggested that full release of oaks rather than an incremental release may be more beneficial for oaks in the Puget Sound region (Devine and Harrington 2004). In addition, the PNW Research Station has been conducting research on the factors affecting acorn production (Peter and Harrington 2002, 2004). These studies may help in improving methods of habitat enhancement for western gray squirrels. The Nature Conservancy was also involved in oak release and habitat restoration on JBLM (Fimbel 2004b).

Partners and cooperators: Joint Base Lewis-McChord, University of Washington, National Park Service, U.S. Forest Service, The Nature Conservancy, Washington Department of Natural Resources, Klickitat County, Yakama Nation, Oregon Department of Fish and Wildlife, Pacific Biodiversity Institute.

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Mazama Pocket Gopher

(*Thomomys mazama*)

State Status: Threatened, 2006
Federal Status: Candidate, 2001
Recovery Plan: State, 2013 (Draft)

The Mazama pocket gopher was state-listed as Threatened in 2006. In 2012, four subspecies were proposed for listing as Threatened under the Endangered Species Act (USFWS 2012).

Figure 1. Mazama pocket gopher (*photo by Rod Gilbert)*.

The Mazama pocket gopher is one of the smallest of 35 species in the pocket gopher family. In Washington, it is only found west of the Cascades. It differs from the similar-sized northern pocket gopher (*T. talpoides*) of eastern Washington in fur color, tooth and skeletal characteristics, and a larger dark patch of fur behind their ears. Pocket gophers spend most of their time within their system of burrows. They are frequently confused with moles, but moles do not have prominent teeth (Figure 2), and the soil mounds that they leave behind are dome-shaped while the mounds left by gophers are often lower and more irregular or fan-shaped. Gophers are believed to be generally solitary and exclude other gophers from their burrows except when breeding and when females have litters. When pocket gophers have established a territory, they generally remain there, although they will shift their home range in response to seasonally wet soils.

Figures 2,3. Mazama pocket gopher showing characteristic incisors, front claws, and cheek pouches (left), and soil mounds created by a gopher (right).

Pocket gophers have been called 'keystone species' and 'ecosystem engineers' because they affect the presence and abundance of plants and other animals (Vaughan 1961, 1974; Reichman and Seabloom 2002). Their extensive excavations affect soil structure and chemistry, and their food caches and latrines enrich the soil, affecting plant community composition and productivity. Mazama pocket gophers eat a wide variety of roots and above-ground plant parts. Perennial forbs are preferred over grasses, and fleshy roots and bulbs, such as camas (*Camasia* spp.) are important when green vegetation is not available. Gophers also eat fungi and disseminate the spores of species that have an important role in facilitating plant growth. Mazama pocket gophers are an important prey species for many predators, including hawks, owls, coyotes, and weasels, and their burrows provide retreats for many salamanders, western

toads, frogs, lizards, small mammals, and invertebrates (Stinson 2005).

Several populations are sufficiently distinct to be described as separate subspecies, particularly those that are geographically isolated. The species is currently represented in Washington by six existing subspecies (Figure 2). Mazama pocket gophers are currently known to be in Clallam (1), Mason (2), Pierce (4) and Thurston (5,6,7) counties (Figure 3). They were also historically found around Tacoma (3), and in Wahkiakum County (8) but these may all be extinct.

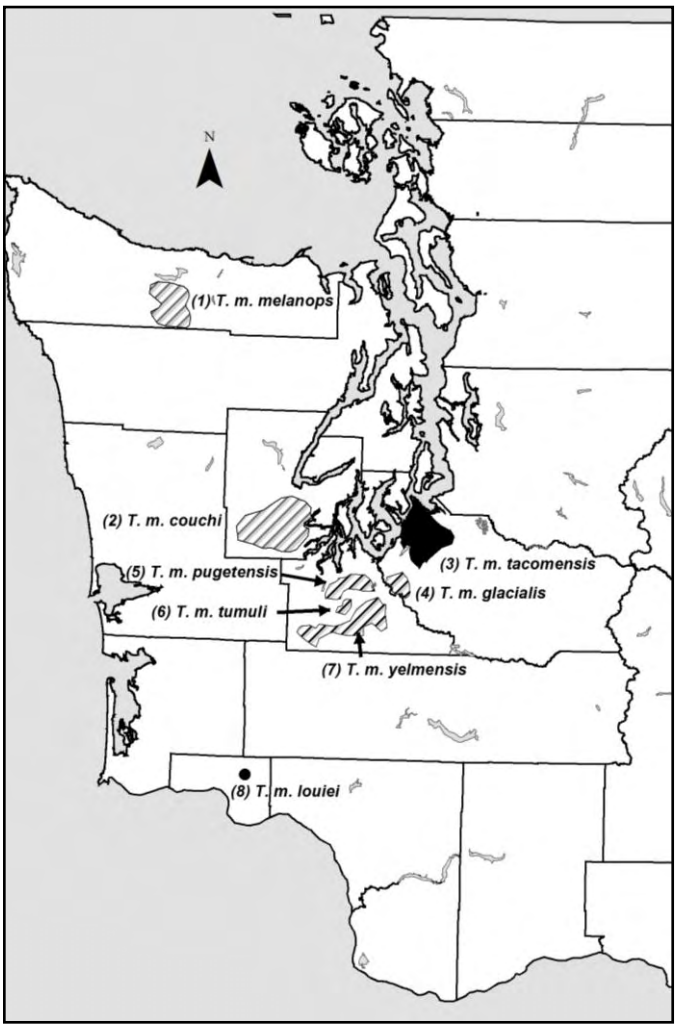

Figure 3. Ranges of 6 extant (diagonal lines) and 2 extinct (black) subspecies of *T. mazama* in Washington (Hall 1981).

Habitat. Mazama pocket gophers were historically widespread and abundant on the glacial outwash prairies of the southern Puget Sound region; and they also occur on subalpine meadows of the Olympic Mountains (Dalquest 1948). While they are most commonly found in areas with sandy or gravelly loam soils on land that historically was prairie; they will move into sites with well drained soil where forest cover has been removed, including recent clearcuts. This has most frequently been observed in Mason County. They are otherwise essentially absent from forest habitats in Washington. Mazama pocket gophers occur in woodland in Oregon, particularly in ponderosa pine communities, but they are absent from dense forest (Verts and Carraway 1999). Gophers also are rare where grassland has been taken over by dense Scotch broom (Steinberg 1996, Olson 2011b). Mazama pocket gophers do not appear to require high quality prairie, but can live in a wide range of grasslands, particularly if they include a significant component of forbs, such as clover, lupines, dandelions, false dandelions, and camas. In addition to remnant prairies, occupied sites in Washington include grassy fields at airports, pastures, fields, and Christmas tree farms. *T. m. melanops* is found in open parkland and subalpine meadows in the Olympic Mountains (Johnson and Cassidy 1997).

The distribution and abundance of pocket gophers are greatly affected by soils. Soil characteristics that affect gophers include depth and texture, particularly rock and clay content that affects burrowing ability, permeability that can result in periodic flooding of burrows, and water-holding capacity and fertility that affect growth of plant foods. In general, pocket gophers prefer deep, light-textured, well-drained soils, and do not occur in peat or heavy clay soils (Chase et al. 1982, Baker et al. 2003). The distribution of Mazama pocket gophers appears correlated with prairie soil types, but they are not found on all remnant prairie sites. They rarely occur where soil is very rocky (Steinberg and Heller 1997, Olson 2011b). There are local populations in non-prairie loam, sandy, and gravelly soil types (e.g., Indianola loamy sand, Grove, Everett) that may have been unused by gophers historically due to forest cover. These occurrences often are adjacent to more typical prairie soils (e.g., Nisqually soils). They may be able to

occupy any site that supports herbaceous vegetation, does not have significant tree cover, and is well-drained sandy, loamy, or gravelly soil. *T. mazama* in Washington have not been found in clay, and there are few records in silt soils. In summary, deep well-drained, sandy loam or loamy sand with sufficient fertility and water holding capacity to support desired forbs appears to provide optimal habitat (Baker et al. 2003).

Population status. There are perhaps 3 or 4 large Mazama pocket gopher populations (i.e., 1,000s) in the Thurston and Pierce County area. The Olympia Airport and surrounding Tumwater area is located on the best soil type for gophers, and probably contains the largest remaining population. The largest populations appear to be found on the Olympia and Shelton Airports, Scatter Creek Wildlife Area, and Joint Base Lewis McChord. Many surviving *T. mazama* subpopulations are small (<50) and appear to be isolated from other subpopulations, although there are few data on dispersal to help delineate genetically connected populations.

There has been an increased survey effort in recent years to minimize impacts of development and to inform recovery planning. In 2011, WDFW staff revisited nearly all the historical locations of gophers in Tacoma and Dupont in Pierce County; there was little or no habitat remaining at many sites, and no sign of gophers. Gopher presence was confirmed with live-trapping at a few previously unreported sites in Mason County in fall 2011. Cursory observations suggested that gophers may still exist at some historical sites in the county where they were thought extirpated. In 2012, WDFW conducted extensive Mazama pocket gopher surveys with 784 plots in Thurston, Mason, Pierce, and parts of Lewis and Grays

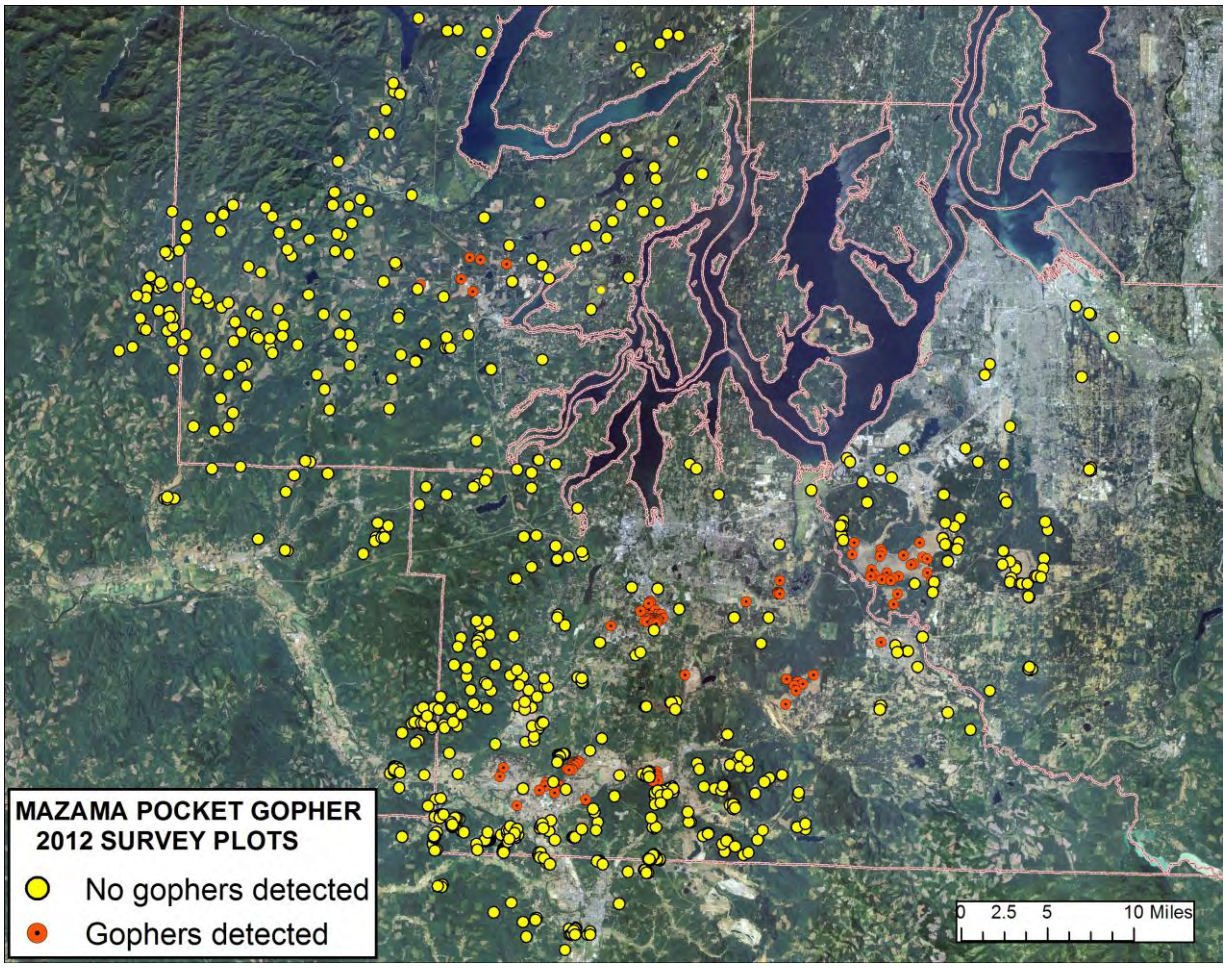

Figure 4. Plots sampled for Mazama pocket gophers in the south Puget Sound region, 2012.

Harbor counties, and ~150 supplemental site visits in these counties as well as Wahkiakum and Clark counties. Historical sites were also revisited in Clallam County. The survey results (Figure 4) confirmed previous descriptions of the distribution of Mazama pocket gophers in Washington as summarized in Stinson (2005).

Threats/reason for decline. Although significant areas remain in grassland, substantial portions of the Mazama pocket gopher habitat in the south Puget Sound have been lost to development, agriculture, and succession to forest, and what remains continues to be degraded by invasion of Scotch broom and other non-native plants. Residential development that becomes high density has been particularly destructive to prairie habitat, and probably led to extinction of *T. m. tacomensis*. Though Mazama pocket gophers are generally protected in recent years by state, county, and local regulation, development may result in some unavoidable habitat loss and additional fragmentation and isolation of habitat patches. Pocket gophers may not persist in high density residential areas due to effects of frequent mowing, herbicides, impervious surfaces, and perhaps elevated mortality rates resulting from predation by cats and dogs and trapping or poisoning intended for moles. These degraded sites may often represent habitat that can support young that have dispersed, but offer inadequate food to consistently support reproduction. Most occupied habitat on public lands is affected by non-conservation uses including military training and recreation. Gopher populations at airports can be affected by development of airport-related facilities and businesses and management of the vegetation around airport runways and taxiways. Gopher populations benefit from mowing at airports and prescribed burns at Join Base Lewsi-McChord which prevents invasion of the extensive grassland by woody vegetation.

Research projects. A pilot translocation project, initiated in 2005, appears to have succeeded in establishing a population on mounded prairie at Wolf Haven International in Thurston County (Linders 2008). WDFW initiated a study in 2009 to evaluate the feasibility of using translocations to establish new populations of gophers (Olson 2012). Gophers were captured at Olympia Airport and released at WDFW's West Rocky Prairie Wildlife Area in Thurston County, where a small population is established. The study demonstrated that establishing a self-sustaining population is feasible, but can require a significant, multi-year effort involving release of large numbers of animals (e.g., >100 animals per year). A third WDFW study is investigating characteristics of gopher dispersal that can help evaluate the degree of connectivity and long-term viability of populations (Olson 2011a).

An occupancy modeling study completed by WDFW found that gophers were much more detectable in fall than in spring, and that gopher presence was negatively associated with Scotch broom, shrubs, and percent of visible substrate in rocks (Olson 2011b). Results will be helpful in predicting whether sites are suitable for gophers.

Habitat management. Habitat management efforts (control of shrubs such as Scotch broom, exotic grasses, and re-establishment of a diversity of native grasses and forbs) to benefit Mazama pocket gophers are ongoing at a number of sites, including: Scatter Creek Wildlife Area, West Rocky Prairie Wildlife Area, Wolf Haven International, and Weir and Tenalquot prairies on Joint Base Lewis-McChord.

Partners and cooperators: U.S. Fish and Wildlife Service, Joint Base Lewis-McChord, Thurston County, Center for Natural Lands Management, University of Washington, Olympic National Park, Wolf Haven International, Port of Olympia, Washington Department of Transportation.

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Steller Sea Lion

(*Eumetopias jubatus*)

State Status: Threatened, 1993
Federal Status: Threatened, 1990
Recovery Plans: Federal, 2008

Figure 1. Male and female Steller sea lions (*photo by Andrew Trites)*.

Steller sea lions in Washington belong to the Eastern U.S. stock, which occurs east of 144° longitude from California to southeastern Alaska (Allen and Angliss 2013). Adult males and females weigh up to 1,100 kg and 350 kg, respectively, which makes the species considerably larger than the California sea lion (adult males up to 450 kg, females up to 100 kg). Male Steller sea lions set up territories on rookeries in mid-May; females arrive soon after and give birth to a single pup between late May and early July. Females alternate between nursing their pup and making feeding trips. Most pups are weaned by the end of their first year. In Washington, the species uses jetties, offshore rocks, coastal islands, and navigation buoys as haulout sites. A number of haulouts have been documented in the state (Jeffries et al. 2000). Recent counts found over 1,000 Steller sea lions at haulout sites along the outer Washington coast during their summer breeding season (Figure 2; S. Jeffries, unpubl. data).

The species is not known to migrate, but individuals disperse widely outside of the pupping season, thus potentially intermixing with animals from other areas. Despite the wide-ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears low, although males have a higher tendency to disperse than females (NMFS 1995, Trujillo et al. 2004, Hoffman et al. 2006).

Rookeries in the Eastern U.S. stock are located in Alaska, British Columbia, Oregon, and California. Based on branding and telemetry studies, Steller sea lions in Washington originate from rookeries in Oregon, British Columbia, and Alaska. Pupping areas occur along the outer Washington coast with up to 25 pups born annually. A northward shift in the overall breeding distribution has occurred, with a contraction of the range in southern California and new rookeries established in southeastern Alaska (Pitcher et al. 2007). The stock has been increasing 3.1% annually in southeastern Alaska, British Columbia, and Oregon since the mid-1970s, and decreasing in southern and central California since the early 1980s (Pitcher et al. 2007, Allen and Angliss 2013). The minimum population size for the stock was 52,847 animals based on counts of hauled out individuals from 2001 to 2009 (Allen and Angliss 2013). This count did not include sea lions that were at sea. Using pup counts at rookeries near the end of the birthing season from 2006-2009, the population was estimated at 58,334 to 72,223 sea lions.

Steller sea lions are vulnerable to a number of human-related forms of mortality (NMFS 2008). For the Eastern U.S. stock, these include fisheries-related mortality, subsistence harvest in Alaska and British Columbia, illegal shooting, disturbance, entanglements in debris, and contaminants. Other potential factors are predation by killer whales, climate change, and reduced prey biomass, although none are currently considered serious threats (NMFS 2008, Allen and Angliss 2013). Total fisheries-related mortalities for the stock are estimated at about 46 sea lions per year (Allen and Angliss 2013). No

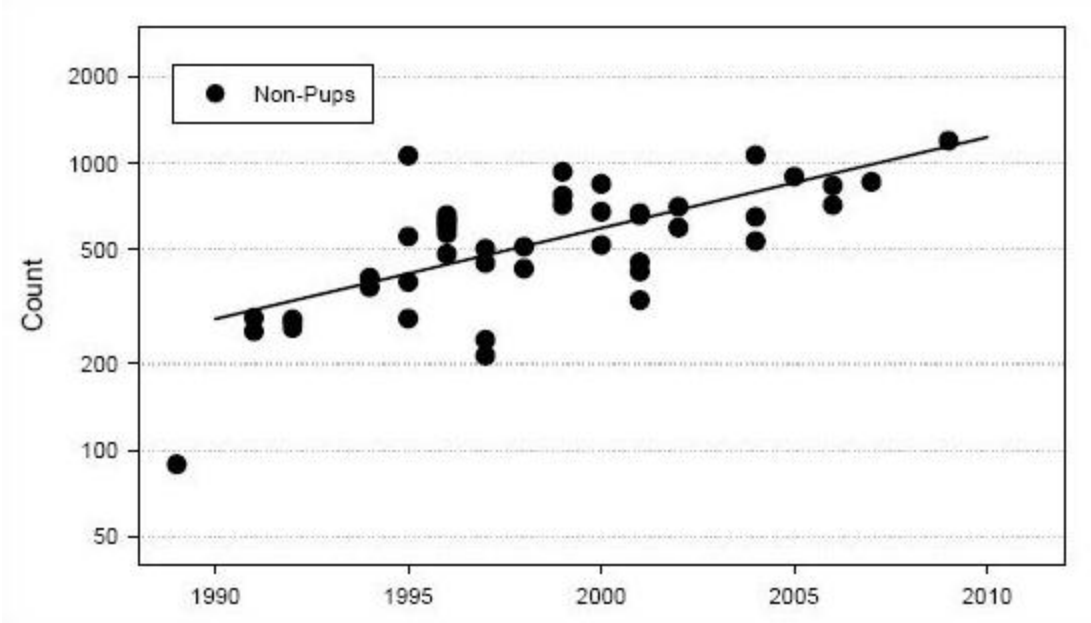

Figure 2. Trends in abundance of Steller sea lions in Washington based on aerial surveys conducted during the summer breeding season (WDFW unpublished survey data).

mortalities have been reported for drift gillnet and set gillnet fisheries in Washington and Oregon this decade, although mortalities have occurred in the past. Small numbers were killed during the WA/OR/CA groundfish trawl from 2005-2009. No data are available after 1998 for the northern Washington marine set gillnet fishery. Three fishery-related strandings of Steller sea lions occurred in Washington, Oregon, and California between 2006 and 2010. During this same period, two strandings of animals with gunshot wounds were recorded in Oregon and Washington (one in 2006 and one in 2010); this number represents a minimum estimate of this problem. In December 2011-January 2012, a Steller sea lion was one of seven sea lions found shot and killed in Washington.

A federal recovery plan for the species was recently revised (NMFS 2008). Critical habitat for the Eastern U.S. stock exists in southeastern Alaska and southwestern Oregon, but not in Washington.

Columbia River sea lion management. California and Steller sea lions have greatly increased in abundance below Bonneville Dam since 2002, where they've annually eaten thousands of federally threatened and endangered salmon and steelhead migrating up the Columbia River, as well as white sturgeon. Since about 2005, wildlife managers from WDFW and the Oregon Department of Fish and Wildlife have worked with federal and tribal partners to chase away or remove California sea lions from the area immediately below the dam (Brown et al. 2011). Removals include lethal removals and captures for permanent placement in marine aquaria and zoos. Steller sea lions prey more on white sturgeon than spring salmon and steelhead (Brown et al. 2011). However, ecause of their federal threatened status, Steller sea lions have only been harassed in an attempt to drive them from the area; none have been removed.

Monitoring. Non-pup and pup counts at rookery and haulout sites are conducted every few years in most of the U.S. range and British Columbia for this stock (Allen and Angliss 2013). Steller sea lion surveys are routinely done in the summer in Washington during annual sea otter surveys (Figure 2).

Federal status review and delisting proposal. NOAA Fisheries released a draft status review for the Eastern U.S. stock of Steller sea lions in 2012 (NMFS 2012a). The document reviewed available

population data, threats, and management of the stock, and evaluated whether its current listing classification is accurate. Based on the findings of the status review, which confirmed that the stock has sufficiently recovered and is expected to continue growing in the foreseeable future, NMFS (2012b) published a proposal to remove the stock from listing under the federal Endangered Species Act in April 2012. A final decision on the delisting proposal is pending.

Research. Considerable research is ongoing for the Eastern U.S. stock and is directed at threats to recovery, including natural and human-related factors. Since 2001, the National Marine Mammal Laboratory and Oregon Department of Fish and Wildlife have been conducting a multi-year demographic study of sea lions tagged or branded as pups in Oregon and northern California. Part of the study involves resighting surveys of branded animals at haulouts in Washington and neighboring regions. Alaska Department of Fish and Game conducts vessel and land-based surveys to estimate survival and reproductive rates and collect scats in southeastern Alaska. The University of British Columbia performs resighting surveys of marked sea lions in southeastern Alaska and British Columbia. Research into the prey requirements and salmon consumption by Steller sea lions in southern British Columbia and Washington has also been conducted (Olesiuk et al. in prep.).

Partners and cooperators: NOAA Fisheries, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, University of British Columbia, Alaska Department of Fish and Game, Olympic Coast National Marine Sanctuary, Columbia River Intertribal Fish Commission, Makah Tribal Fisheries, and U.S. Army Corps of Engineers, Bonneville Dam Fisheries Field Unit.

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North American Lynx

(*Lynx canadensis*)

State Status: Threatened, 1993
Federal Status: Threatened, 2000
Recovery Plans: State, 2001

Figure 1. Female lynx captured in Okanogan County in 2012 (*photo by Jeff Heinlen)*.

Lynx are slightly larger than bobcats and smaller than cougars. Features that distinguish them from bobcats include longer legs, larger paws, fuller facial ruff, longer ear tufts (Figure 1), and a blunt, black-tipped tail. Adults average 19-22 lb, with males being slightly larger and heavier that females.

Lynx inhabit the northern forests of North America. In Washington, lynx are found in high-elevation forests of northeastern Washington in Okanogan, Chelan, Ferry, Stevens, and Pend Oreille counties. A breeding population also occurred historically in the southern Cascades near Mount Adams.

Lynx are adapted to cold temperatures and deep snows of boreal forest. In Washington, this generally includes conifer forests above 4,000 ft, such as lodgepole pine or Engelmann spruce-subalpine fir forests, and rarely dry lowland forests. Optimal lynx foraging habitat is vegetated with dense young stands of lodgepole pine that support high numbers of snowshoe hares.

Lynx were trapped in Washington until 1991. Their numbers dwindled in the 1970s when old burns that had provided the best habitat became mature, and snowmobiles and new roads gave trappers greater access. Today, lynx persist in small numbers in Okanogan County and occur intermittently in the other northeastern Washington counties. The most important factors affecting lynx in Washington are fire history and suppression, forest management, and insect epidemics. Forest management and lynx harvest in British Columbia also adversely affect Washington lynx and dispersal of lynx into Washington. Ripple et al. (2011) hypothesized that the decline of lynx and low densities of snowshoe hares in the coterminous U.S. are at least partly the result of the extirpation of wolves. The elimination of wolves resulted in higher populations of coyotes that prey on hares, and higher populations of deer and elk that compete with hares for browse. Ripple et al. (2011) suggested that the hypothesis be tested, and that wolf restoration and management should consider these kinds of interactions.

Lynx are largely dependent on a single prey species, the snowshoe hare, but they also eat red squirrels, small mammals, and birds (Aubry et al. 2000). In northern boreal forests, lynx undergo cyclical changes in abundance that lag 1 year behind the 10-year snowshoe hare population cycle. Starvation is a common cause of death, especially during snowshoe hare declines, but lynx are also killed by other predators, including cougars and wolves. About 85% of the lynx habitat in Washington is in national forests, with the remainder on state and private lands. Goals of lynx habitat management are to maintain a mosaic of seral stages offer time, with a portion of the landscape in young regenerating stands with high stem densities of saplings that support high numbers of snowshoe hares. The U. S. Forest Service, Washington Department of Natural Resources, and two private timber companies each have habitat management plans that attempt to balance the needs of lynx within the economic constraints of timber management (Ruediger et al. 2000, Gilbert 2006, Roloff 2007). WDFW completed a state recovery plan in 2001

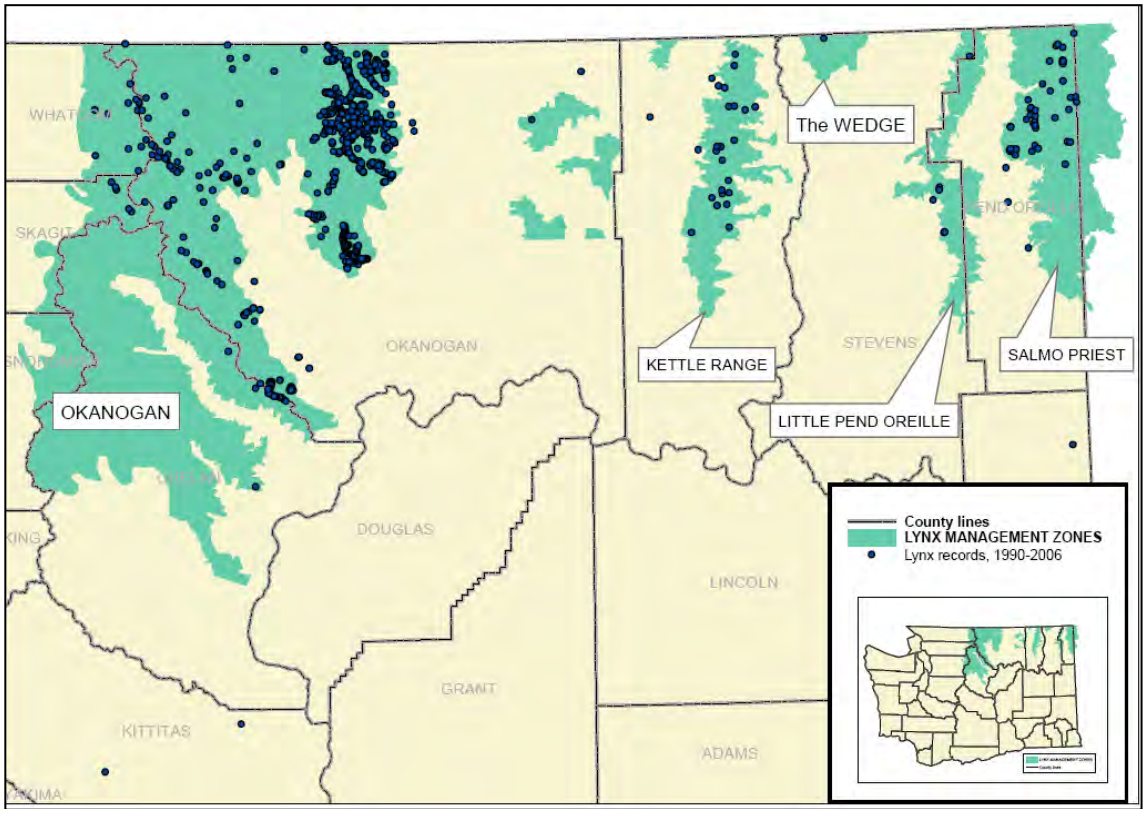

Figure 2. Lynx records and management zones in Washington (from Stinson 2001).

(Stinson 2001). It identified Lynx Management Zones for Washington based on lynx occurrence records and vegetation work done by the U.S. Forest Service (Figure 2).

Climate change and large fires. The dependence of lynx on winter snow and boreal forest makes the species vulnerable to the insect epidemics and fires associated with climate change. The short-term prospects of maintaining lynx in Washington have been made more difficult by recent fires in the core of their range. Since 1985, half of the 2,411 km^2 of suitable habitat for lynx in Chelan and Okanogan counties has burned. The 2006 Tripod Fire burned 600 km^2 of what was considered the best and most extensive lynx habitat in Washington (Figure 4; Stinson 2001, Koehler et al. 2008). Widespread tree mortality from mountain pine beetle (*Dendroctonus ponderosae*) has been worsened by mild winters that increase winter survival of the beetles (Raffa et al. 2008) and threatens to increase the incidence of large high intensity wildfires.

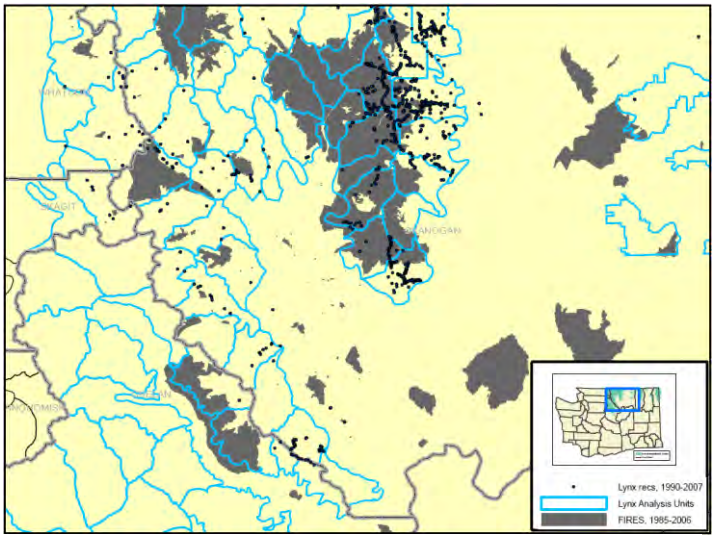

Figure 4. Recent fires, lynx detections, and Lynx Analysis Units in the Okanogan region of Washington.

Habitat analyses suggest that lynx require at least four months of continuous winter snow cover (Gonzales et al. 2007). Under future climate scenarios, suitable habitat for lynx may shift northward as much as 200 km by the year 2100. Thus, Washington could lose much of its lynx habitat in the

Figure 5. Male lynx captured (left) and being released (right) in Okanogan County, 2012.

long-term (Gonzales et al. 2007).

Land conservation. In 2011, WDFW acquired two groups of properties that may benefit lynx. These included 3,075 acres in the Okanogan-Similkameen watershed and 1,418 acres in the Methow watershed.

Monitoring and research. Lynx Management Zones were regularly surveyed for lynx presence by WDFW and volunteers from partner organizations from 1990-2008, except where winter access was extraordinarily difficult. Snow-tracking surveys documented lynx intermittently in northeastern Washington, except in western Okanogan County, where kitten tracks were consistently observed each winter. Maletzke et al. (2008) snow-tracked lynx during 2002-2004 and found increased hunting behavior in Englemann spruce and subalpine fir forests, where densities of snowshoe hares were relatively high. Koehler et al. (2008) used snow-tracking data to develop a model of lynx–habitat relationships that could be used to assess the potential distribution of lynx in Washington. They estimated about 3,800 km^2 of suitable habitat, indicating that Washington could support up to 87 lynx, but they believed this was an overestimate because it was based on an area where hare densities were high.

In 2006, the WDFW, Washington Department of Natural Resources, U.S. Forest Service, U.S. Bureau of Land Management, and U.S. Fish and Wildlife Service initiated research to: 1) assess the status of lynx populations in Okanogan County, 2) identify landscape and habitat parameters used seasonally by lynx, 3) assess whether vegetation management prescriptions for lynx habitat implemented by the U.S. Forest Service and Washington Department of Natural Resources were adequate to maintain or improve lynx habitat and lynx populations, and 4) provide recommendations, if needed, to assure the persistence of a viable lynx population in Washington. From January 2007 to December 2010, 11 males and one female were captured and marked with ear tags and with VHF/GPS collars, with >10,000 GPS coordinates recorded from these animals (Koehler et al. 2011). An additional four new lynx were captured and marked during 2011. Additional past research has focused on lynx habitat use and snowshoe hares in Washington, in part to improve understanding of lynx habitat needs and how timber management can better accommodate those needs (Interagency Lynx Committee 1999, von Kienast 2003, Gilbert 2005, Walker 2005, Poelstra 2007).

A pilot study conducted in 2010 assessed the effectiveness of using dogs to find lynx scats from which DNA profiles can be obtained to determine the number of individual lynx present in an area. During the study, 10 of the 14 scats collected were identified as being from lynx.

In 2010, a University of Washington PhD student began research on snowshoe hares in Loomis State Forest and Okanogan National Forest. From 2010-2013, 364 hares were captured, and radio collars deployed 238 times during 27 months of field work. Data from predation events were collected, and DNA from saliva, hair, and observations were collected to identify the predators.

In 2012, two females and two male lynx were captured in a study area in the Methow Valley Ranger District of Okanogan-Wenatchee National Forest and fitted with new GPS collars that record their movements which can be downloaded for analysis. One of the males had originally been captured in 2011, but his collar had failed. The carcass of another male collared in March 2011 was found in shrub-steppe east of the Scotch Creek Wildlife Area. The collar was intact and data on its movements were downloaded. WDFW and USFS staff radio-tracked and successfully downloaded GPS location data from 3 of 4 lynx collared in 2011. Two graduate projects are using the accumulated data from lynx locations. A Washington State University Master's student is analyzing data from 9 lynx in a study of seasonal habitat use. A second Master's project involves a student from University British Columbia-Okanogan using the data to look at habitat connectivity, and is expected to generate maps of core and corridor habitat based on lynx movements.

Partners and cooperators: Washington Department of Natural Resources, U.S. Forest Service, U.S. Fish and Wildlife Service, Seattle City Light, University of British Columbia-Okanagan, Oregon Zoo, Washington State University, University of Washington, Conservation Northwest, University of Montana, Central Washington University, Forest Capitol Partners, Stimson Lumber Company.

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Figure 6. Lynx tracks (right) and high elevation habitat in Okanogan County (*photos by S. Fitkin*).

Greater Sage-Grouse

(*Centrocercus urophasianus*)

State Status: Threatened, 1998
Federal Status: Candidate, 2001 (Washington Distinct Population Segment)
Recovery Plans: State, 2004

Figure 1. Male greater sage grouse on a lek in Douglas County (*photo by M. Schroeder*).

The greater sage-grouse is the largest North American grouse species. In the breeding season, adult males weigh between 5.5–7.0 lb, while adult females weigh between 2.9–3.7 lb (Schroeder et al. 1999). Historically, greater sage-grouse were distributed throughout much of the western United States in 13 states and along the southern border of three western Canadian provinces.

The spring courtship display of males is the most conspicuous behavior of sage-grouse and occurs when birds gather for displaying and mating at specific locations, called leks. Male sage-grouse establish small territories on the lek and perform a strutting display to proclaim and defend a territory and attract females.

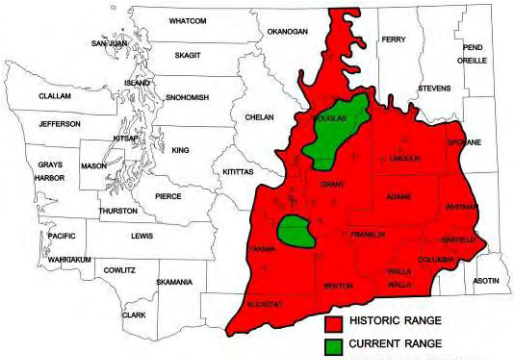

Figure 2. Recent and historical range of sage-grouse in Washington.

Habitat. Greater sage-grouse inhabit shrub-steppe and, as their name implies, are closely associated with sagebrush. Wyoming big sage (*Artemesia tridentata wyomingensis*) and three-tip sage (*Artemesia tripartita*) are the most important species in Washington. Habitat generally consists of sagebrush/bunchgrass communities with medium to high (10-35%) canopy cover in sagebrush and a diverse grass and forb understory. Seasonal habitat needs vary somewhat with their diet and extansive areas are needed to sustain a sage-grouse population. Sagebrush, grasses, forbs, and insects comprise the annual diet of sage-grouse. Sagebrush comprises 60-80% of the yearly diet of adult sage-grouse (Schroeder et al. 1999) and up to 95-100% of the winter diet. Forbs are important to nesting hens in the pre-laying period and insects are essential for growing chicks.

Population trends. Greater sage-grouse have declined dramatically in both distribution and population size in Washington due to conversion of shrub-steppe for production of crops and degradation of the remaining native habitat (Stinson et al. 2004). Of 69 lek complexes documented since 1960, 68% are currently vacant (Stinson et al. 2004). Many of these vacant lek complexes (55%) are in areas where sage-grouse have been extirpated since 1960. Current range in the state is about 8% of the historical range. Birds persist in two relatively isolated areas: one primarily on the U.S. Army's Yakima Training Center (YTC) in Kittitas and Yakima counties and the other in Douglas County (Figure 2; Schroeder et al. 2000). A third population is currently being reestablished in Lincoln County.

Based on changes in number of males counted on lek complexes, the sage-grouse population size in Washington declined more than 50% from 1970 to 2012 (Schroeder et al. 2012). The 2012 spring

population was estimated to be about 1,084 birds (Figure 3), with 148 on the YTC, 853 in Douglas County, and ~83 in Lincoln County. The declines and the isolated nature of these populations were part of the U.S. Fish and Wildlife Service's (2001) assessment of whether sage-grouse in Washington and northern Oregon represented a distinct population segment and whether the population warranted federal threatened status. Listing was determined to be warranted, but has been precluded by higher listing priorities.

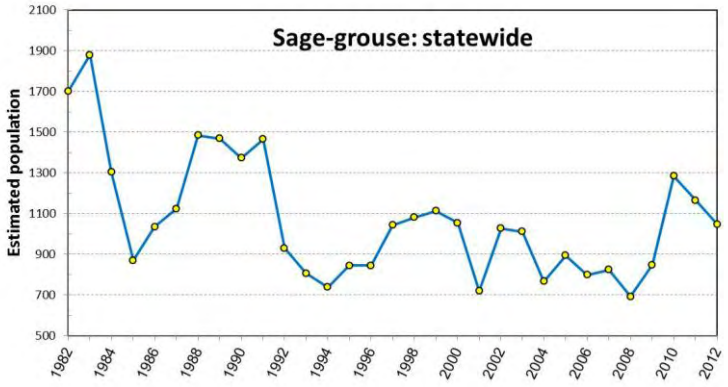

Figure 3. Statewide population estimate of sage-grouse in Washington, 1982-2012.

The population centered in Douglas County occupies mostly private lands that are a mosaic of small areas of high-quality shrub-steppe and farmlands enrolled in the federal Conservation Reserve Program (CRP). In 2010, a large lek was discovered on CRP land that was unsuitable cropland until relatively recently. CRP has allowed the Douglas County population to remain relatively stable, while the Yakima Training Center population has continued a downward trend, even though it occupies one of the largest areas (1,300 km^2) of shrub-steppe remaining in the state (Figure 4). Military training and wildfires pose the greatest threats to habitat security on the YTC. Cross-country maneuvers with military vehicles decrease habitat quality by killing sagebrush and disturbing understory plant communities (Cadwell et al. 2001). Training also starts wildfires that have degraded significant portions of the habitat, although the adjacent highway is also the source of some fires.

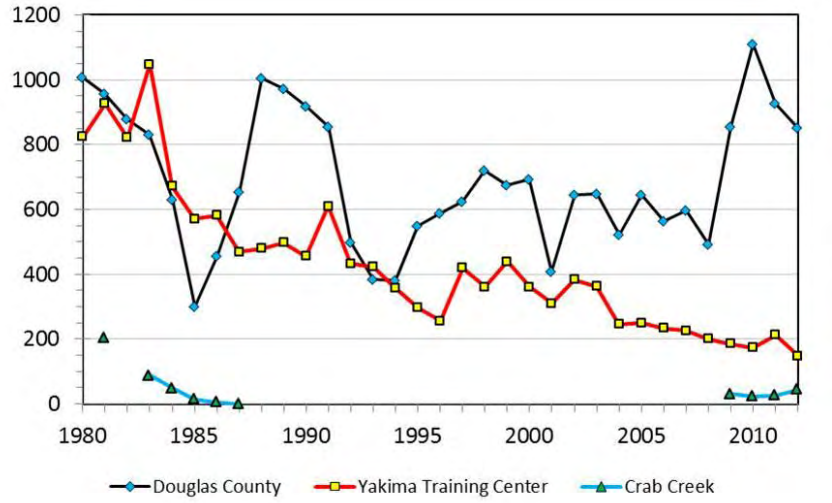

Figure 4. Estimates for three populations of sage-grouse in Washington, 1980-2012.

Monitoring. WDFW staff count birds at 26 active leks each year and another 9 inactive leks are checked for activity, and searches for new leks were done opportunistically. To focus efforts on the most likely locations for new leks to occur a GIS-based lek search model was developed. Data from current active leks in Douglas County was used to assess landscape variables and inter-lek characteristics to develop a profile of lek locations. This model was used to predict areas where other leks might exist, and resulted in locating 4 sage-grouse leks in 2010, and 3 in 2012. In 2012, we counted a high of 331 males in Douglas County representing a 9% decrease from 2011 (362); reports from other states suggest a rangewide decline, likely related to drought conditions. Yakima Training Center also reported a continued decline (44 males, down from 56 in 2011). The Yakima Training Center initiated a telemetry project in 2012 to validate core use areas, document off-post movements, and investigate sources of mortality.

