# Threatened and Endangered Wildlife

## STATE OF WASHINGTON

## Annual Report 2011

Washington Department of
Fish and Wildlife
Wildlife Diversity Division
Wildlife Program

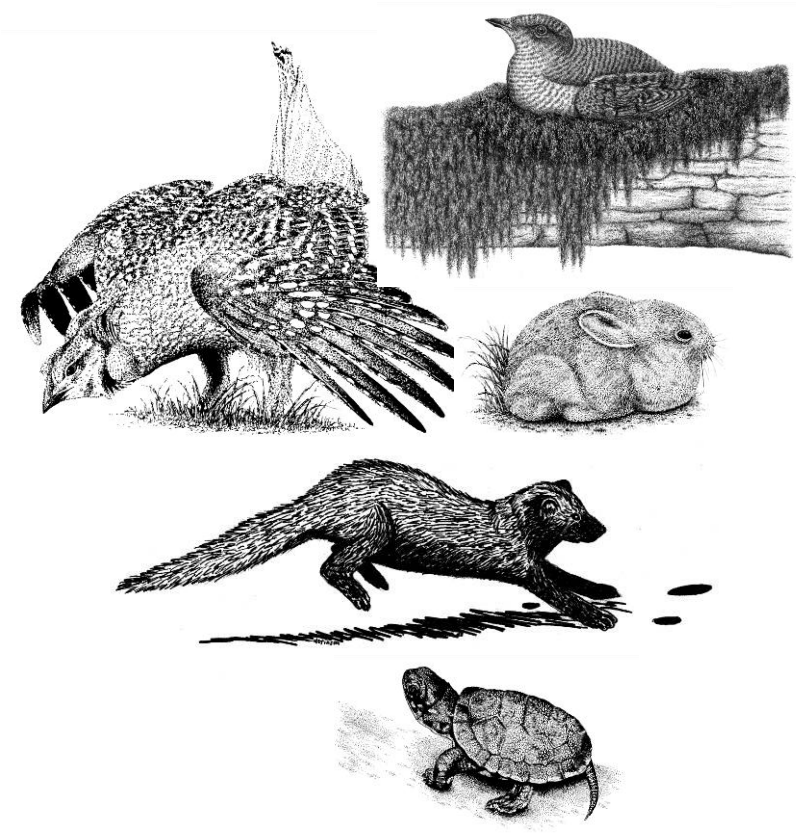
This report should be cited as:

Washington Department of Fish and Wildlife. 2012. Threatened and Endangered Wildlife in Washington: 2011 Annual Report. Endangered Species Section, Wildlife Program. Washington Department of Fish and Wildlife, Olympia. 180 pp.

.

**Cover photos by:** *Joe Higbee (sandhill crane, western gray squirrel), Melissa Reitz (turtle), Chris Johnson (gray whale), Chris Sato (sharp-tailed grouse in hand), Jessica Hoffman (fisher), Derek Stinson (Taylor's checkerspot), and Derek Stinson (Big Buck Unit of the Methow Wildlife Area background). Title page illustrations by Darrell Pruett and Derek Stinson (fisher)*

# THREATENED AND ENDANGERED WILDLIFE IN WASHINGTON: 2011 ANNUAL REPORT



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

2012

# Table of Contents

# 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, Keith Aubry, Lynne Barre, Dana Base, Penny Becker, Gary Bell, Gretchen Blatz, Joe Buchanan, Steve Desimone, Joe Engler, Greg Falxa, John Fleckenstein, Rich Finger, Paul Frame, Gary Ivey, Lisa Hallock, Molly Hallock, Jeff Heinlen, Eric Holman, Steve Jeffries, Mary Linders, Mike Livingston, Travis Nelson, Brent Norberg, Gail Olson, Ann Potter, Scott Pearson, Leslie Robb, Elizabeth Rodrick, Lori Salzer, Chris Sato, Tammy Schmidt, Michelle Tirhi, Matt Vander Haegen, Jim Watson, and Kristin Wilkinson.

# 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 2011. It also includes accounts for 15 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. Wildlife conservation also benefits from the many people 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 (transients, offshores, others) | - |
| Southern Resident | FE |
| 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 | FC |

## 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) | |
|---|---|
| Ferruginous Hawk | FSC |
| Marbled Murrelet | FT |
| Greater Sage-Grouse | FC |
| Columbian Sharp-tailed Grouse | FSC |

| 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** | - |
| **Peregrine Falcon** | FSC | **AMPHIBIANS (1)** | |
| **Bald Eagle** | 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** | |
| South of the Yakima River | FSC |
| **Olympic Marmot** | - |
| **Cascade Red Fox** | - |
| **Wolverine** | FC |

**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 |
| 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 and 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# | - | Middle Columbia | FT | Silver-bordered Fritillary | - |
| China Rockfish# | - | Lower Columbia | FT | Great Arctic | - |
| *#Puget Sound, the San Juan Islands, and the Strait of Juan de Fuca east of the Sekiu R.* | | Bull Trout | FT | **Island Marble** | FSC |
| **Chinook Salmon** | | **INSECTS (19)** | | **MOLLUSKS (9)** | |
| Snake River Fall | FT | Beller's Ground Beetle | FSC | Giant Columbia River Limpet | - |
| Snake R. Spring/Summer | FT | Mann's Mollusk-eating Ground Beetle | - | Columbia Pebblesnail | FSC |
| Puget Sound | FT | Columbia River Tiger Beetle | - | California Floater | FSC |
| Upper Columbia Spring | FE | Hatch's Click Beetle | FSC | Northern Abalone | FSC |
| Lower Columbia | FT | Bog Idol Leaf Beetle | - | Olympia Oyster | - |
| **Chum Salmon** | | Columbia Clubtail (dragonfly) | - | Columbia Oregonian (snail) | - |
| Hood Canal Summer (includes Strait of Juan de Fuca, not Puget Sound) | FT | Pacific Clubtail | - | Poplar Oregonian (snail) | - |
| | | Sand-verbena Moth | - | Dalles Sideband (snail) | - |
| Columbia River | FT | Yuma Skipper | - | Blue-gray Taildropper (slug) | - |
| **Sockeye Salmon** | | Shepard's Parnassian | - | | |
| Snake River | FE | Makah Copper | FSC | **OTHER INVERTEBRATES (2)** | |
| Ozette Lake | FT | Chinquapin Hairstreak | - | **Giant Palouse Earthworm** | - |
| **Steelhead** | | Johnson's Hairstreak | - | Leschi's Millipede | - |
| Snake River | FT | Juniper Hairstreak | - | | |
| Upper Columbia | FT | Puget Blue | - | | |
| | | Valley Silverspot | FSC | | |