Conservation activities. Enhancement of existing populations and re-establishment of additional populations were identified as high priorities in the state recovery plan (Stinson et al. 2004). WDFW, in cooperation with the U.S. Bureau of Land Management (BLM), Washington State University, Oregon Department Fish and Wildlife, and the U.S. Fish and Wildlife Service, initiated a project in 2008 to reintroduce greater sage-grouse to the Swanson Lakes Wildlife Area and adjacent BLM lands in Lincoln County. Sage-grouse were extirpated from the county in 1987, but habitat has improved since that time, with more than 200 km^2 of shrub-steppe habitat now present on public lands. From spring 2008 to spring 2012, 181 greater sage-grouse were translocated from southern Oregon to the release area (Table 1). The movements, productivity, habitat use, and survival of these birds have been monitored. Display behavior was first observed in 2010, and in 2011, a lek site was established by males from previous years' releases with a high count of 10. The same lek was active again in 2012 with a high count of 16. One female moved ~85 km to Douglas County, while two others that attempted that move were found dead near a large transmission line. Thirteen nesting attempts were documented in 2012, 8 clutches hatched, and at least 4 hens fledged broods. Nine sage-grouse hens have reared at least one chick to 50 days of age, and hens without collars were observed with broods (2011 and 2012), indicating recruitment is occurring. Plans for 2013 include continuation of the translocation effort into Lincoln County.

Table 1. Greater sage-grouse released in the Crab Creek Sage-grouse Management Unit (Swanson Lakes Wildlife Area, Lincoln County).

	Spring 2008	Fall 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Total
Male	10	7	15	23	19	18	92
Female	7	17	13	15	17	20	89
Total	17	24	28	38	36	38	181

The Yakama Nation and University of Idaho have re-engaged in a project to re-establish a population on the reservation. Eight birds were observed in 2012, likely a result of previous releases, but no active leks are known. Releases of birds from Nevada are planned for 2013-2015. A concurrent project will erect fencing around a 25,000 ac area to exclude feral horses which negatively affected habitat.

SAFE/CRP. The U.S. Department of Agriculture's CRP program is currently the main financial incentive for private landowners to provide sage-grouse habitat, and has been essential for providing habitat for sage-grouse in Washington (Schroeder and Vander Haegen 2006, 2011) and in other states. State Acres for Wildlife (SAFE), a new initiative under the CRP program, may boost grouse populations; 63,000 ac were allocated in 2010 for sage-grouse and sharp-tailed grouse habitat in northern Douglas County. WDFW biologists have been assisting landowners with planting plans for lands accepted into the sage-grouse and sharp-tailed grouse SAFE, and working with Farm Service Agency (FSA), Natural Resources Conservation Services (NRCS) and conservation district staff to facilitate program implementation. A total of 356 conservation plans covering 56,918 acres have been written since October 2010. In October 2012, an additional 8,900 acs were allocated to the Shrub-steppe SAFE; with the acres already enrolled, this creates a total of 16,222 acres in sage/sharp-tailed-grouse management zones in northern Grant, Lincoln and Okanogan counties.

Habitat restoration. Since 1996, WDFW has restored almost 2,500 ac in Lincoln County, and is currently finishing up restoring 100 ac in the Telford area. Fence collisions can be a major source of mortality for sage-grouse, and making them more visible can dramatically reduce collisions (Stevens et al. 2012). In 2011, BLM funded a project to mark 55 miles of fences on WDFW lands and 71 miles of fences on adjacent BLM lands in Lincoln County to reduce grouse collision mortalities. WDFW also assisted the Lincoln County Conservation District with an ALEA grant to remove 15 miles of unneeded fencing in 2010 and an additional 5 miles in 2011. Wenatchee Sportsmen marked 28 miles of fences on

WDFW lands in Douglas County with the help of a grant in 2011. In northern Douglas County, work is currently underway to restore 413 ac of old grain fields to shrub-steppe with a $250,000 grant. In 2011, WDFW acquired 473 acres of land in Douglas County that may benefit sage grouse.

Wildfires in 2012. The Apache Pass fire in Lincoln County started several miles west of Swanson Lakes Wildlife Area (SLWA), and burned 1,069 ac on SLWA. In addition to good sage and sharp-tailed grouse habitat being burned at SLWA, the BLM had 7,648 acres of its ground burned, including crucial sage-grouse habitat. SLWA staff and BLM wildlife and range biologists collaborated to reseed 100 ac on SLWA and 100 ac of BLM land with a grass/forb/legume mix.

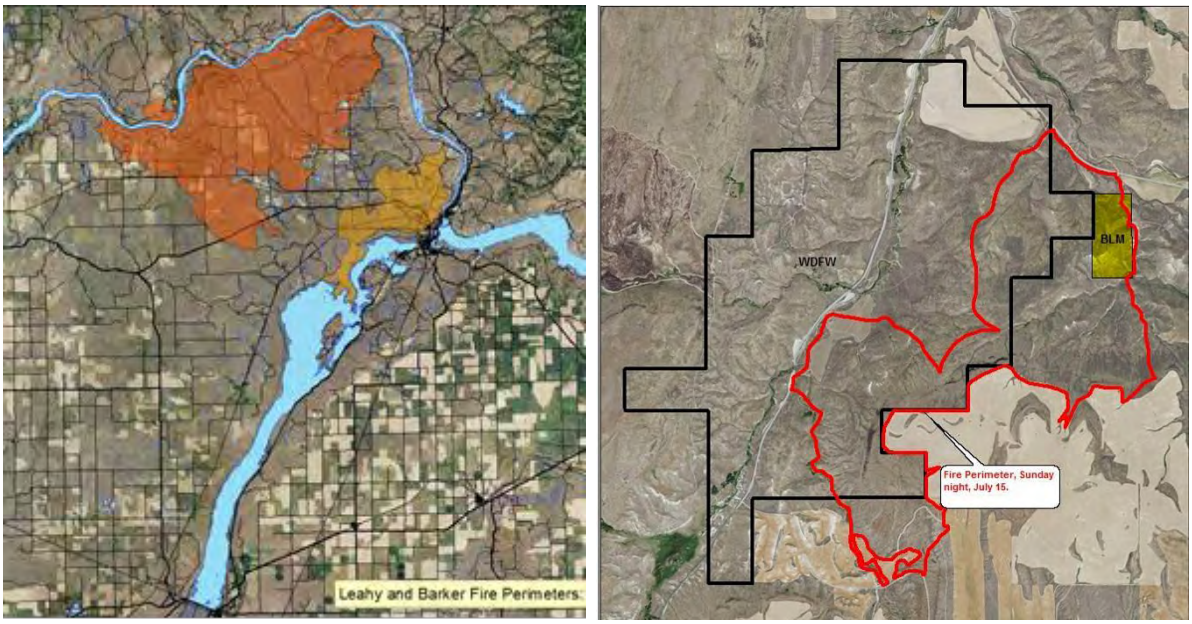

Figure 5. The Leahy and Barker Fires (left) and the Foster Creek Fire perimeters (right).

Douglas County was impacted by wildfires ignited by lightning storms. The Barker and Leahy fires in northeast Douglas County burned 17,000 plus acres of cropland, CRP, and shrub-steppe and the Leahy fire burned over 73,000 acres. Within the Leahy fire perimeter, one active and one inactive sage grouse lek was burned. The leks represent complexes of nesting, brood rearing and wintering habitat associated with a lek site. Many of the CRP-SAFE fallow fields to be seeded this fall acted as firebreaks saving many homes in the area.

An estimated 725 acres of WDFW land burned in the Foster Creek Fire, much of which was sagebrush that was in excess of 30% cover. The total acreage for the Foster Creek Fire is approximately 1,350 including private lands, BLM and WDFW. A helicopter was used to seed a total of 140 acres between the Foster Creek burns and another burn in Central Ferry Canyon. BLM acreage within the Foster Creek burn was also seeded.

Landscape planning. The Washington Wildlife Habitat Connectivity Working Group is addressing connectivity patterns for numerous focal species, including greater sage-grouse. An analysis of statewide connectivity patterns was published in 2010 and an ecoregional analysis for the Columbia Plateau was completed in 2012 (Robb and Schroeder 2012). The latter analysis is modeling habitat concentration areas and movement corridors for greater sage-grouse. The Arid Lands Initiative is a group of governmental (WDFW, WDNR, BLM) and non-governmental organizations (e.g. TNC) formed in 2010 to engage landowners with the goal of conserving shrub-steppe across multiple jurisdictions. Greater sage-grouse have been identified as one of the focal species for which conservation strategies will be

developed and implemented.

Partners and cooperators: Bureau of Land Management, Oregon Department of Fish and Wildlife, Washington State University, U.S. Fish and Wildlife Service, Department of Defense-Yakima Training Center, Wenatchee Sportsmen, Inland Northwest Wildlife Council, Spokane Audubon, Lincoln County Conservation District, The Nature Conservancy, Yakama Nation, Farm Service Agency, Natural Resource Conservation Service.

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Figure 6. Sage-grouse on a re-established lek in Lincoln County, 2012 *(photo K. Thorburn).*

Columbian Sharp-tailed Grouse

(*Tympanuchus phasianellus columbianus*)

State Status: Threatened, 1998
Federal Status: Species of concern
Recovery Plans: State, 2012

Figure 1. Sharp-tailed grouse at Chesaw Unit, Scotch Creek Wildlife Area (*photo by Mike Schroeder*).

The Columbian sharp-tailed grouse (Figure 1) is the rarest of six described subspecies of sharp-tailed grouse. Male sharp-tailed grouse gather on dancing grounds where they engage in specialized behavioral displays to attract females in hopes of mating. These communal dancing grounds, called leks, are also characteristic of mating behavior in sage-grouse and prairie chickens. Sharp-tailed grouse are culturally significant to Native Americans in eastern Washington, the Great Plains, the Great Lakes states, and Canada (Connelly et al. 1998). They are the subject of many legends and inspired 'chicken dances' that remain an important tradition at annual powwows.

Good sharp-tailed grouse habitat contains a mix of perennial bunchgrasses, forbs, and a few shrubs. In Washington, riparian areas with deciduous trees and shrubs that provide cover, berries, seeds, buds, and catkins provide critical winter habitat when the ground is snow-covered. The most important trees and shrubs include water birch, serviceberry, chokecherry, rose, hawthorn, snowberry, cottonwood, and aspen (Stinson and Schroeder 2012). Some areas with suitable nesting and brood-rearing habitat may remain unused because the area lacks adequate winter resources. Shortages of nesting, brood rearing, and wintering habitats are important factors limiting population recovery.

Population status. Columbian sharp-tailed grouse were an abundant and important game bird in eastern Washington during Euro-American settlement. They declined dramatically with the spread and intensification of agriculture and livestock grazing, and were extinct in significant portions of their historical range in Washington by the 1920s (Figure 2). Hunting seasons for sharp-tailed grouse were shortened and bag limits were reduced steadily beginning in 1897. The season was closed statewide from 1933 to 1953, but short seasons were opened from 1954 to1987. The population continued to decline after 1950, perhaps a time-lagged response to past habitat loss, but probably also due to continued loss of riparian winter habitat and intensive livestock grazing on remaining areas of steppe vegetation. The population declined almost continually between 1970 and 2004. Annual changes in attendance at leks suggest a 74% decline during this period. The current distribution of sharp-tailed grouse covers

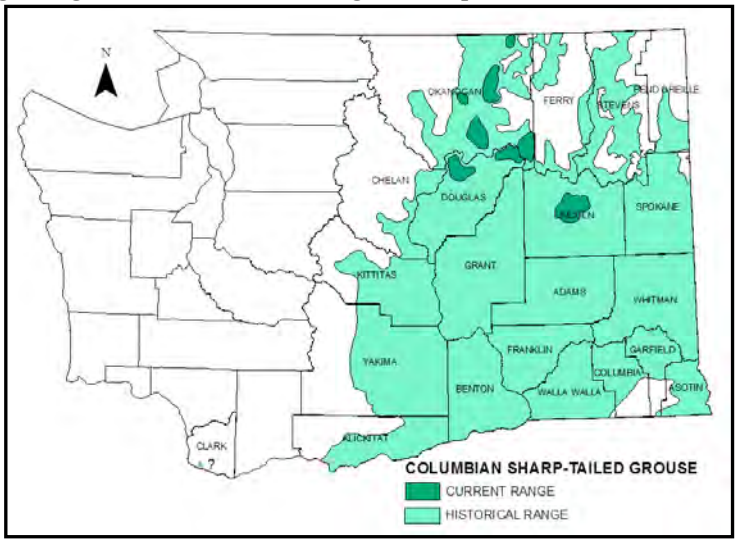

Figure 2. Historical and current range of Columbian sharp-tailed grouse in Washington (*modified from Schroeder et al. 2000*).

about 2,173 km^2, which is only 2.8% of the historical range in Washington.

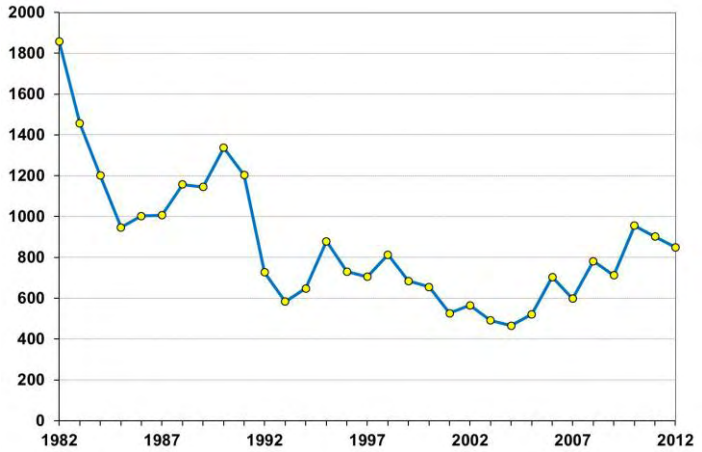

Figure 3. Estimated total population of Columbian sharp-tailed grouse in Washington, 1982-2012.

Sharp-tailed grouse persist in seven scattered populations in Lincoln County, the Colville Indian Reservation, northern Douglas County, and valleys and foothills east and west of the Okanogan River in Okanogan County. Declines of some remnant populations have continued in recent years with continued degradation of habitat, isolation of small populations, and probably a concurrent decline in genetic health. The small remaining subpopulations in Washington may not persist unless they are able to increase in size. One population appears to have gone extinct since 2000. The total population estimate dipped to a low of 465 in 2004, then increased to 956 in 2010, probably in response to augmentations and habitat restoration, but estimates dipped to 902 birds in 2011, and 850 in 2012 (Figure 3).

Population augmentations. Sharp-tailed grouse from healthy populations outside the state have been translocated to Washington to improve the vigor of local populations (Schroeder et al. 2012). Population augmentation in the 1990s apparently prevented extirpation of the population at Scotch Creek Wildlife Area. Since 1998, a total of 391 sharp-tailed grouse have been translocated and released in areas with declining populations. During 1998–2000, 63 birds from southeastern Idaho (51 birds) and the Colville Indian Reservation (12 birds) were released on the Scotch Creek Wildlife Area. An additional 328 birds from Idaho, Utah, and British Columbia were released during 2005-2012 at sites in Okanogan, Douglas, and Lincoln counties (Table 1). Additional releases are planned in future years to stabilize existing populations and eventually establish additional populations.

Table 1. Numbers and release locations for sharp-tailed grouse translocated to Washington, 2005-2012.

Release Location	County	2005	2006	2007	2008	2009	2010	2011	2012	Total
Swanson Lakes WLA	Lincoln	20	12	14	14	28	51	20	7	166
Dyer Hill/West Foster Cr.	Douglas	20	12	15	14	0	0	0	0	61
Colville Indian Reservation	Okanogan	19	11	12	14	10	0	9	26	101
Totals		59	35	41	42	38	51	29	33	328

Habitat acquisition. In 2011, WDFW acquired two groups of properties that may benefit sharp-tailed grouse. These included 473 acres in Douglas County. In 2012, WDFW completed the purchase of the 373 acres Thornburg property adjacent to Scotch Creek Wildlife Area in Okanogan County. The purchase, which will provide habitat for sharp-tailed grouse, was funded by grants from the U.S. Fish and Wildlife Service under the Section 6 program and from the Washington Wildlife and Recreation Program.

Habitat restoration and enhancement. Fence collisions have been identified as a mortality factor for grouse and other low-flying birds, and it has been shown that attaching markers (Figure 4) to increase the visibility of wire can dramatically reduce collisions and mortalities (Wolfe et al. 2007, Stevens et al. 2012). WDFW have removed many miles of unneeded fences on its land, and with partners have begun attaching vinyl markers to fences that pose a hazard to grouse. The Wenatchee Sportsmen marked 28 miles of fences on WDFW lands to reduce grouse collision mortalities in Douglas County in 2011. BLM

also marked 55 miles of fences on WDFW lands and 71 miles of fences on adjacent BLM lands in Lincoln County. WDFW also assisted the Lincoln County Conservation District with an ALEA grant to remove 15 miles of unneeded fencing in 2010 and an additional 5 miles in 2011. In 2012, an ALEA project marked almost 5 miles of fence on two units of the Scotch Creek Wildlife Area. Staff also marked fencing on the Chesaw, Tunk Valley, and Scotch Creek units for a total of 20 miles. This effort prompted a neighboring landowner of the Tunk Valley Unit to mark their fences; WDFW supplied the landowner with markers who marked another 3 miles of fence.

Figure 4. Fence with vinyl markers and sign warning hunters that protected sharp-tailed grouse are in the area.

In 2012, staff at Scotch Creek WLA were in the process of restoring 95 ac in Coulee Creek drainage and 95 ac on the Tunk Creek Unit. A total of >3500 ac have been restored on Scotch Creek WLA over the years. Also in 2012, 2,383 native trees and shrubs were planted along Scotch Creek by WDFW staff and the Department of Ecology, Washington Conservation Corp. This was the culmination of a larger project to excavate a meandering Scotch Creek channel, eradicate 40 acres of reed canary-grass, and restore a native grass/forb upland seed mix and riparian trees. Approximately 1,000 plants were also installed in the Tunk Valley unit, where remnants of water birch and wild rose are all that's left after decades of grazing.

Figure 5. Planting shrubs trees along restored section of Scotch Creek.

In Douglas County, staff on the Wells/Sagebrush Flats WLA finished planting forbs on the last 100 of a 300 ac restoration project funded by a Recreation and Conservation Office grant. They also worked on restoring another 180 acres with native grasses and forbs.

In Lincoln County, WDFW finished restoring 103 ac on Swanson Lakes with a BLM cost share grant, and BLM removed 2 mi of power distribution line this year (and 2 mi in 2011); BLM hopes to restore 300 ac of cropland in the Hawk Creek area, if funding is available.

Conservation Reserve Program. Enhancement of habitat in occupied areas and, where possible, re-establishing habitat connections between occupied areas, are essential for recovery. The U.S. Department of Agriculture's Conservation Reserve Program (CRP) is currently the main financial incentive for private landowners to provide sharp-tailed grouse habitat in Washington and other states. However, many CRP fields enrolled in the 1980s and 1990s were seeded to crested or intermediate wheatgrass, smooth brome, or other exotic grasses, and provide little habitat value to sharp-tailed grouse compared to native grassland or more diverse CRP typical of more recent contracts. Fields in this condition need to be

Figure 6. Shrub planting in the Central Ferry Canyon Unit in 2009 (left), and in 2012 (center and right).

reseeded with native seed mixes in order to be of value to sharp-tailed grouse. State Acres for Wildlife (SAFE), a new initiative under the CRP program, may boost grouse populations. A total of 63,000 ac were made available since 2010 for sage-grouse and sharp-tailed grouse habitat in northern Douglas County.

Figure 7. Sharptails budding in trees along Scotch Creek during December 2012 *(photo by Jim Olson).*

In 2012, approximately 12,000 acres were enrolled in Douglas County and 1,000 acres in Grant and Lincoln Counties. WDFW Private Lands Biologists wrote 61 SAFE plans and submitted all required forms to Foster Creek Conservation District (FCCD) covering 10,793.68 acres. They also assisted Farm Service Agency (FSA) with contacting 40 landowners selected on their proximity to active leks Douglas County about the opportunity to sign up their (CRP) tracts that expire in September 2012 into SAFE. WDFW staff developed two proposals that resulted in getting 8,900 additional acres added to 7,322 already enrolled for a total of 16,222 acres in sage/sharp-tailed-grouse management zones in northern Grant, Lincoln and Okanogan Counties.

Wildfires. Lighting storms ignited many fires in Eastern Washington in 2012 that affected important sharp-tailed habitat. Some impacts are expected to be negative, particularly where riparian wintering habitat does not recover. Where grasses and some shrubs recover, there may be some long term benefit.

In Douglas County, the Foster Creek Fire burned an estimated 1,291 ac, with approximately 720 acres of that on the Bridgeport and Central Ferry Canyon units of the wildlife area. To speed vegetation recovery, WDFW drill seeded 100 ac, and aerial seeded another 140 ac on the Foster Creek and Central Ferry Canyon burns. The Crane Road Fire burned 13,000 mostly private land on which much riparian habitat was lost; where aspen was present most will come back. The Barker and Leahy fires in northeast Douglas County burnt over 92,000 acres of cropland, CRP, and Shrub-steppe. The Barker fire burned 17,000 acres and the Leahy fire burned over 73,000 acres. Many of the CRP-SAFE fallow fields to be seeded this fall acted as firebreaks saving many homes in the area. The fires directly affected habitat for nesting, brood rearing and wintering associated with lek sites. One active and one inactive sharp-tailed grouse lek was burned over in the Barker fire, and 4 active and 3 inactive lek sites were within the Leahy perimeter.

Figure 8. Lightning sparked fire burns shrub-steppe in Douglas County.

In Lincoln County, the Apache Pass Fire burned a total of 24,531acres, including 1,069 ac on Swanson Lakes WLA, and 5,874 ac of adjacent BLM land. Wildlife Area staff seeded some of the burned areas, including 100 ac of bulldozer lines and 100 ac of old farm ground on BLM land.

Landscape management. An analysis of statewide connectivity patterns for sharp-tailed grouse in the Columbia Plateau was completed in 2012 (WHCWG 2012). The analysis modeled habitat concentration areas and movement corridors.

The Arid Lands Initiative is a group of governmental (WDFW, WDNR, BLM) and non-governmental organizations (TNC) formed in 2010 to engage landowners with the goal of conserving shrub-steppe across multiple jurisdictions. Sharp-tailed grouse have been identified as one of the focal species for which conservation strategies will be developed and implemented.

Partners and cooperators: Bureau of Land Management, Colville Confederated Tribes, Washington State University, Idaho Fish and Game, Utah Division of Wildlife, British Columbia Ministry of the Natural Resources, Inland Northwest Wildlife Council, Spokane Audubon, Wenatchee Sportsmen, Lincoln County Conservation District.

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Ferruginous Hawk

(Buteo regalis)

State status: Threatened, 1983
Federal status: species of concern
Recovery Plan: State, 1996

Figure 1. Ferruginous hawk (*photos, left to right, by Jim Watson, and Jerry Liquori*)

The ferruginous hawk is the largest North American buteo. Adults have a wingspread of 48-56 in, with females averaging larger and heavier than males. Ferruginous hawks inhabit semi-arid, and prairie ecosystems of western North America. Nests are built on cliffs, rock outcrops, small trees, transmission line towers, and artificial platforms. Territories often contain more than one nest, which allows the pair to relocate if disturbed early in the nesting cycle.

Washington state is on the northwestern edge of the species breeding range (Bechard and Schmutz 1995). In Washington, nests have been found in steppe or shrub-steppe habitat. Franklin and Benton counties together host about 60% of the ferruginous hawk territories, and Grant, WallaWalla, Adams, and Yakima counties also have had 13 or more territories each (Richardson 1996).

Population status. The ferruginous hawk population in North America is thought to be stable or to have declined somewhat in recent years. However, Alberta, which has had one of the largest concentrations of nesting ferruginous hawks listed them as endangered in 2006. Washington historically supported a substantial population (Richardson et al. 2001). Of 241 cumulative known total territories, the highest number occupied since surveys began was 69 in 1996. Increasing fragmentation of shrubsteppe habitats from agricultural conversion and residential development has been a factor contributing to the decline and listing of the ferruginous hawk as a state Threatened Species. Declines of shrubsteppe mammals, such as black-tailed jackrabbits (*Lepus californicus*) and the Washington and Columbian ground squirrels (*Urocitellus washingtoni, U. columbianus*), have contributed to dietary shifts of ferruginous hawks to smaller mammals, insects, and gulls (*Larus* spp.) (Leary et al. 1996, Richardson et al. 2001). Changes in prey and increased distance to foraging ranges may be affecting population numbers by reducing juvenile hawk survival (Leary et al. 1998, Richardson et al. 2001).

In 1981, the Department surveyed all known ferruginous hawk territories in the state. Follow-up surveys and searches for additional nest sites were undertaken in 1987 and again from 1992 to 1995. Surveys conducted by WDFW in 2003 found ferruginous hawks occupied 64 of 231 historical territories checked in the state and produced an estimated 92 young (Table 1). The ferruginous hawk has not shown signs of recovery since listing as threatened in Washington, and evidence suggests further decline. Surveys in 2010 indicated the lowest number of active and successful territories on record; only 19% of the historical nesting territories were occupied and many historical sites have remained vacant for years.

Table 1. Ferruginous hawk pairs and productivity in Washington, 1996, 2003 and 2010.

	1996	2003	2010
Number of Territories Checked	173	231	192
Number of Territories Occupied	70	78	36
Young produced	115	92	24

Ferruginous populations can exhibit numeric responses to changes in cyclic prey such as ground squirrels (Schmutz and Hungle 1989) or jackrabbits (Woffinden and Murphy 1989). Woffinden and Murphy (1989) reported a ferruginous hawk population crash concurrent with the local jackrabbit population in Utah. They speculated that the proliferation of cheatgrass has contributed to longer term declines of jackrabbits. As noted above, significant loss of hares and ground squirrel species in Washington and dietary shifts to insects and smaller mammals suggested the declining population trend of ferruginous hawks may continue.

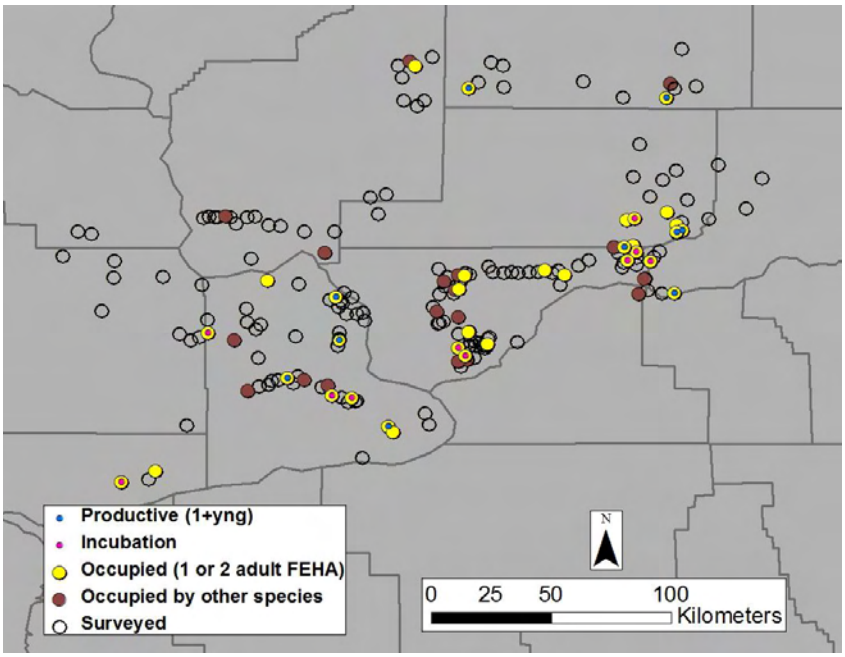

Figure 2. Occupancy and success of ferruginous hawk territories surveyed in Washington, 2010.

Migration study. WDFW conducted a study of Ferruginous Hawk migration, range use, and survival. Between 1999 and 2003, 13 adult and 15 juvenile ferruginous hawks from Washington were monitored with satellite telemetry (Watson 2003). The hawks generally migrated in two stages, often moving east to the front range of the Rocky Mountains by August, and from early August to early October to the plains of North Dakota, Nebraska, and Oklahoma. Some individuals relocate to northeast and central Oregon by late fall. Ferruginous hawks from Washington seem to migrate to where an abundance of ground squirrels and prairie dogs are available.

Six adults monitored for 2 years repeated similar migration patterns, and returned to the same wintering area. They all returned to breeding territories. Young and adults from the same nests migrated independently, and followed dissimilar migration patterns. Two young migrated over 2,000 km less to winter ranges in their second year, compared to the first year. In their first year, juveniles wandered an average of 6,139 km throughout western North America for three months prior to settling on winter ranges in California, the Central Plains, or

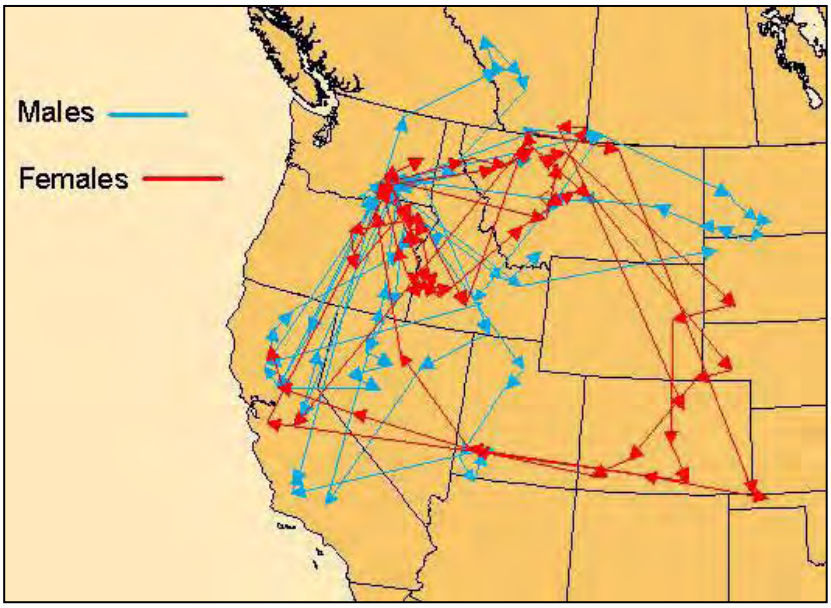

Figure 3. Migration patterns of 13 adult ferruginous hawks from southcentral Washington (Watson 2003).

Mexico.

The Washington hawks ranged widely during half the year. Recent evidence suggests shooting mortality and exposure to West Nile Virus are important fall/winter mortality sources for ferruginous hawks from the Pacific Northwest. Maintenance of prey and habitat resources, principally in the Northern Plains and central valley of California, are important to sustain hawks through the winter and replenish adult fat reserves for reproduction the following spring. Widespread agricultural conversion and urbanization are significant threats to these habitats. Juvenile survival, although less important than adult survival to population maintenance, is most impacted by poor foraging conditions in Washington, likely a result of depressed prey populations and drought.

Recovery plan. WDFW completed a recovery plan for the species in 1996 (Richardson 1996). The recovery objective is 60-plus breeding pairs (measured annually by number of nests with eggs) for a five-year average, distributed throughout the historic range. However, surveys needed to compute the 5-year average are not done annually due to other priorities.

Conservation. The ferruginous hawk SAFE (State Acres for Wildlife Enahancement) is a new initiative in 2012 allocating up to 20,000 acres within ferruginous hawk territories in Benton, Franklin and Adams Counties. SAFE is a special program under the U. S. Department of Agriculture's Conservation Reserve Program (CRP). The initiative is a state and federal partnership designed to meet state wildlife priorities for high value species on private land. It is part of the Farm Service Agency's Conservation Reserve Program (CRP) and is implemented in cooperation with the Washington Department of Fish and Wildlife. SAFE is a voluntary program, in which cooperating landowners receive rental payments, establishment and maintenance cost-share, and incentive payments in return for entering a contract to provide specific wildlife habitat.

Active farm fields within the 3.3 miles of active or recently active ferruginous hawk nest sites will be eligible for sign up. Outreach will specifically target lands adjacent to the most recently active nests. Sign-ups will be available after Congress passes a Farm Bill. The SAFE program is a 15-year contract. The requirements for SAFE fields are stricter than they are for regular CRP, and provide better habitat for species of interest.

Partners and co-operators: Woodland Park Zoo, BLM Spokane District, Hanford Reach National Monument, Farm Service Agency.

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Marbled Murrelet

Brachyramphus marmoratus

State Status: Threatened, 1993
Federal Status: Threatened, 1992
Recovery Plan: Federal, 1997

Figure 1. Adult marbled murrelet in breeding plumage (*left, Pacific Southwest Research Station, U.S. Forest Service*); nestling on nest (*right, by Tom Hamer*).

The marbled murrelet is a robin-sized seabird that inhabits shallow coastal areas from the Aleutian Islands of Alaska, south to central California (Figs. 1, 2). In breeding plumage, adults are cryptically colored in brown with white "marbling"; hence the name.

Marbled murrelets have the unique behavior of foraging in marine waters and flying inland to nest in large conifer trees. Nesting behavior has been detected as far as 88 km (55 mi) from the ocean in Washington (Figure 2; WDFW Marbled Murrelet database 2012). Murrelets nest mostly on large branches or other suitable platforms in large trees (Hamer and Nelson 1995, Nelson 1997, Ralph et al. 1995), with a preference for mature and old forest in Washington, Oregon, and California (Nelson et. al 2006). The species is unusual among alcids (i.e. family Alcidae which includes auks, murres, and puffins) in that it does not nest in colonies.

The small size, dark coloration, and fast flight speed during low ambient light make marbled murrelets difficult to observe during their flights over land. Because of their cryptic behavior, the first documented nest in North America was not described until 1974 and no nesting location was confirmed in Washington until after 1987 (Leschner and Cummins 1992). Murrelets fly from marine foraging areas to nest sites to exchange incubation or chick-rearing duties with the nest-bound parent. Flights begin as early as 2 hours before sunrise during April-July. The parent then usually remains at the nest until dusk for the next incubation exchange with its mate or until food is brought in.

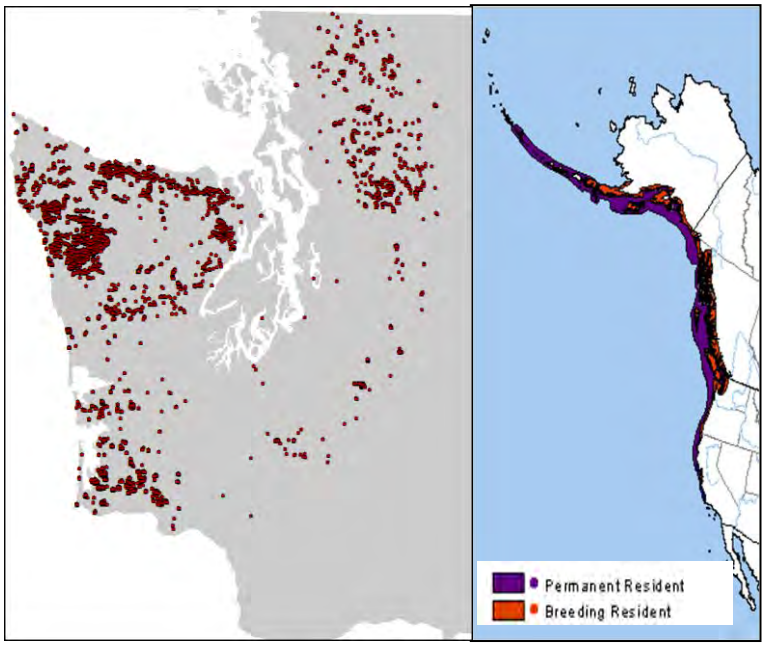

Figure 2. Range of the marbled murrelet (right, Ridgely et al. 2007), and breeding season occurrences in Washington, left.

Marbled murrelets prey primarily on near-shore forage fish such as Pacific herring, northern anchovy, Pacific sand lance, and capelin. Fish regularly comprise 60-100% of the diet (Nelson 1997). A small sample

of dead murrelets recovered from beaches in Washington and the Salish Sea had digestive tract contents of 80% herring and sand lance (S. Pearson, pers. comm.). Krill (Euphausiacea) is also eaten when fish are scarce.

Status and management. In 1992, the marbled murrelet was listed by the U.S. Fish and Wildlife Service (USFWS) as federally threatened under the Endangered Species Act in Washington, Oregon and California, primarily due to declining population trends and loss of old forest nesting habitat from commercial timber harvesting (USFWS 1992). In 1996, USFWS designated critical habitat considered essential to the conservation of the species in these states. In Washington, all critical habitat was designated on federal lands. The primary objective of the Marbled Murrelet federal recovery plan is to stabilize the population at or near current levels by maintaining or increasing productivity and removing or minimizing threats to survivorship (USFWS 1997).

The murrelet was listed as state threatened in 1993 (WAC 232-12-001), and in 1997 the Department of Natural Resources enacted permanent State Forest Practices Rules for the species (WDNR 1997). The rules require forest landowners owning more than 500 acres within 50 miles of marine waters to identify potential nesting habitat and conduct surveys to detect murrelets before any modification or alteration of habitat could take place. If surveys determine there is a high likelihood that nesting is present in a stand, the contiguous habitat is designated "occupied" and is protected from harvest (WDNR 1997).

Federal status reviews led by the USFWS (McShane et al. 2004, USFWS 2009) have retained the listing status as federally threatened. This was supported in part by collection of murrelet blood samples from Washington and Oregon (Bloxton and Raphael 2009) The analyses of these samples confirmed an earlier finding that murrelets from the main genetic unit, eastern Aleutians to northern California, are genetically distinct from peripheral populations in the west-central Aleutian Islands and from central California (Piatt et al. 2007).

Habitat and population monitoring. Habitat loss and fragmentation was one of the factors leading to population declines of marbled murrelets. Only 5-20% of original old-growth forests remain in Washington, Oregon, and California (USFWS 1997), most of which is in relatively small, fragmented patches or in national forest, parks and reserves. The conservation of nesting habitat is one of the central goals of the recovery plan (USFWS 1997). The interagency Northwest Forest Plan was developed in 1993 to meet requirements to track status and trend of watershed condition, late-successional and old-growth forests, and population and habitat trends for marbled murrelets and northern spotted owls (FEMAT 1993). Trends in murrelet nesting habitat and populations are being tracked over time. Habitat changes are monitored by comparing habitat over time to the 1993 baseline level of nesting habitat (Huff et al. 2006a, Raphael et al. 2006, 2011). Population size and trends are monitored by using standardized surveys for murrelets at sea during the breeding season (Miller et al. 2006, Raphael et al. 2007). The ultimate goal is to relate population trends to nesting habitat conditions (Madsen et al. 1999). More information on the Plan can be found at http://www.reo.gov/monitoring/index.shtml.

To monitor the murrelet population in Washington, random transect counts are conducted within 1.5 km of the shoreline to census foraging birds at-sea during most of the breeding season (15 May–31 July). In 2012, the population estimate for Puget Sound and the Strait of Juan de Fuca was 4,393 birds (95% confidence interval = 2,689–6,367 birds), with a 7.43% (standard error = 1.63%) annual rate of decline for the 2001–2012 period (Lance et al. 2013). The population estimate for the outer Washington coast for 2012 (Zone 2) was 1,240 birds (95% confidence interval = 833 – 1,504 birds) with a 7.59% (standard error = 2.01%) annual rate of decline for the 2001-2012 period. As in previous years, higher densities of murrelets occurred from Cape Flattery to the Quinault River mouth than further south. The highest densities of birds were observed from Destruction Island south to Kalaloch and Raft River (Pearson et al. 2011, Lance et al. 2013). For all of Washington, there was an annual rate of decline in murrelet density

from 2001–2012 (adjusted R^2=0.3445; *P*= 0.02632), which represents a 4.07% annual rate of decline during this period (Figure 3; Lance et al. 2013).

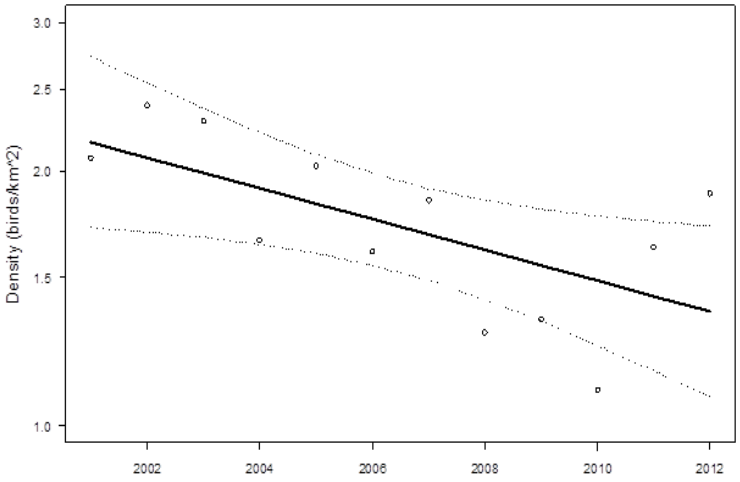

Figure 3. Washington marbled murrelet population density trend for 2001-2012 with 95% confidence intervals for Zones 1 and 2 combined i.e., all marine waters of Washington State (Lance et al. 2013).

NWFP terrestrial habitat monitoring. One of the primary objectives of the effectiveness monitoring plan for Marbled Murrelets is to estimate changes in the amount of nesting habitat over time (Raphael et al. 2011). A broad-scale landscape model based on satellite imagery estimated a baseline of 3.8 million acres of marbled murrelet nesting habitat in Washington and Oregon in 1994 and in California in 1996. Most (89%) of the habitat on federal lands occurred within reserved-land allocations. Thirty-six percent of baseline habitat occurred on nonfederal lands. By 2006-2007, about 13% of high quality potential nesting habitat had been lost over all ownerships in Washington, Oregon, and California (Raphael et al. 2011). Fire was identified as the major cause of nesting habitat loss on federal lands in Oregon and California since Northwest Forest Plan (NWFP) implementation, whereas timber harvest was the primary cause of loss on nonfederal lands (Raphael et al. 2011). From 1996 to 2006, model-defined potential nesting habitat in Washington declined by an estimated 252,600 ac out of 2.3 million ac (~11%). Most of this loss (>90%) was attributed to timber harvest (Table 5 *in* Raphael et al. 2011). Severe windstorms have also contributed to losses of habitat on state and private ownership in southwestern Washington since 2006 (WDNR 2008).

Raphael et al. (2002a, 2011) found that murrelet population size is strongly correlated with the amount of potential nesting habitat present, suggesting that conservation of remaining nesting habitat and restoration of non-habitat (i.e., through senescence and conservation of near-habitat stands) is key to the recovery of the species.

Nesting/telemetry studies. The Strait of Juan de Fuca and northern Puget Sound have the highest marine densities of marbled murrelets in Washington during the breeding season (Miller et al. 2006, Lance et al. 2013). Adjacent forestlands on the Olympic Peninsula and Vancouver Island provide potential nesting sites for murrelets, especially older forests in or near Olympic National Park, National Forest and provincial parks on Vancouver Island. The Washington portion of this region was the focus of murrelet breeding ecology research (Bloxton and Raphael 2009). From 2004 to 2008, murrelets were captured at sea (Strait of Juan de Fuca, Washington outer Coast, San Juan Islands), radio-tagged, and tracked to inland breeding locations to gain a better understanding of breeding ecology. During this period, only 4 of the 20 nests monitored were successful. Summer home ranges of radioed adults varied from 13 to 7,816 km^2 when total marine waters, land areas, and travel corridors were measured (Bloxton and Raphael 2009). Excluding land, the same birds had marine home ranges of 13 to 3,215 km^2. Birds with nests located farther from the ocean had larger home ranges.

Surveys using radar technology. Land-based marine radar has been used to detect abundance of murrelets during morning flights to and from the sea over large areas. Morning sampling studies have shown that numbers of murrelets detected on inbound flights from the ocean are correlated with the

amount of habitat in watersheds, showing the link between at-sea populations and nesting habitat (Burger 2001, Raphael et al. 2002a, Cooper et al. 2006).

Perceived population threats. Low murrelet nest success in recent years (Peery et al. 2004, Bloxton and Raphael 2009) is a major concern. At present rates, adult birds are not able to replace themselves. Nest success is influenced by forest structure, the spatial mix of habitat and non-habitat, human disturbance, prey availability, and marine foraging conditions. Human disturbance can lead to higher predation levels by Steller's and gray jays, crows, ravens, and other species that seek human-related foods and refuse at high-use recreational areas (Peery et al. 2004, Marzluff and Neatherlin 2006). Forest fragmentation can also increase the abundance and distribution of corvids and cause increased predation of nests (Raphael et al. 2002b, Peery et al. 2004). Raphael et al. (2002b) found higher rates of predation at artificial nests within 50 m of forest edge, but the relationship varied with proximity to human activity and structure of the adjacent forest. Predation increased with proximity to edges when the forest matrix contained human settlement and recreation areas, but not when the area was dominated by younger and regenerating forests.

Loss or degradation of forests used by nesting murrelets is an ongoing problem in Washington. Damage regularly results from catastrophic winds and smaller storms (WDNR 2008) and can be exacerbated where murrelet habitat is not adequately buffered along its edges (e.g., when harvest of mature trees happens next to nesting habitat). Attrition of potential nesting habitat also occurs from harvest on state and private lands through negotiated agreements (e.g., habitat conservation plans), or in habitat surveyed under Washington Forest Practices Rules (FPR) and not documented to have "occupied" murrelet behavior. Unintended losses of habitat have occurred when FPR-defined habitat is unreported or is not correctly identified on state or private land Washington Forest Practices applications (WDFW, unpublished data). Outside of federal and some WDNR and WDFW state lands, no incentive exists for landowners to develop recruitment habitat to help with murrelet recovery goals.

Catastrophic oil spills (e.g., the *Tenyo Maru* and *Exxon Valdez* incidents) have the potential to devastate local marbled murrelet populations. Chronic smaller scale oil pollution is also a concern, but is much harder to track.

Fishing net mortality, or "bycatch," of marbled murrelets is currently considered rare in Washington (WDFW Puget Sound Chinook Harvest Plan, Draft EIS April 2004), but is a continuing concern. Only two studies have been done for Puget Sound and represent a small portion of the area sampled. Net fisheries should be monitored closely.

The USFWS assembled a team of scientists in October 2011 to investigate causes for the continued decline in murrelet populations. The outcome of these discussions listed many factors, chiefly loss of potential nesting habitat as the main reason for hindrance of population recovery goals. The Pacific Seabird Group is currently reviewing aspects of the 2003 standard terrestrial survey protocol for clarifying delineation of forest habitat, definitions, survey effort, and guidance.

Coastal wind energy projects within the range of marbled murrelets in Washington, Oregon, and California have been proposed in recent years. One project with 4 wind turbines has been completed and is now in operation on the Pacific-Grays Harbor county line. The owner is currently devising a monitoring scheme for wildlife impacts. To standardize information to assess potential project impacts, a protocol for using radar technology to survey for murrelets near proposed wind energy projects is currently being developed for the USFWS. The protocol will collect data on murrelet passage rates, flight paths, flight altitudes, and needed survey effort on proposed project sites to help identify risk to the species.

Partners and cooperators. U.S. Forest Service (Pacific Northwest Research Station, Redwood Sciences Laboratory), U.S. Fish and Wildlife Service, Washington Department of Natural Resources, National Park Service, Crescent Coastal Research.

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Green Sea Turtle
(*Chelonia mydas*)

State Status: Threatened, 1981
Federal Status: Threatened, 1978
Recovery Plans: Federal, 1998

Figure 1. Green (upper right) and loggerhead (above) sea turtles (*photos by Andy Bruckner, NOAA, and NOAA, respectively)*.

Loggerhead Sea Turtle
(*Caretta caretta*)

State Status: Threatened, 1981
Federal Status: Endangered, 2011 (North Pacific Distinct Population Segment) (Threatened, 1978-2011)
Recovery Plans: Federal, 1998

All sea turtles occurring in U.S. waters are listed under the Endangered Species Act (ESA) and are under the joint jurisdiction of the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). Measures to reduce sea turtle interactions in fisheries are implemented through regulations and permits under the ESA and Magnuson-Stevens Fishery Conservation and Management Act. Regulations were first instituted in 1992 to require turtle excluder devices in shrimp trawl fisheries to reduce interactions between turtles and trawl gear; prior to these protective regulations, bycatch in U.S. fisheries was estimated to result in the death of 71,000 sea turtles annually. Since implementation of mitigation measures, estimated mortality has declined by about 94% (Finkbeiner et al. 2011).

Sea turtles are protected by various international treaties and agreements as well as national laws. They are listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), which prohibits international trade of these species. The U.S. is also a party to the Inter-American Convention for the Protection and Conservation of Sea Turtles, which is the only binding international treaty dedicated exclusively to marine turtles.

Green Sea Turtles

Green sea turtles are the largest of the hard-shelled sea turtles. Adults reach lengths of up to 5 feet and weights of 250-400 pounds. Growth is slow and sexual maturity occurs at 20-50 years. Adults are unique among sea turtles in that they are herbivorous, feeding primarily on seagrasses and algae. This diet is thought to give them greenish-colored fat, from which they take their name.

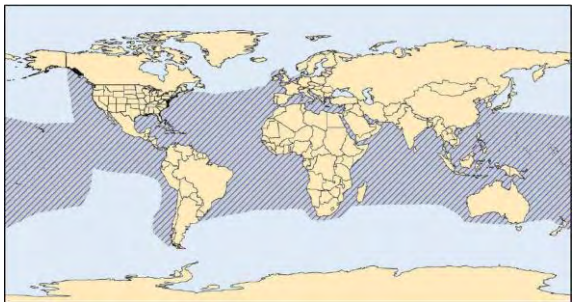

Figure 2. Range of green sea turtles (*NMFS, Office of Protected Resources*).

Adult females return every 2-4 years to lay eggs at

the same sandy beaches where they were born. Females nest at approximately two-week intervals, laying an average of five clutches of eggs. In Florida, green turtle nests contain an average of 135 eggs, which incubate for about 2 months before hatching. After emerging from the nest, hatchlings swim to the open ocean, where they feed close to the surface on a variety of pelagic plants and animals. Once juveniles reach 3-5 years of age, they leave the pelagic habitat and travel to nearshore foraging sites. Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of miles each way.

Green sea turtles generally occur in tropical and subtropical waters near islands and along continental coasts between 30°N and 30°S (Figure 2). Nesting occurs in over 80 countries. In the eastern North Pacific, they primarily occur south of San Diego, but rarely extend northward to southern Alaska. Green sea turtles are rarely recorded in Washington. Four individuals were stranded on outer coast beaches from 2002-2012, with the most recent of these occurring in November 2010 (K. Wilkinson and L. Todd, unpublished data).

Population trends. The two largest nesting populations are found at Tortuguero on the Caribbean coast of Costa Rica, where about 22,500 females nest each year, and Raine Island on the Great Barrier Reef in Australia, where 18,000 females nest. In the U.S., green turtles nest primarily along the coast of Florida, where 200-1,100 females nest annually. Extensive population declines have occurred in all oceans (NMFS and USFWS 2007). Trends at 32 nesting areas around the world indicated a 48-65% decline in the number of females nesting over the past 100-150 years.

Conservation. The principal cause of population declines is harvest of eggs and adults on nesting beaches and juveniles and adults on feeding grounds (NMFS and USFWS 1998a, 2007). These harvests continue in many areas and inhibit recovery. Incidental capture in fishing gear also adversely affects the species. Green turtles are also threatened in some areas of the world by a disease known as fibropapillomatosis. In the U.S., NMFS and USFWS have established regulations to eliminate or reduce threats to sea turtles. Since 1989, the U.S. has prohibited the importation of shrimp harvested in a manner that adversely affects sea turtles.

In Washington, a man was successfully prosecuted under the federal ESA for capturing and killing a green sea turtle on the beach at Ocean Park in 2003. A turtle that stranded in poor condition in November 2009 on the Long Beach Peninsula was taken to the Oregon Coast Aquarium and then to SeaWorld San Diego for rehabilitation. It was released into the wild off San Diego in June 2011.

Loggerhead Sea Turtle

Loggerheads are named for their relatively large heads, which support powerful jaws and enable them to feed on hard-shelled prey, such as whelks and conches. The diet of all life stages is mostly benthic invertebrates (crabs, other crustaceans and mollusks) and occasionally jellyfish. Adults average about 3 feet long and weigh up to 250 lbs. Sexual maturity is reached at an average of 45 years of age. Females lay eggs in three to five nests per nesting season, with 80-120 eggs in a clutch. Incubation lasts about two months, with hatching occurring between late June and mid-November. Loggerheads nest on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. The species is known to make long migrations; some Pacific loggerheads migrate over 7,500 miles (12,000 km) between nesting beaches in Japan and feeding grounds off Mexico.

Loggerheads occur throughout the tropical and temperate regions of the Atlantic, Pacific, and Indian Oceans (Figure 3). In the eastern Pacific, loggerheads have been reported as far north as Alaska, and as far south as Chile. Along the U.S. west coast, occasional sightings are reported from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California. The west coast of

Mexico, including the Baja Peninsula, provides critically important habitat for juvenile loggerheads. Loggerheads nest in tropical and subtropical regions, and the only known nesting areas for loggerheads in the North Pacific are found in southern Japan (Conant et al. 2009). Loggerhead turtles are rarely recorded in Washington. No individuals were stranded on outer coast beaches in the state from 2002-2012 (K. Wilkinson and L. Todd, unpublished data).

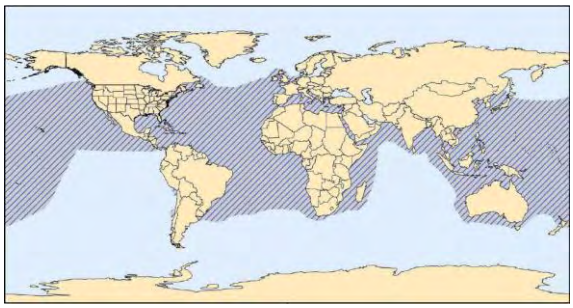

Figure 3. Range of loggerhead sea turtles (*NMFS, Office of Protected Resources*).

Population trends. Loggerheads are the most abundant species of sea turtle in U.S. coastal waters. The most recent reviews show that only two loggerhead nesting beaches have greater than 10,000 females nesting per year: South Florida (U.S.) and Masirah Island (Oman). Total estimated nesting in the U.S. is 68,000 to 90,000 nests per year. Recent analyses of long-term nesting data from the southeastern U.S. show a decline in abundance. Populations in Honduras, Mexico, Colombia, Israel, Turkey, Bahamas, Cuba, Greece, Japan, and Panama have also been declining. Declines are primarily attributed to incidental capture in fishing gear, directed harvest, coastal development, increased human use of nesting beaches, and pollution (NMFS and USFWS 1998b). The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges. Harvest of loggerheads still occurs in many places (e.g., the Bahamas, Cuba, and Mexico) and is a serious and continuing threat to recovery.

Conservation. In 2009, NMFS and USFWS published an updated status review (Conant et al. 2009). In September 2011, NMFS and USFWS listed nine distinct population segments of loggerhead sea turtles under the Endangered Species Act (NMFS and USFWS 2011). Protecting loggerheads on U.S. nesting beaches and in U.S. waters alone is not sufficient to ensure the continued existence of the species. The highly migratory behavior of the species makes international cooperation in conservation efforts essential.

Partners and cooperators: NOAA-National Marine Fisheries Service, U.S. Fish and Wildlife Service.

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Gray Whale

(*Eschrichtius robustus*)

State Status: Sensitive, 1997
Federal Status: None (delisted from Endangered in 1994)
Recovery Plans: None
State Management Plan: None

Figure 1. Gray whale (*photo by Chris Johnson*).

Two stocks of gray whales are recognized: the Eastern North Pacific stock along western North America, including Washington, and the critically endangered Western North Pacific stock off eastern Asia (Carretta et al. 2013). Most of the Eastern North Pacific stock spends the summer feeding in the Bering, Chukchi, and Beaufort Seas off Alaska and Siberia (Rice and Wolman 1971, Berzin 1984). About 200 gray whales, known as the Pacific Coast Feeding Group, also summer in waters from southeastern Alaska to northern California (Rice and Wolman 1971, Darling 1984, Rice et al. 1984, Calambokidis et al. 2002, 2010). Recent genetic data suggest that whales in this group are somewhat distinct from the main stock, but that some interbreeding between the two groups occurs (Frasier et al. 2011, Lang et al. 2011). Additionally, at least 12 members of the Western North Pacific stock have been detected visiting waters from off Vancouver Island to Mexico since 2004 (Mate et al. 2011, Weller et al. 2012).

Gray whales are a coastal species usually found over the continental shelf. Feeding occurs on the sea bottom in shallow waters. Members of the Eastern North Pacific stock migrate south along the North American coast from Alaska to Baja California from October to January, then resume migration back toward northern feeding areas from mid-February to June (Rice and Wolman 1971, Rice et al. 1981, 1984, Rugh et al. 2001). Wintering occurs primarily along the west coast of Baja California, where shallow lagoons and bays are used for calving in January and February (Rice et al. 1981). In Washington, southbound migration peaks in December, northbound migration is highest first in late March and early April, and again in May through early June when mostly females with calves pass by (Calambokidis et al. 1994).

Usually fewer than 20 gray whales visit the inner marine waters of Washington and British Columbia beginning in about January, with some staying until summer (Orca Network 2011). Six to ten of these are Pacific Coast whales that return most years to feeding sites near Whidbey and Camano Islands. The remaining individuals appear unfamiliar with feeding areas, often arrive emaciated, and commonly die of starvation.

Whaling depleted the Eastern North Pacific stock to between a few hundred and a few thousand whales by about 1930 (Reilly et al. 1980), but recovery was achieved within 50 years following adequate protection. The most recent minimum population estimate is about 18,000 whales based on data from 2006-2007 (Figure 2; Carretta et al. 2013). Despite high levels of mortality in 1999 and 2000, the population is considered to have fluctuated around its average carrying capacity for the last 30 years (Carretta et al. 2013). Subsistence hunting in Russia, where an average of 123 whales was taken per year

from 2006 to 2010, is the largest known source of mortality for the stock. Four gray whales have also been killed by native American hunters in recent years, including two (one unauthorized) by the Makah tribe in Washington since 1999 and two in Alaska in 1995. Commercial fisheries and various types of entanglements are minor causes of mortality, with a minimum average of three whales killed annually in U.S. waters (Carretta et al. 2013). Reports of deaths from ship strikes average about 1-2 per year, although this is likely an underestimate.

Another threat to the species is climate change, which is causing a loss of sea ice in some regions of the Arctic. Bluhm and Gradinger (2008) predicted this will increase the pelagic prey of gray whales and decrease benthic prey. Because gray whales feed on both pelagic and benthic prey, they may be more adaptable and fare better than marine mammals that only feed benthically (Moore and Huntington 2008). Reductions in sea ice are also expected to expand oil and gas exploration and shipping in areas used by gray whales, which will intensify the risk of oil spills and ship strikes (Hovelsrud et al. 2008). Ocean acidification will probably affect prey abundance.

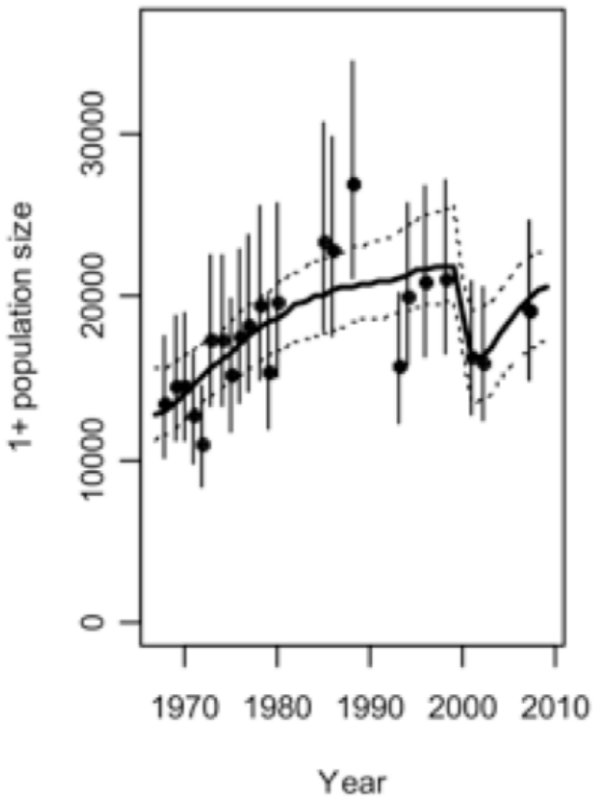

Figure 2. Estimated abundance of gray whales in the Eastern North Pacific stock from counts of whales migrating past Granite Canyon, California (error bars indicate 90% probability intervals; solid line represents the estimated trend of the population with 90% intervals as dashed lines; *from* Punt and Wade 2010).

Monitoring and research. Survey efforts for gray whales are conducted by NOAA Fisheries and partner groups, such as Cascadia Research Collective and the Makah Tribe. Updated stock assessments are regularly derived from survey results and include information on abundance, population trends, and mortality from fisheries, ship strikes, and other sources. Sightings of gray whales in the inner waters of Washington are posted monthly by Orca Network (http://www.orcanetwork.org/sightings/map.html). Research is underway on a number of aspects of the species' population biology.

Makah Tribe's proposed whale hunt. The Makah Tribe retained the right to hunt gray whales at traditional sites under the Treaty of Neah Bay in 1855. The tribe resumed whaling in 1999, but has since been prevented from doing so by a 2004 court ruling that it must follow the necessary procedures for obtaining authorization to take whales under the Marine Mammal Protection Act (MMPA). The Makah have applied for a waiver from the MMPA regulations. The tribe proposes to harvest up to five gray whales per year and to target only whales migrating through the tribe's usual and accustomed hunting area off the northwestern end of the Olympic Peninsula. One of the concerns with the hunt is that it may negatively impact the small Pacific Coast Feeding Group population, particularly members regularly occurring off northern Washington and southern Vancouver Island. Similarly, the hunt might result in the take of members of the highly endangered Western North Pacific stock migrating through this same area (IWC 2011a, 2011b). A draft environmental impact statement for the hunt was prepared to meet NEPA requirements in 2008 (NMFS 2008), but review of the document was stopped in May 2012 (NMFS 2012). A new draft environmental impact statement will likely be prepared in 2013 and will incorporate

new information on the Pacific Coast Feeding Group and migration patterns in the Western North Pacific stock.

Management of entanglements and ship strikes. NOAA Fisheries has expanded its efforts to document entanglements and ship strikes of all large whales in the eastern North Pacific. To better address the problem of entanglements, the agency has held disentanglement training sessions and cached disentanglement equipment at sites in Washington and elsewhere along the U.S. west coast.

Figure 3. Dead gray whale that stranded in Samish Bay in 2010 (*photo by Cascadia Research Collective*).

Stranding responses. NOAA Fisheries Northwest Region coordinates responses to strandings of gray whales through the Northwest Region Marine Mammal Stranding Network, which is comprised of cooperating scientific investigators, institutions, organizations, and state/federal fish and wildlife agencies. Stranding data are entered into a national database. Strandings of gray whales are more common than for any other large whale in Washington and Oregon (Norman et al. 2004), with an average of 4.7 (range of 2 to 11) individuals per year in Washington during the past decade (NOAA Fisheries, unpublished data). Three strandings of gray whales occurred in Washington in 2012 (NOAA Fisheries, unpublished data). Cascadia Research samples or necropsies many of the stranded individuals to determine cause of death, animal condition, and health.

Partners and cooperators: NOAA Fisheries, Cascadia Research Collective, Makah Tribe, Orca Network, Fisheries and Oceans Canada, Dungeness National Wildlife Refuge, Olympic National Park, Olympic Coast National Marine Sanctuary, Port Townsend Marine Science Center, Wolftown, Marine Science and Technology Center at Highline Community College, and local marine mammal stranding networks.

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Common Loon

(*Gavia immer*)

State Status: Sensitive, 2000
Federal Status: None
Recovery Plans: None
State Management Plan: None

Figure 1. Adult male common loon and chick on North Twin Lake, Ferry County, Washington (*photo by Dan Poleschook)*.

Loons are large birds with 50-55 inch wingspans, and they weigh 8 1/2 - 19 lbs. The striking black and white breeding plumage gives way in winter to a duller gray above, white below garb. They are best known for their vocalizations: they hoot, wail, yodel, and give a tremolo call. Common loons breed across Alaska, Canada, and the northern coterminous states. They winter along both coasts, from the Aleutians to Mexico, and from Newfoundland to the Gulf coast.

The common loon population in North America is relatively healthy and robust, with a total estimated breeding population of >200,000 territorial pairs (Evers 2007); most of these birds breed in vast lake-rich areas in Canada where they are relatively isolated from shoreline development and recreational activities. The southern limit of common loon breeding has retreated northward since the 19th century due to human factors. In the northwestern U.S., common loons once nested as far south as the Mount Shasta area, but are now extirpated from California, Oregon, and Idaho (Evers 2007, Poleschook and Gumm 2009).

Historical data for the state are limited, but loons were probably once a more common nester, particularly in western Washington. Today, small numbers of loons nest on lakes and reservoirs in Ferry, Okanogan, Chelan and Douglas counties in eastern Washington, and King and Whatcom counties in western Washington. There are also unconfirmed reports of nesting in Benton, Clallam, Grant, Grays Harbor, and Jefferson counties. Non-breeding loons have been reported during summers at a total of 140 lakes, reservoirs, and rivers in the state. Post-breeding migration probably begins in late August and continues through November; subadults often remain in the marine environment all summer. Common loons winter on Washington's coastal and inland marine waters, as well as the Columbia River and Lake Chelan. Puget Sound and the Strait of Juan de Fuca hosts 3,000-4,000 wintering birds; most of these nest in Canada and Alaska. Washington may be the only known state where common loons overwinter on both saltwater and fresh water.

Diet. Loons feed mainly on fish, typically of a size between 0.35 to 2.45 ounces. In fresh water, these include shad, alewife, trout, smelt, mudminnows, dace, chubs, shiners, suckers, sticklebacks, bluegills, crappie, yellow perch, and walleye. Saltwater prey include eels, menhaden, herring, sprat, haddock, whiting, pipefish, shiner perch, sandlance, gobies, blennies, Irish lords, gurnards, sculpins, flounder, sole, and skates. They also occasionally take amphibians, crayfish, small crabs, and dragonflies; and in eastern Washington, adults have been observed feeding dragonfly nymphs to chicks.

Habitat. Common loons usually nest on lakes surrounded by forest that have deep inlets and bays. Lakes where loons nest in Washington range in size from 14-7,800 acres. Use of a lake is dependent on an ample supply of small fish for prey and isolation from human disturbance, such as wave action created from powerboats or personal watercraft. Loons often forage in shallow clear water. They primarily use

the top 15 ft of the water column, but have been recorded diving to 180 feet in clear water to obtain food. During migration, loons aggregate on rivers, reservoirs, and lakes with abundant food. In autumn, most loons move to coastal marine locations; and they winter on shallow, sheltered marine waters.

The development of lakeshores has probably eliminated nesting in many parts of the state; while reservoir development, particularly for municipal water supplies where public access is restricted, has added nesting habitat that did not exist historically. However, rapid fluctuations of water levels in reservoirs can result in nest failures due to flooding. The introduction of fish to many lakes has provided additional prey, but the use of rotenone to remove undesirable fish before stocking game fish temporarily depresses fish and invertebrate prey.

Natural sources of mortality include predation, especially of young; injuries resulting from territorial fighting; botulism; and parasitism. Predators include bald eagles, river otters, coyotes, weasels, raccoons, skunks, and mink. Human disturbance can facilitate predation on eggs and chicks. Human-related mortality factors include lead poisoning from ingestion of lead fishing sinkers, entanglement in fishing lines, injuries from fishhooks, shooting, drowning in fish nets and traps, contamination by spilled oil, poisoning by mercury or lead, and collisions with boats, powerlines and vehicles. Pollution, such as oil spills, may be the greatest threat to wintering loons where they concentrate in shallow marine waters.

Breeding population. Common Loons are long-lived and do not nest until at least 5 years of age, and more typically not until age 7 or later. Once a nesting territory is established, loons return to the same site each year. In recent years, <15 pairs of loons have nested at lakes in Washington. Volunteers and WDFW staff generally monitor 14 sites in western Washington and 16 in eastern Washington to determine common loon nesting status. In 2012, a minimum of 13 nests were initiated, producing at least 7 chicks surviving to fledging.

Productivity data for 2004-2009 for 13 sites had ten sites that averaged 0.78 fledglings/territory/year and three that averaged 0.33 fledglings/territory/year (Poleschook and Gumm, unpubl. data). Increases in productivity since the 1990s (Figure 2) have resulted from conservation work, primarily done by dedicated volunteers. These activities have included providing nesting platforms, erecting predator

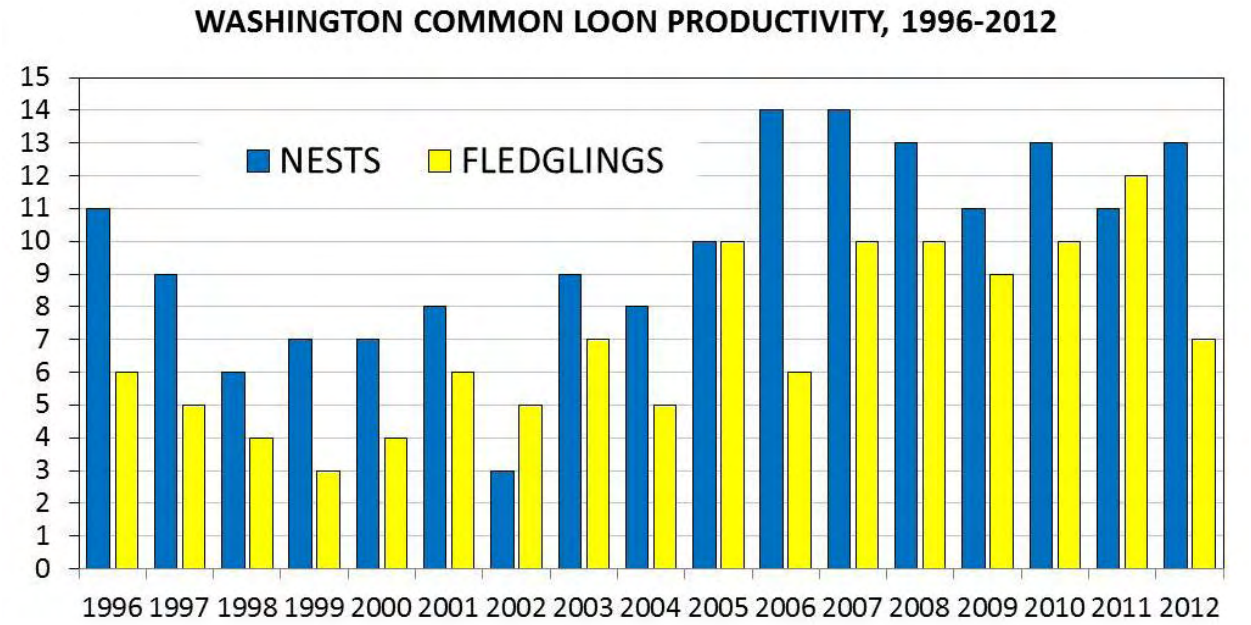

Figure 2. Number of known active loon nests and fledglings produced in Washington, 1996-2012.

guards over nests to deter avian predators (e.g. bald eagles), capture of loons to remove tangled fishing line, erecting signs and buoys to discourage disturbance by boats, purchasing fingerlings for some lakes with low food resources, monitoring, documenting mortalities, and assisting with studies of mercury contamination (Poleschook and Gumm 2001, 2004, 2006, 2007, 2009).

In June 2011, the Loon Lake Loon Association, in partnership with the USFS Colville Ranger District, donated a BioHaven floating platform to WDFW, which was installed on Blue Lake on the Sinlahekin Wildlife Area. The Loon Lake Loon Association, the Pacific Biodiversity Research Institute in Gorham, Maine, and WDFW, have banded common loons in Washington since 1995.

Figure 3. A 20-month old common loon on the Columbia River near Pateros, Washington, January 2010; this bird was banded as a chick on Bonaparte Lake, Okanogan County (*Photo by Daniel Poleschook, Jr. and Virginia Gumm Poleschook*).

In 2012, loons nested for the first time on Crawfish Lake in Okanogan County, and fledged 1 chick. Due to limited natural nesting opportunities on this lake, a floating platform was installed in the mid-1990s and a loon pair used the platform this year. Common loons have been observed on the lake for many years but this is the first documented nesting on this lake. Loons attempted to nest on Beaver Lake for the first time, but the attempt failed. Daniel Poleschook, Biodiversity Research Institute, Virginia Gumm, and WDFW staff banded loons at North Twin, Ferry, Swan, Pierre, and Lost lakes; this included 1 adult male, 2 adult females, and 5 chicks; three of the adult birds also had geolocators attached. Geolocators record time and daylight, and when recovered at a future date and uploaded to a computer, it can provide data on migration and wintering location.

Also in 2012, for the first time since banding began in 1995, a bird banded as a chick, returned and nested on North Twin Lake, and fledged one chick. The bird was banded on Bonaparte Lake in 2005.

Columbia River wintering. In 2010, a winter survey of loons on the Columbia River was conducted by the BioDiversity Research Institute, U. S. Army Corps of Engineers, and WDFW to assess the extent of wintering by common loons (Poleschook et al. 2010). A total of 114 loons were observed along 101 river miles (Table 1). Four common loons observed on Lake Pateros during recent winters had been banded on breeding lakes in northeastern Washington.

Table 1. Winter survey of common loons on the Columbia River in central-northeast Washington, 2010 (Poleshook et al. 2010).

Date	River segment	Miles surveyed	Number of birds	Loons/linear mile
28 Jan	Rufus Woods Lake	50	4	0.1
29 Jan	Lake Pateros	28	79	2.8
30 Jan	Below Wells Dam	2	23	11.5
6 Mar	Lake Roosevelt	21	8	0.4
Total		**101**	**114**	**1.1 average**

Inner marine waters wintering. WDFW conducted annual aerial surveys of common loons and other marine waterbirds in Washington's inner marine waters from 1996 to 2008. These surveys suggested that

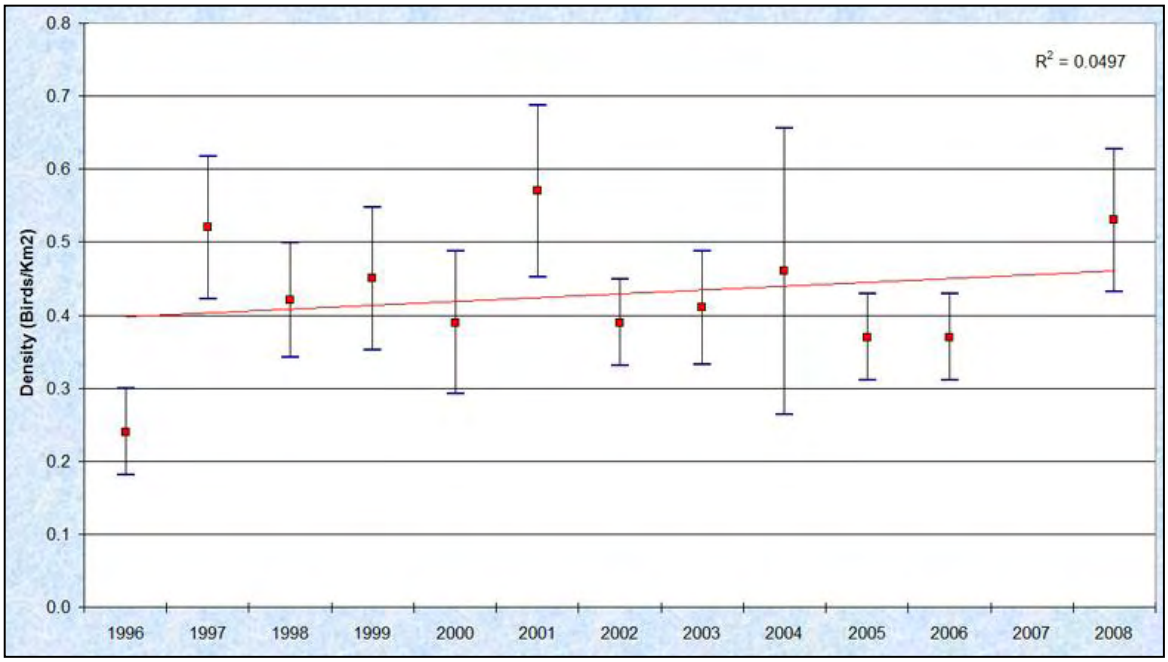

Figure 4. Density of common loons wintering on inner marine waters of Washington, 1996-2008 (WDFW data, available at: http://wdfw.wa.gov/mapping/psamp/).

wintering common loon numbers are generally stable or perhaps slightly increasing in this area (Figure 4).

Lead poisoning. Throughout the range of common loons, where loons breed on lakes with a substantial recreational fishery, ingestion of lead fishing tackle is a leading cause of death (Pokras and Chafel 1992, Sidor et al. 2003, Evers 2007). The ingestion of a single lead sinker is sufficient to cause death by poisoning. Lead toxicosis is a leading cause of known common loon mortalities in Washington (Figure 5).

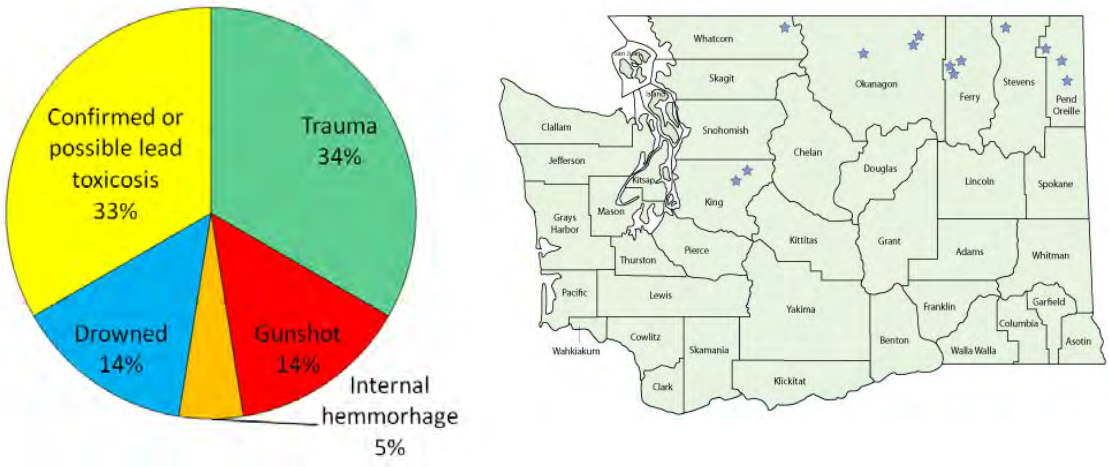

Figure 5. Thirteen lakes with lead fishing tackle restrictions to protect breeding loons (right); causes of death for 21 common loons in Washington, 1999-2010 (left; *data sources included: Washington Animal Disease Diagnostic Laboratory; radiographs taken at the Veterinary Teaching Hospital at Washington State University or at private veterinary clinics; necropsy reports from the Biodiversity Research Institute; and behavioral observations by Biodiversity Research Institute staff. Likelihood of lead toxicosis based on liver Pb (lead) level of >6ppm and detection of Pb in GI (gastrointestinal) tract via radiology or necropsy, or documented clinical signs or pathology consistent with Pb toxicosis).*

In May 2011, new rules went into effect at 13 lakes where loons nested. The rules prohibit the use of lead fishing tackle (weights and jigs that measure 1½ inches or less) on those lakes. The use of non-lead fishing tackle is intended to improve common loon survival in Washington on the lakes with known nesting activity (http://wdfw.wa.gov/conservation/loons/).

Partners and cooperators: Daniel Poleschook and Virginia Gumm, Loon Lake Loon Association, WSU School of Veterinary Sciences, Biodiversity Research Institute, U.S. Fish and Wildlife Service, Hancock Timber Resource Group, Seattle Public Utilities, Tacoma Water, Bonneville Power Administration, U.S. Department of Energy, U.S. Bureau of Reclamation, Colville National Forest, and U.S. Forest Service.

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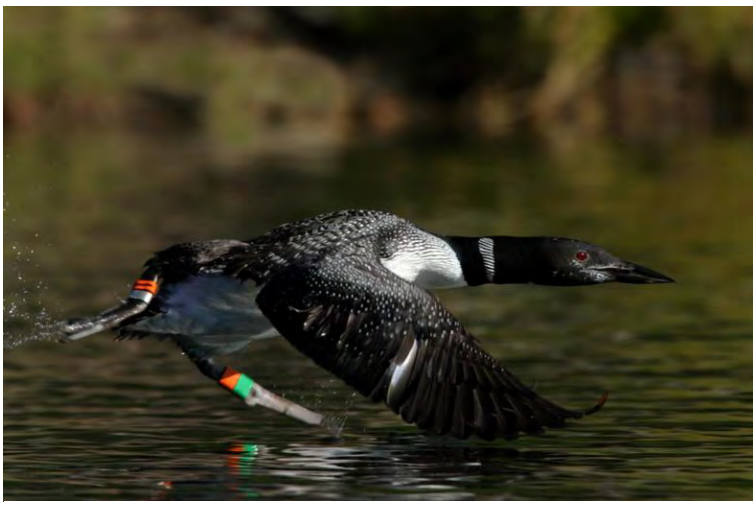

Figure 6. Female common loon banded in Washington (*photo by Daniel Poleschook Jr.*).

Bald Eagle

(*Haliaeetus leucocephalus*)

State Status: Sensitive, 2008 (Threatened, 1983-2008)
Federal Status: Species of concern (Threatened 1978-2007)
Recovery Plans: None
State Management Plan: None

Figure 1. Bald eagle at Blue Lake, Sinlahekin WLA (*photo by Justin Haug*).

The bald eagle population has made a dramatic recovery in Washington and the U.S. in recent decades since its listing under the federal Endangered Species Act in 1978 and the banning of the pesticide DDT. Bald eagles (Figure 1) are now a common breeding bird near low elevation water bodies in much of Washington (Seavey 2005). The state's population is supplemented by many wintering eagles that breed in northern Canada; these birds winter along Washington rivers with substantial salmon runs (Watson and Pierce 2001).

Recent estimates for the lower 48 states total nearly 10,000 nesting pairs. The U.S. Fish and Wildlife Service initially proposed federal delisting the bald eagle in 1999, but this was delayed while protections under federal laws were clarified and a long-term monitoring plan was developed (USFWS 2007). The species was removed from the Endangered Species Act in 2007 and was downlisted to state sensitive in Washington in 2008. Bald eagles are affected by shoreline development, fisheries, and forest management, and there is a continued need to conserve nesting habitat and foraging opportunities.

Only 105 pairs of bald eagles nested in Washington in 1980 (Watson et al. 2002). From 1981-2005, the nesting population in the state increased 707% (Figure 2). The last statewide surveys conducted in 2005 at 1,125 known territories recorded 840 occupied nests (Stinson et al. 2007). A few subpopulations, such as along western Olympic Peninsula rivers and on Lake Roosevelt, appear to still be increasing. However, recent declines in nest occupancy rates in parts of western Washington suggest that the population is approaching saturation in other areas (Stinson et al. 2007). The appearance of nests in developed areas may also be related to increased competition for optimal nesting sites. Recent research in southern British Columbia found that the recovering bald eagle population may be limited by increased competition for winter chum salmon (*Oncorhynchus keta*) (Elliott et al. 2011). Declines in late winter salmon stocks may have forced eagles to exploit more marginal food supplies and as a result, may have increased late winter eagle mortality.

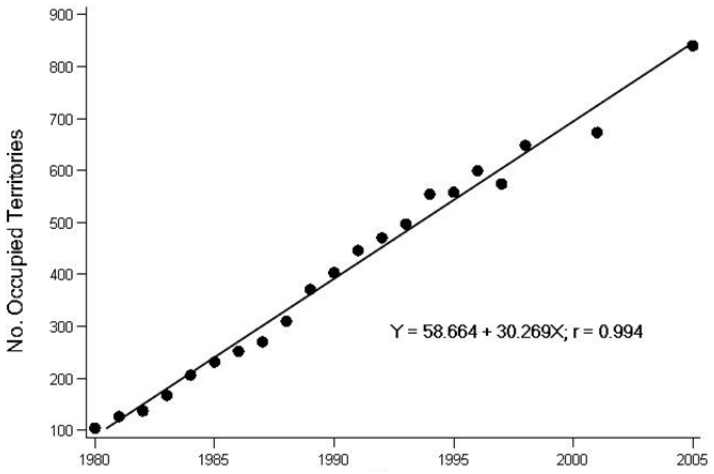

Figure 2. Number of occupied bald eagle nests in Washington, 1980-2005.

Bald eagles can be found in all the forested parts of Washington throughout the year, but they are much more abundant in the cooler, maritime region west of the Cascade Mountains than in the drier eastern half of the state. Bald eagle nests are most numerous near marine shorelines, but nests are also found on many of the lakes, reservoirs, and rivers of Washington. Few birds eat as wide a variety of foods as do bald eagles. Fish are usually the most common prey taken throughout North America, but bald eagles also capture a variety of birds, particularly waterfowl (Stalmaster 1987). In Washington, bald eagles often raid gull and seabird roosts or nesting colonies to prey on adults, nestlings, and eggs (Watson 2002).

Bald eagle protection and management. The state bald eagle protection rules (Appendix A) were amended in 2011 to apply to eagles only when they are listed as endangered or threatened. Because eagles are now listed as Sensitive, the previous requirement to develop state bald eagle management plans is no longer in effect. While WDFW will not be asking local governments to require management plans prior to issuing local permits, they may continue to protect eagles under local critical areas ordinances pursuant to the Growth Management Act. Bald eagles remain protected under state and federal law, and landowners must still comply with the federal Bald and Golden Eagle Protection Act to avoid impacting eagles. Information on bald eagles can be found at the WDFW website at: http://wdfw.wa.gov/conservation/bald_eagle/ and at the federal website at: http://www.fws.gov/pacific/eagle/index.html . Winter communal night roosts and important foraging areas are also protected.

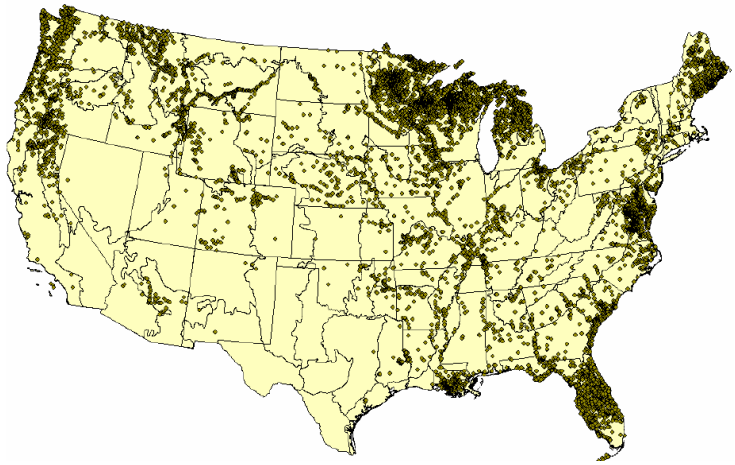

Figure 3. Distribution of bald eagle nests in 2004-2006 (USFWS 2009).

In 2012, two dead bald eagles from Okanogan County were sent to labs for necropsy and toxicology work. Both bald eagles were found to contain toxic levels of lead in their systems, presumably from lead shot, bullets, or fishing tackle ingested with their prey.

Post-delisting monitoring plan. A federal Post-delisting Monitoring Plan was completed in 2009 (USFWS 2009). The status of the bald eagle will be monitored nationally by collecting data on occupied nests over a 20-year period with sampling events held once every 5 years. The sampling scheme was developed after a pilot study that included surveys in Washington and several other states. The first monitoring surveys were done in 2009, and the 2nd round is scheduled for 2014. The sample design is based on an 80 percent chance of detecting a 25 percent or greater change in occupied bald eagle nests over any period, measured at five-year intervals. If such declines are detected, the USFWS's Bald Eagle Monitoring Team in conjunction with the states will investigate causes of these declines. The result of the investigation will be to determine if the population of bald eagles in the contiguous 48 states warrants expanded monitoring, additional research, and/or resumption of Federal protection under the Endangered Species Act. The USFWS will conduct a final review at the end of the 20-year monitoring program.

Eaglecams. The Eaglecam was the first WildWatchcam project to appear on the WDFW website. Initiated in 2000, the project continues to bring the home life of eagles to peoples'computers all over the world via the internet. The Eaglecam website receives about ½ million 'hits' each nesting season and has been highly successful in informing and educating the public about eagles and their conservation.