## SPECIES RECENTLY REMOVED from the STATE CANDIDATE SPECIES LIST

| | |
|---|---|
| **Merlin** | - |
| **Newcomb's Littorine Snail** | **FSC** |

## Pygmy Rabbit

(*Brachylagus idahoensis*)

**State Status:** Threatened, 1990; Endangered, 1993
**Federal Status:** Endangered, 2001 (Columbia Basin Distinct Population Segment)
**Recovery Plans:** State, 2011; Federal, 2011 (draft)

Figure 1. Pygmy rabbit captured in Nevada awaiting release in Washington (*photo by C. Warren*).

The pygmy rabbit is the smallest rabbit in North America, with adults typically weighing less than 1 lb (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 40,000-115,000 years (Lyman 1991; Warheit 2001; Lyman 2004). Museum specimen records and reliable sight records show that pygmy rabbits formerly occupied sagebrush habitat in Benton, Adams, Grant, Lincoln, and Douglas counties, and paleontological evidence suggests that the species had a broader distribution in Washington thousands of years ago (Figure 2).

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 (USDI 2003). A draft federal recovery plan has been developed and an amended draft is being reviewed (USFWS 2011).

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), and 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 (USFWS 2003). 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 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. By March 2001, rabbits remained only at Sagebrush Flat Wildlife Area, and that population suffered a

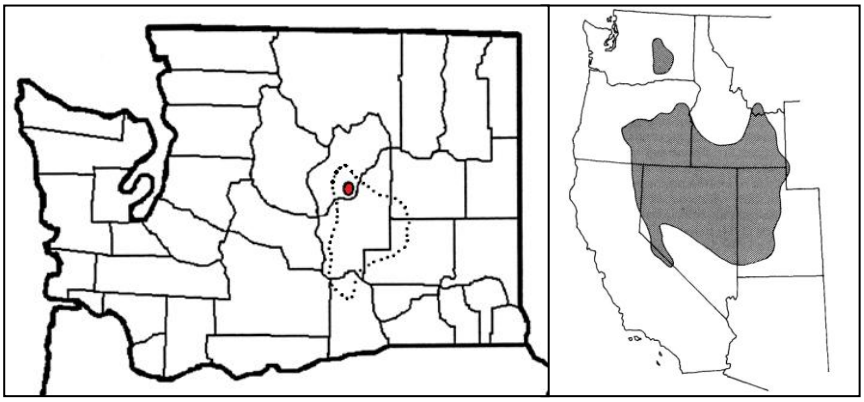


Figure 2. Historical range (right) and Columbia basin Distinct Population Segment of the pygmy rabbit (*adapted from Green and Flinders 1980, and USFWS 2003*).

sudden large decline during the winter of 2000-2001.

WDFW conducted genetic analyses of pygmy rabbits in 2001. The results indicated that the Columbia Basin population of pygmy rabbits appeared to have suffered from a reduction in genetic diversity over the past 50 years (Warheit 2001). With so few Washington pygmy rabbits left in the wild, it was decided to capture the remaining rabbits from the wild in May 2001 to establish a captive population for future recovery efforts. Fourteen rabbits were captured.

***Captive breeding.*** A captive breeding program was initiated in 2001 as a cooperative project involving the WDFW (lead agency), Washington State University, the Oregon Zoo, and Northwest Trek Wildlife Park. Although Columbia Basin pygmy rabbits were not taxonomically separated from pygmy rabbits throughout the Great Basin, genetic studies prompted WDFW to manage the population to maintain its unique genetic characteristics. The 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 2006). 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 intercrossed with pygmy rabbits from Idaho. The largest proportion of the 2010 population was at 75% Columbia Basin genes.

Additional early recovery efforts 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 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. Plans were developed to use 'soft-release' techniques with limited periodic predator control for future releases. The reintroduction did succeed in demonstrating that captive-reared Columbia Basin pygmy rabbits will breed in their first season of release in the wild.

Since genetic diversity was increased by intercrossing animals, reproduction has largely improved for captive 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 have transitioned from captive breeding to translocating pygmy rabbits from other states.

***Reintroduction.*** The captive breeding program was reduced in spring 2011 by reintroducing captive-reared individuals and their new offspring at Sagebrush Flats WLA. Several steps were taken to increase the likelihood of successfully re-establishing a pygmy rabbit population, including: 1) releasing both captive Columbia Basin rabbits and wild-caught rabbits from neighboring states to boost numbers and genetic diversity; 2) soft releasing the rabbits by containing them within enclosures on site; and 3) maximizing reintroduction numbers each year over the next several years. The majority of captive pygmy rabbits were released in 2011 and the remaining captive rabbits will be released in spring and summer 2012. Retaining a small number of captive pygmy rabbits beyond summer 2012 will only occur if it is necessary for continued success of the reintroduction efforts. Future translocations will depend upon ongoing assessments of program results and the availability of rabbits from neighboring states.