Partners and cooperators: U.S. Fish and Wildlife Service, Washington Department of Natural Resources, Joint Base Lewis-McChord, U.S. Forest Service.

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Peregrine Falcon

(*Falco peregrines*)

State Status: Sensitive, 2002 (Endangered, 1980-2002)
Federal Status: Species of concern, 1999 (Endangered 1970-1999)
Federal Recovery Plan: None
State Management Plan: None

Figure 1. Peregrine falcon (*photo by Brian Caven*).

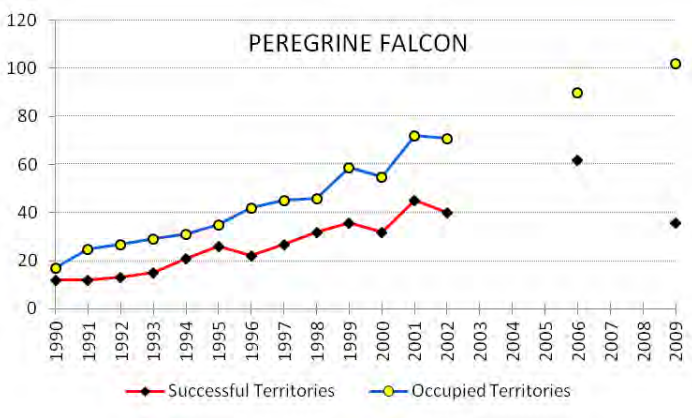
The peregrine falcon is a medium-sized raptor (15 –21 inches long, 40 inch wingspan) that generally preys on other birds, such as songbirds, shorebirds, ducks, and—in urban areas—starlings and pigeons. The nest scrape is usually on a high cliff ledge, but some are placed on manmade structures, including skyscrapers, towers, and bridges.

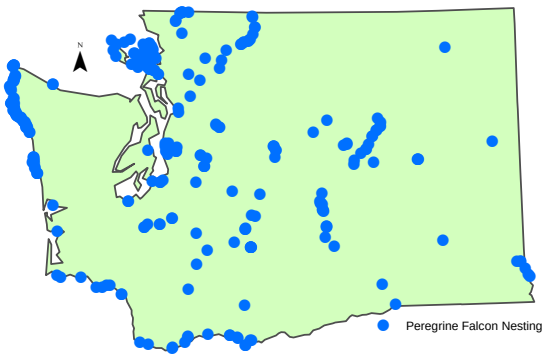
The peregrine falcon declined dramatically following the widespread use of the insecticide DDT after World War II that caused eggshell thinning and widespread reproductive failure. Peregrine falcons were never very abundant. Studies in the 1930s and 1940s estimated that there were about 500 breeding pairs in the eastern United States and about 1,000 pairs in the West and Mexico. By the mid-1970s, the species had been eliminated from nearly all of the eastern U.S. and reduced by 80 to 90 percent in the western states. WDFW began monitoring the population in the late 1970s and found only 5 pairs in the state in 1980.

National restriction on DDT use, along with captive breeding and reintroduction programs, have allowed the peregrine population to increase in the last 30 years. In August 1999, the U.S. Fish and Wildlife Service removed the American peregrine falcon from the federal list of endangered species.

The species was downlisted to state sensitive in Washington in 2002. Population numbers have been steadily increasing, with just over 100 occupied territories in 2009 (Figure 2). WDFW and cooperators continue to monitor the known sites. WDFW also interacts with landowners and agencies on disturbance and other issues that could jeopardize nest site occupancy at individual sites.

Small numbers of peregrine falcon chicks have been available by special permit for falconry purposes in Washington since 2004. A lottery system was initially used for the take of falcon eyasses, but demand





Figures 2, 3. Number of occupied peregrine falcon territories in Washington 1990-2009 (left), and distribution, 2000-2011 (right).

has decreased in the last several years. The falconry regulations were changed in 2010 and first year falcons can now be taken at areas other than nest sites, although the opportunities for this are somewhat limited in Washington. Five birds were collected in 2011. In 2012, 5 peregrines were acquired out of the 10 permits issued; two of the birds taken fell out of bridge nests and were transferred from wildlife rehabbers that were caring for them.

In 2011, the Washington Forest Practices Board proposed removing peregrine falcon Critical Habitat from state forest practices rules (WAC 222-16-080). This rule change was approved in February and became effective in March 2012.

A new potential conservation issue for peregrine falcons arose in recent years with the detection of widely used flame retardant chemicals in peregrine eggs in Spain and Canada (Guerra et al. 2011). The chemicals, PBDEs, may have neurological or endocrine effects that, at high levels, could affect reproduction. Environmental contamination is one of the few threats that can impact such a sparsely dispersed species. Since 2000, the European Union, the U.S. Environmental Protection Agency, and many states, including Washington, have placed restrictions on the use of PBDEs and deca-BDE (Washington Department of Ecology 2011). Over time, exposure to PBDE flame retardants should decline in the U.S. as production of two of the three types of PBDEs was voluntarily discontinued in 2004 and the last type is planned for phase-out in 2013 (Washington Department of Health 2011). Exposures will continue from existing building materials, furnishings, and consumer products that contain PBDEs. PBDE use and production continue in other parts of the world, so PBDEs will still be in products imported to the U.S.

Population monitoring. Federel post-delisting monitoring surveys conducted in 2003 estimated the U.S., Canada, and Mexico population at about 3,000 breeding pairs. Post-delisting monitoring is continuing at 3-year intervals (2006, 2009, 2012; Figure 2), with the final survey scheduled for 2015 (USFWS 2003). Post-delisting monitoring was performed by WDFW regional staff during April-July 2012 at 25 locations statewide in Washington. Site examination and data records were performed and collected according to an established protocol. Washington Department of Transportation staff assisted with monitoring of 1 territory (Lewis and Clark Bridge). Reproductive performance was substantial in 2012, with territory occupancy at 84%. Productivity was 1.81 young among 21 occupied territories and 2.38 young among 16 successful territories.

Partners and cooperators: U.S. Fish and Wildlife Service, Falcon Research Group, Washington Falconers' Association, Port of Olympia, Washington Department of Natural Resources, Washington Department of Transportation.

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Pygmy Whitefish

(*Prosopium coulteri*)

State Status: Sensitive, 1998
Federal Status: Species of concern
Recovery Plans: None
State Management Plan: None

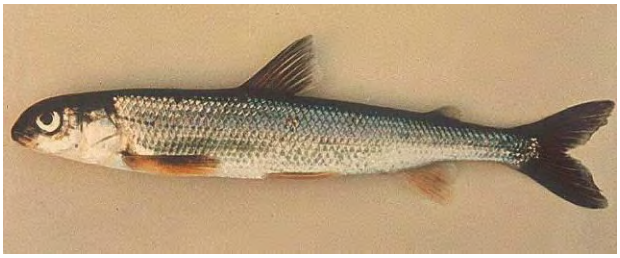

Figure 1. Pygmy whitefish (*photo from Wydoski and Whitney 2003)*.

The pygmy whitefish, a small (usually < 20 cm) member of the family Salmonidae, is distributed across the northern tier of the United States, throughout western Canada and north into southeast Alaska, and in one lake in Russia (Hallock and Mongillo 1998). Their widely scattered distribution, primarily in deep lakes, suggests they are relics of a wider distribution prior to the last ice age (Wydoski and Whitney 2003). Washington is at the extreme southern edge of their native range in North America.

Pygmy whitefish are most commonly found in cool oligotrophic lakes and streams of mountainous regions. However, they have been collected from smaller, shallow, more productive lakes in British Columbia and Washington. Pygmy whitefish eat crustaceans, aquatic insect larvae and pupae, fish eggs, and small mollusks. Pygmy whitefish are important forage fish for larger predatory species including bull trout (*Salvelinus confluentus*).

Historically, pygmy whitefish resided in at least 16 lakes in Washington (Figure 2; Hallock and Mongillo 1998). Currently they inhabit only nine. Their demise in six lakes is attributed to piscicides, introduction of exotic fish species and/or declining water quality. Because of the very limited range of the pygmy whitefish in Washington, they are vulnerable to additional extirpations without cooperative management.

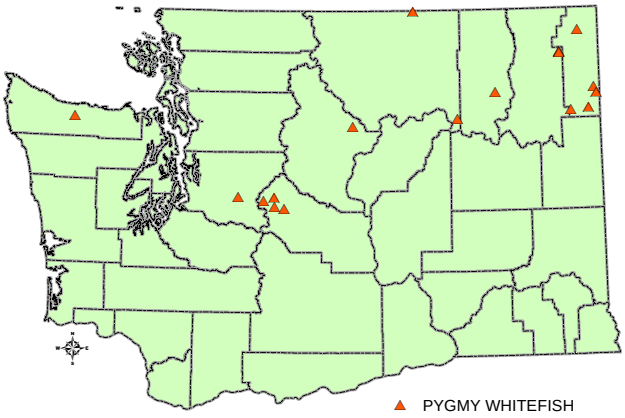

Figure 2. Lakes where pygmy whitefish have been collected.

Pygmy whitefish surveys require specialized techniques because of the fish's small size and tendency to inhabit the deeper portions of lakes; their presence in lakes heavily sampled for other species sometimes goes undetected. Pygmy whitefish have been caught in water depths ranging from 7 to 92 m in Washington. Pygmy whitefish are broadcast spawners and deposit their eggs over cobble and gravel substrates in riverine habitat (Hallock and Mongillo 1998). They spawn when temperatures for incubation are coldest, often below 4 ˚C in the Cedar and Rex rivers (Barnett and Paige 2012).

Surveys. The only targeted surveys for pygmy whitefish in Washington since 1998 have been made at Chester Morse Reservoir in King County, which has one of the strongest and most protected populations in the state. Seattle City Light has conducted pygmy whitefish spawning surveys at the reservoir every year since 2001 and is conducting research on the species' ecology. Pygmy whitefish are espcailly important prey for bull trout in Chester Morse Resrvoir, where the fish community is composed of only four species (pygmy whitefish, bull trout, rainbow trout (*Oncorynchus mykiss*), and shorthead sculpin (*Cottus confuses*)) (Barnett and Paige 2012).

Pygmy whitefish have also been incidentally recorded at Lake Crescent, Keechelus Reservoir, and Sullivan Lake since 2004, confirming the continued presence of populations in these water bodies. The population at Lake Crescent (Clallam County) is also fairly well protected because it occurs on National Park Service land. In 2004, Olympic National Park staff deployed a remote controlled tracker with video capability on the floor of Lake Crescent to determine fish usage of an old car body; small schools of pygmy whitefish were recorded on the video tape.

In 2009, the Pend Oreille County Public Utility District investigated fish presence associated with Sullivan Lake Dam using various fish capture/observation methods. Consistent with past gill netting efforts in Sullivan Lake, only a couple of pygmy whitefish were captured. However, an entrainment trapping study in Outlet Creek below Sullivan Dam captured 14 pygmy whitefish over a two-month period.

In 2010, the Bureau of Reclamation conducted a fish entrainment (the incidental trapping of any life stage of fish within waterways or structures that carry water being diverted for human uses) study below Keechelus Dam in Kittitas County (USBOR 2011). Pygmy whitefish were the second most common fish captured in the study, but suffered a high mortality rate of about 90%. During the 3.5-month sampling period, it was estimated that 2,500-10,000 pygmy whitefish were entrained below Keechelus Reservoir, suggesting a relatively healthy population in the reservoir. It is not known if this entrainment loss is abnormally high due to Keechelus Dam operations (EES 2010).

Recent research. Barnett and Paige (2012) collected fertilized eggs and monitored development in incubation boxes under natural river conditions. Pygmy whitefish eggs required a long incubation period of 127–145 days, suggesting the eggs may be vulnerable to increased scouring flows that may occur with climate change (Littell et al. 2009), which would reduce reproductive success (Barnett and Paige 2012).

Partners and cooperators: U.S. Fish and Wildlife Service, Seattle Public Utilities, Bonneville Power Administration, U.S. Department of Energy, U.S. Bureau of Reclamation.

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Olympic Mudminnow

(*Novumbra hubbsi*)

State Status: Sensitive, 1999
Federal Status: None
Recovery Plans: None
State Management Plan: None

Figure 1. Olympic mudminnow (*photo by Roger Tabor, USFWS*).

The Olympic mudminnow (Figure 1) is a small (2–3 in; 50 –75 mm) freshwater fish found only in Washington. It is one of five species worldwide in the family Umbridae and is the only member of the genus *Novumbra*. Olympic mudminnows are found in the southern and coastal drainages of the Olympic Peninsula, the Chehalis river basin, south Puget Sound west of the Nisqually River (Mongillo and Hallock 1999), and a few sites in Snohomish and King counties (Figure 2; Trotter et al. 2000). They are usually found in slow-moving streams, wetlands, and ponds. Within these habitats, mudminnows require a muddy bottom, little or no water flow, and abundant aquatic vegetation.

There were likely many more Olympic mudminnow populations before Euro-American settlement of Washington when much more wetland habitat was available. Wetland loss in Washington since settlement is estimated to range from 20 to over 50 percent in various parts of the mudminnow's range. Little is known about mortality and limiting factors, but mudminnows are less abundant when associated with exotic species of fish. Typically they do not occur where there are large, predatory fishes such as largemouth bass. This may be due to a combination of competition and predation. Mudminnows eat an assortment of invertebrates and have a high tolerance of low oxygen levels.

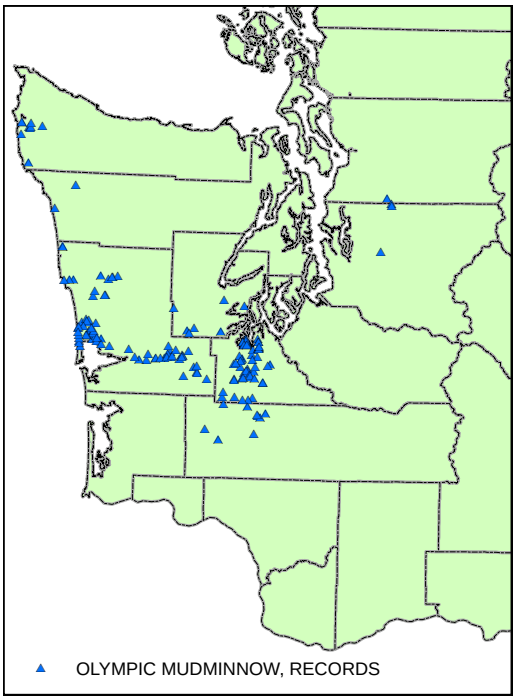

Figure 2. Sites where Olympic mudminnows have been recorded through 2011.

Most monitored populations of Olympic mudminnow seem to be stable. However, the species is completely dependent on healthy wetlands for its survival. Development which changes the hydrology (water diversions, increased storm flow, decreased summer-low flow, delivery of contaminants off impervious surfaces) and characteristics (substrate, vegetation) of a watershed can be detrimental to mudminnow habitat. Due to the mudminnow's need for healthy wetland habitat and restricted range, it is vulnerable and requires habitat protection and cooperative management.

In 2010-2011, many historical sites were resurveyed; mudminnows were still present at most, but some habitat has been affected by land use practices (M. Hallock, pers. comm.). Electrofishing was used to catch and release fish in the 1973, 1993, and 2010-2011 surveys. Catch-per-unit-effort measurements were much lower at all sites in 2010-2011 than in 1973 and 1993. It is difficult to determine if this

Figures 3,4. Olympic mudminnows are sexually dimorphic (left); typical wetland habitat (right) (Glasgow and Hallock 2009).

represents a real decline or is the result of habitat changes that made sampling more difficult in 2010-2011. Development of a more efficient and accurate monitoring technique is needed. Many mudminnow habitats are mis-mapped or misclassified as "non-fish bearing" waters on the Washington State Department of Natural Resources regulatory water type maps, which can substantially reduce mudminnow habitat protection (Glasgow and Hallock 2009). The current mapping of mudminnow distribution among area streams, ditches, and wetlands does not adequately identify specific locations where fish are present or where presence should be presumed, and thus the regulations offer only limited protection for the species. Some important mudminnow habitat has been compromised because of a lack of fish distribution information and coordination among agencies.

Figure 5. Olympic mudminnows captured in Thurston County (Glasgow and Hallock 2009).

During 2012, the U.S. Fish and Wildlife Service conducted additional surveys and collected fin clips for genetic testing to help determine the relative uniqueness of each Olympic mudminnow population. Nearly all of the sampling locations constitute separate populations with limited gene flow among populations. Populations from east of Puget Sound are most genetically similar to south Olympic populations and may represent introductions.

In October 2012, an Olympic Mudminnow Workshop was hosted by U. S. Fish and Wildlife Service (http://www.fws.gov/wafwo/Olymudminnow_wkshp.html). The goals of the workshop were to provide attendees with updated information on mudminnow biology and to establish a coalition of partners to

develop and implement a conservation strategy for the species and its habitats.

Partners and cooperators: U.S. Fish and Wildlife Service, Wild Fish Conservancy.

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Margined Sculpin
(*Cottus marginatus*)

State Status: Sensitive, 1998
Federal Status: Species of concern
Recovery Plans: None
State Management Plan: None

Figure 1. Margined sculpin (*from Wydsoki and Whitney 2003*).

The margined sculpin is a small (2.5 in) native freshwater fish (Figure 1) found only in southeastern Washington and northeastern Oregon (Mongillo and Hallock 1998, Wydoski and Whitney 2003). In Washington, it occurs only in the Tucannon and Walla Walla River drainages (Figure 2). The historical range of the sculpin is unknown. It is primarily a pool dweller in streams and its preference for pools does not appear to be strongly affected by seasons. It is normally found in water temperatures less than 20°C and adults tend to be found in deeper, faster water than juveniles.

The species appears to be locally common, but disturbances can have profound effects on its persistence. Most of the waters inhabited by margined sculpins have been degraded by development, logging, agriculture, livestock grazing, and channelization. These activities produce sedimentation of substrate, elevated water temperatures, algal blooms, and reduction in pool habitat. Agricultural and yard chemicals not used properly can directly eliminate fish as well as cause indirect problems such as algal blooms.

Populations in southeastern Washington appear stable, but based on the species' small geographic distribution and limited quality habitat, it could become threatened or endangered without protection of habitat and cooperative management.
Margined sculpin in the Tucannon and Walla Walla drainages will likely benefit from habitat protection measures implemented in recent years to protect federally listed chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*O. mykiss*), and bull trout (*Salvelinus confluentus*).

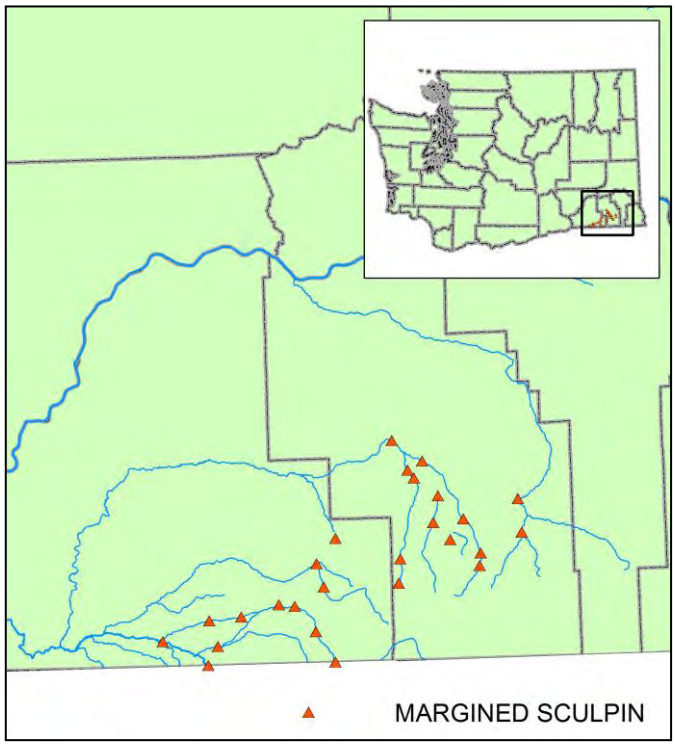

Figure 2. Sites in Washington where margined sculpins have been recorded.

Recent information. Some data on margined sculpin populations were gathered during annual salmonid assessments for the Walla River Basin in 1999-2005, when information on relative abundance for other fish species was also collected (e.g., Mendel et al. 2005). For survey years when sculpins were identified by species, margined sculpin appeared more abundant and were collected at more sites than Paiute sculpin (*C. beldingi*). Overall relative abundance of sculpins appeared stable during this period.

Recent research. Two Whitman College student projects have recently focused on margined sculpin. Johnson (2007) explored

the summer distribution and habitat selection of the species and Hagan (2006) conducted a phylogeographic analysis. Johnson's collection, identification, and extrapolation of numbers produced estimates of 0 to 833 (average = 99) margined sculpins per sampling site. Johnson (2007) observed a difference in microhabitat selection between margined sculpin and Paiute sculpin, with margined sculpins appearing to select shallower water. Estimates of relative population density were highly variable among the sites, but fish were considered fairly abundant at some sites.

Carlin et al. (2012) sampled fishes in the Walla Walla watershed during 2005-2006 and conducted genetic analysis of 26 specimens. Margined sculpin occurrence was high, with 7,485 individuals observed. Margined sculpins made up 49.3% of the fish identified to species, and occurred in 29 of 37 fish-bearing sites sampled. Occurrence was significantly correlated with more boulders and slightly warmer watertemperatures. The species seemed to be locally abundant with relatively wide habitat tolerances. Genetic analysis indicated substantial gene flow (historical or recent) occurring in the Walla Walla sub-basin and rapid population expansion from a small founder population, or bottleneck (Carlin et al. 2012). They noted, however, that margined sculpin still have a very restricted distribution, and as such they could be vulnerable to human related habitat change.

Partners and cooperators: U.S. Fish and Wildlife Service, Bonneville Power Administration, U.S. Department of Energy, Whitman College, Confederated Tribes of the Umatilla Indian Reservation, Gustavus Adolphus College, Jones and Stokes Inc.

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Larch Mountain Salamander
(*Plethodon larselli*)

State Status: Sensitive, 1993
Federal Status: Species of concern
Recovery Plans: None
State Management Plan: None

Figure 1. Larch Mountain salamander (*photo by Bill Leonard*).

The Larch Mountain salamander (Figure 1) is a relatively rare species endemic to the Pacific Northwest. It is the smallest of the western Plethodontidae, which are lungless salamanders. They use cutaneous respiration, and for that reason, must live in moist habitats (Petranka 1998). Maintenance of subsurface microhabitats and microclimates are essential to their survival because they have a very limited period of surface activity in the spring and fall when surface moisture and temperature are suitable, and they cannot disperse long distances to find new habitat (Jones et al. 2005). The nest and courtship of Larch Mountain salamanders have not yet been described. Species of *Plethodon* have direct development (no tadpole) and the females guard the eggs (Wells 2007). From size-frequency distributions of Larch Mountain salamander captured from four sites in the Columbia River Gorge, Herrington and Larsen (1987 inferred that males attain sexual maturity when they were 3 to 3.5 years of age and females were sexually mature at 4 years of age. The number of eggs in a clutch ranged from 2-12 (mean=7.33, Herrington and Larsen 1987).

Larch Mountain salamanders occur primarily in Washington, with populations found in the Columbia River Gorge and in the Cascade Mountains from central Washington to northern Oregon. In Washington, they occur in Clark, Cowlitz, Skamania, Lewis, King, Pierce, Klickitat, and Kittitas counties (Figure 2). Current knowledge of the species' range is likely incomplete and several range extensions have occurred in the past decade.

The Larch Mountain salamander is a terrestrial species dependent on late-seral forest conditions or combinations of rocky substrates, soils, and vegetation that provide suitable cool, moist microhabitat conditions (Crisafulli et al. 2008). Primary threats include timber harvest, road and trail construction, residential development, and talus mining. These activities often affect canopy closure, disturb substrates and soils, and alter microhabitats and microclimates. The species was listed as state sensitive due to its limited distribution, low numbers, fragmented habitat, and vulnerability to timber harvest and land management activities.

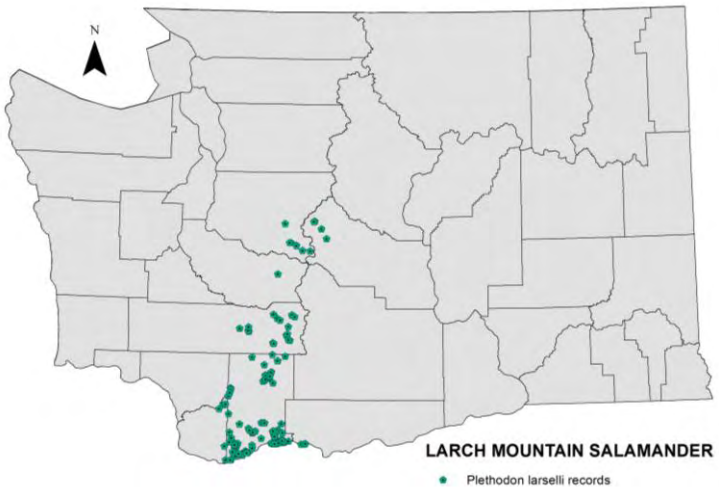

Figure 2. Records of Larch Mountain salamander in Washington through 2011.

Nothing is known about population trends in this species. Surveys were conducted at 825 forested sites from 1996-2002, with individuals detected at only 55 (6.7%) locations (Crisafulli et al. 2008). Additional

observations suggest that Larch Mountain salamanders are patchily distributed but locally abundant at a number of sites in the Columbia River Gorge and Washington Cascades (C. Crisafulli, unpubl. data, 1996-2006). In 2008, there were 145 known locations (Crisafulli et al. 2008), with 103 on federal lands and 42 on non-federal lands; most of the sites are in Washington. About 70% of currently known sites on federal lands occur in areas with special management designations, such as late seral reserves.

Wagner et al. (2005) reported that DNA analysis indicated there was substantially less differentiation among populations of Larch Mountain salamanders in Washington than in populations in Oregon. The Columbia River provides a long-term barrier indicating that populations are currently on separate evolutionary trajectories. They suggested that distinct management strategies for northern versus southern populations may be appropriate (Wagner et al. 2005).

Partners and cooperators: U.S. Forest Service.

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Townsend's Big-eared Bat

(*Corynorhinus townsendii*)

State Status: Candidate
Federal Status: Species of Concern
Recovery Plans: None

Figure 1. Townsend's big-eared bat (*photo © Merlin D. Tuttle, Bat Conservation International, www.batcon.org*).

Townsend's big-eared bat is a medium-sized insectivorous bat with very large ears connected at the base and two prominent lumps on either side of the nostrils (Nagorsen and Brigham 1993, Gruver and Keinath 2006). Five subspecies are recognized, with only *C. t. townsendii* present in Washington.

Townsend's big eared bats occupy a broad range of arid and moist habitats. In Washington, this species is found in lowland conifer-hardwood forest, montane conifer forest, ponderosa pine forest and woodland, shrub-steppe, riparian habitats, and open fields (Johnson and Cassidy 1997, Woodruff and Ferguson 2005). Caves, lava tubes, mines, old buildings, bridges and concrete bunkers are commonly used as day roosts in Washington (Senger and Crawford 1984, Woodruff and Ferguson 2005), with rock crevices and very large trees with basal hollows occupied in other regions (Pierson et al. 1999, WBWG 2005). Temperatures within potential roosting structures are particularly important in the selection of day roosts, as well as roost dimensions, sizes of openings, light quality, and extent of airflow (Pierson et al. 1999, Gruver and Keinath 2006). Hibernacula occur mainly in caves, mines, lava tubes, and occasionally in buildings (Pierson et al. 1999, Gruver and Keinath 2006). Hibernacula feature moderate airflow and stable temperatures typically ranging from -3 to 13°C, with those below 10°C preferred (Nagorsen and Brigham 1993, Doering 1996, Pierson et al. 1999). More than 90% of the diet is comprised of moths (Pierson et al. 1999, WBWG 2005, Gruver and Keinath 2006).

This species occurs from southern British Columbia southward through most of the western United States to central Mexico (NatureServe 2009). Isolated populations also exist in the Ozarks and Appalachians. Documented records exist for most counties in Washington, but are lacking for the southern Columbia Basin and Blue Mountains (WDFW, WRDS database). Within the species' range, distribution is often linked to the presence of suitable sites for maternity roosts and hibernacula located near foraging habitat (Gruver and Keinath 2006).

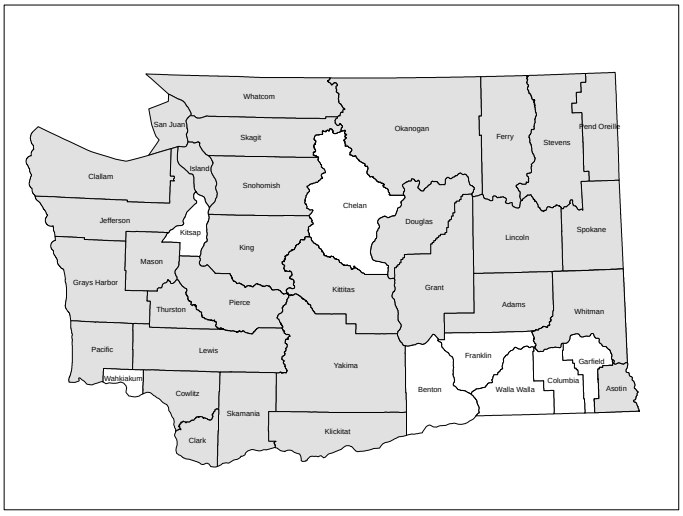

Figure 2. Counties in Washington where Townsend's big-eared bat have been recorded (gray shading).

Townsend's big-eared bats generally occur at low densities across their range (Gruver and Keinath 2006). Long-term population trends are difficult to assess for most western populations because of

the scarcity of adequate count data, the species' dynamic roosting behavior, and the use of multiple roosts under some conditions (Ellison et al. 2003, Sherwin et al. 2003, Gruver and Keinath 2006). In Washington, long-term count data are available for only a small number of roosts. Comparisons of bat numbers during the 1970s-1980s against those in the 1990s-2000s can be made for six hibernacula, with four of these showing increases and two being stable during this period (WDFW WSDM database). However, two of the sites featuring increases experienced major declines (from >200 bats to ≤30 bats) from the mid-1960s to early 1970s, probably due to researcher activity (Senger and Crawford 1984). One of these has subsequently recovered, but the other remains at less than half its former size. Count data for the 1970s-1980s versus the 1990s-2000s are available for only two maternity colonies in the state, with one showing an increase and one a decrease (WDFW WSDM database). A third site that held a major maternity roost into the 1930s was abandoned by the 1960s and remains unoccupied by breeding bats (St. Hilaire 2012). Townsend's big-eared bats are typically rarely detected during capture and acoustic surveys in Washington (see Hayes and Wiles in prep.). Because this species is difficult to capture in mist nets and has quiet echolocation (WBWG 2005b), standard capture and acoustic surveys may be poorly suited for measuring abundance.

Human disturbance of roosts (e.g., by recreational cavers and vandals) and closure or reuse of abandoned mines are major threats to Townsend's big-eared bats (Senger and Crawford 1984, Pierson et al. 1999, WBWG 2005, Gruver and Keinath 2006). Roosts that experience repeated human visitation frequently show severe population declines or abandonment. Loss of roosts in buildings from gradual structural decay, destruction, reuse by people, or deliberate exclusion practices is also a problem. Non-target pesticide spraying to control outbreaks of moth pests (e.g., spruce budworm, tussock moths, and gypsy moths) and other insects on forest and agricultural lands near roosts may affect overall moth abundance, thereby reducing food resources for this species. Degradation and loss of foraging and roosting habitat from timber harvest practices, land conversion, and livestock grazing are other threats.

Monitoring and surveys. A relatively small number of known maternity roosts and hibernacula of this species in Washington are surveyed annually or less frequently by staff from the U.S. Forest Service, WDFW, Cascadia Research Collective, Tacoma City Light, National Park Service, and U.S. Army Corps of Engineers. During 2012, new colonies of this species were reported in San Juan County (maternity site), Stevens County (maternity site), and Island County (hibernaculum).

Roost protection. Gating of caves and mines has been performed to protect the maternity roosts and hibernacula of this species in Washington in recent decades. In 2012, a new gate was installed inside Boulder Cave, Yakima County, to protect a chamber used by hibernating Townsend's big-eared bats (Figure 3). The gate may also provide a safe area for the return of reproductive females, which used the cave as a maternity site until at least the 1930s. The gate was built by cave-gating expert Jim Nieland, Forest Service staff, volunteers, and WDFW staff, with funding from the U.S. Forest Service and Bureau of Land Management.

Figure 3. New gate being built at Boulder Cave, September 2012.

Research. A study of winter roosting behavior and roost selection in southern Thurston and eastern Grays Harbor counties continued in 2012 and is being conducted by Cascadia Research Collective.

Figure 4. A maternity colony of Townsend's big-eared bats on a WDFW conservation easement property in Okanogan County. The site is part of a complex of old structures used by the colony.

Bat conservation plan. WDFW is preparing a conservation plan for bats in Washington (Hayes and Wiles, in prep.), which will be completed in 2013. The plan will provide: 1) a summary of bat biology and threats, 2) species accounts for all 15 species of bats living in the state, and 3) strategies and tasks for conserving bats in Washington, including Townsend's big-eared bats.

Partners and cooperators: U.S. Forest Service, Bureau of Land Management, Cascadia Research Collective, National Park Service, Cascade Grotto, Tacoma City Light, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, The Nature Conservancy, Joint Base Lewis-McChord.

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Keen's Myotis
(*Myotis keenii*)

State Status: Candidate, 2000
Federal Status: None
Recovery Plans: None

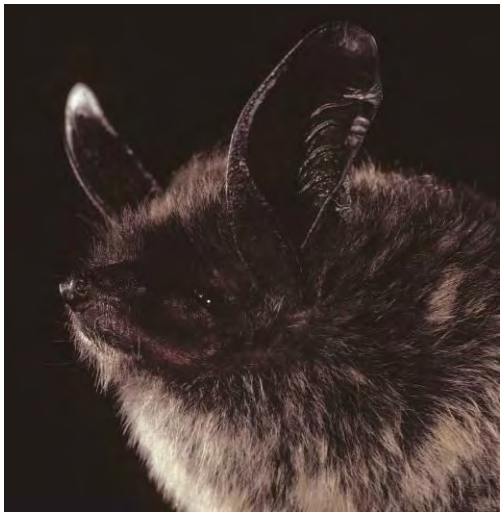

Figure 1. Keen's myotis (*photo © Merlin D. Tuttle, Bat Conservation International, www.batcon.org*).

Keen's myotis (Figure 1) is one of three similar long-eared *Myotis* species in Washington, making simple field identification impossible in western Washington and southwestern British Columbia (Burles and Nagorsen 2003). Keen's myotis are largely restricted to moist coastal forests of lower elevations dominated by western hemlock, Sitka spruce, and other conifers, although a few records come from urban sites (Firman et al. 1993, Burles and Nagorsen 2003, Boland et al. 2009a). Keen's myotis roost in caves, rock crevices, large trees, snags, and buildings (Burles and Nagorsen 2003, Boland et al. 2009a). Hibernacula are known to include mid-elevation caves.

Keen's myotis has one of the smallest distributions of any North American bat, occurring in coastal areas from southeast Alaska to the Olympic Peninsula, Puget Sound, and Mt. Rainier in Washington (Burles and Nagorsen 2003, Boland et al. 2009a; WDFW WSDM database). They have been reported in five counties in Washington (Figure 2). Population size and trends are unknown (NatureServe 2009). They are generally considered rare, but problems with field identification complicate efforts to assess populations. Low densities have been reported in British Columbia (Firman et al. 1993, Burles and Nagorsen 2003) and southeast Alaska (Boland et al. 2009b). No roosts of this species are currently known in Washington. The last confirmed detection in the state was in 2008.

Threats or potential threats include loss and fragmentation of habitat caused by clearcutting of old-growth coastal forests and human development; disturbance of hibernacula and maternity sites through human visitation and logging road construction; predation by cats; and pesticide use in forests (Burles and Nagorsen 2003, NatureServe 2009).

Figure 2. Five counties in Washington where Keen's myotis has been recorded (gray shading).

Surveys. Inventories and monitoring of bat populations in western Washington have not reported Keen's myotis since 2008. These survey efforts have been conducted by various agencies, conservation organizations, and volunteers.

Bat conservation plan. WDFW is preparing a conservation plan for bats in Washington (Hayes and Wiles, in prep.), which will be completed in 2013. The plan will include: 1) a summary of bat biology and threats, 2) species accounts for all 15 species of bats living in the state, and 3) strategies and tasks for conserving bats in Washington, including Keen's myotis.

Partners and cooperators: U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, Oregon Department of Fish and Wildlife.

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White-tailed Jackrabbit
(*Lepus townsendi*)

State Status: Candidate.
Federal Status: None.
Recovery Plans: None

Black-tailed Jackrabbit
(*Lepus californicus*)

State Status: Candidate.
Federal Status: None.
Recovery Plans: None

Figure 1. White-tailed jackrabbit *(photo by Joe Higbee*).

White-tailed Jackrabbit. The white-tailed jackrabbit is an ecologically important species affecting habitats and serving as prey for a wide variety of raptors and mammalian predators (Flinders and Chapman 2003). Its range extends from the prairies of the midwestern states and Canadian provinces westward to the Rocky Mountains, Cascades and Sierra Nevada mountain ranges and southward to the northern borders of Arizona and New Mexico. Most populations are declining due to factors such as, habitat loss, degradation, fragmentation, competition with black-tailed jackrabbits, and unregulated hunting (Flinders and Chapman 2003). In Washington, it is found throughout the semi-arid portions of the Columbia Plateau.

In parts of its historical range, where cultivation, drought or overgrazing have affected the habitat, white-tailed jackrabbits have been replaced by black-tailed jackrabbits (Lim 1987). In areas where the two species overlap they use different habitats: black-tailed jackrabbits occur primarily in sagebrush habitats with open grass while white-tailed jackrabbits are most common in bunchgrass habitats with less shrub cover (Couch 1927, Lim 1987). In Washington, they occur at somewhat higher elevations, in habitats such as grassy hills and plateaus (Johnson and Cassidy 1997). Dalquest (1948) found white-tailed jackrabbits on arid, hilly bunchgrass sites during the summer and in lower sagebrush valleys during winter. He also noted that as bunchgrass decreased due to overgrazing so did numbers of white-tailed jackrabbits.

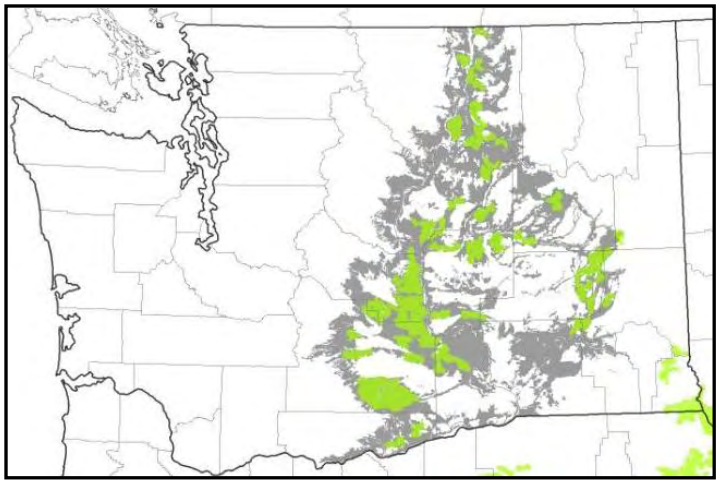

Figure 2. White-tailed jackrabbit modeled distribution (gray; from Johnson and Cassidy 1997), and habitat concentration areas (green; WHCWG 2010).

White-tailed jackrabbits are largely nocturnal which makes population monitoring a challenge; no reliable census method exists for all population levels. Home range of the white-tail is reported as 2 to 3 km in diameter (Lim 1987), but information is scant.

In Wyoming, white-tailed jackrabbits bred from late-February or mid-March until July, often giving birth to tree litters in succession (Rogowitz 1992). Average annual female production was 15 young in

North Dakota (James and Seabloom 1969). Young white-tailed jackrabbits are very precocial with eyes open, incisors erupted, and fully furred (Lim 1987).

The primary predators of white-tailed jackrabbits in Washington are coyotes, bobcats, and eagles (Dalquest 1948). They are also at considerable risk for mortality from vehicle traffic, shooting, and harassment by pets.

Black-tailed Jackrabbit. The black-tailed jackrabbit is the most common jackrabbit in the western U.S. (Flinders and Chapman 2003). Its range extends from southern-central Washington to South Dakota and southward into Baja California and well into south-central Mexico (Chapman and Flux 1990). They also have been successfully introduced into various eastern states.

Figure 3. Black-tailed jackrabbit *(photo by Mike Schroeder).*

Black-tailed jackrabbits were not present in Washington in the early 19th century. They first appeared in Washington in Walla Walla County around 1870 (Couch 1927). They spread north to the Snake River, and beyond it when the Snake froze over around 1908. They spread across Benton County after the Columbia River froze in 1920 (Couch 1927). Black-tails had occupied most of the Columbia Basin by 1930 (Figure 4; Johnson and Cassidy 1997).

In central Washington, east of the Cascade Mountains, black-tailed jackrabbit distribution is concentrated in the semi-arid Columbia Plateau shrubsteppe and grassland habitats, and extends south into Oregon. Areas used include sagebrush and rabbitbrush (*Chrysothamnus* sp.) dominated habitats as well as areas of mixed grassland and shrub (Johnson and Cassidy 1997). Black-tailed jackrabbits tend to occupy areas with more shrubs and less grass than white-tailed jackrabbits and are more tolerant of grazing by livestock (Best 1996). Their diet varies seasonally, consisting of a higher percentage of shrubs in winter, forbs in spring, and mostly grasses with almost no shrub ingestion in summer (Grant 1987). Black-tailed jackrabbits are generally nocturnal and solitary (Flinders and Chapman 2003). Like white-tailed jackrabbits, about daylight they retire to resting sites in taller vegetation, such as a 'form' under a shrub (Lechleitner 1958a). Population monitoring is a challenge as no reliable census method exists for all population levels.

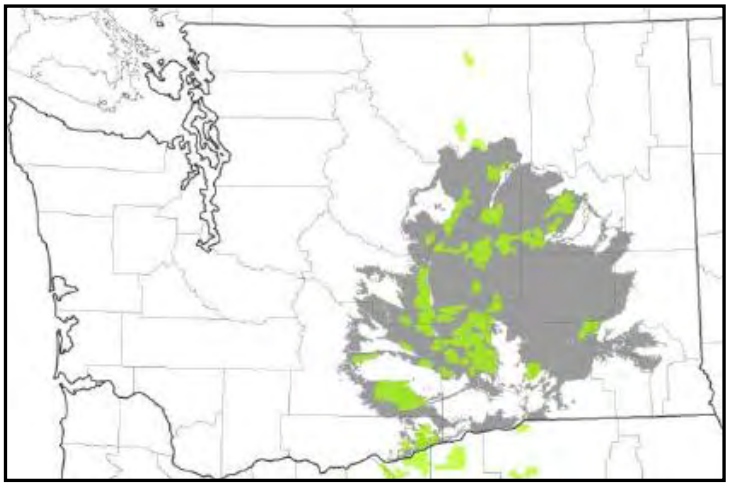

Figure 4. Black-tailed jackrabbit modeled distribution (gray; from Johnson and Cassidy 1997), and habitat concentration areas (WHCWG 2010).

Black-tailed jackrabbits are highly mobile. Size of home range varies from 20–300 ha (Lechleitner 1958b, Smith 1990). The literature suggests that no

regular seasonal migration occurs; however, most recorded large movements are between fall and winter ranges and winter and spring ranges (Rusch 1965; Grant 1987; Smith et al. 2002). Grant (1987) reported distances travelled by black-tailed jackrabbits averaged 16.2 km with a range of 2.2–57.3 km.

Black-tailed jackrabbits produce about 10-12 young annually, giving birth to multiple littles during a three month breeding season. Only 3.5–9% survived to 1 year of age (Verts and Carraway 1998). Predators known to prey on black-tailed jackrabbits include coyotes, badgers, bobcats, golden eagles, several species of hawk, owls, rattlesnakes, and gopher snakes. Additionally, they are at considerable risk for increased mortality from vehicle traffic, persecution, and harassment by pets.

Jackrabbits are vulnerable to loss of habitat connectivity from all four major connectivity threats: clearing and vegetation removal, development, roads and traffic, and the presence of people and domestic animals.

Conservation actions. Washington State University is working on development of survey methodology with funding from BLM. The study will compare the use of pellet counts to using spotlighting.

Landscape management. The Washington Wildlife Habitat Connectivity Working Group is addressing the conservation and restoration of habitat connectivity for numerous focal species, including jackrabbits. Connectivity analyses were completed for the state in 2010 (WHCWG 2010) and for the Columbia Basin in 2012 (WHCWG 2012).

Partners and cooperators: U.S. Fish and Wildlife Service, Washington State University, U.S. Bureau of Land Management.

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Washington Ground Squirrel

(*Urocitellus washingtoni*, formerly *Spermophilus washingtoni*)

State Status: Candidate, 1997
Federal Status: Candidate, 1999
Recovery Plans: None

Figure 1. Washington ground squirrel (*photo by Jodie Delavan*).

Washington ground squirrels (Figure 1) occupy shrub-steppe and native grassland habitats, especially on sites with deep silty loam soils, which may enhance burrow digging. They occur only in the Columbia Basin region of eastern Washington and north-central Oregon. In Washington, the species is found east and south of the Columbia and Spokane Rivers. Historical records exist for 10 counties in the state, but several of these are no longer occupied (Figure 2).

Washington ground squirrels are active for only 4-5 months, spending the rest of the year hibernating in underground burrows. Hibernation generally lasts from late May–late June through mid-January–late February. It is crucial that individuals gain adequate fat reserves before hibernation. The species occurs both in concentrated colonies and as scattered individuals distributed across the landscape. Abundance within colonies usually ranges from a few to 36 squirrels per acre, although densities of 50-100 animals per acre have been estimated at prime locations. Most juvenile males permanently disperse an average of 0.6 mi from their birth sites only a few weeks after weaning (Klein 2005), whereas most juvenile females settle near their mother's burrow. Mothers and daughters commonly form strong social alliances and work cooperatively to protect their young in subsequent breeding seasons (Sherman and Shellman Sherman 2005-2010). Litters average 5-8 pups.

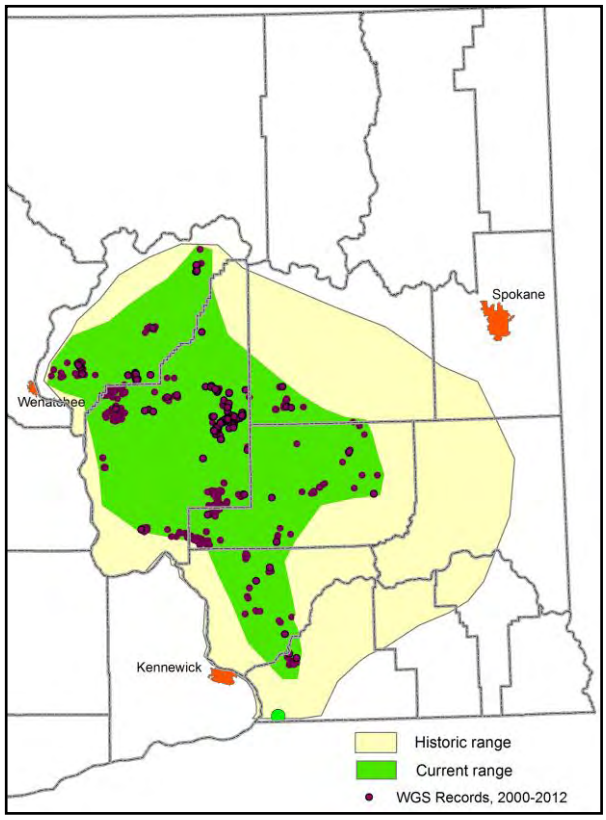

Figure 2. Approximate historical and current ranges of Washington ground squirrels in eastern Washington through 2012.

This species has experienced major declines in abundance and range since the beginning of the twentieth century. Declines have continued in many areas since the 1970s. For example, the Seep Lakes region of Grant County has lost more than half of its population sites since the 1990s. During the last major survey of Washington ground squirrels in Washington in 2004, at least 220 sites were active in Douglas, Grant, and Adams counties (Finger et al. 2007). A few additional locations are known in some neighboring counties. Known populations are typically small and are often isolated by habitat fragmentation. The species exists as a series of

metapopulations and based on survey efforts over the last decade, it appears that the rate of extinction of subpopulations currently exceeds the rate of colonization of unoccupied habitats, particularly at the edge of the species' current distribution. There are no estimates of the size of the Washington or Oregon populations.

Figure 3. Washington ground squirrels released after marking and weighing.

Numerous problems threaten Washington ground squirrels (USFWS 2010). Much of the species' habitat was converted to agriculture beginning in the late 1800s. Lands restored through the Conservation Reserve Program do not appear suitable because they no longer support natural forb communities that ground squirrels depend on for food. Farmers and ranchers have long considered the squirrel a pest, which resulted in poisoning programs and shooting to control numbers. These threats remain a concern for some colonies. Intensive grazing and non-native plants have reduced the availability of food needed for gaining weight to survive hibernation. Many colonies isolated by agricultural conversion, urban development, and waterways may gradually become extinct with no opportunity for natural recolonization. Disease and drought are other threats.

Translocations. WDFW (with help from other agencies and volunteers) has conducted a series of Washington ground squirrel translocations since 2006, with squirrels moved to sites on public lands in Grant, Adams, Douglas, and Lincoln counties (including Columbia National Wildlife Refuge and Columbia Basin Wildlife Area) in an attempt to reestablish new populations in unoccupied areas of suitable habitat (Figure 3). Initial translocations through 2009 had mostly poor results, primarily because they relied on hard releases of squirrels during May. This methodology appeared to result in nearly all squirrels dispersing away from release locations. Soft release methods have been used since 2010, with pregnant females placed into wire enclosures to keep them on site for longer periods (i.e., 2-8 days; Finger 2012; Figure 4). This technique greatly improved results, with far more females remaining on site and producing litters.

In 2012, 88 pregnant females were caught in February at the Sage Hills Golf Course near Warden, Grant County, and translocated to single sites on Columbia NWR and near Steamboat Rock on the Columbia Basin Wildlife Area (Finger 2012). Each site contained 11 release enclosures, with four females placed in each. Artificial tunnel systems were dug at both locations using a "burrow building" machine. Ten adult males were also released at Columbia NWR and five near Steamboat Rock in late March so they would be available for breeding with females in the following breeding season. The Columbia NWR translocation failed by early April, probably because of high rates of predation by raptors perching on high nearby canyon walls. However, the Steamboat Rock

Figure 4. One type of soft release enclosure used during translocations of Washington ground squirrels in 2011 and 2012 (*photo by Rich Finger*).

translocation was quite successful, with nearly half of the females producing litters on the site and squirrels persisting on the site through the end of the active season. Use of this method will be expanded to new locations in 2013.

Monitoring and surveys. Monitoring of Washington ground squirrel populations in Washington has continued at reduced levels since the 2004 comprehensive survey of known sites in Grant, Douglas, and Adams counties (Finger et al. 2007). Some sites are visited annually or less often to determine occupancy, but many others have not been checked since 2004. Surveys conducted since 2010 have located 237 new ground squirrel sites, many of which were found near the proposed Odessa irrigation canal system (WDFW WSDM database).

Research. A five-year study involving development of a long-term monitoring protocol for Washington ground squirrels was completed in 2012. Occupancy and detection modeling was used from 2008-2011 to determine the most efficient survey design for maximizing squirrel detections. Pilot work was also conducted in 2011 to test the survey protocol developed in 2008-2011. In 2012, the protocol was used to survey for ground squirrels at 204 random sample plots located in Douglas, Grant, Lincoln, and Franklin counties, with animals detected at 116 of the plots (Watson 2012). The protocol will be used in the future for conducting periodic (e.g., 3-5 years) surveys at established locations throughout the species' range in Washington to assess status, trend, and extinction/colonization probabilities over time.

Habitat enhancement. WDFW is currently conducting a habitat enhancement trial at the Seep Lakes Unit of the Columbia Basin Wildlife Area. The trial is intended to develop methods for restoring cheatgrass-dominated sites, where non-native annual forbs such as Russian thistle and tumble mustard are present. Results from the trial will be reported by summer 2014.

Landscape management. The Washington Wildlife Habitat Connectivity Working Group is addressing the conservation and restoration of habitat connectivity for numerous focal species, including Washington ground squirrels. Connectivity analyses were completed for the state in 2010 (WHCWG 2010) and for the Columbia Basin in 2012 (WHCWG 2012). The latter analysis modeled habitat concentration areas and movement corridors for Townsend's ground squirrels.

The Arid Lands Initiative is a group of governmental (WDFW, WDNR, BLM) and non-governmental organizations (TNC) formed in 2010 to engage landowners with the goal of conserving shrub-steppe across multiple jurisdictions in Washington. During 2012, members of the Initiative worked on prioritizing habitat types and species groups (e.g., grouse, burrowing animals) as targets for conservation efforts. Development of more detailed information on landscape connectivity also began (WHCWG, in prep.). Washington ground squirrels are one of the focal species for which conservation strategies will be developed and implemented.

Partners and Cooperators: U.S. Fish and Wildlife Service, Sage Hills Golf Course, Bureau of Land Management, Cornell University, The Nature Conservancy, Washington Department of Natural Resources.

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Townsend's Ground Squirrel

(*Urocitellus townsendii townsendii*; formerly, *Spermophilus townsendii townsendii*)

State Status: Candidate, 2003
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Townsend's ground squirrel (*photo by Mike Livingston*).

Townsend's ground squirrels (Figure 1) inhabit shrub-steppe, native grasslands, pastures, orchards, vineyards, highway margins, vacant city lots, and the banks of canals. They are found only in Washington in the Columbia Basin west of the Columbia River in Klickitat, Benton, Yakima, and Kittitas counties (Figure 2). Two subspecies are recognized, with *U. t. townsendii* found south and west of the Yakima River, and *U. t. nancyae* restricted to areas north and east of the Yakima River (Yensen 2001, Yensen and Sherman 2003). The subspecies differ in the number of chromosomes (*U. t. townsendii* has 36 vs. 38 for *U. t. nancyae*; Nadler 1968).

Animals are active for only 4-5 months, spending most of the year hibernating in underground burrows (Scheffer 1941). The active season begins from late January to late February and extends until late May to late June. Squirrels must gain sufficient fat deposits by early summer to survive hibernation. The species occurs in concentrated colonies and presumably as scattered individuals distributed across the landscape. The diet is largely green vegetation, with Sandberg's bluegrass (*Poa secunda*), western tansymustard (*Descurainia pinnata*), lupine (*Lupinus laxiflorus*) and woollypod milkvetch (*Astragalus purshii*) occurring most frequently in the diet (Johnson 1977, Rogers and Gano 1980).

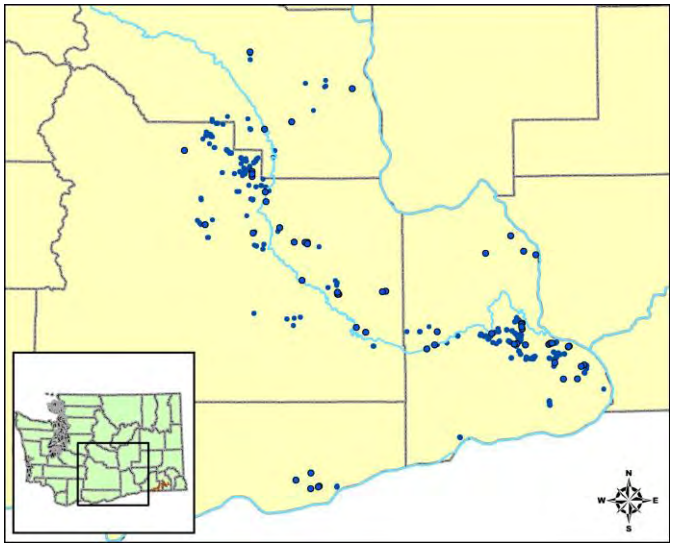

Figure 2. Distribution of Townsend's ground squirrel records through 2012.

Townsend's ground squirrels fulfill several important ecological functions, including affecting soil structure and fertility through their burrowing, providing burrow habitats for other wildlife, and serving as prey for numerous predators (Yensen and Sherman 2003). They are prey for the state threatened ferruginous hawk (*Buteo regalis*) (Richardson et al. 2001), as well as snakes, ravens (*Corvus corax*), prairie falcons (*Falco mexicanus*), badgers (*Taxidea taxus*), weasels, and others (Scheffer 1941, Yensen 2001).

No comprehensive population surveys of Townsend's ground squirrels have been conducted. However, overall abundance appears to have undergone significant decline, especially in the subspecies *U. t. townsendii* (Yensen and Sherman 2001). Most of this subspecies' geographic range has been converted to agriculture, and much of the remaining shrub-steppe is being degraded by cheatgrass and other exotic annuals. Studies of closely related species in Idaho found a strong negative relationship with cheatgrass

because it is not a reliable year-to-year food source (Yensen et al. 1992). Recent urban development and agricultural expansion have destroyed significant areas of suitable habitat for this species and continue to be a threat. Similarly, control programs involving poisoning and shooting, which were widely practiced in the past, remain a concern for some locations where farmers and fruit growers consider the squirrel a pest. Many colonies isolated by agricultural conversion and urban expansion may eventually die out. Disease and drought are other threats.

Research and monitoring. Little research and few conservation actions aimed specifically at Townsend's ground squirrels have been undertaken. WDFW maintains a database of known sites for the species, which is updated as new reports are received. In 2012, 18 previously unreported locations for the species were added to the database (WDFW WSDM database).

Landscape management. The Washington Wildlife Habitat Connectivity Working Group is analyzing habitat connectivity for numerous focal species, including Townsend's ground squirrels. Connectivity analyses were completed for the state in 2010 (WHCWG 2010) and for the Columbia Basin in 2012 (WHCWG 2012). The latter analysis modeled habitat concentration areas and movement corridors for Townsend's ground squirrels.

The Arid Lands Initiative is a group of governmental (WDFW, WDNR, BLM) and non-governmental organizations (TNC) formed in 2010 to engage landowners with the goal of conserving shrub-steppe across multiple jurisdictions in Washington. During 2012, members of the Initiative worked on prioritizing habitat types and species groups (e.g., grouse, burrowing animals) as targets for conservation efforts. Development of more detailed information on landscape connectivity also began (WHCWG, in prep.). Townsend's ground squirrels are one of the focal species for which conservation strategies will be developed and implemented.

Partners and Cooperators: U.S. Fish and Wildlife Service, The Nature Conservancy, Washington Department of Natural Resources, Yakama Nation.

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Olympic Marmot

(*Marmota olympus*)

State Status: Candidate, 2008
Federal Status: None
Recovery Plans: None

Figure 1. Olympic marmot (*photo by Rod Gilbert*).

The Olympic marmot is an endemic species, found only in the Olympic Mountains of Washington (Figure 1). It inhabits subalpine and alpine meadows and talus slopes at elevations from 920-1,990 m (Edelman 2003). Its range is largely contained within Olympic National Park. The Olympic marmot was added to the state Candidate list in 2008, and was designated the State Endemic Mammal by the Washington State Legislature in 2009. The Olympic marmot differs from the Vancouver Island marmot (*M. vancouverensis*), in coat color, vocalization, and chromosome number.

Olympic marmots were numerous during a 3-year study in the 1960s, but in the late 1990s rangers began noticing many long-occupied meadows no longer hosted marmots. Olympic marmots differ from most rodents by having a drawn out, 'K-selected' life history; they are not reproductively mature until 3 years of age, and, on average, females do not have their first litter until 4.5 years of age. Marmots can live into their teens.

Data from 250 ear-tagged and 100 radio-marked animals indicated that the species was declining at about 10%/year at still-occupied sites through 2006, when the total population of Olympic marmots was thought to be fewer than 1,000 animals. During 2007-2010, a period of higher snowpack, marmot survival rates improved and numbers at some well-studied colonies stabilized. Human disturbance and disease were ruled out as causes, but the decline was apparently due to low survival of females (Griffin 2007, Griffin et al. 2007, and Griffin et al. 2008). Annual survival of adult females during 2002-2006 was <70% compared to about 89% in the 1960s; this is lower than the population can sustain (Griffin 2007). Predation by coyotes was the most common cause of mortality (Griffin 2007, Witczuk 2007). Coyotes have reportedly inhabited high elevation areas of the Olympic Peninsula for around 60 years, but were rare or absent from the Olympics historically when wolves were widespread in western Washington (Taylor and Shaw 1929, Dalquest 1948, Scheffer 1995).

The telemetry data indicated that about half the females and two-thirds of the males disperse at age two or three. The median distance traveled by 2 and 3-year olds was was 1,800 m for males, but only 305 m for females, suggesting that they may be slow to re-occupy vacant habitat patches (Griffin et al. 2009).

The decline in the marmot population during the 1990s and early 2000s, followed by an increase in marmot survival in years with higher snowpack, suggests that coyote predation is affected by snowpack. If this relationship is confirmed, it indicates Olympic marmots will be affected by any decline in average snowpack resulting from climate change.

Conservation activities. The National Park Service has supported Olympic marmot research and monitoring activities since 2002, including two University of Montana graduate research projects (Griffin 2007, Witczuk 2007) and a citizen science monitoring effort. Conducted since 2010, monitoring has involved more than 80 volunteers each year to check on occupancy of suitable habitat patches. The

program is supported by Washington's National Park Fund, Olympic National Park, and the U. S. Forest Service. In 2012, the effort involved 92 volunteers and expanded to include sites outside the park in Olympic National Forest (National Park Service 2012). Of the 351 survey units assigned, surveyors completely surveyed 279 and partially surveyed 32 units (Figure 2). Some units could not be surveyed due to above average late season snowpack. Of the 28 new units in Olympic National Forest identified from habitat modeling, 25% were occupied by marmots.

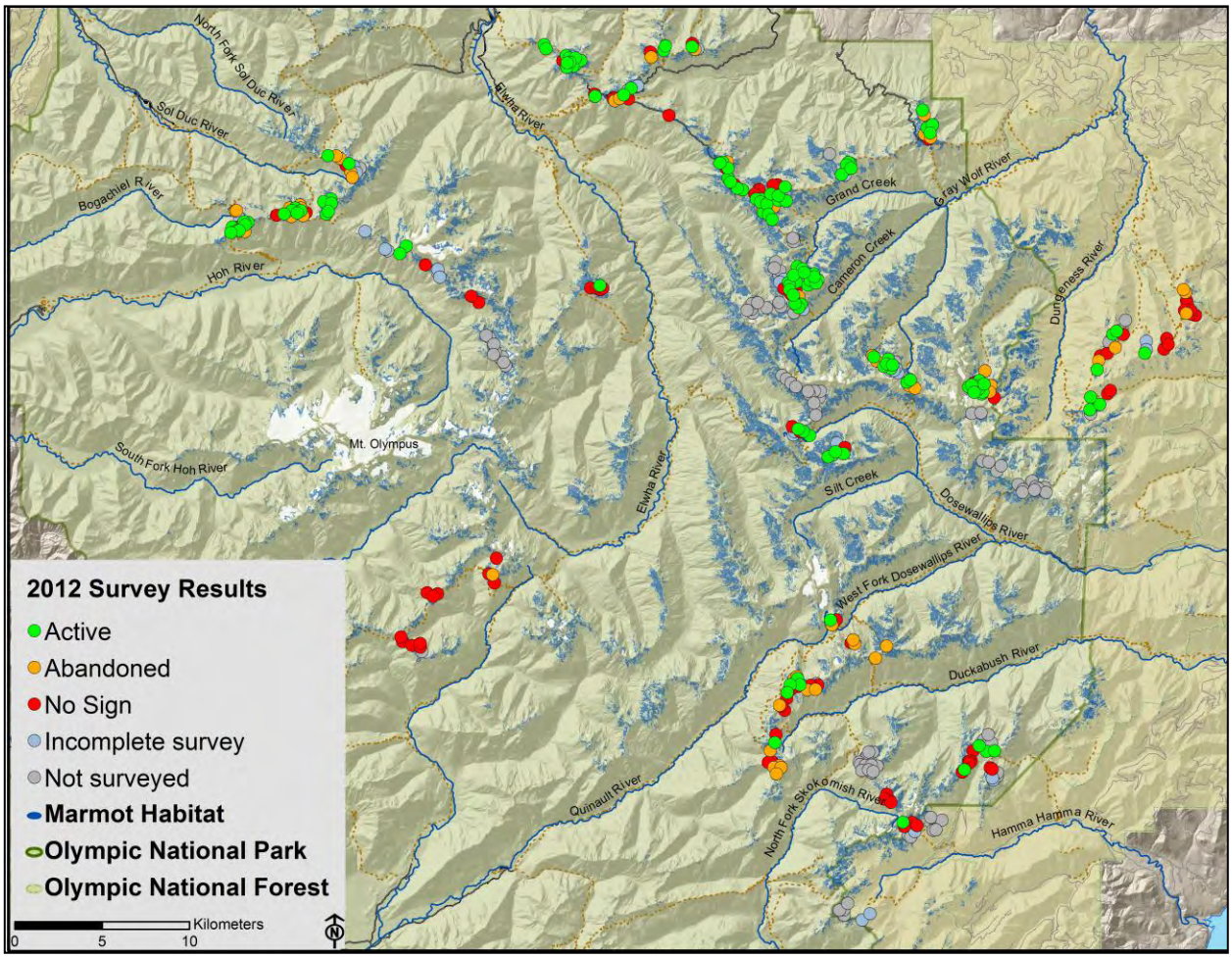

Figure 2. Olympic marmot habitat and monitoring results, 2012 (*courtesy P. Happe, Olympic National Park*).

Partners and cooperators: Olympic National Park, Washington's National Park Fund.

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Cascade Red Fox

(*Vulpes vulpes cascadensis*)

State Status: Candidate, 2010
Federal Status: None
Recovery Plans: None

The Cascade red fox is a rare, isolated Washington endemic subspecies. It is known to occur in alpine and subalpine habitats on Mt. Rainier and Mt. Adams, and there is some evidence of their presence in the central Cascades. Cascade red foxes come in a variety of coat colors including red, tan, and black (Figures 1, 2).

Figure 1. Cascade red fox in Mt. Rainier National Park (*photo by Joe Higbee*).

The Cascade red fox and other montane red fox populations appear to be specialized for occupying subalpine and alpine habitats, and may possess physiological adaptations that other populations lack (Aubry 1984, Swanson et al. 2005). The subalpine parklands and alpine meadows that montane red foxes inhabit (Aubry 1984, Kamler and Ballard 2002) may represent the modern analogue of forest conditions occupied in the Western mountains during the last glaciation. Presumably, the range of red foxes in the Western mountains shifted up in elevation with their primary habitat during glacial retreat. The findings of Aubry et al. (2009) support treating the montane red foxes as evolutionarily distinct. Recent genetic analyses also indicate that the Cascade red fox is distinct from the montane fox in Oregon and only occurs in Washington (Sacks et al. 2010).

The population size at Mt. Rainier and Mt. Adams is unknown, and the fox's status elsewhere in its range is unknown. The volcanoes of the Cascade Range seem to provide islands of habitat for small populations of Cascade red fox that may be isolated. A population size of less than a few thousand individuals may put the subspecies at risk of inbreeding depression and other genetic issues that could affect its future existence. A University of California-Davis graduate research project was initiated in the Mt. Rainier and Mt. Adams areas in 2010 with support from the U.S. Forest Service. Systematic surveys are needed in Washington's central and northern Cascades to determine the current status and distribution of Cascade red foxes. Scat was collected at several sites in Mt. Rainier National Park during 2011-2012 for DNA analysis to assess whether populations are connected (Akins 2012).

The Cascade red fox status in the North Cascades is uncertain. One was caught in a lynx trap in the North Cascades in the 1980s, but none have been caught during recent trapping for lynx or wolverines there, although red foxes in Yellowstone National Park are often incidentally caught in similar traps. There were also no detections of Cascade red foxes in the North Cascades during forest carnivore surveys (camera sets, hair snares, etc.) conducted in the 1990s.

Most of the apparent threats to the Cascade red fox are not new, but may be increasing in significance. Small, isolated populations are at risk of inbreeding and erosion of genetic health, and the impact of canine diseases may be more detrimental. Increasing human activities and ongoing climate change may also be facilitating movements of coyotes, a potential competitor and predator, into the range of the Cascade red fox. Lowland red foxes, bred from stock that originated in the eastern U.S. and escaped from

fur farms (Statham et al. 2012), seem to be increasing in Washington and could hybridize with the Cascade red fox. Climate models suggest that wildlife restricted to high-elevation habitats (such as the Cascade red fox) may be at risk of extinction due to climate change.

Foxes at Mt. Rainier National Park eat northern pocket gophers, snowshoe hares, songbirds, and huckleberries (Akins 2012). The foxes in the Paradise area of the park are increasingly becoming habituated to humans, which may put them at greater risk of vehicle collisions (Reese 2007).

Partners and cooperators: U.S. Forest Service-PNW Lab, National Park Service, University of California-Davis.

Figure 2. Cascade red fox in Mt. Rainier National Park (*photo by Cliff Rice*).

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Wolverine

(*Gulo gulo*)

State Status: Candidate, 1998
Federal Status: Candidate, 2010
Recovery Plans: None

Figure 1. Wolverine captured in northern Cascades, Washington, 2012 (*photo by Scott Fitkin, WDFW*).

The wolverine is a carnivore that occupies arctic, alpine and subalpine habitats in the northern portions of the northern hemisphere (Copeland et al. 2010). It is the largest terrestrial member of the weasel family (Mustelidae), with females weighing 18-27 lbs (8-12 kg) and males weighing 26-44 lbs (12-20 kg) (Pasitschniak-Arts and Lariviere 1995, Copeland and Whitman 2003). Wolverines are stocky with short, rounded ears, small eyes, a bushy tail and large feet that are useful for traversing snow (Figure 1). Their fur is dark brown, but has tawny colored bands that run down both sides of its body to its tail. The wolverine is among the most elusive of North America's carnivores because it avoids people and developed areas, and prefers cold and remote mountainous areas. They seem to be specialists at exploiting a cold, unproductive niche that limits competition from other carnivores (Inman et al. 2012a). Wolverine home ranges in the Greater Yellowstone Ecosystem averaged 303 km^2 for 8 females and 797 km^2 for 5 males, and both sexes moved a distance greater than the circumference of their home range per week (Inman et al. 2012b).

In Washington, the wolverine historically occurred in the alpine and subalpine habitats of the Cascades, Blue Mountains, and Rocky Mountains. Ongoing research projects and recent carnivore surveys have detected wolverines in or near each of these areas of Washington. Wolverines did not historically occur on the Olympic Peninsula or in southwest Washington. In 2009 and 2010, wolverines were photographed at seven detection stations deployed near Mt. Adams in the southern Washington Cascades. While it could not be determined if these detections accounted for more than 1 individual wolverine, they do confirm the continued existence of wolverines in the southern Cascades.

In 2010, the U.S. Fish and Wildlife Service concluded that listing the wolverine as a threatened or endangered species was warranted, based largely on the threat to the species' continued existence in much of the southern portion of its range due to climate change (USFWS 2010). The environmental niche of the wolverine appears to be defined by areas with persistent spring snow cover, which Copeland et al. (2010) suggested was related to the thermal advantages rendered by snow for denning, and thermal intolerance of high summer temperatures. Inman et al. (2012a) suggested a "refrigeration-zone" hypothesis that related wolverine distribution to the ability to cache food, such as winter-killed ungulates, in cold microsites. McKelvey et al. (2012) predicted from climate modeling that wolverine habitat would decline in extent but persist throughout most of the species range at least through the first half of the 21st century; populations would likely become smaller and more isolated.

Figure 2. Female wolverine exiting den in the North Cascades *(photo WDFW).*

Since 2006, researchers with the U.S. Forest Service, WDFW,

and British Columbia Ministry of Environment have studied wolverines in the Cascades of northern Washington and southern British Columbia to learn more about their status, distribution, and general ecology in this region. Given their dependence on cold, snowy environments, wolverines are an indicator species for climate change, making the data from this initial study even more valuable. From 2006 to 2011, researchers captured 9 wolverines (7F, 2M) and fitted 7 with satellite collars in an effort to locate natal dens and gather data on movements. The wolverines moved extensively, established large home ranges, and some made long distance dispersal movements.

During 2012, biologists captured one new male wolverine and recaptured 3 study animals, including two adult females. Telemetry helped pinpoint the natal dens of the two females, the first documented in the Pacific states. Remote cameras documented kit production and den visitation by the resident dominant male (presumed father). Researchers returned to the den during snow-free conditions to gather DNA samples and document den characteristics. Both sites were located in remote subalpine locations holding deep snow late into spring. One occurred in a space between very large boulders, and the other in a log pile at the toe of an avalanche chute (Figure 3).

Figure 3. Wolverine dens, found in Washington's North Cascades with the aid of telemetry in 2012, were in a space under boulders (lower right) and in a log pile in an avalanche chute (left and upper right; *photos by Scott Fitkin, Jeff Heinlen WDFW*).

U.S. Forest Service and WDFW researchers plan to continue trapping and remote camera surveys in 2013, and hope to collar up to 6 wolverines in Washington with satellite/VHF collars. Ministry of Environment biologists in British Columbia and Conservation Northwest volunteers will continue to collaborate on remote camera work.

In 2012, Conservation Northwest's volunteer camera crew obtained remote camera photos of 3 new wolverines in the Steven's Pass area south of the capture study area. In addition, the Carnivore Connectivity Project/Western Transportation Institute obtained remote camera photos in August of an

uncollared wolverine west of the Cascades crest near Glacier Peak Wilderness.

Partners and cooperators: U.S. Forest Service-PNW Research Station, Okanogan-Wenatchee National Forest, British Columbia, Ministry of Environment, Western Transportation Institute, University of California- Davis, Conservation Northwest, North Cascades National Park, U.S. Fish and Wildlife Service.

Figure 4. WDFW District Biologist Scott Fitkin with a male wolverine captured in the North Cascades of Okanogan County, Washington, in 2012 *(photo WDFW)*.

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Western and Clark's Grebes

(*Aechmophorus occidentalis* and *A. clarkia*)

State Status: Candidate, 2001 (Western) and 2010 (Clark's)
Federal Status: None
Recovery Plans: None

Western and Clark's grebes are closely related picivorous aquatic birds that once were considered different color phases of the same species (Figure 1), and they do occasionally interbreed (Konter 2011). Clark's grebe was recognized as a distinct species in 1985 (AOU 1985). Western and Clark's grebes are best known for their elaborate courtship displays, particularly the Rushing Ceremony, in which two birds often appear to 'skate' across the water side-by-side with heads held high (Storer and Nuechterlein 1992). Numbers of both species seem to have declined and both are affected by several of the same factors, and a draft WDFW status report for both is in preparation.

Figure 1. Clark's grebe, left, is similar to the western grebe, right, but has white around the eye and a brighter yellow bill (*photos by Joe Higbee*).

In summer, these species are found on inland freshwater lakes and marshes in eastern Washington. Western and Clark's grebes make floating nests from emergent and submergent vegetation, and nesting areas contain at least several square kilometers of open water bordered by emergent vegetation (Storer and Nuechterlein 1992). Western and Clark's grebes feed on a wide variety of fish, but also will take salamanders, crustaceans, worms, and insects. Fish comprise 80% of the diet and are pursued under water. Males feed their mates large quantities of fish during the period of egg development (Storer and Nuechterlein 1992).

During fall, western and Clark's grebes move to the Pacific coast, with migration peaking in October and apparently occurring at night (Storer and Nuechterlein 1992). In winter, western grebes occupy nearshore marine waters of Washington, but Clark's grebes are largely found further south. There are few surveys conducted that allow clear coast-wide comparisons of trends concerning western and Clark's grebes, but available data indicate that both have undergone sizeable declines in the northern portion of their breeding and wintering range. How much of the decline reflects a southward shift versus a population reduction is not clear.

Breeding populations. Small populations of western and Clark's grebes breed on eastern Washington lakes, but breeding areas may be of lower quality compared to those historically available. Systematic

Table 1. Numbers of western (WE) and Clark's (CL) grebes at breeding locations in eastern Washington, 1988-2012.

Site	County	Species	Year and numbers
Lower Spokane River (east end of Long Lake)	Spokane	WE	2006: up to 40 pairs 2007: at least 12 nests 2011: 110 adults; 66 nests
North and South Twin Lake	Ferry	WE	2007: 6 adults on territory, no nesting noted
Owhi Lake (northeast of Nespelem)	Okanogan	WE	2007: 4 adults
Sprague Lake	Adams	CL, WE	2007: 275 adults (50 CL) plus young 2010: 15 adults (May) 2011: 63 adults (May)
Upper Hampton Lake	Grant	CL likely	2007: 2 adults
Winchester Lake and Wasteway	Grant	WE	2007: 2 adults with 2 flightless young 2011: 12 adults
Moses Lake (Goat, Gailey's, Marsh and Crest Islands)	Grant	CL, WE	1990: 344 adults (270 CL) 2007: ~100 nests 2011: 56 adults
Potholes Reservoir (multiple locations)	Grant	CL, WE	1990-91: 850-1270 adults; 425-635 nests; CL 5-10% 2011: 524 ad (12% CL); 222 nests; many nests appear to have failed due to water drop. 2012: 247 WE nests in the northern part of the reservoir; at least half failed due to various causes.
Saddle Mountain Lake	Grant	CL, WE	1990:60 adults15 pair WE; 15 pair CL
Banks Lake (several locations from Steamboat Rock Park south along eastern shore)	Grant	CL, WE	1988: 139 WE adults, 74 young. Nesting reported at 3 sites on eastern shore 2009: 64 nests (Osborne Bay) 2010: 4 nests 2011: 35 adults

surveys of western and Clark's grebe nesting numbers and reproductive success have not been conducted, but available data suggest possible declines in both species. The combined numbers of western and Clark's grebes summering in eastern Washington in recent years are probably less than 2,500-3,000 birds, with most of these (1,500-2,000) in the Potholes Reservoir area based on limited data (Table 1). Counts in late August or early September in 2000 and 2001 that tallied 1,900 and 2,200 western grebes at Potholes Reservoir would have included young of the year and migratory birds (Wahl 2005).

Repeated surveys have been conducted only in the past few years to assess changes in Washington's breeding populations of western and Clark's grebes, and historical data for analyzing population changes in nesting grebes is sparse. A large nesting colony of several hundred pairs present on Moses Lake in the late 1960s was abandoned in 1982 or 1983. Storer and Nuechterlein (1992) indicate that colony locations within large water systems are only semi-traditional, and may change year-to-year with water conditions. Documenting an overall decline requires data from a wider area.

WDFW biologists have collected some data on changes in breeding western and Clark's grebe populations in Washington (Table 1). Counts of at least 100 nests in 2007, 136 nests in 2009, and at least 184 nests in 2011 of both species combined (mostly western) were made on Potholes Reservoir. Similarly, at least several hundred nesting attempts by both species occurred in Moses Lake in the 1980s; but in 2007, only about 100 nest attempts by Clark's grebe occurred there. While there is no firm tally of total numbers nesting now, there were clearly fewer western and Clark's grebes nesting in 2007 at

Potholes Reservoir and Moses Lake than in the 1980s and early 1990s. In 2009, at least 64 nests (mostly Clark's) were recorded at Osborne Bay, Banks Lake; only 2 nests were present in 2010.

Breeding Bird Survey trends (http://www.mbr-pwrc.usgs.gov/bbs/bbs.html) suggest a decline in the combined numbers of western and Clark's grebes in Washington, although the decline is not statistically reliable due to a limited sample size (Sauer et al. 2011). However, the trends for Oregon and the western North American survey area, which have larger sample sizes, also show sizable declines, but with numbers somewhat stable since about 1990 (Figure 2; Sauer et al. 2011).

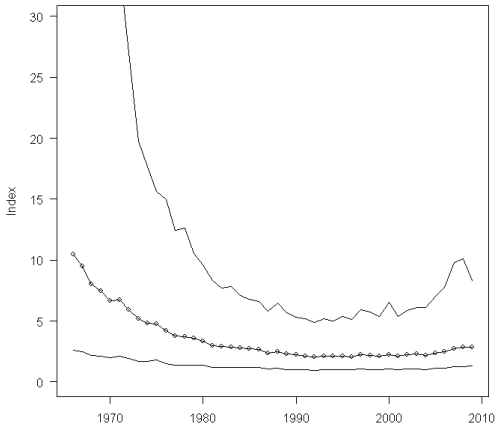

Figure 2. Trend (with 95% confidence interval) in summer numbers of western and Clark's grebes in the western North American Breeding Bird Survey region (Sauer et al. 2011).

Factors affecting breeding populations. Much of the grebe nesting habitat in the Columbia Plateau is tied to reservoirs that are directly influenced by surrounding water use. The largest known Western grebe nesting colonies in Washington are primarily associated with Potholes Reservoir, the hub of the Columbia Basin Irrigation Project. This project services over 671,000 acres of irrigated farmland in the Columbia Plateau, and as a result, associated reservoirs are characterized by sizable water level fluctuations.

During 2012, WDFW biologists made weekly visits from late June to late July to monitor water levels and the Western grebe colony at Job Corps Dike on Potholes Reservoir. Water level change can be a large contributor to egg loss and ultimately, nest failure as anchored nests tend to tip as a result of receding water levels, spilling eggs. During the survey period from 20 June – 18 July, water level dropped an average of 1.9 inches/day from, or >4 ft total. The average water drop between these dates was 2.3 inches/day for the period 2002-2011. A high estimate of 247 nests was made in 2012. Of 49 individual nests monitored, 24 (49%) hatched and 21 (43%) appeared to fail, another 4 (8%) had an unknown fate but were suspected to have hatched. Of the 21 confirmed failures, 29% appeared to be from declining water levels, 24% were from nest destruction (likely from wind and carp activity), 24% from egg depredation,10% from abandonment, and 14% from unknown reasons (R. Finger, pers. comm.). Some grebes compensated by

Figure 3. Parent western grebe returns to a nest after an egg check by biologists in 2012. Eggs are individually marked to track rates of egg loss and replacement through the season (*photo by R. Finger*).

building a lip on the nest to prevent eggs from spilling out. Nest failure due to water level fluctuations might be greater in a more typical year when water levels drop more rapidly.

Boat wakes created by recreational fishing boats may affect grebe nesting success (Robison et al. 2008), and requires investigation. Jim Tabor, WDFW biologist in the Columbia Basin for 26 years, suggested that an apparent reduction in nesting numbers since the 1980s may primarily be the result of increased human disturbance. He felt that most other negative factors (e.g., predation, fluctuating water levels) have remained relatively static over that same time. Repeated disturbance by curious boaters, particularly during the early stages of colony formation, can lead to a high incidence of nest abandonment (Storer and Nuechterlein 1992, Robison et al. 2008).

Wintering populations. Wintering western grebes have declined by almost 95% in Washington's inner marine waters since the late 1970s (Puget Sound Action Team 2007). Recent data suggest that numbers may have stabilized since 1998 (Figure 4). Up to 20-25% of the world's population of western grebes overwinters in Washington. Fish can comprise over 80% of the diet and Pacific herring *(Clupea pallasii)* can make up more than 50% of their winter diet. The simultaneous declines of wintering western grebe populations and forage fish stocks like the Cherry Point herring, around which western grebe concentrations historically gathered, suggest that changes in food resources have played a role in the decline of wintering populations of this species in Washington.

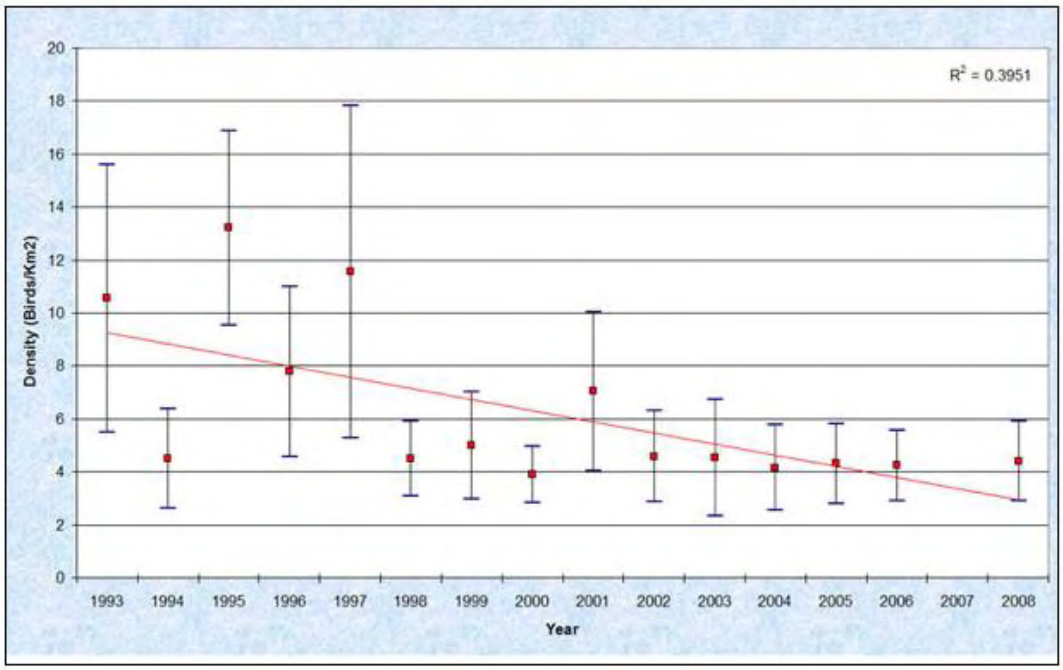

Figure 4. Winter trends in western grebe densities in the inner marine waters of Washington, 1993-2008 (WDFW 2011).

Henny, et al. (1990) reported that western grebes wintering on Commencement Bay, in Tacoma during 1985-1986 accumulated significant amounts of mercury, arsenic, DDE, PCB, and other contaminants. The birds appeared to be in good condition, but the study methods precluded evaluation of sub-lethal effects. Other factors that may contribute to the declines in both species on wintering areas along the West Coast include fishing bycatch and derelict fishing gear. Both species have been killed in gill nets and found entrapped in removed derelict monofilament fishing nets. Western and Clark's grebes have been killed by numerous oil spills and are considered to be among the marine bird species most often

impacted by oil spills off the coast of California, Oregon, Washington, and British Columbia. In the fall of 2009, large numbers of wintering western grebes were killed by a severe algal bloom caused by the dinoflagellate *Akashiwo sanguine* along the outer Washington and Oregon coasts (Phillips et al. 2011). More focused study and monitoring on the species' breeding and wintering grounds are needed to understand the causes of grebe declines.

Conservation activity. In 2012, WDFW signed a memorandum of understanding with the U.S. Bureau of Reclamation, Ecology Office of Columbia River regarding implementation of the Bureau's Odessa water project, a long-planned second phase of the Columbia Basin Irrigation Project. The MOU included provisions to establish a Western Grebe Management Area with floating nesting platforms and other waterfowl habitat enhancements.

Partners and cooperators: U.S. Fish and Wildlife Service, SeaDoc Society, Washington Environmental Council, Washington Audubon Society chapters.

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Golden Eagle

(*Aquila chrysaetos*)

State Status: Candidate, 1991
Federal Status: None
Recovery Plans: None

Figure 1. Golden eagle (*photo by Jim Watson*).

The golden eagle is a large, dark raptor with a golden crown and nape, and wingspan of up to 7 feet (Figure 1). The species breeds at higher densities in mountainous and open areas dominated by shrub-steppe communities, but also nests at lower densities in conifer forest where open space occurs (e.g., burns, clearcuts). Most nests in mountainous areas occur on large cliffs, but tree nests are used in flat terrain at lower elevations in more open and semi-open landscapes and in areas dominated by conifer forest (Kochert et al. 2002, Watson 2010). Golden eagles forage in grasslands and shrublands and prey primarily on mammals, such as jackrabbits, cottontails, ground squirrels, and marmots, and secondarily on birds, such as ring-necked pheasants and chukars (Knight and Erickson 1978, Kochert et al. 2002). Washington breeding birds are non-migratory.