Pygmy rabbits are vulnerable to a wide range of predators, so soft release enclosures, 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 was done initially and will be done intermittently throughout the reintroductions in the form of hazing of raptors, and trapping of problem weasels, coyotes and badgers. Soft release enclosures allow an increased ability to monitor the health of the rabbits more closely up until release.

To improve survival of rabbits after releases in Washington, artificial burrows have been constructed in the release area of Sagebrush Flat. In the core release area, 60 artificial burrows were installed for soft releases, adding to 15 that were available from the 2007 release. Small, temporary soft release enclosures were erected throughout the core release area. Once the rabbits have been held for a sufficient amount of time, the enclosures are breached on two sides and the rabbits are allowed to move freely. Large enclosures (about 6 and 10 acres each) were also erected on Sagebrush Flat, which are semi-permanent structures that can be used throughout the reintroduction efforts.

Preparation of reintroduction sites at Sagebrush Flat in 2011 included management 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, construction of fire breaks, and other management activities designed to improve habitat conditions for pygmy rabbits (USFWS 2011).

***Other conservation actions.*** In 2011, WDFW acquired 473 acres of land in Douglas County that may benefit pygmy rabbits.

**Partners and cooperators:** 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, Association of Zoos and Aquariums, Riverbanks Zoo and Garden.

### Literature Cited


Becker, P. A., D. W. Hays, and R. D. Sayler. 2011. Columbia Basin pygmy rabbit (*Brachylagus idahoensis*) reintroduction and genetic management plan. Washington Department of Fish and Wildlife, Olympia, Washington.

Dobler, F. C., and K. R. Dixon. 1990. The pygmy rabbit *Brachylagus idahoensis*. Pages 111-115 *in* J. A. Chapman and J. E. C. Flux, eds. Rabbits, hares and pikas--Status survey and conservation action plan. IUCN/SSC Lagomorph Specialist Group. 168 pp.

Elias, B. A. 2004. Behavior, reproduction, and survival in captive Columbia Basin and Idaho pygmy rabbits (*Brachylagus idahoensis*). M.S. Thesis, Washington State University, Pullman, Washington. 55 pp.

Green, J. S. and Flinders, J. T. 1980. *Brachylagus idahoensis.* Mammalian Species 125:1-4.

Hays, D., and Ken Warheit 2007. Columbia Basin pygmy rabbit captive breeding and genetic management plan. Washington Department of Fish and Wildlife, Olympia, Washington.

Lyman, R. L. 1991. Late quaternary biogeography of the pygmy rabbit (*Brachylagus idahoensis*) in eastern Washington. Journal of Mammalogy 72:110-117.

Lyman, R. L. 2004. Biogeographic and conservation implications of late quaternary pygmy rabbits (*Brachylagus idahoensis*) in eastern Washington. Western North American Naturalist 64:1-6.

Warheit, K. I. 2001. Genetic diversity and population differentiation of pygmy rabbits (*Brachylagus idahoensis*). Washington Dept. of Fish and Wildlife, Olympia, Washington. 27 pp.

WDFW. 1993. Status of the pygmy rabbit in Washington. Olympia, Washington. 25p.

WDFW. 1995. Washington state recovery plan for the pygmy rabbit. Olympia, Washington. 74pp.

U.S. Fish and Wildlife Service. 2006. Draft recovery plan for the Columbia Basin distinct population segment of the pygmy rabbit (*Brachylagus idahoensis*). Preliminary draft document under review at the U.S. Fish and Wildlife Service Regional Office, Portland, Oregon. 78 pp.

U.S. Fish and Wildlife Service. 2011. Amendment to the Draft Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*). U.S. Fish and Wildlife Service Regional Office, Portland, Oregon. 29 pp.

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

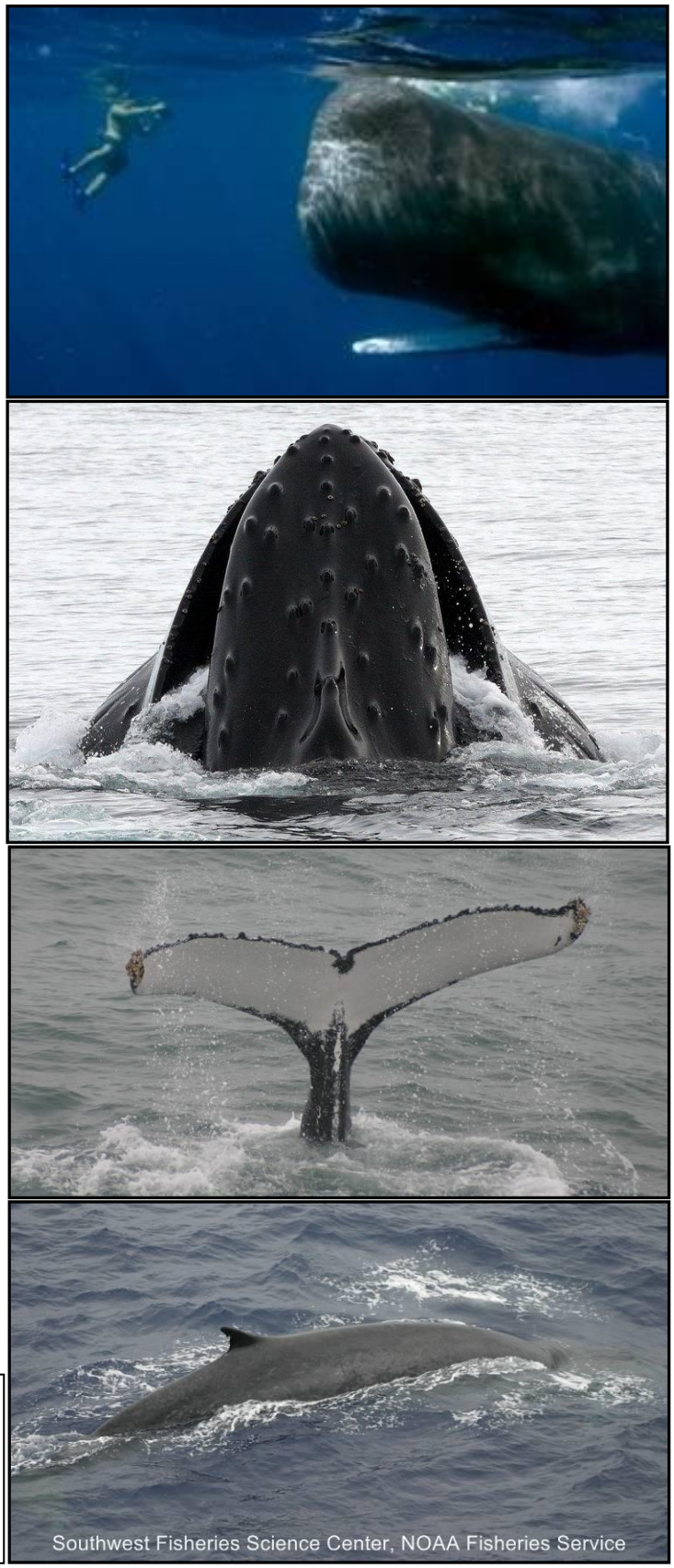
## Humpback Whale
(*Megaptera novaeangliae*)
**State Status:** Endangered, 1981
**Federal Status:** Endangered, 1970
**Recovery Plans:** Federal, 1991