Annual surveys conducted in the western U.S. (excluding California and Alaska) from 2006-2010 indicated no significant trends in abundance, with an estimated 23,833 golden eagles present in 2010 (Nielson et al. 2011). Because populations may fluctuate cyclically with prey populations (e.g., Kochert and Steenhof 2002), surveys of less than ten years are not likely to the long-term trend in abundance.

Humans are the leading cause of golden eagle mortality, either directly or indirectly (Kochert et al. 2002). A compilation of the causes of 4,300 bald and golden eagle deaths during the early 1960s to mid-1990s found that humans caused >70% of recorded deaths, with accidental trauma (e.g., collisions with vehicles, power lines, and other structures) being the primary factor (27%), followed by electrocution (25%), illegal shooting (15%), and poisoning (6%) (Franson et al. 1995). These major threats continue to affect golden eagles today.

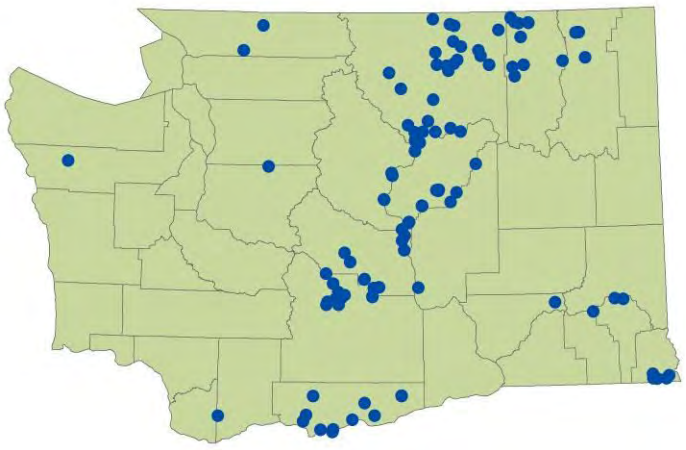

Figure 2. Occupied golden eagle breeding sites in Washington during the previous statewide surveys, 2004-2005.

Lead poisoning is a concern for golden eagles in most parts of their western range. In Washington, elevated lead levels in blood were detected in more than half of 14 birds, with four of the birds having lead levels indicative of toxicosis (Watson and Davies 2009). Individuals likely ingest lead by feeding on injured or dead waterfowl, small mammals, or deer shot by hunters.

Golden eagles, particularly immature birds, are the most commonly electrocuted

raptor in the U.S. (Harness and Wilson 2001, Lehman et al. 2007, 2010). Many power pole designs place conductors and ground wires close enough together that a large bird like a golden eagle can touch them simultaneously with its wings or other body parts causing electrocution (Lehman et al. 2007). The majority of electrocutions are associated with low-voltage power lines or those with transformers, rather than high-voltage power lines (Lehman 2001, Lehman et al. 2007).

Expanding wind energy development represents another concern for golden eagles. High numbers of golden eagles have been killed at a wind farm in California, but comparable levels of mortality have not been documented at other sites in the U.S. (Watson 2010). The expansion of wind farms in Washington will require long-term monitoring to assess potential effects of mortality on this long-lived raptor. Seven golden eagles have been killed and five injured and had to be euthanized at wind farms in Washington through 2012 (T. Nelson, pers. comm.). WDFW and some wind power companies are collaborating on research of radio-tagged golden eagles to assess movements of nesting birds in and around wind turbines (Watson et al. in review).

Declining prey bases are another threat to golden eagles and are commonly caused by habitat loss, alteration, and fragmentation, as well as past and ongoing control efforts. In Washington, a number of prey species of golden eagles have declined, including jackrabbits, Washington and Townsend's ground squirrels, and yellow-bellied marmots. Inadequate prey availability can affect territory occupancy and nesting success of golden eagles (Kochert et al. 2002).

Surveys and monitoring. WDFW and partners have monitored nesting territories in Washington at varying levels of effort since 1990, with more intensive surveys conducted in 1990, 1999, 2000, 2004, and 2005 (Figure 2; WDFW database). About 60 breeding pairs of golden eagles are currently estimated in the state, with about 270 historical breeding territories known (J. Watson, unpubl. data). In 2012, several new territories were identified from data collected on golden eagle territories and observations from other agencies in preparation for surveys planned for 2013 (Figure 3).

Conservation actions and research. WDFW is completing research on habitat characteristics and prey sources and levels of contamination in golden eagles. Resource characteristics of home ranges used by satellite-telemetered eagles will be described for informing proposals to develop windpower. Ongoing and future research being conducted

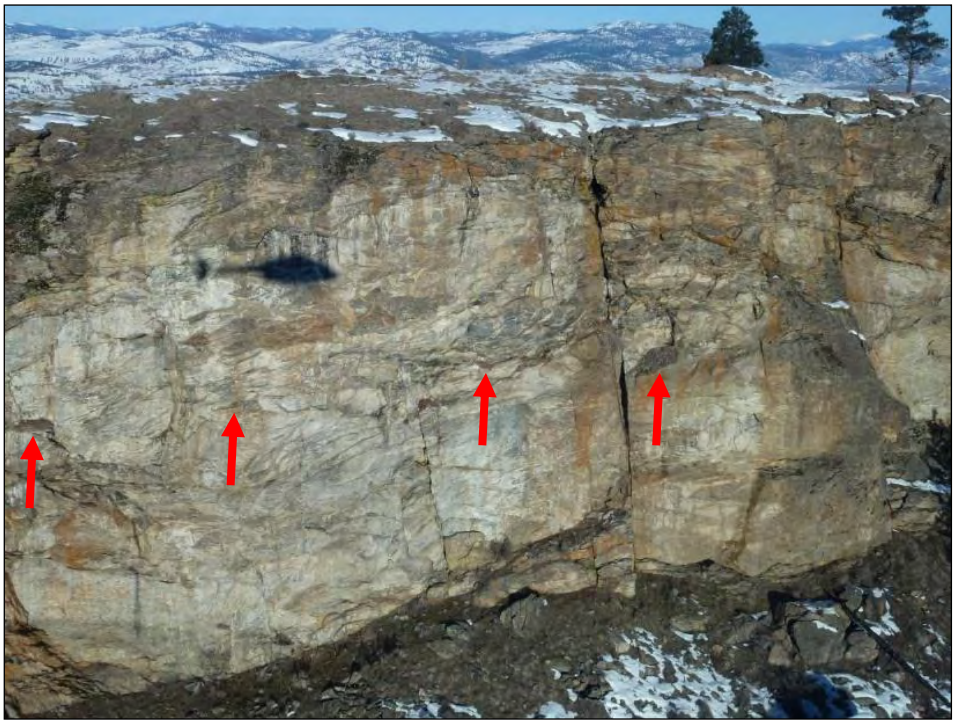

Figure 3. Golden eagle nesting cliff in Okanogan County; red arrows indicate four nests present in the frame (*photo by Jeff Heinlen, WDFW*).

cooperatively with the Woodland Park Zoo, includes nesting eagle and wind turbine interactions and juvenile movements and survival.

The U.S. Fish and Wildlife Service is completing a conservation plan for bald and golden eagles. Eagles are protected under state and federal law, and landowners must still comply with the federal Bald and Golden Eagle Protection Act to avoid impacting eagles.

Partners and cooperators: U.S. Fish and Wildlife Service, Bureau of Land Management, Woodland Park Zoo, U.S. Forest Service, U.S. Army-Yakima Training Center, Washington Department of Natural Resources.

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Tufted Puffin

(*Fratercula cirrhata*)

State Status: Candidate, 1998
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Tufted puffin (*photo by Peter Hodum*).

Tufted puffins are one of the most distinctive appearing birds in Washington (Figure 1). During the breeding season, they nest in soil burrows, rocky crevices, or occasionally in dense shrubbery on isolated offshore islands, and forage mainly in continental shelf areas. During the remainder of the year, tufted puffins are found on deep oceanic waters.

The tufted puffin was considered common in Washington historically, with 44 nesting colonies documented along the outer coast, in the San Juan Islands, and the Strait of Juan de Fuca. The statewide population was estimated at >25,000 individuals in 1909 and remained in that range for much of the twentieth century (Jewett et al. 1953). Speich and Wahl (1989) estimated the population at 23,342 in the 1980s. However, more recent surveys have found nesting birds at only 19 sites (nearly all along the outer coast) and estimated the total population at no more than several thousand birds (Wahl and Tweit 2000; Hodum et al., unpubl. data; S. Pearson et al., unpubl. data). This work suggests that tufted puffins in Washington have undergone a dramatic population decline and nearly a 60% drop in site occupancy over the past 25 or more years (Figure 2). This decline corresponds with similar population trends in California and Oregon.

Potential causes of the decline of tufted puffins in Washington include prey scarcity, introduced species (primarily European rabbits [*Oryctolagus cuniculus*]), changing oceanic and climatic conditions, oil spills, and entrapment in fishing nets. Increased shoreline development continues to impact forage fish spawning grounds in the San Juan Islands and parts of the Strait of Juan de Fuca. The largest known mortality event in the state was in 1991 during the *Tenyo Maru* oil spill, which killed an estimated 9% of the state's puffin population. Chronic small-scale discharges of oil from routine shipping activity represent another potential risk for the species.

Monitoring. Breeding surveys on Tatoosh Island from 2005 to 2008 indicated an overall fledging success of 23-63% (P. Hodum and S. Pearson, unpubl. data), which is considerably lower than that reported by Piatt and Kitaysky (2002) for several other sites. Annual boat-based surveys for marbled murrelets (*Brachyramphus marmoratus*) and other seabirds indicate that the on-the-water density of tufted puffins between Pt. Grenville and Cape Flattery has declined an average of 8.9% per year from 2001 to 2012 (Figure 3; S. Pearson, unpubl. data). These surveys were made within 8 km of shore from mid-May to late July. Data from the 2009 survey, in which 1,380 km of water were surveyed (Raphael et al. 2007, Falxa et al. 2011), generated an estimate of 2,958 tufted puffins for Washington's outer coast (S. Pearson, unpubl. data). This result represented the estimated number of birds on the water and did not account for individuals provisioning chicks, otherwise attending colonies during the survey period, or those farther offshore.

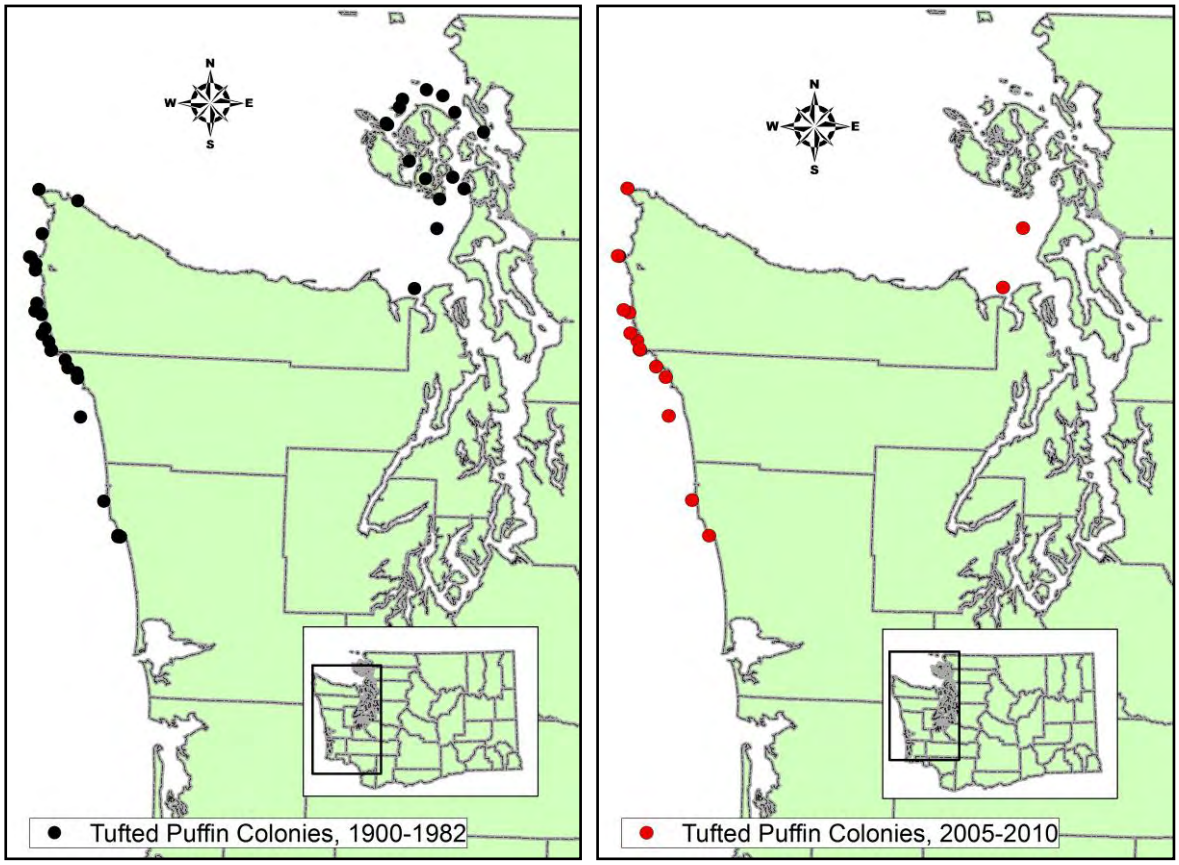

Figure 2. Locations of historical and current tufted puffin colonies in Washington.

Conservation activities. A draft status report for tufted puffins in Washington is being prepared for WDFW with funding from The Seadoc Society. The report will go through the state's listing procedures (WAC 232-12-297, Appendix A) to determine whether a recommendation would be made to list the species as endangered, threatened, or sensitive in Washington. A manuscript is also being prepared to assess the status of Washington's tufted puffin nesting colonies based on recent surveys of historically occupied sites (P. Hodum and S. Pearson, in prep.).

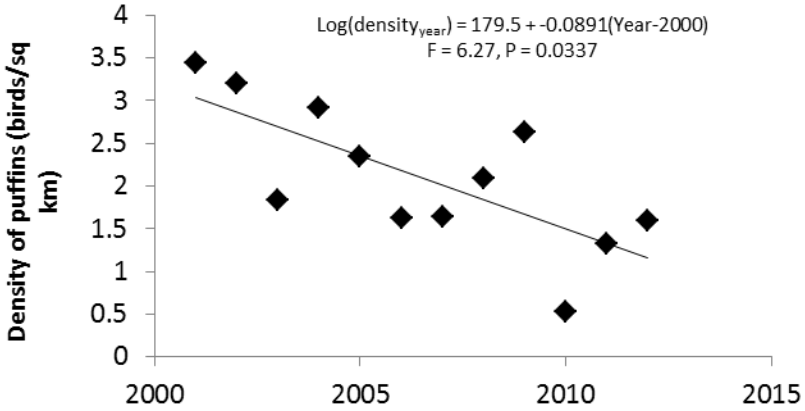

Figure 3. Trend in the on-the-water density of tufted puffins during boat-based surveys within 8 km of shore between Pt. Grenville and Cape Flattery, 2001-2012 (S. Pearson, unpubl. data).

The U.S. Fish and Wildlife Service has recently completed comprehensive conservation plans for the Flattery Rocks, Quillayute Needles, and Copalis National Wildlife Refuges (USFWS 2007), and the Protection Island and San Juan Islands National Wildlife Refuges (USFWS 2010). These will direct management activities over the next 15 years, including measures that should benefit nesting tufted puffin.

Partners and cooperators: U.S. Fish and Wildlife Service, SeaDoc Society, University of Puget Sound, University of Washington, NOAA Fisheries, Makah Tribe, Quinault Tribe, Quileute Tribe, National Park Service.

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Yellow-billed Cuckoo

(*Coccyzus americanus*)

State Status: Candidate, 1991
Federal Status: Candidate, 2001 (Western U.S. Distinct Population Segment)
Recovery Plans: None

Figure 1. Yellow-billed cuckoo *(© David Speiser, www.lilibirds.com)*.

Yellow-billed cuckoos feature unmarked grayish brown upper plumage, white underparts, large reddish brown wing patches, a long brown tail marked with bold white spots, and a mostly yellow bill (Figure 1). Vocalizations include a distinctive *ka, ka, ka, ka, ka, kow, kow, kow* call. The species is migratory and once bred across much of the U.S. and parts of Canada, Mexico, and the Caribbean. Breeding range in the U.S. is now largely restricted to the eastern and central regions (Hughes 1999). Wintering occurs across much of the northern two-thirds of South America (Hughes 1999, Sechrist et al. 2012). Two subspecies are often recognized, with the western yellow-billed cuckoo (*C. a. occidentalis*) present in western North America (Figure 2; Hughes 1999).

In the breeding range, yellow-billed cuckoos prefer open lowland deciduous woodlands with clearings and shrubby vegetation, especially those near rivers and streams (Hughes 1999). In western North America, there is a strong preference for large continuous riparian zones with cottonwoods and willows. Diet consists mainly of large insects such as caterpillars, grasshoppers, katydids, beetles, and crickets; small frogs and lizards, bird eggs, and nestling birds are also occasionally eaten.

In western North American, yellow-billed cuckoos begin arriving from migration in mid- to late May, making them one of the last migrants to return (Bent 1940, Hughes 1999, Tweit 2005). Most nesting occurs between June and early August, but can extend from late May until late September (Brown 1923, Jewett et al. 1953, Hughes 1999). Unlike many species of cuckoos, yellow-billed cuckoos often build their own nests and care for their own young. Nests are usually loose platforms of twigs lined with leaves or finer materials and, in the West, are often placed in willows, cottonwoods, and shrubs (Brown 1923, Gaines and Laymon 1984). Clutch size ranges from 1-5 eggs, but is usually 2-3 (Hughes 1999). The entire period from egg laying to fledgling is one of the shortest among all bird species and lasts only 17-18 days, with incubation extending 9-11 days and nestlings fledging at 7-9 days of age (Hughes 1999). Young can fly at three weeks of age. Two clutches may be laid in years of good food supply. Yellow-billed cuckoos also occasionally lay their eggs in the nests of other yellow-billed cuckoos as well as other species, such as American robins, gray catbirds, and wood thrushes. This behavior is known as brood parasitism.

Population status. The western yellow-billed cuckoo has experienced a major decline in its breeding range since the 1800s and is now extirpated throughout most of its historical range except for small and widely dispersed nesting populations in California, Arizona, and New Mexico (Figure 2) and a few scattered nesting pairs in Idaho, Utah, Colorado, and Nevada (Reynolds and Hinckley 2005, Johnson 2009). Breeding no longer occurs in Washington, Oregon, and British Columbia (Campbell et al. 1990,

Marshall 2003, Tweit 2005). In Washington, J. K. Townsend considered yellow-billed cuckoos abundant along the lower Columbia River at present-day Vancouver in the 1830s (Jobanek and Marshall 1992). Subsequent observations suggest they were an uncommon nester in the Puget Trough in the early 20th century, but were rare in the state by the late 1930s or 1940s (Burleigh 1929, Jewell et al. 1953, Smith et al. 1997, Tweit 2005). Breeding had apparently ended by 1934 (Roberson 1980). No nesting records exist for eastern Washington, despite the presence of apparently suitable riparian corridors, occasional past sightings during the summer, and documented breeding in eastern Oregon and southern Idaho. Reports of individual cuckoos have been very rare in recent decades, with only about 12 records made between 1950 and 2000 (four in western Washington, eight in eastern Washington; Tweit 2005; U.S. Fish and Wildlife Service, unpublished data). Three reports are known since 2000, these being near Lind (Adams Co.) in 2001, near Eureka (Walla Walla Co.) in June 2007, and from Little Pend Oreille National Wildlife Refuge (Stevens Co.) in June 2012 (*WOSNews* and eBird reports; U.S. Fish and Wildlife Service, unpublished data). It is unknown if all of these records involve the western subspecies (Roberson 1980, Tweit 2005).

Figure 2. Historical and current distribution of western yellow-billed cuckoos (from Laymon and Halterman 1987, Johnson 2009).

Threats. Habitat loss and pesticide use are thought to be two of the main causes for the precipitous decline of western yellow-billed cuckoos (Gaines and Laymon 1984, Laymon and Halterman 1987, Iten et al. 2001, Wiggins 2005). Agriculture, grazing, reservoir construction, flood control, urbanization, and other factors across the West have caused the large-scale loss and degradation of lowland riparian forest, which is the cuckoo's primary habitat. In California, cuckoos prefer intact riparian woodlands of 10-15 ha or more. Exposure to pesticides in both the breeding and wintering ranges is another potential threat that may be causing reduced availability of insect prey and eggshell thinning. Other unknown factors may also threaten the population.

Inventory and conservation. Almost all recent records of yellow-billed cuckoos in Washington have come through the birdwatching community. No management activities specific to this species are currently conducted due to its scarcity in the state, although broader efforts to protect and restore riparian forests would likely be beneficial. In 2012, the U.S. Fish and Wildlife Service began working on a proposed rule to list the western distinct population segment of cuckoos and expects to publish this in 2013 (USFWS 2012).

Partners and cooperators: U.S. Fish and Wildlife Service.

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Flammulated Owl

(*Otus flammeolus*)

State status: Candidate, 1991
Federal status: Species of concern
Recovery Plans: None

Figure 1. Flammulated owl (*photo from Greg Lasley, USGS*).

The flammulated owl is a small (6-7" long) dark-eyed owl (Figure 1), more often heard than seen, that inhabits dry montane forests of eastern Washington. Flammulated owls are known for their ventriloquial hoots (McCallum 1994). Their breeding range extends from southern British Columbia to Mexico. Flammulated owls are largely insectivorous, and migrate south when cold temperatures make insects scarce, wintering from central Mexico to El Salvador (McCallum 1994). Flammulated owls are a late spring migrant, with most arriving in Washington in late May (Buchanan 2005). After young are fledged by about mid-August, they cease to vocalize and are less often detected.

Flammulated owls eat nocturnal arthropods, primarily noctuid moths, crickets, grasshoppers and beetles (McCallum 1994). They nest in natural cavities and old woodpecker holes, and they may compete with bluebirds (*Sialia* spp.), northern flickers (*Colaptes auratus*), and northern flying squirrels (*Glaucomys sabrinus*) for nest sites. Linkhart and Reynolds (2007) reported high fidelity to breeding territories in Colorado. Flammulated owls have a lower reproductive rate than most other North American owls. Clutch size is usually 2-3, and occasionally 4 eggs (McCallum 1994).

In northeastern Oregon, flammulated owl territories are often in forests of large diameter (>50 cm dbh) ponderosa pine/Douglas-fir or grand fir with ponderosa pine in the overstory (Bull et al. 1990). In Washington, flammulated owls are an uncommon to fairly common summer resident in the ponderosa pine zone of the Cascades, northeastern Washington, and Blue Mountains (Figure 2; Buchanan 2005). Jewett et al (1957) considered the flammulated owl a rare species, but with higher numbers of field observers in recent decades, it is evident that they are not rare in appropriate habitat. Flammulated owl abundance may have declined in response to timber harvest and the effects of fire suppression. Dry forest management that restores more open structure of pine and mixed conifer stands may improve habitat conditions for flammulated owls. The most immediate threat may be cutting of snags for firewood (McCallum 1994). Aerial

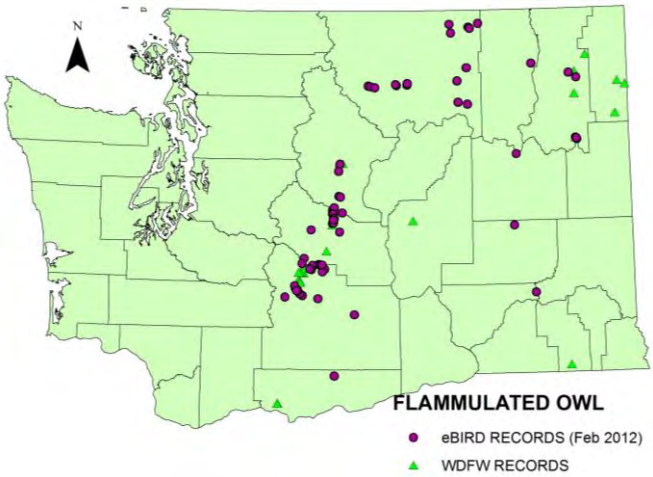

Figure 2. Flammulated owl records in Washington, (WDFW database and eBird 2012).

spraying of BTk or carboryl-based insecticides suppress non-target moths, and may negatively affect flammulated owls.

Flammulated owls have received little study in Washington, and there are few data on basic aspects of their biology such as abundance, habitat use, and reproductive ecology.

Surveys. In 2011 and 2012, WDFW conducted surveys using a standardized protocol involving broadcasts of recorded calls at points along specified routes in potentially occupied habitat (Fylling et al. 2010). Biologists in four WDFW regions conducted road-based surveys for flammulated owls in five forest cover types (lodgepole pine, mesic forest, mixed conifer, oak woodland and ponderosa pine). Each route consisted of 10 stations that were ≥1 mile apart and visited on 3 occasions. In 2011, surveys were conducted on 9 routes (270 station visits) and there were 17 detections of flammulated owls. In 2012, there were 46 detections during 925 station visits on 13 of 31 routes surveyed. Owls were detected in all 5 cover types, with most detections occurring in ponderosa pine and mixed conifer cover types (Figure 3). This project was part of a multi-state effort and Washington data will be included in a multi-state analysis to better understand distribution and habitat use.

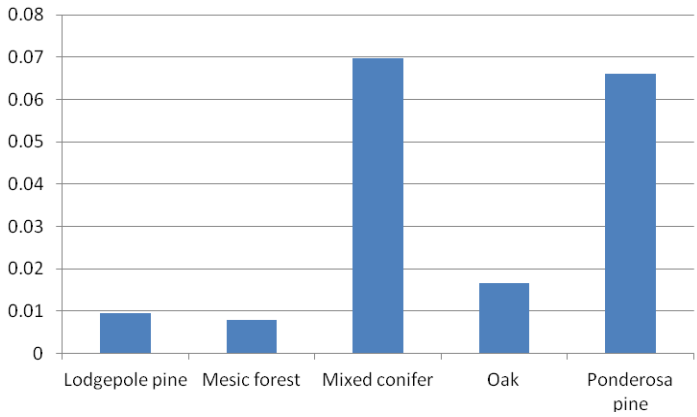

Figure 3. Flammulated owl detections per station for 5 cover types in Washington during 2012.

Migration research project. A project to identify migration routes and wintering areas of flammulated owls is underway using geolocators (Figure 4); data from geolocators can be used to identify migration pathways and wintering areas. In 2012, there were 3 main study areas: 1) the Naches Ranger District, Wenatchee National Forest in Washington; 2) north-central Utah; and 3) the Manitou Experimental Forest, near Colorado Springs, Colorado. Plans for 2013 include recapturing marked owls and deploying geolocators in northern California.

Figure 4. Flammulated owl with geolocator attached (*photo by Kay Schultz*).

Partners and cooperators. Boise State University, Global Owl Project, HawkWatch International, Idaho Bird Observatory, Partners in Flight, Rocky Mountain Bird Observatory, Southern Sierra Research Station, U.S. Fish and Wildlife Service, U. S. Forest Service.

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Burrowing Owl

(*Athene cunicularia*).

State Status: Candidate, 1991
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Burrowing owl in Adams County (*photo by Joe Higbee*).

The burrowing owl is a small owl of open grassland and shrub-steppe habitats in eastern Washington and the western U.S. (Figure 1). There are breeding records from most of the non-forested low elevation areas of eastern Washington (Figure 2), but historical information suggests that their range in Washington has undergone a significant contraction in recent decades. Burrowing owls have become uncommon to rare outside of Benton, Franklin, Grant, and western Adams counties. A WDFW status report for the species was initiated in recent years, but was delayed because of other priorities and completion may require additional surveys.

The burrowing owl has been declining in large portions of its range, which has contracted, particularly in northern and eastern regions (Figure 3). It is listed as an endangered species in Canada, a threatened species in Mexico, and a species of concern in several states. Burrowing owls were extirpated in British Columbia sometime after 1979 and have been the subject of a reintroduction and captive rearing program there since 1983 (Haug et al. 1993).

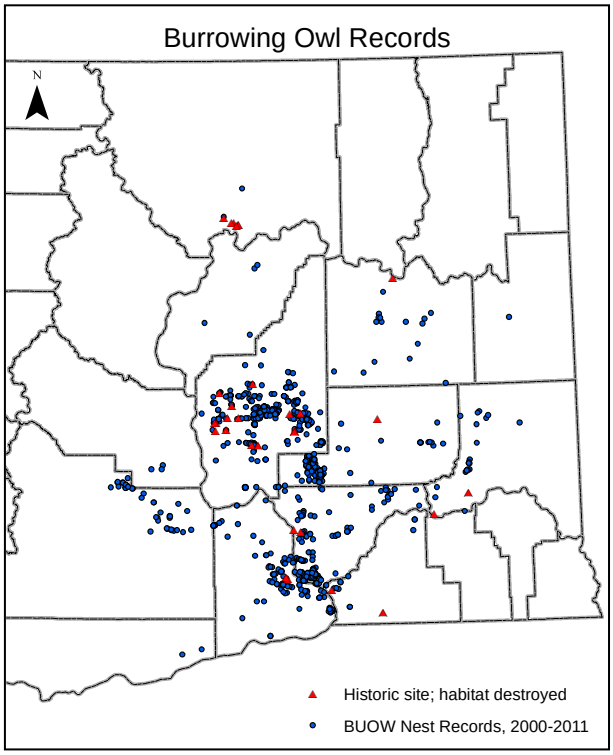

Figure 2. WDFW burrowing owl records in Washington through 2011.

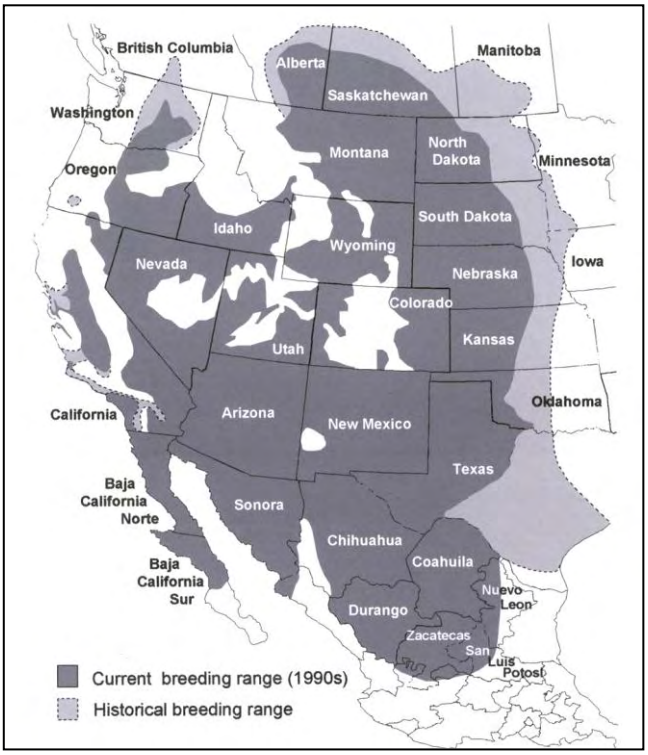

Figure 3. Reduction in burrowing owl range (modified from Wellicome and Holroyd 2001).

Analysis of Breeding Bird Survey data for Washington indicated an estimated 1.5% annual decline 1968–2005, which equated to an overall decline of 45% (Conway and Pardieck 2006). Burrowing owls most often use the abandoned burrows of mammals for nesting, food caching, and roosting. Conway et al. (2006) suggested that the reason for the population decline in Washington may be the reduction in numbers of ground squirrels, yellow-bellied marmots, and badgers, but loss of habitat to the intensification of agriculture and development has also affected the species. A decline concurrent with burrowing mammals would be consistent with anecdotal observations that poisoning campaigns directed at Columbian ground squirrels affected burrowing owls in parts of their Washington range (Smith et al. 1997). Rapid suburban development and shrub-steppe conversion to irrigated agriculture has affected many burrowing owl sites around the Tri-Cities in recent years.

Conway et al. (2006) compared demographic rates of burrowing owls in agricultural versus urban habitat in Washington. They reported that burrowing owls seem to be attracted to agriculture due to high prey abundance, but natal recruitment and adult return rates were lower, suggesting that agricultural areas may constitute a population sink.

A portion of the Washington population winters in the Columbia Basin (Conway et al. 2002); 2-week surveys conducted during 2 winters detected 5-12% of banded adults wintering at or near their nest burrows. Conway et al. (2005) reported that 3 owls banded as juveniles in Washington apparently wintered in California (2 were resighted in Orange and Sonoma counties, 1 was found dead in San Francisco). Another banded juvenile was killed by a train in Havre, Montana (Conway et al. 2005). A burrowing owl found dead beneath a wind turbine in Klickitat County in February 2011, was banded as a juvenile in July 2010 near Kamloops, British Columbia.

Artificial burrow project. Artificial burrows have been studied and refined since its inception. Johnson et al. (2013) provide a synthesis of material relevant to the use of artificial burrows for burrowing owls, insights into the placement, design specifications and installation techniques, and anti-predator strategies. In 2010 and 2011, WDFW installed 61 artificial burrows in the Tri-Cities area. An earlier project had installed about 200 artificial burrows, primarily on local golf courses around the Tri-Cities. Most were in poor locations and the small design was not favorable to owls. A new design and strategic placement of the artificial burrows near existing colonies yielded much higher success; most of the new artificial burrows in Washington were occupied in 2011. In March 2012, WDFW installed 3 clusters of 3 artificial burrows in the Tri-Cities area, and all three were occupied in May.

Figure 4. Burrowing owl captured from artificial burrow near Tri-Cities Airport is banded and ready for release (*photo by D. Stinson*).

Research. A cooperative project to identify migratory routes and wintering areas of Washington and Oregon burrowing owls was initiated in 2010 by the Mid-Columbia River National Wildlife Refuge Complex, the Global Owl Project, and the Umatilla Army Depot near Hermiston, Oregon. Geolocators were attached to 20 burrowing owls at the Umatilla Depot. Geolocators are small devices (Figure 5) that record light levels and, when recovered later from a bird can be used to determine the bird's movements to within 150 km during migration. In 2011, WDFW became a cooperator in the study and an additional 73 geolocators were attached to adult owls (30 in Washington, 43 in Oregon). One female banded as a nestling on the

Umatilla Depot in 2010 nested near Pasco (60 miles from the Depot) and had 8 nearly-fledged young (D. J. Johnson, pers. comm.). In May 2012, burrowing owls were again trapped to document banded birds that returned, band new birds, and recapture as many owls with geolocators as possible (Figures 7, 8, after lit. cited). Eight of the 47 owls captured in the Pasco area had geolocators. Data from these geolocators indicated that most of the owls wintered in central or southern California (Figure 6). One male wintered in Washington. Additionallly, a chick banded at a nest on the Umatilla Depot was one of 2 owls recovered from a settling pond northwest of Bakersfield covered in oil; it was rehabbed and later released.

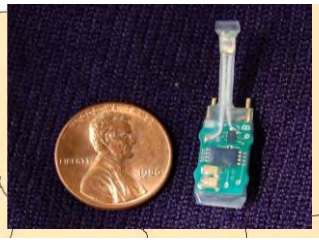

Figure 5. Geolocator used on burrowing owls in a study of migration routes and wintering areas.

Figure 6. Wintering areas for burrowing owls: males (blue) captured at nests near Pasco (2) and on the Hanford Reach National Monument, ALE Reserve (1); 3 females captured near Pasco (red); and an unsexed bird banded as a chick on the Umatilla Depot, Oregon (green, dashed) (Data from the Global Owl Project).

Burrowing owl cam. Burrowing owls have been the subject of one of WDFW's Wildwatch video cameras since 2006. During 2011-2012, WDFW and volunteer videographer Gaylord Mink installed a camera inside an artificial burrow to document what goes on inside a burrowing owl burrow. Footage was obtained during prenesting, egg laying, incubation, and nestling stages; some of this video, along with other footage can be viewed at http://wdfw.wa.gov/wildwatch/owlcam/b_owl.html.

Partners and cooperators: U.S. Fish and Wildlife Service, Mid-Columbia River National Wildlife Refuge Complex, Global Owl Project, Department of Defense-Umatilla Depot, Lower Columbia Basin Audubon Society, Tree Top, Inc. The U.S. Army's Umatilla Chemical Depot in Oregon received the U.S. Fish and Wildlife Service's 2010 Military Conservation Partner Award recognizing an extraordinary conservation partnership that has provided numerous conservation benefits for burrowing owls.

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Figures 7,8. Left, burrowing owl has its geolocator removed by David Johnson, Global Owl Project, and Rocky Ross, WDFW, for data download; right, owl is ready for release (*photos by C. Alexander*).

Vaux's Swift
(*Chaetura vauxi*)

State Status: Candidate, 1991
Federal Status: None
Recovery Plans: None

Figure 1. Vaux's swift (*photo by Curt Young*).

Vaux's swifts (Figure 1), known for their aerobatic flying abilities, breed from southeastern Alaska to central California, and inland to western Montana (Figure 2). Resident populations also exist in Mexico and Central America. The species winters from central Mexico to Central America and Venezuela (Bull and Collins 1993).

Vaux's swifts are present in Washington as spring and autumn migrants and as summer residents. Migration occurs from late April to late May and again from mid-August to late September. During the breeding season, the species is mainly associated with old-growth and mature forests in western Washington, the eastern Cascades, northeastern Washington, and the Blue Mountains (Smith et al. 1997, Lewis and Nordstrom 2005).

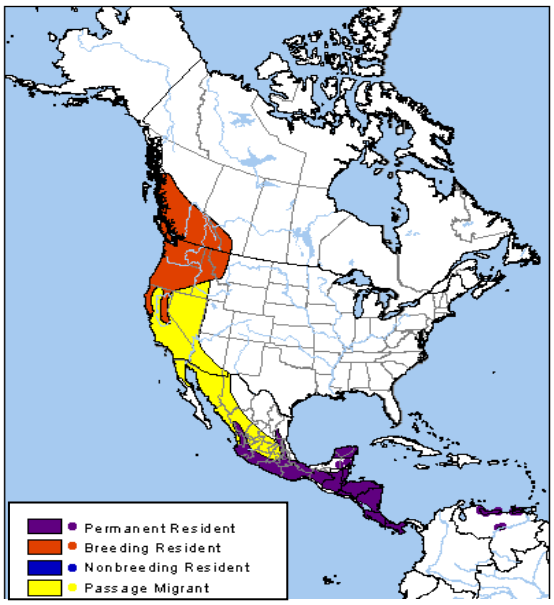

Figure 2. Range of Vaux's swift (*NatureServe*).

Vaux's swifts spend most of their day in the air foraging for flying insects, which they pursue and capture in their beak. Foraging occurs over forests, grasslands, and aquatic habitats (Bull and Beckwith 1993). After nestlings hatch, adults collect boluses of insects in their mouths that are brought to the nest for feeding the young. Boluses examined in the Blue Mountains in Oregon contained mainly leafhoppers, flies, mayflies, and flying ants (Bull and Beckwith 1993). Adults forage mostly within a quarter mile of the nest when young are present.

Vaux's swifts have short legs and tiny weak feet, and rarely perch on tree limbs. Instead, they usually cling to rough vertical surfaces when roosting (Figure 1).

Habitat. Vaux's swifts are strongly associated with old-growth coniferous forests, where the insides of large hollow trees and snags are frequently used for nesting and roosting (Bull and Cooper 1991, Huff and Raley 1991, Lundquist and Mariani 1991, Manuwal 1991, Bull and Collins 1993, Bull and Hohmann 1993, Bull and Blumpton 1997). Characteristics of old-growth forest stands (e.g., age, canopy layering, stem density) do not appear to be as important as the availability of nesting and roosting trees (Bull and Hohmann 1993). Nests are often placed in hollow trees used by roosting pileated woodpeckers (*Dryocopus pileatus*), with swifts entering these trees through woodpecker holes. Without these excavations, Vaux's swifts would have no access to many hollow tree chambers (Bull and Collins 1993, Sterling and Paton 1996).

Chimneys are also occasionally used as nest sites, with older brick chimneys preferred. One nest per chimney is typical, but up to five nesting pairs per chimney have been noted (Griffee 1961, Baldwin and Zaczkowski 1963, Bull and Collins 1993).

Vaux's swifts commonly gather at large communal roosts during spring and fall migration along the West Coast. These roosts are typically located in large old brick chimneys, but large hollow trees and snags are also used. At least 25 of these sites are known in Washington (15 in western Washington, 11 in eastern Washington) (Vaux's Happening, http://www.vauxhappening.org/Vauxs_Happening_Home.html). The most active of these during fall 2012 were in chimneys at Joint Base Lewis-McChord (this had the second largest count of any roost on the West Coast), Sedro-Wooley, and Monroe (Table 1).

Factors affecting populations. The strong connection of Vaux's swifts to old-growth forests, where breeding season population densities are highest, suggests that the availability of this habitat and its associated features (e.g., large hollow trees and snags) limits the species' distribution and abundance (Bull and Hohmann 1993). Population declines during the 1970s and 1980s were probably related to the continued logging of these forests (Bull and Collins 1993).

Brick chimneys have also become less common and accessible to swifts during recent decades as chimney styles change and many are covered with screen spark-arresters (Bull and Collins 1993). The reduced availability of chimneys suitable for nesting and roosting may affect population sizes in some areas and overall migration patterns.

Conservation actions. Since 2008, Audubon's Vaux's Happening has been assembling information and organizing counts of migrating Vaux's swifts across much of the species' North American range by contacting biologists, birdwatchers, and interested citizens from Alaska to Mexico (http://www.vauxhappening.org/Vauxs_Happening_Home.html). This effort has discovered additional important migration roosts, including a chimney on Joint Base Lewis-McChord.

Audubon chapters and community efforts have helped protect several important migration roosts in Washington. One such site is the chimney at Frank Wagner Elementary School in Monroe, which the Monroe School District had been considering for removal because of safety concerns. Audubon began working to save the chimney after counts revealed large numbers of swifts using it in spring and fall. The school district responded positively and protected the chimney in about 2009. Monroe Swift Night Out has become an annual fall event at the school and is attended by hundreds of people interested in

Figure 3. Migrating Vaux's swifts enter the chimney at Wagner Elementary School in Monroe to roost for the night (*photo by Martha Benedict*).

Table 1. High counts of Vaux's swifts at Washington roost sites, September 2012 (*from Vaux's Happening*).

Roost site	High count
Camas NE 6	134
Camas residence	400
Ellensburg old hospital	240
Joint Base Lewis-McChord, 2068 Big Stack	15,320
Selleck old schoolhouse	2,248
Totem Lake	250
Monroe administr building	1,230
Monroe Wagner Elem. School	8,640
Sedro-Wooley, ONS Hospital	11,150

watching the swifts come to roost.

The Vaux's Swiftcam was established at Wagner Elementary School in 2010 to help inform the public about Vaux's swifts and their conservation by streaming video to the Internet. The camera was developed by Larry Schwitters, project coordinator for Vaux's Happening, with funding from WDFW and assistance from many supporters and partners. Footage from the camera can be viewed at http://monroeswifts.org/see-the-swifts/webcam-live-stream/.

WDFW published Priority Habitat and Species Management recommendations for Vaux's swift in 2002 (Lewis et al. 2002). These give information on protecting and maintaining large hollow trees, snags, and brick chimneys, and reducing the use of insecticides near swift populations.

Partners and cooperators: Monroe Swift Watch, Pilchuck Audubon Society, Eastside Audubon Society, Seattle Audubon Society, Vaux's Happening, Larry Schwitters, Progressive Animal Welfare Society (PAWS), Monroe School District, Monroe Correctional Complex, many others.

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White-headed Woodpecker

(*Picoides albolarvatus*)

State Status: Candidate
Federal Status: None
Recovery Plan: None

Figure 1. Male white-headed woodpecker in Yakima County (*photo by Joe Higbee*).

White-headed woodpeckers breed from southern British Columbia and western Idaho to southern California (Garrett et al. 1996). They are not abundant anywhere in their range, and abundance decreases north of California. They are uncommon to rare in their range in Washington, Oregon, and Idaho (Frederick and Moore 1991, Marshall 1997). In Washington, they are found in ponderosa pine (*Pinus ponderosa*) forests on the east slopes of the Cascade Range as well as in the Okanogan Highlands and Blue Mountains.