## 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. Whales processed at whaling stations in Bay City, Washington, and in British Columbia.

| Species | 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 were estimated at 971 whales based on ship surveys conducted in 2005 and 2008 (Carretta et al. 2011). Estimates of stock size are variable among years, with the most recent estimate being lower than in previous surveys (Carretta et al. 2011). 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. 2011). 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. 2011).

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).

**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. 2011), with the current population trend unknown. Mortality associated with ship strikes has been relatively high off California during the past several years, but no recent deaths from drift gillnet fisheries have been reported (Carretta et al. 2011). 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. 2011). 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. 2011). 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. 2011). Sightings of fin whales in the state's inner marine waters are very rare. There was a stranding of a fin whale in Washington in 2010.

**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. 2011). 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. 2011). 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.

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

**North Pacific right whale.** This species may be the most endangered large whale in the world (Allen and Angliss 2011). 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 2011). 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 2011). Current stock size and trend are not known, but the population is very small (Allen and Angliss 2011). 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.).

***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 2010, the last year having complete data, there was only one stranding (a fin whale) involving these six species in Washington. 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, Port Townsend Marine Science Center, Wolftown, Marine Science and Technology Center at Highline Community College, and local marine mammal stranding networks.

## Literature cited

Allen, B. M., and R. P. Angliss. 2011. Alaska marine mammal stock assessments, 2010. NOAA Technical Memorandum NMFS-AFSC-223, Alaska Fisheries Science Center, Seattle, Washington.

Brownell, R. L., P. J. Clapham, T. Miyashita, and T. Kasuya. 2001. Conservation status of North Pacific right whales. Journal of Cetacean Research and Management 2(Special Issue):269-286.

Calambokidis, J. 2009. Abundance estimates of humpback and blue whales off the US west coast based on mark-recapture of photo-identified individuals through 2008. Report # PSRG-2009-07 to the Pacific Scientific

Review Group, San Diego, California.
Calambokidis, J., and G. H. Steiger. 1990. Sightings and movements of humpback whales in Puget Sound, Washington. Northwestern Naturalist 71:45−49.
Calambokidis, J., E. Falcone, A. Douglas, L. Schlender, and J. Huggins. 2009. Photographic identification of humpback and blue whales off the U.S. west coast: results and updated abundance estimates from 2008 field season. Final Report for Contract AB133F08SE2786 for the Southwest Fisheries Science Center, La Jolla, California.
Calambokidis, J., E. A. Falcone, T. J. Quinn, A. M. Burdin, P. J. Clapham, J. K. B. Ford, C. M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J. M. Straley, B. L. Taylor, J. Urban, D. Weller, B. H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: structure of populations, levels of abundance and status of humpback whales in the North Pacific. Final report for Contract AB133F-03-RP-00078 prepared for U.S. Department of Commerce, Seattle, Washington.
Calambokidis, J., G. H. Steiger, D. K. Ellifrit, B. L. Troutman, and C. E. Bowlby. 2004. Distribution and abundance of humpback whales (*Megaptera novaeangliae*) and other marine mammals off the northern Washington coast. Fishery Bulletin 102:563-580.
Calambokidis, J., G. H. Steiger, K. Rasmussen, J. Urban R., K. C. Balcomb, P. Ladron de Guevara P., M. Salinas Z., J. K. Jacobsen, C. S. Baker, L. M. Herman, S. Cerchio, and J. D. Darling. 2000. Migratory destinations of humpback whales that feed off California, Oregon and Washington. Marine Ecology Progress Series 192:295-304.
Carretta, J. V., K. A. Forney, E. Oleson, K. Martien, M. M. Muto, M. S. Lowry, J. Barlow, J. Baker, B. Hanson, D. Lynch, L. Carswell, R. L. Brownell Jr., J. Robbins, D. K. Mattila, K. Ralls, and M. C. Hill. 2011. U.S. Pacific marine mammal stock assessments: 2010. NOAA Technical Memorandum NMFS-SWFSC-476, Southwest Fisheries Science Center, San Diego, California.
Douglas, A. B., J. Calambokidis, S. Raverty, S. J. Jeffries, D. M. Lambourn, and S. A. Norman. 2008. Incidence of ship strikes of large whales in Washington state. Journal of the Marine Biological Association of the United Kingdom 88:1121–1132.
Green, G. A., J. J. Brueggeman, R. A. Grotefendt, C. E. Bowlby, M. L. Bonnell, and K. C. Balcomb, III. 1992. Cetacean distribution and abundance off Oregon and Washington. Pages 1-1 to 1-100 in J. J. Brueggeman, editor. Oregon and Washington marine mammal and seabird surveys. Pacific OCS Region, Minerals Management Service, U.S. Department of the Interior, Los Angeles, California.
Gregr, E. J., L. Nichol, J. K. B. Ford, G. Ellis, and A.W. Trites. 2000. Migration and population structure of northeastern Pacific whales off coastal British Columbia: an analysis of commercial whaling records from 1908-1967. Marine Mammal Science 16(4):699-727.
Norman, S. A., C. E. Bowlby, M. S. Brancato, J. Calambokidis, D. Duffield, P. J. Gearin, T. A. Gornall, M. E. Gosho, B. Hanson, J. Hodder, S. J. Jeffries, B. Lagerquist, D. M. Lambourn, B. Mate, B. Norberg, R. W. Osborne, J. A. Rash, S. Riemer, and J. Scordino. 2004. Cetacean strandings in Oregon and Washington between 1930 and 2002. Journal of Cetacean Research and Management 6:87-99.
Rowlett, R. A., G. A. Green, C. E. Bowlby, and M. A. Smultea. 1994. The first photographic documentation of a northern right whale off Washington State. Northwestern Naturalist 75:102-104.
Scheffer, V. B., and J. W. Slipp. 1948. The whales and dolphins of Washington state with a key to the cetaceans of the west coast of North America. American Midland Naturalist 39:257-337.
Schorr, G. S., E. A. Falcone, J. Calambokidis, and R. D. Andrews. 2010. Satellite tagging of fin whales off California and Washington in 2010 to identify movement patterns, habitat use, and possible stock boundaries. Report prepared under Order No. JG133F09SE4477 from the Southwest Fisheries Science Center, La Jolla, California.

## 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 42 (L), 26 (J), and 20 (K) members in July 2011. 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 in 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.

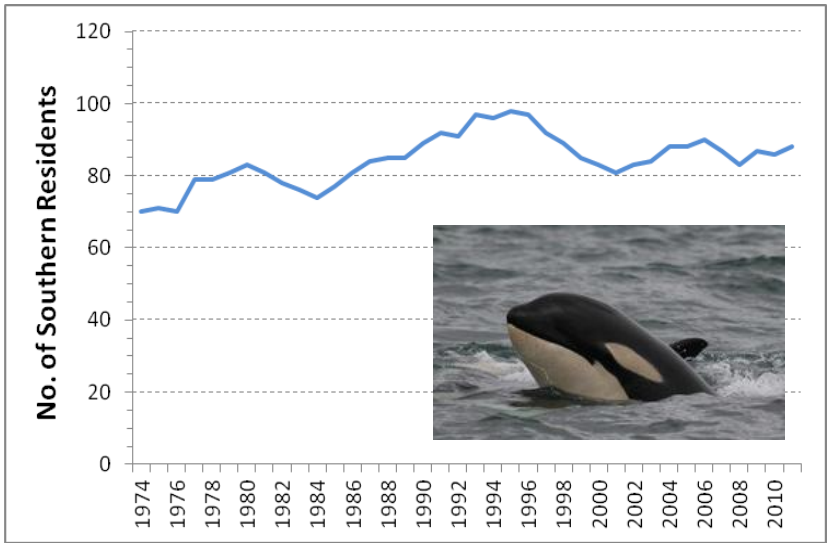



Figure 2. Population trend of southern resident killer whales, 1974-2011 (*photo by Robin Baird*).

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, but has increased since then and numbered 88 individuals in July 2011. In 2011, NOAA Fisheries completed a 5-year review concluding that the southern residents should remain listed as endangered (NMFS 2011). Transients and offshores are thought to total about 300-400 whales and at least 240 whales, respectively, 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 enactment of modern 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, 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.

***New vessel 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 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.

***Chinook salmon management.*** Because chinook salmon are the main food of the southern residents, NOAA Fisheries, Fisheries and Oceans Canada, and other partners have begun evaluating whether chinook fisheries in Washington and elsewhere along the West Coast may be having a negative effect on the whales' population. Analyses conducted to date suggest that there may be times when chinook availability is insufficient to meet the dietary needs of the whales (Ford et al. 2010, Williams et al. 2011). Completion of analyses will inform future harvest management decisions actions pertaining to chinook.

***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. The Puget Sound Partnership identified orcas as a dashboard 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 and participation in oil spill drills are ongoing. Among the many activities being done was the recent development of a protocol to haze killer whales away from oil spills. Hazing equipment (e.g., oikumi pipes, seal bombs) for this purpose was purchased in 2011 and has been pre-staged in the San Juans and Puget Sound for rapid deployment during a spill.

***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.

***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 view killer whales and other marine wildlife from shore (Figure 3). Twenty-five 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. Another non-profit, Orca Network, continues to post online sightings of killer whales and information about the species.