Habitat. White-headed woodpeckers are primarily associated with open-canopied ponderosa pine forests. They often use large well-decayed snags for nesting and roosting, and they forage primarily on the bark of large ponderosa pines (>60 cm [24 in] dbh) (Thomas et al. 1979, Raphael and White 1984, Garrett et al. 1996). Kozma (2009), however, described 36 nest sites in managed forest with smaller trees (nest tree mean of ~36.6 cm dbh). White-headed woodpeckers prefer to forage for insects on the scaly bark of live trees (Raphael and White 1984, Morrison et al. 1987), and they feed heavily on seeds from unopened pine cones during winter (Ligon 1973, Garrett et al. al. 1996).

White-headed woodpeckers usually nest low to the ground (<10 m [33 ft], mean = 2-3 m [6.5-10 ft]) in cavities within snags and stumps (Raphael and White 1984, Milne and Hejl 1989). This species infrequently nests in live trees (Buchanan et al. 2003). Nest trees include ponderosa pine, jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), red fir (*Abies magnifica*), and occasional quaking aspen (*Populus tremuloides*) (Raphael and White 1984, Milne and Hejl 1989, Dixon 1995b, Garrett et al. 1996). Studies conducted outside of Washington found that white-headed woodpeckers prefer nesting in snags or trees that are 4 -8 m (13-26 ft) tall with a dbh of 65-80 cm (26-31 in) (Raphael and White 1984; Milne and Hejl 1989; Dixon 1995a, b; Garrett et al. 1996). In eastern Washington, this species nests primarily in ponderosa pine snags averaging 12.6 m (41.3 ft) in height with a mean dbh of 51.5 cm (20.3 in) (Buchanan et al. 2003). Larger trees and snags characterized the immediate surroundings of active nest

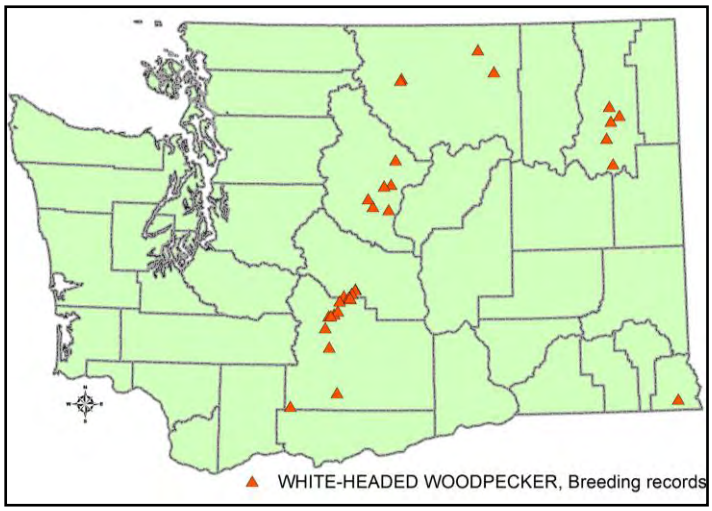

Figure 2. Records of white-headed woodpeckers in Washington (WDFW data).

sites. The canopy closure in sites containing nesting birds was considerably open, averaging 7.2%. Kozma (2009) observed nest initiation in May and early June in Washington. Incubation takes 14 days, and young leave the nest after a 26-day fledging period (Garrett et al. 1996). Mean clutch size was 4 eggs for 21 nests in Washington, and mean number fledged was 2.54 for 24 nests (Kozma 2009).

The importance of pine seed in its diet appears to vary regionally (Morrison and With 1987). Other food sources include ants, beetles, termites, scale insects, and insect larvae, sap, and plant matter (Ligon 1973, Garrett et al. 1996). Foraging involves gleaning insects from the trunks of live trees and snags, typically pines and firs, foliage gleaning, and drilling into pine cones (Raphael and White 1984, Morrison et al. 1987, Garrett et al. 1996). Garrett et al. (1996) indicated that they feed on sap only occasionally, but Kozma (2010) reported that ponderosa pine sap is an important food source in Washington during spring when pine seedscrops fail or are seasonally depleted.

White-headed woodpeckers most frequently roost in cavities, but also roost in spaces behind peeling bark and in crevices within tree trunks (Dixon 1995a, b; Garrett et al. 1996). They typically roost in ponderosa pines (live trees and snags) averaging 60 cm (24 in) dbh and 7 m (23 ft) tall. Males roost in the nest cavity with their young until they fledge. Cavities are also used as winter roosts, and frequently the same cavity is used over an entire season (Dixon 1995a, b; Garrett et al. 1996).

Home ranges of white-headed woodpeckers appear to require larger areas to reproduce in a managed forest landscape than in relatively contiguous old growth. In fragmented habitat, home ranges averaged 321 ha (793 ac) and 342 ha (845 ac) for central and south-central Oregon, respectively, but were much smaller in continuous old growth (104 ha [257 ac] and 212 ha [524 ac]) (Dixon 1995a, b).

Conservation. Population data that would demonstrate a clear trend are not available for Washington, but historical logging of ponderosa pine and habitat changes resulting from fire exclusion are believed to have resulted in a decline of this species. Generally open, parklike, old-growth stands with grassy understories that were maintained by frequent, low- and moderate-intensity fires once typified the dry forest landscape of eastern Washington and Oregon, and covered extensive areas prior to 1850 (Everett et al. 1994). A long history of selective harvesting of large pines, intensive grazing, and fire suppression greatly altered this forest landscape. For example, Henjum et al. (1994) estimated that 92%–98% of the old-growth ponderosa pine that once existed in the Deschutes, Fremont, and Winema national forests in Oregon has been logged or converted to other land uses. Garrett et al. (1996) stated that the loss of large-diameter ponderosa pine poses the greatest threat to this species. Wisdom et al. (2000) identified the decline in late-seral ponderosa pine and basin-wide loss of large diameter snags (>53 cm [21 in]), as high priority issues for white-headed woodpeckers.

The production of pine seed and foraging efficiency of bark-gleaning are both correlated with tree size (Raphael and White 1984, Krannitz and Duralia 2004, Covert-Bratland et al. 2006). White-headed woodpeckers are a weak primary cavity excavator and require snags with at least moderate decay for nesting (Kozma 2009). Population stability will require maintaining an adequate supply of soft snags. Kozma (2009, 2010) reported that although white-headed woodpeckers were able to reproduce in younger managed forest, he noted that they fledged fewer young than hairy woodpeckers and hypothesized that managed stands do not provide adequate resources to fledge as many young. The predominance of smaller-diameter trees in some landscapes may force them to forage over a much larger area to obtain important pine seed resources (Dixon 1995a, b).

Partners and cooperators: U.S. Forest Service, Yakama Nation.

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Black-backed Woodpecker

(*Picoides arcticus*)

State Status: Candidate, 1991
Federal Status: None
Recovery Plans: None

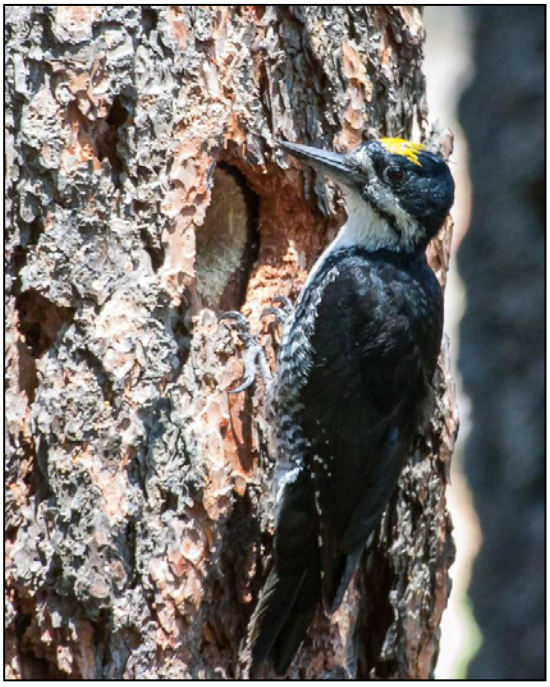

Figure 1. Black-backed woodpecker (*photo by Joe Higbee*).

The black-backed woodpecker (Figure 1) inhabits the boreal forests of North America, including the Cascade Mountains, the northern portions of the Sierra Nevada and Rocky Mountains, Alaska, much of Canada, northern New England, and the upper Midwest. In Washington, it is found primarily in the eastern Cascade Mountains, northeastern Washington, and the Blue Mountains (Figure 2; Smith et al. 1997, Leach 2005). The species is rare to locally uncommon in mid- to high elevation conifer forests in eastern Washington and rare west of the Cascade crest (Leach 2005).

Black-backed woodpeckers are early post-forest fire specialists, being much more abundant in recently burned forests as standing dead trees rapidly become infested with wood-boring beetle larvae (Buprestidae and Cerambycidae), which are an important part of the diet (Dixon and Saab 2000). Birds quickly immigrate to recently burned locations, with numbers then declining 4 to 6 years post-fire as prey availability decreases (Hutto 1995, Kreisel and Stein 1999). Stand-replacement burns are more readily occupied than burns of low and moderate severity (Kotliar et al. 2002). In the Pacific Northwest, burned coniferous forests with standing dead lodgepole pine (*Pinus contorta*), ponderosa pine (*Pinus ponderosa*), and western larch (*Larix occidentalis*) are typicaly inhabited, although tree species composition is generally not an important factor in determining site use (Dixon and Saab 2000).

The species strongly prefers burns that have not been salvaged logged. Individuals were most common at sites with the highest level of snag retention (15-32 snags/ac) in salvage-logged stands in the Washington Cascades (Haggard and Gaines 2001). Birds did not nest in stands with low densities of retained snags (0-5 snags/ac). In burned ponderosa pine/Douglas-fir forest in southwestern Idaho, Saab and Dudley (1998) noted that black-backed woodpeckers favored units that had not been salvage-logged, and nest sites were typically in unlogged units with a relatively high density of small hard snags (≥50 snags [>9”dbh]/ac).

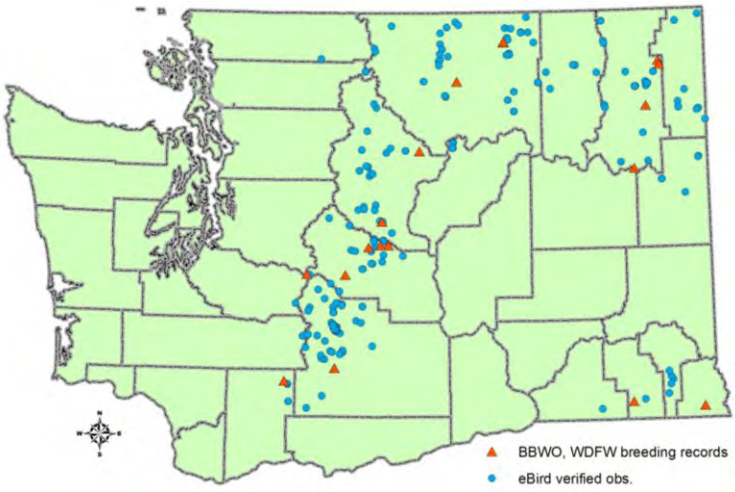

Figure 2. Black-backed woodpecker breeding records in the WDFW WSDM database and eBird verified observation records through 9 May 2013 (eBird 2013).

Whether burns are essential for

population persistence is uncertain. Black-backed woodpeckers also occur in beetle-ravaged forests (Bull et al. 1986, Bonnot et al. 2008) and in low numbers in unmanaged or mature forests (Bevis 1994, Leach 2005). Winter densities were twenty times higher in burned forest than unburned forest in northeastern Washington (Kreisel and Stein 1999). Little is known about black-backed woodpecker habitat needs and population dynamics in unburned forests. Several studies suggest that unburned forest is sink habitat, where the species persists due to emigration from recent burns (Hutto 1995, Murphy and Lehnhausen 1998). Frequency of fire within the dispersal range of individuals may therefore be a key determinant in species presence (Murphy and Lehnhausen 1998). Very frequent or large fires, however, may be detrimental because they destroy too much secondary habitat. Bonnot et al. (2008) reported that nest success was similar in both beetle-killed forests and recently burned forests. In the absence of fires, bark beetles (Scolytidae), such as the mountain pine beetle (*Dendroctonus ponderosae*), become a regular part of the diet (Dixon and Saab 2000).

Black-backed woodpeckers excavate nests in the sapwood of trees, while weaker excavators (e.g., Williamson's sapsucker, *Sphrapicus thyroideus*) excavate cavities in heartwood affected by fungal decay. Bull et al. (1986) suggested that black-backed woodpeckers often nest in pines because they have a thicker sapwood layer than other tree species of the same size.

Threats affecting populations. Historical and recent fire management policies have negatively impacted black-backed woodpeckers by reducing the occurrence of large, high intensity wildfires that create optimal conditions for the species (Dixon and Saab 2000). Goggans et al. (1988) suggested that the traditional approach of managing cavity nesters by retaining a relatively small number of snags and green replacement trees in harvested forest stands may not maintain enough foraging substrate to sustain viable populations of black-backed woodpeckers. Kotliar et al. (2002) concluded that, in general, clearcut forests do not function as substitutes for burned forests.

Post-fire salvage logging is also detrimental to the species (Kotliar et al. 2002). Therefore, where salvage logging is planned, it is important to delay any work for the first five years after the fire (Hutto 1995, Dixon and Saab 2000). This span is critical in providing habitat because the woodpecker's primary food source (wood-boring beetles) becomes less abundant after this period (Caton 1996). Hutto and Gallo (2006) concluded that reduced woodpecker density in post-fire salvage-logged areas is more related to the reduction in food (wood boring beetles) than nest-site availability.

Conservation actions. In May 2012, the U.S. Fish and Wildlife Service was petitioned to list black-backed woodpecker populations in the Sierra Nevada, Oregon Cascades, and Black Hills of South Dakota and Wyoming (USFWS 2013). These populations are isolated from the remainder of the species' range. The petition did not include the population in Washington, which may be contiguous with populations in Canada.

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Loggerhead Shrike
(*Lanius ludovicianus*)

State Status: Candidate, 1991
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Loggerhead Shrike in Grant County, Washington (*photo by Joe Higbee*).

The loggerhead shrike was probably much more abundant in Washington prior to the widespread conversion of shrub-steppe to cropland (Smith et al. 1997). The loggerhead shrike is a small black-masked predator that hunts from perches and sometimes impales its prey on thorns or barbed wire. Shrikes do not possess large feet and talons like raptors, and this habit is an adaptation to eating large prey. Sometimes called 'butcherbirds' (the genus name *Lanius* means 'butcher' in Latin), shrikes are the only passerines capable of killing vertebrates by biting the neck and disarticulating neck vertebrae.

The species is found in portions of Alberta and Saskatchewan, and throughout much of the U.S. south to southern Mexico (Yosef 1996). Northern populations are migratory, wintering across the southern U. S. and Mexico (Figure 2). In Washington, these shrikes are primarily a breeding resident of the eastside shrub-steppe zone. The Interior Columbia River Basin Ecosystem Management Project listed the loggerhead shrikes as a species of high management concern, which was defined as a species "experiencing long-term population declines, thereby suggesting that current management activities may not be compatible with long-term persistence" (Saab and Rich 1997).

Most loggerhead shrikes arrive in Washington mid- to late March and depart on fall migration by September (Poole 1992, Leu and Manuwal 1996, Stepniewski 1999). They are generally rare during

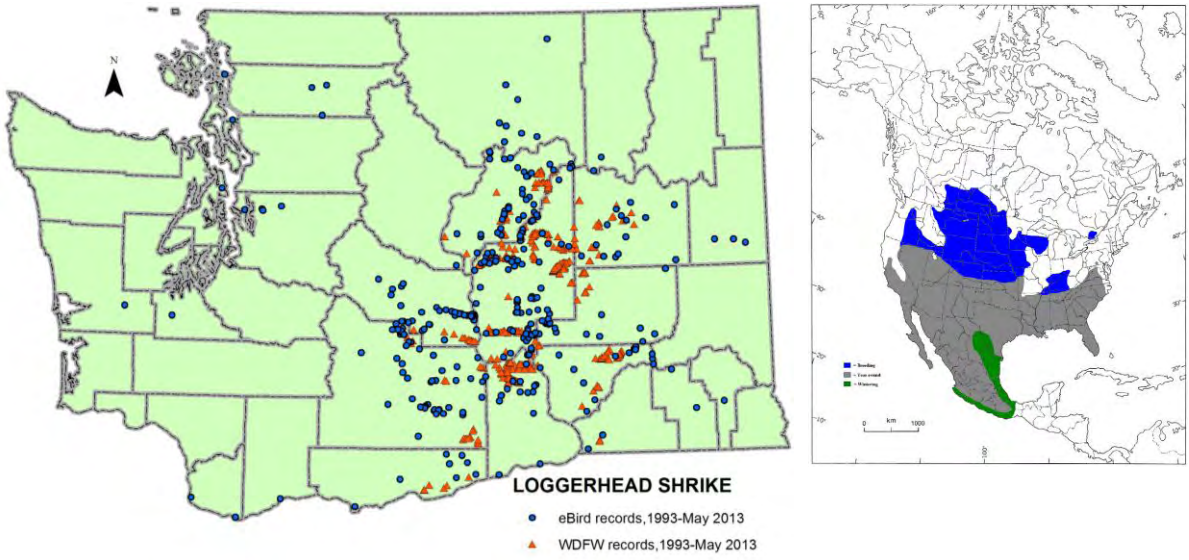

Figure. 2. Left, observation records of loggerhead shrikes in Washington, 1993-May 2013 (eBird 2013, WDFW WSDM database); right, breeding (blue), year-round (gray), and winter-only ranges (green) in North America (from Wiggins 2005).

winter in eastern Washington (Wahl 2005), but a small number winter on the Hanford Site in Benton County (H. Bowers, unpublished data). A few winter and spring records also exist for western Washington (Wahl 2005). Migration patterns are not well understood, and the wintering areas of birds breeding in Washington are unknown.

Loggerhead shrikes are generalists, feeding on any animal they can subdue, including insects, small mammals, birds, reptiles, and amphibians. During the breeding season in Washington, shrikes are largely insectivorous. On the Hanford Site, shrikes preferred grasshoppers, lizards, and small mammals (Poole 1992). On the Yakima Training Center in Yakima County, shrikes' pursuit of small passerine birds peaked during the April migration, whereas pursuit of grasshoppers increased from 0% in April to nearly 100% in August (Leu and Manuwal 1996).

This species is highly territorial and defends larger areas than other insectivorous perching bird species of similar size, with mean territory size ranging from 7.5 to 34 ha (18.5-84 ac) (Yosef 1996). The average distance separating the closest nesting pairs of shrikes was 610 m (2,000 ft) at Hanford (Poole 1992).

Of 207 nesting pairs monitored on the Hanford Site, at least 19% renested 1-3 times after nest failures; most pairs produced one brood, but 5% fledged 2 broods in a nesting season (Poole 1992). Predation was the most frequent cause of nest failure, particularly by gopher snakes (*Pituophis melanoleucus*), black-billed magpies (*Pica pica*), common ravens (*Corvus corax*), and coyotes (*Canis latrans*). Most shrike territories (96%) were re-occupied the 2nd year of the study, suggesting high survival rates of adults or a shortage of nesting sites (Poole 1992). On the Yakima Training Center, Leu and Manuwal (1996) observed that 63.7% of 77 territories were re-occupied the 2nd year. Studies of banded birds elsewhere indicate that while re-occupancy may be high, site fidelity is generally lower (14-41%) (Pruitt 2000). Leu and Manuwal (1996) reported that nest failure from predation was 11.1% in the first year and 36.5% in the 2nd year of their study. Nesting success and fledgling survival were higher in a wetter year.

Habitat. Loggerhead shrikes use open habitat with scattered shrubs during both breeding and nonbreeding seasons. In the shrub-steppe of eastern Washington, Poole (1992) found that shrikes nested in shrub-dominated plant communities and were rare or absent in grasslands, riparian zones, and areas dominated by rabbitbrush and cheatgrass. Nesting territories were a mosaic of tall shrubs and openings of grass or sand dune, and were not located in upland sagebrush lacking openings for foraging. Openings dominated by cheatgrass were rarely used. Leu and Manuwal (1996) noted that shrikes most often foraged on bare ground or in sparse ground cover, and avoided areas of continuous cover created by exotic vegetation (e.g., cheatgrass and tumblemustard). Poole (1992) noted that shrikes did not nest in riparian zones or within 500 m of water, possibly to avoid nest predation by magpies and ravens. Shrikes were most abundant in areas of flat topography, deep soils, and patchy vertical structure of taller shrubs, particularly old sagebrush or bitterbrush that had been patchily burned. Consistent with Poole's (1992) observations, widespread surveys in eastern Washington shrub-steppe detected more loggerhead shrikes in areas with deep, sandy soil than in areas with loamy or shallow soils (Vander Haegen et al. 2000). At Hanford National Monument, shrikes were most abundant in sagebrush/bunchgrass and secondly in sagebrush/cheat cover types, preferring areas with 11-20% sagebrush cover and 25% bare ground (Earnst and Holmes 2012). Bunchgrass and cheatgrass cover types were not used.

In eastern Washington, loggerhead shrikes nest most often in big sagebrush and bitterbrush, but occasionally nest in mock orange (*Philadelphus lewisii*), greasewood (*Sarcobatus vermiculatus*), clematis (*Clematis* spp.), and currant (*Ribes* spp.) (Poole 1992, Leu and Manuwal 1996). Nesting areas on the Yakima Training Center show varied shrub heights, less cover by exotic grasses and forbs, and taller shrubs than random sites (Leu and Manuwal 1996). Nearly all nests were on ravine flanks with northeast or southeast aspect.

Population status. Loggerhead shrikes were surveyed throughout the Columbia Basin in Washington in 1993-1994, with 152 shrike territories observed on 22 road transects (McConnaughey and Dobler 1994). Routes averaged 0.18 territories/km and nests were separated by at least 666 m. The Hanford route had the highest numbers of territories (0.64/km). Poole (1992) reported that shrike densities in the best habitat types on the Hanford Site were 12-19 times higher than was typical elsewhere in eastern Washington.

Loggerhead shrikes have exhibited widespread and consistent declines for several decades across most regions of their range (Pruitt 2000). Breeding Bird Survey data for the Columbia River Basin (eastern Washington, eastern Oregon, Idaho, western Montana) showed a significant decline in shrike abundance during 1968-1994 ($p<0.10$; Saab and Rich 1997). Breeding Bird Survey data for western North America indicated an annual decline of -1.7% from 1966-2009 (Figure 3; Sauer et al. 2011); data for Washington suggest a -3.4%/year decline for the period, but the smaller sample size makes this conclusion less reliable. Some of the decline in the northeastern and Great Lakes states represents a retraction with the regrowth of forest; shrikes likely expanded their range into these regions with the clearing of forest for agriculture in the 19th century (Cade and Woods 1997). However, continued declines and disappearance from areas with suitable habitat have not been explained.

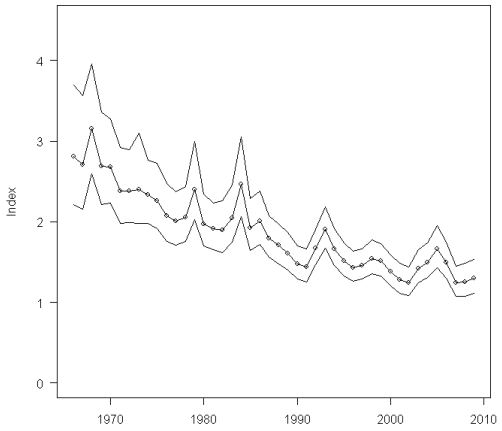

Figure 3. Index (±95% CI) of loggerhead shrike abundance in Breeding Bird Surveys in the Western BBS Region, 1966-2009 (Sauer et al. 2011).

Factors affecting populations. Suggested causes of population declines include loss of breeding habitat, low overwinter survival due to loss of wintering areas, high mortality rates from vehicle collisions, and exposure to pesticides (Pruitt 2000). Loss of shrub-steppe habitat, particularly on flat areas with deep soil, probably is the most important factor in the historical declines of the species in Washington (Poole 1992, Smith et al. 1997, Vander Haegen et al. 2000), but other factors may be involved. Declining patch size, fragmentation, wildfires that eliminate shrubs, and degradation by cheatgrass and other invasive plants all affect shrike habitat (Pruitt 2000).

Loggerhead shrikes appear susceptible to accumulation of some pesticides, although the exact impacts on populations have not been determined (Pruitt 2000). Ingestion of pesticide-laden prey can lead to toxic effects on adults and in eggs, and pesticide applications can significantly reduce the local availability of insects, especially grasshoppers. The organochlorine, DDT, is known to have caused eggshell thinning in raptors and reduced reproductive success in some species. However, shrike eggshells collected in California and Florida before and after the introduction of DDT showed no significant thinning (Morrison 1979). Clutch and brood sizes declined after the introduction of organochlorines, possibly because of reduced food supply (Yosef 1996). Sharp declines of loggerhead shrikes in the Great Plains corresponded to dieldrin treatment of grasshoppers (Yosef 1996). In one Florida study, 15% of shrikes had bill or foot deformities that may have been related to pesticide exposure.

Collisions with vehicles are another important concern (Pruitt 2000) and probably result from the species' habits of hunting along roadways, where perches are sometimes plentiful, and flying low over the ground.

Conservation. The U.S. Fish and Wildlife Service conducted a rangewide status assessment of the loggerhead shrike and summarized information from each of the states and Canada (Pruitt 2000). No recent activities specific to loggerhead shrikes are currently underway in Washington, but several efforts

to protect and restore shrub-steppe habitat will benefit the species.

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Slender-billed White-breasted Nuthatch

(*Sitta carolinensis aculeata*)

State Status: Candidate, 1998
Federal: Species of concern
Recovery Plans: None

Figure 1. Slender-billed white-breasted nuthatch (*photo by Rod Gilbert*).

White-breasted nuthatches are a common small passerine of deciduous forest in much of North America. The slender-billed subspecies (Figures 1, 3) is restricted to parts of western Washington, western Oregon, California, and extreme northern Baja (AOU 1957). It has a slimmer bill, is smaller, and has buffier underparts than the much more common subspecies (*S. c. tenuissima*) present in eastern Washington. Genetic analyses indicate that slender-billed white-breasted nuthatches are genetically distinct from other populations in North America, but also demonstrate significant genetic differentiation among populations within this subspecies (Spellman and Klicka 2007).

White-breasted nuthatches, including the slender-billed subspecies, are weak cavity excavators and therefore most often use naturally occurring cavities in living trees for roosting and nesting. Cavities made by woodpeckers and nest boxes are also occasionally occupied (Wilson et al. 1991,Viste-Sparkman 2006). Individuals use multiple cavities during the year (Gumtow-Farrior 1991).

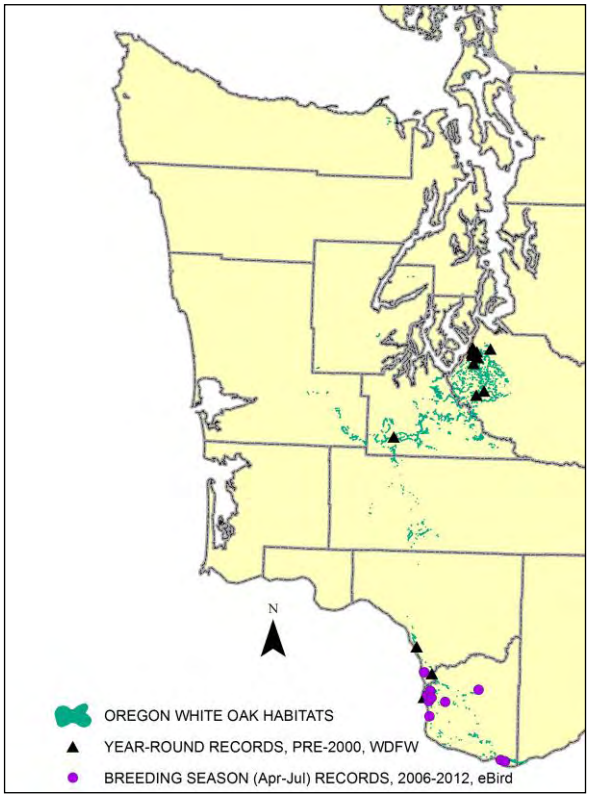

Figure 2. Various records of slender-billed white-breasted nuthatches from western Washington.

In Washington and Oregon, slender-billed white-breasted nuthatches are commonly associated with Oregon white oak (Chappell 2005, Hagar 2006), as well as black cottonwood and Oregon ash (R. Hill, pers. comm.). Nuthatch densities are greater in areas with higher numbers of large trees, which provide more surface area for foraging and have more natural cavities for nesting and roosting (Hagar and Stern 2001, Viste-Sparkman 2006). Large open-grown oaks in woodlands with sparse understories are particularly important as habitat because these trees have more cavities and foraging substrate than oaks grown in densely vegetated habitats. Birds are therefore more abundant in smaller (<12 ha, 30 ac) woodland patches, which by definition have more edge, than in larger (>25 ha, 62 ac) patches (Viste-Sparkman 2006). In Oregon's Willamette Valley, oaks with nests average 70 cm (27.5 in) in diameter (Viste-Sparkman 2006). Pairs establish territories of about 10-15 ha (25-37 ac) and occupy the same territories year-round (Pravosudov and Grubb 1993, Hagar 2006).

Foraging typically occurs on the trunk and larger limbs of trees. Fissured bark, which occurs more on larger trees, supports a greater abundance and diversity of arthropods than smooth bark. In the Willamette Valley, weevils and earwigs are important parts of the diet during breeding and post-breeding periods, with variation in the diet decreasing in winter (Anderson 1976). Slender-billed white-breasted nuthatches also often feed on acorns during winter, and large oaks produce more acorns (Peter and Harrington 2002).

Figure 3. Slender-billed white-breasted nuthatch (*photo by Rod Gilbert*).

Distribution and population trends. Slender-billed white-breasted nuthatches remain somewhat common and widespread in lowland areas of Clark County, with numbers appearing to be highest in the vicinity of Ridgefield National Wildlife Refuge (Figure 2; eBird reports; Chappell 2005; R. Hill, pers. comm.). Population trend in the county is unknown. Birds in this population make extensive use of ashes, cottonwoods, and oaks. The population is probably an extension of the broader population ranging through the Williamette Valley north to Sauvie Island in Oregon. Birds occurred in the area between Woodland and Kalama in Cowlitz County from 1985-1995, but breeding season records have become rare there and no observations of nesting have been made in recent years (Altman 2011).

The subspecies was reportedly once most abundant in the oak/prairie areas of Pierce and Thurston counties (Bowles 1929, Kitchin 1934, Jewett et al. 1953), but did not breed north of Seattle or in the San Juan Islands (Chappell 2005, Altman 2011). The population in South Puget Sound declined greatly by the early 20th century (Dawson and Bowles 1909, Bowles 1929, Kitchin 1934), although birds were still common in south Tacoma and regularly occurred on Joint Base Lewis-McChord in the mid-1960s (Altman 2011). Further decreases took place in Pierce County in the 1980s, when the last nine breeding sites disappeared; the last reported sighting during the breeding season was in 1998 and the subspecies is now considered extirpated in this region (Chappell 2005, Altman 2011).

Factors affecting populations. Oregon white oak-prairie habitats were once far more widespread in South Puget Sound, but have experienced dramatic declines and are among the most threatened habitats in the Pacific Northwest (Hanna and Dunn 1997, ABC 2006). Factors contributing to their loss or degradation include urban, residential, and rural development; harvest of oak trees; conversion to agriculture; fire suppression and associated encroachment by conifers; conversion of oak woodland and forest to conifer stands for timber production; and lack of oak recruitment (Hanna and Dunn 1997, Altman 2011). The decrease of oak habitats has likely been the main cause of the decline and extirpation of slender-billed white-breasted nuthatches from the South Puget Sound lowlands (Altman 2011). Other contributing factors may include scarcity of nesting cavities, competition from starlings for nest sites, insufficient oak mast to support overwintering populations, genetic drift due to small isolated populations, and unknown disease or natural disturbance (Chappell 2005).

Conservation actions. Conservationists have long been aware of the importance of preserving oak communities and their associated wildlife, including slender-billed white-breasted nuthatches, in the Pacific Northwest. Numerous habitat management and restoration projects have been undertaken (e.g., Hanna and Dunn 1997, Devine and Harrington 2004, Dunwiddie and Bakker 2011), although replacing the large oaks that were present historically will require many decades. WDFW developed Priority Habitat and Species (PHS) management recommendations for oak woodlands (Larsen and Morgan 1998),

and many other management plans, recommendations, and landowner guides have been published for this habitat (e.g., Columbia Gorge Audubon Society 1991, Vesely et al. 2004, Harrington and Devine 2006, Altman and Stephens 2012).

Based on the findings of a feasibility assessment (Slater and Altman 2012), a cooperative project was initiated in 2012 by the Ecostudies Institute, American Bird Conservancy, and Joint Base Lewis-McChord to reintroduce a population of slender-billed white-breasted nuthatches into South Puget Sound. The assessment determined that adequate oak woodland existed in the region to support a population of more than 300 birds. This work is planned for 2013 using 4-10 pairs of nuthatches from western Oregon (Slater and Altman 2012).

Partners and cooperators. American Bird Conservancy, Joint Base Lewis-McChord, Ecostudies Institute, Center for Natural Land Management, U.S. Fish and Wildlife Service.

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Oregon Vesper Sparrow

(*Pooecetes gramineus affinis*)

State Status: Candidate, 1998
Federal Status: Species of Concern
Recovery Plans: None

Figure 1. Oregon Vesper Sparrow (*photo by Rod Gilbert*).

Vesper sparrows are a large sparrow with pale brown-streaked plumage, white outer tail feathers, rufous lesser wing coverts, and a white eye-ring. The species occupies open habitats (grassland, shrub-steppe, and agriculture) across much of central and southern North America. The Oregon vesper sparrow is the rarest of four recognized subspecies and has a breeding range that extends from southwestern British Columbia through western Washington, western Oregon, and into the northwestern tip of California (Campbell et al. 2001, Jones and Cornely 2002, Altman 2003). This subspecies is migratory and overwinters from central California west of the Sierra Nevadas to northwestern Baja California, Mexico. A second subspecies known as the western vesper sparrow (*P. g. confinis*) is widespread in western North America, including eastern Washington (Jones and Cornely 2002, Mlodinow 2005).

In Washington, the historical breeding range of Oregon vesper sparrows occurred in lowland areas and probably extended from northern Skagit County, the San Juan Islands, and Clallam County (Dungeness and Sol Duc) south through southern Puget Sound, and possibly Clark County (Figure 2; Jewett et al. 1953, Smith et al. 1997, Mlodinow 2005). Based on records from 1992 to the present, the current breeding population in Washington is now limited mostly to remnant prairies and grasslands in Pierce, Thurston, and Skagit counties, with smaller numbers on islands in the lower Columbia River and in grasslands on San Juan Island (Smith et al. 1997, Mlodinow 2005, Altman 2011). A few birds may also still breed in eastern Clallam County and near Shelton in Mason County. Migration season records since 1992 are scattered through all counties in western Washington except Pierce, Mason, Jefferson, and Wahkiakum counties (WDFW WSDM database).

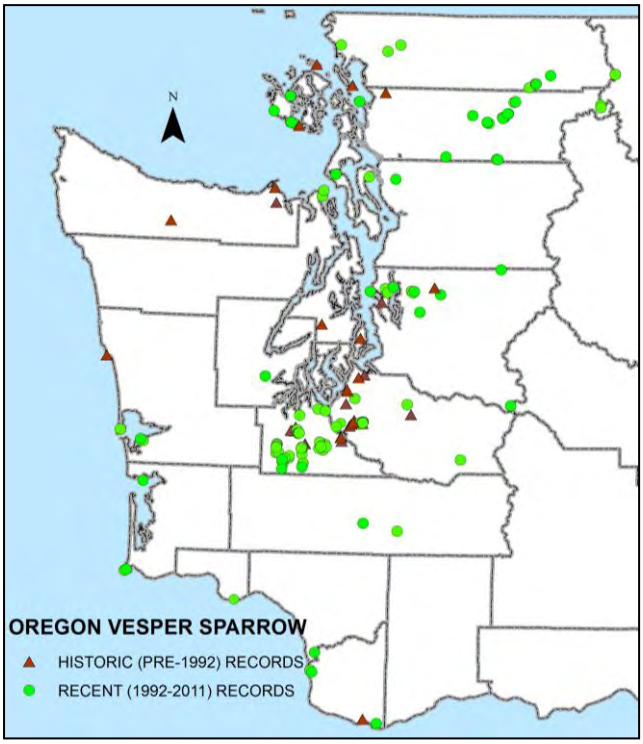

Figure 2. Oregon Vesper Sparrow records from WDFW database, eBird (2012), museum, and literature records through 2011.

Declines of Oregon vesper sparrows are evident across the breeding range (Beauchesne 2006, Altman 2011). In Washington, the subspecies was originally described as "fairly common" to "rather abundant" in localized areas of western Washington (Altman 2011), but apparently was never common over a widespread area. It was

reported as being of limited abundance and range by the mid-1960s (Larrison and Sonnenberg 1968) and as "rare and local….in remnant prairie areas" by the 1990s (Smith et al. 1997), with the exception of 91st Division Prairie on Joint Base Lewis-McChord, where about 100 singing males were on established territories in 1998 (Rogers 2000). The current Washington population is threatened with extirpation (Mlodinow 2005), and is estimated at 250-300 birds in the Puget Lowlands and 50-100 birds on islands along the lower Columbia River (Altman 2011).

Figure 3. Oregon vesper sparrow in hand (*photo by Russell Rogers*).

Oregon vesper sparrows are present in Washington mainly from early April through late September, with relatively few records during other months (Mlodinow 2005; WDFW, unpubl. data). Most spring migration occurs from early April to early May. Fall migration is primarily from mid-August to late September, with fewer records extending into October.

Birds begin singing after arriving at their breeding sites (Altman 2003). Singing occurs most frequently early in the morning and again from sunset to dusk (Jones and Cornely 2002). Singing is typically performed from elevated perches, such as fences, trees along the edges of fields, shrubs, grass, and the stalks of forbs, but may be conducted from the ground when perches are lacking (Jones and Cornely 2002, Altman 2003).

Nests are made from grasses in the shape of a shallow bowl and have an outer diameter of 8-10 cm (3-4 in). Nests are placed on flat ground or in a shallow depression, and are usually located next to a clump of vegetation, crop residue, dirt clod, or at the base of a shrub or tree (Jones and Cornely 2002, Altman 2003). Oregon vesper sparrows nest from about late April to mid-July, with the few western Washington records reported from May 9 to July 7 (Bowles 1921, Altman 2003, Beauchesne 2006; WDFW, unpubl. data). Clutch size for vesper sparrows (including *P. g. affinis*) is usually 3-5 eggs (range = 2-6 eggs). Incubation averages 12-13 days and is performed mostly by the female. Young fledge from the nest after 9-10 days on average and remain dependent on the parents for another 20-29 days.

Oregon vesper sparrows display some variation in breeding habitat. In western Washington, they were originally widespread in prairies and pastures (Jewett et al. 1953), but became restricted to the edges of open prairies by the 1990s (Rogers 2000, Mlodinow 2005). Clegg (1998, 1999) reported that all breeding territories (n = 23) at Joint Base Lewis-McChord were in areas of high quality prairie supporting intact Idaho fescue near prairie edge. Size of the prairie appears to be an important factor in site selection, with only large prairies occupied now. In Oregon's Willamette Valley, nearly all detections of Oregon vesper sparrows are in young Christmas tree farms (i.e., 2-5 years after planting) with extensive grass and weed cover, or in lightly grazed pastures with scattered shrubs and grass heights of less than 30-60 cm (1-2 ft) high (Altman 1999, 2003). In southwestern British Columbia, breeding historically occurred in pastures, agricultural land, and airport fields with patches of grasses and weeds (Campbell et al. 2001), but the few remaining nesting territories are now present only in grasslands next to hayfields (Beauchesne 2006). Rogers (2000) reported reduced vegetation heights (average = 15-21 cm [6-8.5 in]) and densities at foraging locations compared to random sites in prairies in Washington.

Population declines of the Oregon vesper sparrow likely result primarily from habitat loss and degradation, and potentially from increased predation and human disturbance (Smith et al. 1997, Altman 1999, 2003, 2011, Rogers 2000, Beauchesne 2006). South Puget Sound prairies originally covered an estimated 60,470 ha (149,360 ac), but had declined in size by 90% by the mid-1990s, with only 3% remaining in prairies dominated by native vegetation (Crawford and Hall 1997). During this period, the

number of prairies in South Puget Sound fell from 233 to 29 sites and average size decreased from 260 to 175 ha (641 to 433 ac). This decline was driven by urban conversion, encroachment of douglas-fir forests caused by fire control, and conversion to farmland (Chappell and Kagan 2001). Many remaining prairies are degraded by the invasion of Scotch broom and other non-native plants.

Oregon vesper sparrows also may be experiencing increased predation from species associated with semi-urban and residential areas such as American crows, domestic cats, raccoons, and opossums. Human disturbance from various activities in prairies, such as military training, dog field trials, off-leash dog walking and training, horseback riding, bicycling, hiking, model airplane flying, school field trips, prescribed burning, Scotch broom control, and other habitat management activities also may be disruptive or harmful (Rogers 2000).

Habitat management. Although not the target of specific habitat management efforts, Oregon vesper sparrows nevertheless benefit from the ongoing prairie restoration work (i.e., control of Scotch broom and exotic grasses, and re-establishment of native grasses and forbs) being conducted to benefit other species of concern at a number of sites, including Mima Mounds Natural Area Preserve, Scatter Creek Wildlife Area, West Rocky Prairie Wildlife Area, Glacial Heritage Preserve, and Joint Base Lewis-McChord. In 2012, Thurston County (with funding from the U.S. Fish and Wildlife Service) began development of a Habitat Conservation Plan to reduce potential conflicts between listed and candidate species and future development activities in the county.

Inventory activities. In 2012, WDFW compiled a listing of more than 330 Oregon vesper sparrow records for western Washington, which were incorporated into the agency's WSDM database. Records were drawn from a variety of sources, including literature and unpublished sightings, and dated primarily from the 1970s to 2012.

Partners and cooperators: Center for Natural Lands Management, Joint Base Lewis-McChord, American Bird Conservancy, Washington Department of Natural Resources, Thurston County.

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Common Sharp-tailed Snake

Contia tenuis

State Status: Candidate
Federal Status: None
Recovery Plans: None

Figure 1. Common sharp-tailed snake (*photo by Bill Leonard*).

The common sharp-tailed snake is a small regional endemic colubrid snake that is rarely encountered and little studied. In Washington, sharp-tailed snakes rarely exceed 300 mm (11.8 in.) total length (Nussbaum et al. 1983). The dorsal coloration is reddish brown to grayish brown. The red coloration is most intense near the tail, and a narrow band of copper-red may be present along the sides (St. John 2002). The tail is short, tapers to a point and terminates with a short spine-like scale. A dark eye mask is typically present (St. John 2002). The ventral pattern is distinct with alternating black and dull white banding (Nussbaum et al. 1983). A long-tailed form found in coniferous forest of Oregon and California was recently described as a distinct species (Feldman and Hoyer 2010).

The common sharp-tailed snake occurs from British Columbia into southern California (Leonard and Ovaska 1998). The species has a spotty distribution in Washington with almost all records from the east slope of the Cascades (Figure 2; Nussbaum et al. 1983).

Habitat. In Washington, the snakes are known from forest openings dominated by Garry oak (*Quercus garryana*), particularly with rock accumulations, and from riparian deciduous woodland with accumulations of decaying down woody logs within ponderosa pine, oak, or shrub-steppe (Hallock 2009).

The habitat at the newly discovered Orcas Island site (San Juan County) has a mixture of rocky and mossy knolls, oak savannah, and Douglas-fir (*Pseudotsuga menziesii*) forest (O'Donnell and McCutchen 2008). The understory vegetation near the snake was primarily grass with some manroot (*Marah oreganus*), Himalayan blackberry (*Rubus discolor*), and snowberry (*Symphoricarpos* spp.)

Figure 2. Records of common sharp-tailed snakes in Washington (WDFW data).

Common sharp-tailed snakes seem to have a diet mainly restricted to small slugs (Zweifel 1954, Cook 1960, Engelstoft and Ovaska 2000a, Britt et al. 2009, Weaver and Kardong 2010), and their long, re-curved teeth may be a specialization for grasping and holding them (Zweifel 1954, Britt et

al. 2009). They may also prey on terrestrial snails (Weaver and Kardong 2010).