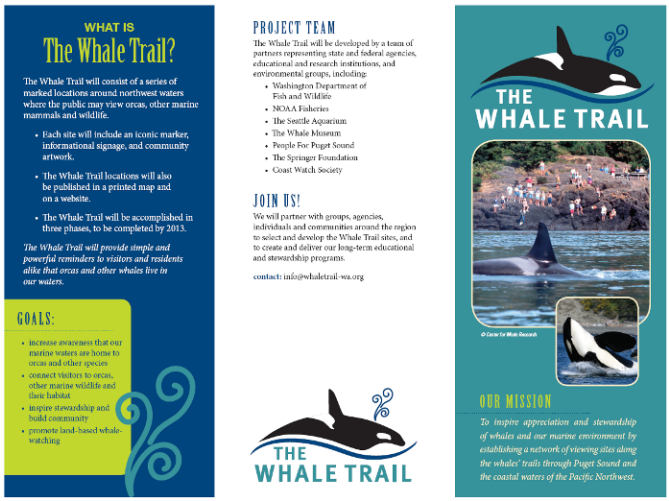



Figure 3. Brochure for The Whale Trail.

**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, People for Puget Sound, Olympic Coast National Maine Sanctuary, Coast Watch Society, Cascadia Research Collective, University of British Columbia, and others.

## Literature Cited

Ford, J. K. B., G. M. Ellis, P. F. Olesiuk, and K. C. Balcomb. 2010. Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator? Biology Letters 6:139-142.

Ford, J. K. B., G. M. Ellis, C. O. Matkin, M. H. Wetklo, L. G. Barrett-Lennard, and R. E. Withler. 2011. Shark predation and tooth wear in a population of northeastern Pacific killer whales. Aquatic Biology 11:213-224.

Hanson, M. B., R. W. Baird, J. K. B. Ford, J. Hempelmann-Halos, D. M. Van Doornik, J. R. Candy, C. K. Emmons, G. S. Schorr, B. Gisborne, K. L. Ayers, S. K. Wasser, K. C. Balcomb, K. Balcomb-Bartok, J. G. Sneva, and M. J. Ford. 2010. Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range. Endangered Species Research. 11:69-82.

NMFS (National Marine Fisheries Service). 2011. Southern resident killer whales (*Orcinus orca*), 5-year review: summary and evaluation. Northwest Region, National Marine Fisheries Service, Seattle, Washington

NMFS (National Marine Fisheries Service). 2008. Recovery plan for southern resident killer whales (*Orcinus orca*). Northwest Region, National Marine Fisheries Service, Seattle, Washington.

NOAA Fisheries Service. 2011. Southern resident killer whales research update. http://www.nwfsc.noaa.gov/publications/documents/SRKW%20Newsletter%202011.pdf.

Norton, D., D. Serdar, J. Colton, R. Jack, and D. Lester. 2011. Control of toxic chemicals in Puget Sound: assessment of selected toxic chemicals in the Puget Sound Basin, 2007-2011. Ecology Publication No. 11-03-055, Washington State Department of Ecology, Olympia, Washington, and King County Department of Natural Resources, Seattle, Washington. www.ecy.wa.gov/biblio/1103055.html

Puget Sound Partnership. 2008. Puget Sound action agenda: protecting and restoring the Puget Sound ecosystem by 2020. Puget Sound Partnership, Olympia, Washington.

Wiles, G. J. 2004. Washington state status report for the killer whale. Washington Department of Fish and Wildlife, Olympia, Washington.

Williams, R., M. Krkošek, E. Ashe, T. A. Branch, S. Clark, P. S. Hammond, E. Hoyt, D. P. Noren, D. Rosen, and A. Winshi. 2011. Competing conservation objectives for predators and prey: estimating killer whale prey requirements for chinook salmon. PLoS ONE 6(11):e26738. doi:10.1371/journal.pone.0026738.

## 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. Members of the Teanaway pack, April 2011 (*Photo by U.S. Forest Service*)

***Background.*** 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. Pack size in the northern U.S. Rockies averages 5-10 animals (Mitchell et al. 2008). Packs defend territories averaging 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 is expected to include 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 largest cause of death in most areas of North America, with illegal killing and lethal control to reduce livestock depredation being the main sources (Murray et al. 2010, Smith et al. 2010). Illegal killing has already been documented in Washington. 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 have been increasing in Washington since 2002 due in part to the recovery of wolf populations in Idaho, Montana, and Wyoming. Washington now has a small breeding population of wolves in the initial stages of recovery. The state's first fully documented wolf pack in many years was confirmed in Okanogan County in 2008. This was followed by the discovery of two additional packs in Pend Oreille County and single packs in Kittitas and Stevens counties from 2009 to 2011.

***Recovery Plan and Recovery Objectives.*** The Washington Fish and Wildlife Commission adopted a Wolf Conservation and Management Plan for Washington (Wiles et al. 2011) in December 2011. The plan serves as the state recovery plan under WAC 232-12-297. Recovery objectives for delisting are 15 successful breeding pairs for three years, with at least 4 in each of three recovery regions and three anywhere for three years (see map). If 18 successful breeding pairs (with at least 4 in each of three recovery regions and six anywhere) are confirmed in any one year, WDFW could consider delisting.

Goals of the plan are to: 1) restore the wolf population in the state to a self-sustaining size and geographic distribution that will result in wolves having a high probability of persisting through the foreseeable future (>50-100 years), 2) manage wolf-livestock conflicts in a way that minimizes livestock losses, while at the same time not negatively impacting the recovery or long-term perpetuation of a sustainable wolf population, 3) maintain healthy and robust ungulate populations in the state that provide abundant prey for wolves and other predators as well as ample harvest opportunities for hunters, and 4) develop public understanding of the conservation and management needs of wolves in Washington, thereby promoting

the public's coexistence with the species. WDFW began preparation of the plan in 2007. Development of the plan and accompanying Environmental Impact Statement included an extensive public process, with input received from a citizen-advisory Wolf Working Group, scientific peer reviews, public scoping and review (including comments from nearly 65,000 people), and WDFW reviews.

***Monitoring.*** WDFW conducts annual monitoring to determine numbers, distribution, and breeding success of wolf packs in the state. WDFW and partners conducted extensive efforts in 2011 to confirm wolf packs in the state, including on-the-ground investigation of wolf sighting reports and deployment of remote trail cameras to follow up on sighting reports. WDFW captured seven wolves in three packs (Diamond Pack, 3; Teanaway Pack, 3; Smackout Pack, 1) in 2011 and five were radio-collared. WDFW monitored radio-collared wolves during the year to determine home ranges and breeding status and success. Three of the five wolf packs in Washington were considered successful breeding pairs in 2011 (Teanaway, Smackout and Diamond). Successful breeding pairs are those with a breeding male and female with at least 2 pups that survive to 31 December. There was also evidence of two more packs: one in the Blue Mountains and a transboundary pack in Whatcom County/British Columbia. An Idaho pack used small portions of Pend Oreille County, and there were likely a few solitary wolves in other scattered locations. The state's population at the end of 2011 was a minimum of 27 wolves in the 5 confirmed packs.

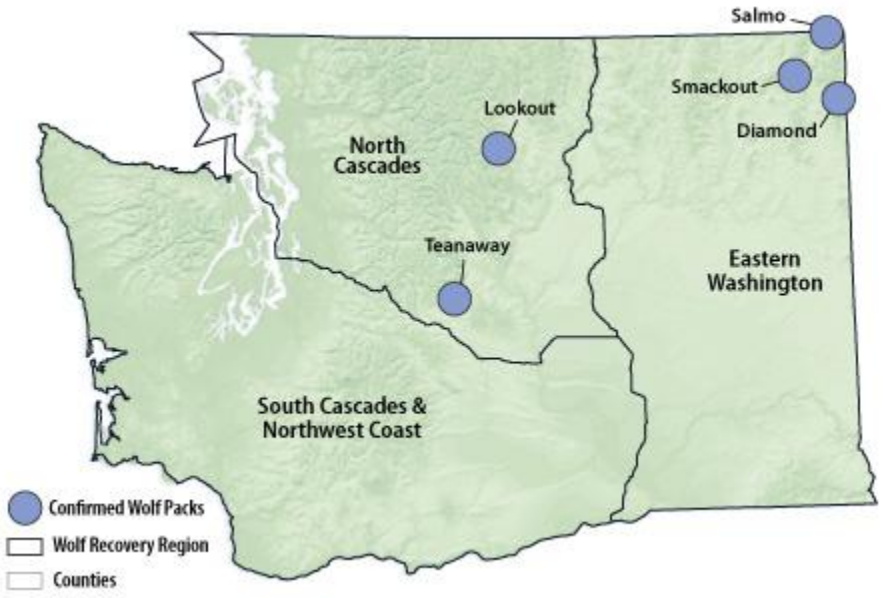



Figure 2. Wolf recovery regions in Washington and the locations of known packs in 2011.

***Outreach and other conservation activities.*** During 2011, WDFW and partner agencies advised some livestock operators on the use of non-lethal techniques for avoiding depredation. WDFW reimbursed one livestock owner for veterinary costs associated with a sheep herding dog injured by a wolf. The agency also began preparing a field manual for staff to use during investigations of potential predator-caused livestock deaths and injuries, and is conducting training for staff in early 2012. Outreach with livestock, hunting, and conservation groups was conducted and staff gave numerous talks during 2011 about wolves and wolf management. The British Broadcasting Corporation conducted filming and deployed remote cameras in Washington for a film on the return of wolves to the state, with WDFW and partners providing technical input and assistance. The Grizzly Bear Outreach Program added wolves to its program of conducting grassroots outreach in local communities on living with predators.

**Partners and cooperators:** U.S. Fish and Wildlife Service, U.S. Forest Service, National Park Service, Conservation Northwest, 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, British Broadcasting Corporation (BBC), Grizzly Bear Outreach Program, and Wolf Haven

International.

## Literature Cited

Hebblewhite, M. and D. W. Smith. 2010. Wolf community ecology: ecosystem effects of recovering wolves in Banff and Yellowstone national parks. Pages 69-120 *in* M. Musiani, L. Boitani, and P. C. Paquet. The world of wolves: new perspectives on ecology, behavior, and management. University of Calgary Press, Calgary, Alberta.

Mitchell, M. S., D. E. Ausband, C. A. Sime, E. E. Bangs, J. A. Gude, M. D. Jimenez, C. M. Mack, T. J. Meier, M. S. Nadeau, and D. W. Smith. 2008. Estimation of successful breeding pairs for wolves in the northern Rocky Mountains, USA. Journal of Wildlife Management 72:881-891.

Murray, D. L., D. W. Smith, E. E. Bangs, C. Mack, J. K. Oakleaf, J. Fontaine, D. Boyd, M. Jiminez, C. Niemeyer, T. J. Meier, D. Stahler, J. Holyan, and V. J. Asher. 2010. Death from anthropogenic causes is partially compensatory in recovering wolf populations. Biological Conservation 143:2514-2524.

Smith, D. W., E. E. Bangs, J. K. Oakleaf, C. Mack, J. Fontaine, D. Boyd, M. Jimenez, D. H. Pletscher, C. C. Niemeyer, T. J. Meier, D. R. Stahler, J. Holyan, V. J. Asher, and D. L. Murray. 2010. Survival of colonizing wolves in the northern Rocky Mountains of the United States, 1982-2004. Journal of Wildlife Management 74:620-634.

Wiles, G. J., H. L. Allen, and G. E. Hayes. 2011. Wolf Conservation and Management Plan for Washington. Washington Department of Fish and Wildlife, Olympia, Washington.