The life history of sharp-tailed snakes is poorly known due to the difficulties associated with studying small species that lead largely subterranean lives (Cook 1960, Leonard and Ovaska 1998). Consequently, little is known about time of mating, oviposition sites, age at sexual maturity, frequency of reproduction, activity patterns, or home ranges (Engelstoft and Ovaska 2000a). Aggregations are often observed, but it is not clear if the snake is gregarious or simply concentrates in small favorable areas (Cook 1960, Leonard et al. 1996, Hoyer et al 2006). Leonard et al. (1996) suggested that aggregations of sharp-tailed snakes observed in April-May on the east slope of the Cascades are related to breeding activities. Most surface activity takes place in the spring and fall (Cook 1960, Nussbaum et al. 1983) with smaller numbers found in July and August typically during or after rain events (Engelstoft and Ovaska 2000a, 2000b).

Observations of this species in the open are uncommon (Cook 1960), but based on individual snakes found on roads, they will at least occasionally cross exposed areas with no plant cover (Hallock 2009). Sharp-tailed snakes are relatively sedentary. A study in British Columbia found 6 of 18 recaptured snakes were always found under the same cover object and movements of tracked individuals under artificial cover objects were relatively short; the average distance between the two farthest captures was about 25 m (Engelstoft and Ovaska 2000a).

Understanding of overwintering behavior is extremely limited and it is not known if the species actually hibernates. The lack of observations during the coldest periods suggests the animals are underground. The period of inactivity, if it occurs, is short (1-3 months) based on seasonal activity patterns (Hallock 2009).

Population trends. Little is known about the population trends of this species. These snakes are apparently abundant and not of conservation concern in Oregon and California (Hoyer et al. 2006, Hallock 2009), but the species is rarer and less well-distributed in Washington and British Columbia. It is considered vulnerable in Washington because it is known to occur in only 14 widely disjunct areas (McAllister 1995, Dvornich et al. 1997, Leonard and Leonard 1998, O'Donnell and McCutchen 2008, R. Weaver unpubl. data; and WDFW WSDM database). West of the Cascade Mountains there is a historical site at Gravelly Lake, Pierce County, where it was last observed in the 1970s, and a recently discovered site on Orcas Island in San Juan County (O'Donnell and McCutchen 2008). East of the Cascade crest, they have been found in two areas in Chelan County, five areas in the Yakima River watershed in Yakima and Kittitas counties, four areas in Klickitat County, and in the Wind River drainage in Skamania County.

Potential threats to species. Although the species appears to tolerate some degree of disturbance, intensified urban development associated with an expanding human population threatens its survival as perhaps demonstrated by the apparent extirpation of the species in the Puget Sound area. Activities that alter moisture regimes, remove rock or woody debris, alter rocky areas by destroying or filling interstitial spaces between rocks, or fragment habitat have the potential to harm sharp-tailed snakes by degrading their habitat and microhabitat features. These activities may also degrade habitat for slugs, their main prey species. Additional activities that may threaten small localized populations include timber harvest, fire, road-building, and development (Hallock 2009). Roads probably cause significant mortality at several sites; sharp-tailed snakes have been found four times on roads in Yakima County where the road runs adjacent to the river in a narrow riparian zone (WDFW WSDM database).

The recovery strategy in British Columbia provides a description of potential threats associated with expanding urbanization including habitat loss, fragmentation, and habitat degradation, and mortalities from vehicles and lawn-mowers, and pesticides (Sharp-tailed Snake Recovery Team 2008). The apparently low population densities and restricted distribution are also factors (Engelstoft and Ovaska 2004, Ovaska and Engelstoft 2008).

Information needs. Owing to the lack of information on distribution and abundance, the main management consideration is to locate possible undiscovered populations especially those that may occur outside the areas where the species is known to exist. If it turns out the species is more common, as was found in Oregon (Hoyer et al. 2006), then additional conservation actions may not be needed beyond basic habitat maintenance where the species occurs. In 2012, a new location for the sharptail snake in Klickitat County was reported. The new location was 15 miles from known observations for this species.

Partners and Cooperators: Washington Department of Natural Resources' Natural Heritage Program, U.S. Forest Service.

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Striped Whipsnake

(*Masticophis taeniatus taeniatus*)

State Status: Candidate, 1991
Federal Status: None
Recovery Plans: None

Figure 1. Striped whipsnake in the Columbia Basin (*photo by Lori Salzer)*.

The striped whipsnake is a long, slender, striped snake (Figure 1). Adults range in size from 30-72 inches total length (Stebbins 2003). Lizards are the predominant prey, but small mammals, snakes, young birds and insects are also eaten (Brown and Parker 1982, Nussbaum et al. 1983). Individuals may live as long as 20 years (Brown and Parker 1982).

Striped whipsnakes reach the northern limit of their geographic range in Washington. Evidence indicates the species was never common in Washington and appears limited to the driest areas of the central Columbia Basin (Hallock 2006). All Washington occurrences are below 1,500 ft. elevation (Figure 2).

The vast majority of lands below 1,500 ft in the Columbia Basin have been converted to agriculture or inundated by reservoirs for the Columbia Basin Irrigation Project (Hallock 2006). In addition, cheatgrass and other invasive weeds have altered the understory of shrub-steppe habitat. This is particularly problematic for this active, visual predator as well as the ground-dwelling lizards on which it preys. Additional potential threats to striped whipsnakes include road mortalities, quarrying of basalt, construction of new transmission lines, and collecting.

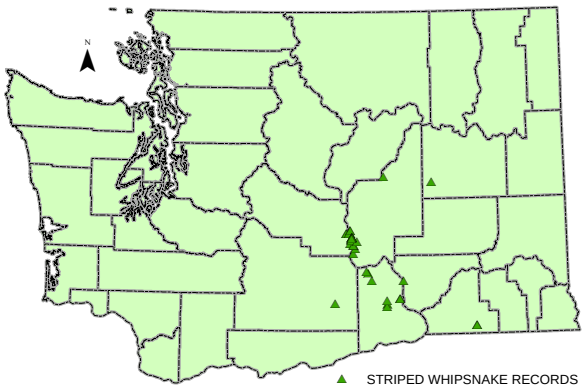

Figure 2. Locations of historical records of striped whipsnakes in Washington through 2011.

Striped whipsnakes use communal dens (i.e. hibernacula) in rock for winter dormancy. Clustering at hibernacula is important for surviving freezing winter temperatures and for locating mates in the spring. This species has high fidelity to hibernacula, returning to it each year to winter (Woodbury et al. 1951). Destruction of a hibernaculum led to the extirpation of a local population in Utah (Brown and Parker 1982). Identification and protection of hibernacula sites is essential for conservation of this species.

Concern about the species' status in Washington was triggered by lack of observations during large scale herpetological inventories in the 1990s (e.g., Hallock 1998a, 1998b, 1999) and surveys at historical striped whipsnake sites by the Washington Department of Natural Resources (WDNR) Natural Heritage Program from 1998-2004. Moreover, WDFW received only three observation reports from 1990-2003. A confirmed report of a striped whipsnake in western Grant County in 2004 triggered surveys at the observation site by WDNR's Natural Heritage Program, the Bureau of Land Management (BLM), and WDFW. In 2005, a cooperative project was initiated between the BLM and WDNR's Natural Heritage Program to describe habitat use and life history of striped whipsnakes at this same site and to evaluate the status of the species in Washington (Hallock 2006).

Whipsnakes are elusive and have proven difficult to find even where they are known to occur. Searching for shed skins eliminates many of the difficulties associated with finding the species and is currently the only method that seems time and cost effective. Shed skin surveys and additional work have produced only two verified striped whipsnake occurrences in Washington (about 7-8 km apart). A corridor of native habitat supporting healthy lizard populations still remains between the two sites (Hallock 2006). WDFW has continued to conduct these surveys annually at the occupied sites to monitor the populations. Numbers of shed skins found has remained small but relatively consistent from year to year including the most recent surveys in 2012 (L. Hallock, unpubl. data). Due to a lack of funding, inventory at other sites has not been conducted in recent years with the exception of the Yakima Training Center (YTC). The YTC has provided shed skins to WDFW for identification. In 2012, WDFW surveyed an area on the YTC that was known to have whipsnakes in the 1970s for the third time since 2006. Although the habitat appears suitable, none of the survey efforts have resulted in evidence that whipsnakes still occur on the YTC.

Shed skins from striped whipsnakes have been collected and stored since 2005 as vouchers for future genetic research. In 2010, researchers at the U.S. Geological Survey were able to isolate genetic material from a small sample of these shed skins. If funding is secured, future efforts will look at the genetic relationship between the Washington population and those in other states to determine if the Washington population is genetically isolated. Also, the genetic health of the Washington population will be examined.

The area currently occupied by striped whipsnakes has been proposed as a Natural Area Preserve. The Natural Heritage Advisory Council reviewed and approved the proposal in 2007. The WDNR's Natural Heritage and Natural Areas Program secured funding for land acquisition in 2012.

Partners and cooperators: Bureau of Land Management Wenatchee Office, Washington Department of Natural Resources, U.S. Army-Yakima Training Center, U.S. Geological Survey.

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Island Marble

(*Euchloe ausonides insulanus*)

State Status: Candidate, 2002
Federal Status: Species of concern
Recovery Plans: None

Figure 1. Island marble perched on the host plant, field mustard (*Brassica campestris)* (*photo by Thor Hanson*).

The island marble is a rare, medium-sized (~2.5 inches) butterfly restricted to San Juan and Lopez islands in northwestern Washington (Figure 1). It is a subspecies of the more widely distributed large marble (*E. ausonides*; Guppy and Shepard 2001). Adult island marbles are on the wing early-to-mid April to mid-June. Females select specific plants and species within the mustard family (Brassicaceae) to lay their eggs. Island marbles were originally known from 14 specimens from southwestern British Columbia collected between 1861 and 1908 (Shepard 2000), and were believed extinct until rediscovered at the American Camp Unit of San Juan Island National Historic Park (NHP) in 1998 (Fleckenstein and Potter 1999). Surveys conducted since then have helped expand knowledge of the island marble's range, flight period, host plant requirements, and natural history, and have identified threats to its conservation. Lambert (2011) termed the island marble a "colonizing species" because its larvae feed on host plants that are early successional species that densely colonize disturbed soil, and die out over time. The island marble must disperse from declining host patches to newly colonized sites.

Population status. Surveys have been conducted in Washington and British Columbia to determine the distribution of the island marble. WDFW led survey efforts to determine the distribution of this butterfly within Washington from 2005 to 2012. Visits to over 240 potential locations in the San Juan Islands, Olympic Peninsula, and northern coastal Puget Sound, resulted in documenting locations only on San Juan and Lopez islands. WDFW annually monitored the species and habitat status at the known sites from 2005 to 2012 in cooperation with private landowners, the National Park Service, Bureau of Land Management, Washington Department of Natural Resources, and San Juan County. Surveys from 1998 to 2011 identified 52 island marble sites representing five populations on the two islands. Over the past few years, however, it has become clear that the majority of sites that were previously occupied no longer support this butterfly. The number of populations and individuals has declined significantly over the last 5 years; most butterflies now occur within San Juan Island NHP. In 2011, 17 sites occupied in prior years were searched (14 on San Juan Island and 3 on Lopez Island). The butterfly was detected at 4 sites, including two locations in San Juan Island NHP. No island marbles were detected on Lopez Island in 2011, but larvae were found at one site there in 2012. In 2012, island marbles were detected at 6 sites, with the highest numbers at 2 in San Juan Island NHP. San Juan Island NHP is the remaining stronghold for this butterfly and park staff are considering a number of efforts to protect and expand populations. Annual monitoring detected a >70% decline in island marble

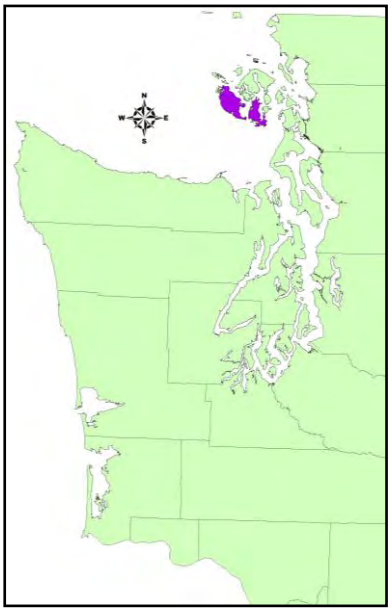

Figure 2. San Juan and Lopez islands in San Juan County, Washington.

adult encounter rate on two of three transects in the park between 2004 and 2011 (Lambert 2011).

Threats. Factors contributing to larval mortality include predation, herbivory (primarily by deer), human disturbance, storm tides, mowing, landscaping or yard maintenance, site development, and weather events. Also, at one site, a non-native snail, *Helix aspersa*, has been observed feeding on island marble host plants in great numbers.

Lambert (2011) recorded the survivorship of island marble eggs during 2005-2008; she reported that of 1,617 eggs, 12% survived to instar IV. Relatively low survivorship was attributed to multiple factors, but the particularly low egg and instar I survival was mainly attributed to predation and deer herbivory. Deer herbivory affected island marbles by reducing the availability of oviposition sites and by direct consumption of eggs and larvae; 415 of 1,617 eggs (26%) were eaten by deer. Survival of island marble eggs and larvae was highest on the native host plant, tall peppergrass (*Lepidium virginicum* var. *menziesii*). Tall peppergrass is found in nearshore habitat that is sometimes negatively impacted by human disturbances.

Figure 3. First (A) and five instar (B) caterpillars of island marble (*photos by Amy Lambert*).

The island marble is vulnerable to climate change because its only native plant host inhabits nearshore habitat that would probably be negatively impacted by increases in frequency and intensity of storm surges (Lambert 2011). Lambert recorded reductions of island marbles in a cooler year at one site, and after a severe storm affected host pants at another site. Butterflies are generally somewhat vulnerable to climate change because they are affected by changes in plant phenology.

A significant loss of island marble habitat has occurred since 2005. Host plants have decreased in abundance at several key island marble sites. Additionally, island marbles are threatened by large-scale soil-disturbing agricultural practices which result in the growth of significant patches of mustard host plants that are subsequently destroyed by tilling or harvesting. Rather than being beneficial to the island marble by increasing host plants, these host plant flushes often act as ecological traps, attracting island marble adults (and subsequent eggs), but not persisting long enough to provide eggs and larvae a chance of surviving to adulthood (Hanson *et al.* 2010). New host patches are not becoming established in secure environments. These factors, plus the documented population declines, suggest that the island marbles is at high risk of extinction. Habitat protection and enhancement is needed to conserve this rare butterfly.

Conservation actions. Since 2007, WDFW has advised a number of private landowners on methods to conserve island marbles and helped prepare a management plan for one landowner, who went on to do transplanting of food plants, fencing, and soil disturbance to assist the butterfly. WDFW has also done some small-scale testing of methods (i.e., seeding, soil disturbance) to enhance habitat. The National Park Service and U.S. Fish and Wildlife Service have experimented with propagating and planting a native mustard eaten by the island marble.

Lambert (2011) studied the natural history and population ecology of the island marble, and provided valuable recommendations for conservation of the species. She noted that understanding host plant

ecology and population dynamics is essential for managing disturbance to avoid creating sink habitat. Results suggested that preserving and increasing topographic and habitat heterogeneity of occupied island marble sites may be critical to the species persistence (Lambert 2011).

An interagency island marble working group was formed in 2012 to develop conservation strategies. Initial focus was on the use of fencing to exclude deer from island marble habitat. WDFW, National Park Service, U.S. Fish and Wildlife Service, and a University of Washington professor met to discuss and layout temporary deer exclosure fencing areas in habitat patches. Three areas were selected for installation and testing of 2 types of temporary fencing. Monitoring of exclosure effectiveness and potential impacts to adult island marble movement will be conducted by a University of Washington researcher.

In August 2012, The Xerces Society submitted a new petition to the USFWS to list the species under the Endangered Species Act (Jordan et al. 2012). The petition provides details about recent declines in occupied sites and numbers detected, and threats to the subspecies. Previously, the U.S. Fish and Wildlife Service conducted a status review and published a finding of 'not warranted' for listing in response to a petition filed in 2002 (USFWS 2006). The finding stated that the majority (82%) of the area occupied by the island marble is subject to short-term impacts that usually create an increased occurrence of mustards through ground disturbance and that this is generally compatible with conservation of the butterfly. The recent petition describes how some of the mustards become ecological traps (Jordan et al. 2012).

Outreach. WDFW produced a brochure on the island marble in 2009. It highlights information on the identification, biology, and conservation of the butterfly and is currently being distributed to the public.

Partners and cooperators: U.S. Fish and Wildlife Service, Xerces Society, San Juan County Land Bank, Island Rec, San Juan Preservation Trust, KWHIAT, University of Washington-Friday Harbor Labs, National Park Service - San Juan Island National Historic Park, Bureau of Land Management, Washington Department of Natural Resources, and many private landowners.

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Giant Palouse Earthworm

(Driloleirus americanus)

State Status: Candidate, 2007
Federal Status: None
Recovery Plans: None

Figure 1. Giant Palouse earthworm (*photo by Kelly Weaver, University of Idaho)*.

The giant Palouse earthworm (Figure 1) is a poorly known native species that has been found at scattered locations in eastern Washington and adjacent Idaho. The species was first described by Smith (1897, 1937) from specimens collected near Pullman, Whitman County. Smith (1897) noted that they were reportedly "very abundant" in the area and wrote that burrows placed in road cuts sometimes extended to depths of over 15 feet. Giant Palouse earthworms appear to be a type of 'anecic' worm, based on observations of castings by J. Johnson-Maynard at locations near Leavenworth, Chelan County (USFWS 2011). Anecic worms live in deep, semi-permanent burrows, move to the surface to feed on fresh plant litter, and are the largest and longest lived of the three general groups of earthworms (James 2000).

Despite Smith's (1897) early report of abundance, only a few records of the giant Palouse earthworm existed until the 1980s, these from near Pullman, and near Moscow, Idaho. The locations and rarity of specimens (none from 1931-1978, 1 in the 1978, and 2 in the 1980s) suggested the species was a nearly extinct Palouse endemic that required deep soil and undisturbed native grassland. A collection near Ellensburg, Kittitas County, in the 1980s was the first record outside the Palouse region. Interest in the worm resumed in 2005, when a specimen was collected in remnant Palouse prairie at Smoot Hill Ecological Preserve near Albion, Whitman County (Sanchez-de Leon and Johnson-Maynard 2009). Researchers began to look more broadly for the species including localities along the eastern slope of the Cascades. This has resulted in specimens being found in a wider range of locations and habitats, including at a number of sites in dry forest between Ellensburg and Lake Chelan in Washington (J. Fleckenstein, unpubl. data) and in Douglas-fir forests in Latah County, Idaho (USFWS 2011). Some specimens await DNA analysis to confirm their species identification. Although the species is cryptic in its habits, increased surveyor familiarity with burrows and castings has greatly aided survey efforts (J. Fleckenstein, pers. comm.). Recent records indicate that the species is found both in deep and shallow loam soils (J. Fleckenstein, unpubl. data).

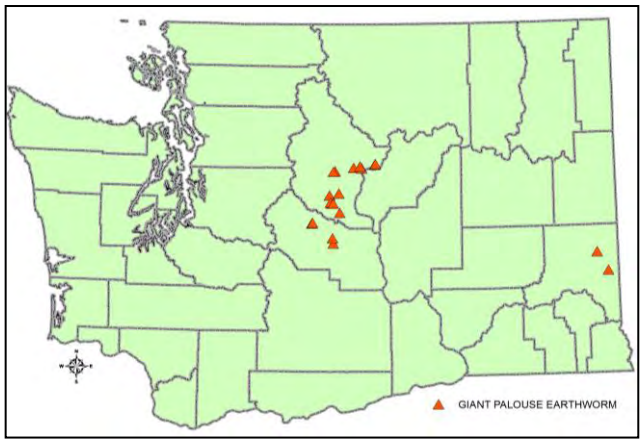

Figure 2. Giant Palouse earthworm records in Washington (Washington Natural Heritage Program).

Sanchez-de Leon and Johnson-Maynard (2009) proposed that a combination of extensive habitat loss and fragmentation in the Palouse region, low habitat quality of remaining prairie remnants, and possibly competitive interactions with exotic earthworms decimated giant Palouse earthworm populations. Agricultural conversion has resulted in a more than 99% reduction of the Palouse prairie ecosystem, and much of the Columbia Basin between the Whitman and Kittitas County sites is probably too dry for

earthworms (James 2000). Soil tillage, compaction, agricultural chemicals, and grazing probably degrade conditions for the species (USFWS 2011). Nonnative earthworms, which are commonly encountered throughout the Palouse region (Fauci and Bezdicek 2002), can invade new habitats, change the ecological soil functions, and displace native species (Hendrix and Bohlen 2002, Hendrix 2006). Native earthworms have an important role in soil formation.

Conservation actions. In response to a petition filed in 2009, the U.S. Fish and Wildlife Service conducted a 12-month status review and published a finding of 'not warranted' for listing under the Endangered Species Act (USFWS 2011). The finding cited the recent collections of giant Palouse earthworms over a broader geographical and ecological range and the lack of data about known direct threats to the species.

Survey efforts in Washington have been greatly expanded, with the Natural Heritage Program of the Washington Department of Natural Resources conducting surveys in the eastern Cascades and on the Palouse since 2010. Thes include visits to about 54 sites in 2011 when giant Palouse earthworms were found at 18 sites. In 2012, an additional 49 sites were survyed and the species was found at two new locations, bringing the total to about 22 sites in Washington.

Personnel from the University of Idaho are currently working to develop and refine sampling methods and strategies, including a soil electroshocking technique that appears promising.

The highest priorities for additional survey work for this species are to the north and south of the known range in the eastern Cascades. Additional species of native earthworm occur in Washington, and investigation of their ecology, distribution, and taxonomy is needed.

Partners and cooperators: Washington Department of Natural Resources, Natural Heritage Program, U.S. Fish and Wildlife Service, University of Idaho, Palouse Prairie Foundation, Palouse Audubon, Idaho Department of Fish and Game, Soil Biology Associates.

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Merlin

(*Falco columbarius*)

State Status: Removed from candidate list, 2010
Federal Status: None
Recovery Plans: None

Figure 1. Merlin taken at Nisqually NWR (*photo by Rod Gilbert*).

Merlins (Figure 1) have increased in western North America and elsewhere on the continent in recent decades (Figure 2; Sauer et al. 2011), possibly reflecting recovery from the impacts of DDT during the 20th century, as observed in populations of bald eagles and peregrine falcons. While merlins are generally uncommon rangewide, they do not appear to be particularly sensitive to human disturbance and have been recorded nesting in suburban parks. The species occurs widely at lower elevations in Washington, mainly as a winter visitor (Gleason et al. 2005).

Merlins were placed on the Washington candidate list in 1997 due to apparent rarity and a concern about the effects of timber harvest practices, but were removed from the list in 2010. Recent changes in logging practices that reduce harvest of riparian trees will mitigate potential logging impacts to some extent. Although merlins are rare and localized breeders in the state (Gleason et al. 2005), they are not particularly sensitive to human activities and there does not seem to be any immediate or widespread threat to their populations.

Figure 2. Trend in Breeding Bird Survey detections of merlins in western North American, 1966-2009 (Sauer et al. 2011).

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Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966-2009. Version 3.23. USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Newcomb's Littorine Snail

(*Littorina subrotundata* [formerly *Almagorda newcombiana*])

State Status: Removed, 2010
Federal Status: Species of concern
Recovery Plans: None

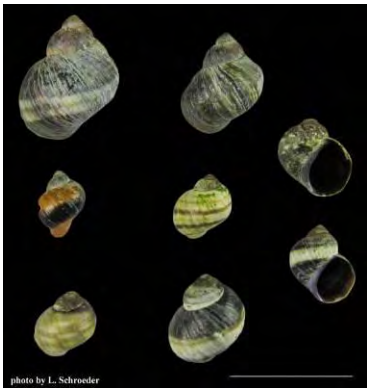

Figure. 1. Saltmarsh or Newcomb's periwinkle *(photo by L. Schroeder)*.

Newcomb's littorine snail (Figure 1), also known as the saltmarsh or Newcomb's periwinkle, was placed on the state candidate list in 1997, but was removed in 2010. It is a common coldwater North Pacific marine gastropod. The species has been studied in recent years and is now known to range from Humbolt Bay in California north to Alaska and west to Russia and the Kurile Islands (J. Carlton, correspondence on file). It is common or abundant in many estuaries and bays along the entire northwest coast. It was once believed to be a very localized salt-marsh species, but more recent study clarified the taxonomy of the species. Recent genetic analysis that included samples from Mukkaw Bay, Grays Harbor, and Shi Shi Beach in Washington confirms the wide distribution and identity of the species (Kyle and Boulding 1998).

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APPENDIX A. Washington Administrative Code:

232-12- 011. Wildlife classified as protected shall not be hunted or fished;
232-12- 014. Wildlife classified as endangered species;
232-12- 297. Endangered, threatened and sensitive wildlife species classification;
232-12- 292. Bald eagle protection rules.

WAC 232-12-011 Wildlife classified as protected shall not be hunted or fished. Protected wildlife are designated into three subcategories: threatened, sensitive, and other.
(1) Threatened species are any wildlife species native to the state of Washington that are likely to become endangered within the foreseeable future throughout a significant portion of their range within the state without cooperative management or removal of threats. Protected wildlife designated as threatened include:

Common Name	Scientific Name
Mazama pocket gopher	*Thomomys mazama*
western gray squirrel	*Sciurus griseus*
Steller (northern) sea lion	*Eumetopias jubatus*
North American lynx	*Lynx canadensis*
ferruginous hawk	*Buteo regalis*
marbled murrelet	*Brachyramphus marmoratus*
green sea turtle	*Chelonia mydas*
loggerhead sea turtle	*Caretta caretta*
greater sage-grouse	*Centrocercus urophasianus*
sharp-tailed grouse	*Phasianus columbianus*

(2) Sensitive species are any wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their range within the state without cooperative management or removal of threats. Protected wildlife designated as sensitive include:

Common Name	Scientific Name
gray whale	*Eschrichtius gibbosus*
common Loon	*Gavia immer*
peregrine falcon	*Falco peregrinus*
bald eagle	*Haliaeetus leucocephalus*
Larch Mountain salamander	*Plethodon larselli*
pygmy whitefish	*Prosopium coulteri*
margined sculpin	*Cottus marginatus*
Olympic mudminnow	*Novumbra hubbsi*

(3) Other protected wildlife include:

Common Name	Scientific Name
cony or pika	*Ochotona princeps*
least chipmunk	*Tamius minimus*
yellow-pine chipmunk	*Tamius amoenus*
Townsend's chipmunk	*Tamius townsendii*
red-tailed chipmunk	*Tamius ruficaudus*
hoary marmot	*Marmota caligata*
Olympic marmot	*Marmota olympus*
Cascade golden-mantled ground squirrel	*Spermophilus saturatus*
golden-mantled ground squirrel	*Spermophilus lateralis*
Washington ground squirrel	*Spermophilus washingtoni*
red squirrel	*Tamiasciurus hudsonicus*
Douglas squirrel	*Tamiasciurus douglasii*
northern flying squirrel	*Glaucomys sabrinus*
Wolverine	*Gulo gulo*
painted turtle	*Chrysemys picta*
California mountain kingsnake	*Lampropeltis zonata*

All birds not classified as game birds, predatory birds or endangered species, or designated as threatened species or sensitive species; all bats, except when found in or immediately adjacent to a dwelling or other occupied building; mammals of the order

Cetacea, including whales, porpoises, and mammals of the order Pinnipedia not otherwise classified as endangered species, or designated as threatened species or sensitive species. This section shall not apply to hair seals and sea lions which are threatening to damage or are damaging commercial fishing gear being utilized in a lawful manner or when said mammals are damaging or threatening to damage commercial fish being lawfully taken with commercial gear.

[Statutory Authority: RCW 77.12.047, 77.12.020. 08-03-068 (Order 08-09), § 232-12-011, filed 1/14/08, effective 2/14/08; 06-04-066 (Order 06-09), § 232-12-011, filed 1/30/06, effective 3/2/06. Statutory Authority: RCW 77.12.047, 77.12.655, 77.12.020. 02-11-069 (Order 02-98), § 232-12-011, filed 5/10/02, effective 6/10/02. Statutory Authority: RCW 77.12.047. 02-08-048 (Order 02-53), § 232-12-011, filed 3/29/02, effective 5/1/02; 00-17-106 (Order 00-149), § 232-12-011, filed 8/16/00, effective 9/16/00. Statutory Authority: RCW 77.12.040, 77.12.010, 77.12.020, 77.12.770. 00-10-001 (Order 00-47), § 232-12-011, filed 4/19/00, effective 5/20/00. Statutory Authority: RCW 77.12.040, 77.12.010, 77.12.020, 77.12.770, 77.12.780. 00-04-017 (Order 00-05), § 232-12-011, filed 1/24/00, effective 2/24/00. Statutory Authority: RCW 77.12.020. 98-23-013 (Order 98-232), § 232-12-011, filed 11/6/98, effective 12/7/98. Statutory Authority: RCW 77.12.040. 98-10-021 (Order 98-71), § 232-12-011, filed 4/22/98, effective 5/23/98. Statutory Authority: RCW 77.12.040 and 75.08.080. 98-06-031, § 232-12-011, filed 2/26/98, effective 5/1/98. Statutory Authority: RCW 77.12.020. 97-18-019 (Order 97-167), § 232-12-011, filed 8/25/97, effective 9/25/97. Statutory Authority: RCW 77.12.040, 77.12.020, 77.12.030 and 77.32.220. 97-12-048, § 232-12-011, filed 6/2/97, effective 7/3/97. Statutory Authority: RCW 77.12.020. 93-21-027 (Order 615), § 232-12-011, filed 10/14/93, effective 11/14/93; 90-11-065 (Order 441), § 232-12-011, filed 5/15/90, effective 6/15/90. Statutory Authority: RCW 77.12.040. 89-11-061 (Order 392), § 232-12-011, filed 5/18/89; 82-19-026 (Order 192), § 232-12-011, filed 9/9/82; 81-22-002 (Order 174), § 232-12-011, filed 10/22/81; 81-12-029 (Order 165), § 232-12-011, filed 6/1/81.]

WAC 232-12-014 Wildlife classified as endangered species. Endangered species include:

Common Name	**Scientific Name**
pygmy rabbit	*Brachylagus idahoensis*
fisher	*Martes pennanti*
gray wolf	*Canis lupus*
grizzly bear	*Ursus arctos*
sea otter	*Enhydra lutris*
sei whale	*Balaenoptera borealis*
fin whale	*Balaenoptera physalus*
blue whale	*Balaenoptera musculus*
humpback whale	*Megaptera novaeangliae*
black right whale	*Balaena glacialis*
sperm whale	*Physeter macrocephalus*
killer whale	*Orcinus orca*
Columbian white-tailed deer	*Odocoileus virginianus leucurus*
woodland caribou	*Rangifer tarandus caribou*
American white pelican	*Pelecanus erythrorhynchos*
brown pelican	*Pelecanus occidentalis*
sandhill crane	*Grus canadensis*
snowy plover	*Charadrius alexandrinus*
upland sandpiper	*Bartramia longicauda*
spotted owl	*Strix occidentalis*
Streaked horned lark	*Eremophila alpestris strigata*
western pond turtle	*Clemmys marmorata*
leatherback sea turtle	*Dermochelys coriacea*
mardon skipper	*Polites mardon*
Oregon silverspot butterfly	*Speyeria zerene hippolyta*
Taylor's checkerspot	*Euphydryas editha taylori*
Oregon spotted frog	*Rana pretiosa*
northern leopard frog	*Rana pipiens*

[Statutory Authority: RCW 77.12.047, 77.12.655, 77.12.020. 06-04-066 (Order 06-09), § 232-12-014, filed 1/30/06, effective 3/2/06. Statutory Authority: RCW 77.12.047, 77.12.655, 77.12.020. 02-11-069 (Order 02-98), § 232-12-014, filed 5/10/02, effective 6/10/02. Statutory Authority: RCW 77.12.040, 77.12.010, 77.12.020, 77.12.770, 77.12.780. 00-04-017 (Order 00-05), § 232-12-014, filed 1/24/00, effective 2/24/00. Statutory Authority: RCW 77.12.020. 98-23-013 (Order 98-232), § 232-12-014, filed 11/6/98, effective 12/7/98; 97-18-019 (Order 97-167), § 232-12-014, filed 8/25/97, effective 9/25/97; 93-21-026 (Order 616), § 232-12-014, filed 10/14/93, effective 11/14/93. Statutory Authority: RCW 77.12.020(6). 88-05-032 (Order 305), § 232-12-014, filed 2/12/88. Statutory Authority: RCW 77.12.040. 82-19-026 (Order 192), § 232-12-014, filed 9/9/82; 81-22-002 (Order 174), § 232-12-014, filed 10/22/81; 81-12-029 (Order 165), § 232-12-014, filed 6/1/81.]

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long-term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data

which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends.

7.1.2 Natural history, including ecological relationships (e.g. food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g. survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives.

11.1.2 Criteria for reclassification.

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to

meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.

11.1.4 Public education needs.

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within 5 years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended.

[Statutory Authority: RCW 77.12.047, 77.12.655, 77.12.020. 02-02-062 (Order 01-283), § 232-12-297, filed 12/28/01, effective 1/28/02. Statutory Authority: RCW 77.12.040. 98-05-041 (Order 98-17), § 232-12-297, filed 2/11/98, effective 3/14/98. Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]

WAC 232-12-292
Bald eagle protection rules.

Rule applicability

1.1 The following rules are only applicable and enforceable when the bald eagle is listed under state law as threatened or endangered.

Purpose

2.1 The purpose of these rules is to protect the habitat and thereby maintain the population of the bald eagle so that the species is not classified as threatened, endangered or sensitive in Washington state. This can best be accomplished by promoting cooperative efforts to manage for eagle habitat needs through a process which is sensitive to the landowner goals as well. The following rules are designed to promote such cooperative management.

Authority

3.1 These rules are promulgated pursuant to RCW 77.12.655.

Definitions

4.1 "Communal roost site" means all of the physical features surrounding trees used for night roosting that are important to the suitability of the roost for eagle use. These features include flight corridors, sources of disturbance, trees in which eagles spend the night, trees used for perching during arrival or departure and other trees or physical features, such as hills, ridges, or cliffs that provide wind protection.

4.2 "Cultural activities" means activities conducted to foster the growth of agricultural plants and animals.

4.3 "Department" means department of fish and wildlife.

4.4 "Endangered" means a species which is seriously threatened with extirpation throughout all or a significant portion of its range within Washington.

4.5 "Government entities" means all agencies of federal, state and local governments.

4.6 "Landowner" means any individual, private, partnership, nonprofit, municipal, corporate, city, county, or state agency or entity which exercises control over a bald eagle habitat whether such control is based on legal or equitable title, or which manages or holds in trust land in Washington state.

4.7 "Nest tree" means any tree that contains a bald eagle nest or has contained a nest.

4.8 "Nest site" means all of the physical features surrounding bald eagle nests that are important to normal breeding behavior. These features include alternate and potential nest trees, perch trees, vegetative screening, foraging area, frequently used flight paths, and sources of disturbance. This site is also referred to as the territory defended by a breeding pair of eagles.

4.9 "Perch tree" means a tree that is consistently used by eagles. It is often close to a nest or feeding site and is used for resting, hunting, consumption of prey, mating display and as a sentry post to defend the nest.

4.10 "Predacides" means chemicals used to kill or control problem wildlife.

4.11 "Region" means an ecological/geographic area that forms a unit with respect to eagles, e.g., Hood Canal, lower Columbia River, outer coast and south Puget Sound.

4.12 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

4.13 "Site management plan" means a legal agreement between the department and the landowner for management of a bald eagle nest or roost site. This plan may be a list of conditions on a permit or a more detailed, site-specific plan.

4.14 "Threatened" means a species that could become endangered within Washington without active management or removal of threats.

Applicability and operation

5.1 The department shall make available to other governmental entities, interest groups, landowners and individuals information regarding the location and use pattern of eagle nests and communal roosts.

5.2 The department shall itself and through cooperative efforts (such as memoranda of understandings pursuant to chapter 39.34 RCW) work with other government agencies and organizations to improve the data base for nest and communal roost site activity and productivity and to protect eagle habitats through site management plans.

5.3 The department's goal shall be to identify, catalog and prioritize eagle nest or communal roost sites. The department shall notify permitting agencies of nesting or roost site locations.

5.4 When a landowner applies for a permit for a land-use activity that involves land containing or adjacent to an eagle nest or communal roost site, the permitting agency shall notify the department.

If the department determines that the proposed activity would adversely impact eagle habitat, a site management plan shall be required. The department, a permitting agency, or wildlife biologist may work with the landowner to develop a plan. The department has final approval authority on all plans.

5.5 It is recognized that normal on-going agricultural activities of land preparation, cultivating, planting, harvesting, other cultural activities, grazing and animal-rearing activities in existing facilities do not have significant adverse consequences for eagles and therefore do not require a site management plan. New building construction, conversion of lands from agriculture to other uses, application of predacides and aerial pesticide spraying, may, following a conference with the department, be subject to the site management planning process described in these rules.

5.6 Emergency situations, such as insect infestation of crops, requires immediate action on the site management plan or special permission to address the impending crisis by the department.

Site management plan for bald eagle habitat protection

6.1 The purpose of the site management plan is to provide for the protection of specific bald eagle habitat in such a way as to recognize the special characteristics of the site and the landowner's property rights, goals and pertinent options. To this end, every land owner shall have fair access to the process including available incentives and benefits. Any relevant factor may be considered, including, but not limited to, the following:

6.1.1 The status of the eagle population in the region.

6.1.2 The useful life of the nest or communal roost trees and condition of the surrounding forest; the topography; accessibility and visibility; and existing and alternative flight paths, perch trees, snags and potential alternative nest and communal roost trees.

6.1.3 Eagle behavior and historical use patterns, available food sources, and vulnerability to disturbance.

6.1.4 The surrounding land-use conditions, including degree of development and human use.

6.1.5 Land ownership, landowner ability to manage, and flexibility of available landowner options.

6.1.6 Appropriate and acceptable incentive mechanisms such as conservation easements, transfer or purchase of development rights, leases, mutual covenants, or land trade or purchase.

6.1.7 Published recommendations for eagle habitat protection of other government entities such as the U.S. Fish and Wildlife Service.

6.2 The site management plan may provide for

6.2.1 Tailoring the timing, duration or physical extent of activities to minimize disturbance to the existing eagle habitat and, where appropriate, identifying and taking steps to encourage and create alternative eagle habitat; and

6.2.2 Establishing a periodic review of the plan to monitor whether:

a) The plan requires amendment in response to changing eagle and landowner circumstances
b) The terms of the plan comply with applicable laws and regulations,
c) The parties to the plan are complying with its terms.

6.3 The site management plan may also provide for implementing landowner incentive and compensation mechanisms through which the existing eagle habitat can be maintained or enhanced.

Guidelines for acquisition of bald eagle habitat

7.1 Real property interests may be acquired and agreements entered into which could enhance protection of bald eagle habitat. These include fee simple acquisition, land trades, conservation easements, transfer or purchase of development rights, leases, and mutual covenants. Acquisition shall be dependent upon having a willing seller and a willing buyer. Whatever interest or method of protection is preferable will depend on the particular use and ownership characteristics of a site. In discussing conservation objectives with private or public landowners, the department shall explore with the landowner the variety of protection methods which may be appropriate and available.

7.2 The following criteria and priorities shall be considered by the department when it is contemplating acquiring an interest in a bald eagle habitat.

7.2.1 Site considerations:
a) Relative ecological quality, as compared to similar habitats
b) Ecological viability - The ability of the habitat and eagle use to persist over time
c) Defensibility - The existence of site conditions adequate to protect the eagle habitat from unnatural encroachments
d) Manageability - The ability to manage the site to maintain suitable eagle habitat
e) Proximity to food source
f) Proximity to other protected eagle habitat
g) Proximity to department land or other public land
h) Eagle population density and history of eagle use in the area
i) The natural diversity of native species, plant communities, aquatic types, and geologic features on the site.

7.2.2 Other considerations

a) Ownership
b) Degree of threat
c) Availability of funding
d) Existence of willing donor or seller and prior agency interest
e) Cost

In general, priority shall be given to the most threatened high quality eagle habitats with associated natural values which require the least management.

Resolution of site management plan disputes

8.1 The department and the landowner shall attempt to develop a mutually agreeable site management plan within 30 days of the original notice to the department.

8.2 Should agreement not be reached, the landowner may request an informal settlement conference with the department.

8.3 If the landowner chooses not to use the informal settlement conference process or if resolution is not reached, the department shall within 15 days provide a site management plan to the landowner.

8.4 Upon issuance of a final site management plan, the landowner may initiate a formal appeal of the department's decision. The appeal shall be conducted according to the Administrative Procedure Act, chapter 34.05 RCW and the model rules of procedure, chapter 10-08 WAC.

A request for an appeal shall be in writing and shall be received by the department during office hours within thirty days of the issuance of the final site management plan. Requests for appeal shall be mailed to Department of Fish and Wildlife, 600 Capitol Way N., Olympia, Washington 98501-1091, or hand delivered to 1111 Washington Street S.E., Wildlife Program, Fifth floor. If there is no timely request for an appeal, the site management plan shall be unappealable.

The written request for an appeal shall be plainly labeled as "request for formal appeal" and shall contain the following:
(a) The name, address, and phone number of the person requesting the appeal;
(b) The specific site management plan that the person contests;
(c) The date of the issuance of the site management plan;
(d) Specific relief requested; and
(e) The attorney's name, address, and phone number, if the person is represented by legal counsel.

The appeal may be conducted by the director, the director's designee, or by an administrative law judge (ALJ) appointed by the office of administrative hearings. If conducted by an ALJ, the ALJ shall issue an initial order pursuant to RCW 34.05.461. The director or the director's designee shall review the initial order and enter a final order as provided by RCW 34.05.464.

Penalties

9.1 Failure of a landowner to comply with the processes set forth in these rules or with the provisions of a site management plan approved by the department constitutes a misdemeanor as set forth in RCW 77.15.130.

[Statutory Authority: RCW 77.12.047. 11-10-049 (Order 11-78), § 232-12-292, filed 4/28/11, effective 5/29/11. Statutory Authority: RCW 77.12.047, 77.12.655, 77.12.020. 02-02-062 (Order 01-283), § 232-12-292, filed 12/28/01, effective 1/28/02. Statutory Authority: RCW 77.12.655. 86-21-010 (Order 283), § 232-12-292, filed 10/3/86.]

Washington State Status Reports and Recovery Plans

Status Reports

2007	Bald Eagle
2005	Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot
2005	Aleutian Canada Goose
2004	Killer Whale
2002	Peregrine Falcon
2000	Common Loon
1999	Northern Leopard Frog
1999	Olympic Mudminnow
1999	Mardon Skipper
1999	Lynx Update
1998	Fisher
1998	Margined Sculpin
1998	Pygmy Whitefish
1998	Sharp-tailed Grouse
1998	Sage-grouse
1997	Aleutian Canada Goose
1997	Gray Whale
1997	Olive Ridley Sea Turtle
1997	Oregon Spotted Frog
1993	Larch Mountain Salamander
1993	Lynx
1993	Marbled Murrelet
1993	Oregon Silverspot Butterfly
1993	Pygmy Rabbit
1993	Steller Sea Lion
1993	Western Gray Squirrel
1993	Western Pond Turtle

Recovery Plans

2012	Columbian Sharp-tailed Grouse
2011	Gray Wolf
2011	Pygmy Rabbit: Addendum
2007	Western Gray Squirrel
2006	Fisher
2004	Sea Otter
2004	Greater Sage-Grouse
2003	Pygmy Rabbit: Addendum
2002	Sandhill Crane
2001	Pygmy Rabbit: Addendum
2001	Lynx
1999	Western Pond Turtle
1996	Ferruginous Hawk
1995	Pygmy Rabbit
1995	Upland Sandpiper
1995	Snowy Plover

Conservation and Management Plans

2013	Bat Conservation Plan

Status reports and plans are available on the WDFW website at:
http://wdfw.wa.gov/publications/search.php