## 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.

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

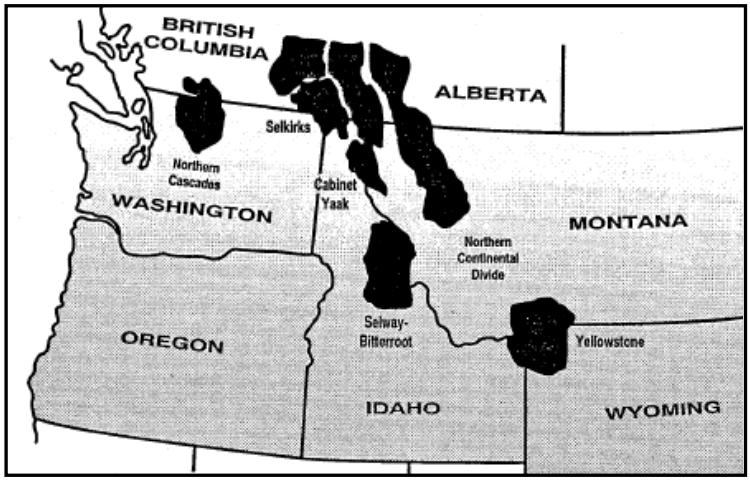



Figure 2. Grizzly bear ecosystems in the coterminous United States (USFWS 1993).

***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).

***North Cascades Ecosystem.*** An assessment by Almack et al. (1993) suggested 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), 1 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).

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)

In 2010 and 2011, 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 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.

Figure 3. Grizzly bear photographed in North Cascades, October 2010 (*photo by Joe Sebille*).

***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 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.

**Literature cited:**

Almack, J.A., W.L. Gaines, R.H. Naney, P.H. Morrison, J.R. Eby, G.F. Wooten, M.C. Snyder, S.H. Fitkin, and E.R. Garcia. 1993. North Cascades grizzly bear ecosystem evaluation: final report. Interagency Grizzly Bear Committee, Denver, CO, USA.

Craighead, J.J., and J.A. Mitchell. 1982. Grizzly bear. Pages 515-556 *in*. in J. A. Chapman and G. A. Feldhamer. (eds.) Wild Mammals of North America: biology, management, and economics. John Hopkins University Press, Baltimore, MD. 1147 pp.

Davis, J. R. 2008. British Columbia North Cascades Grizzly Bear Project: Final Report. Conservation Partnership Center. 5 pp.

North Cascades Grizzly Bear Recovery Team. 2004. Recovery Plan for Grizzly Bears in the North Cascades of British Columbia. 60 pp.

LeFranc, M.N., Jr., M.B. Moss, K.A. Patnode, and W.C. Sugg III, editors. 1987. Grizzly bear compendium. The National Wildlife Federation, Washington, DC, USA.

Mackie, R. S. 1997. Trading Beyond the Mountains: the British fur trade on the Pacific, 1793-1843. UBC Press, Vancouver.

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1991a. Food habits of Yellowstone grizzly bears, 1977-1987. Canadian Journal of Zoology 69:1619-1629.

Mattson, D.J., C.M. Gillin, S.A. Benson, and R.R. Knight. 1991b. Bear use of alpine insect aggregations in the Yellowstone ecosystem. Canadian Journal of Zoology 69:2430-2435.

Morgan, C., J. Davis, N. Laney, and T. Ford. 2004. The Grizzly Bear Outreach Project: promoting knowledge of grizzly bears among recovery zone residents in Washington's North Cascades. Washington Chapter of the Wildlife Society Meeting, February 2004. Abstract. (http://bearinfo.org/wildlife-conference-abstract/ ).

North Cascades Grizzly Bear Recovery Team. 2004. Recovery plan for grizzly bears in the North Cascades of British Columbia. 54 pp.

Proctor, M.F., D. Paetkau, B. McLellan, G. Stenhouse, K. Kendall, R. Mace, W. Kasworm, C. Servheen, C. Lausen, M. Boyce, and C. Strobeck. 2012. Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern USA. Wildlife Monographs 180:1-46.

Rode, K.D., and C.T. Robbins. 2000. Why bears consume mixed diets during fruit abundance. Canadian Journal of Zoology 78:1640-1645.

Romain-Bondi, K.A., R. B. Wielgus, L. Waits, W. F. Kasworm, M. Austin, and W. Wakkinen. 2004. Density and population size estimates for North Cascade grizzly bears using DNA hair-sampling techniques. Biological Conservation 117:417–428.

Schwartz, C.C., S.D. Miller, and M.A. Haroldson. 2003. Grizzly/brown bear. Pages 556-586 *in* G. Feldhamer, B. Thompson, and J. Chapman, eds. Wild mammals of North America: biology, management, and conservation. Johns Hopkins University Press, Baltimore, Maryland.

USFWS. 1998. Finding on Petitions To Change the Status of Grizzly Bear Populations in the North Cascades Area of Washington and the Cabinet-Yaak Area of Montana and Idaho From Threatened to Endangered Federal Register Vol. 63, No. 107 (June 4): 30453-30455.

USFWS. 1999. 12-month Finding on Petitions To Change the Status of Grizzly Bear Populations in the Selkirk Area in Idaho and Washington and the Cabinet-Yaak Area of Montana and Idaho From Threatened to Endangered. Federal Register Vol. 64, No. 94 (May 17): 26725-26733.

USFWS. 2011. Grizzly Bear *(Ursus arctos horribilis)* 5-Year Review: Summary and Evaluation U.S. Fish and Wildlife Service, Grizzly Bear Recovery Office, Missoula, Montana. 205 pp.

Wakkinen, W.L., and W.F. Kasworm. 2004. Demographics and population trends of grizzly bears in the Cabinet-Yaak and Selkirk Ecosystems of British Columbia, Idaho, Montana, and Washington. Ursus 15:65-75.

## Fisher

(*Martes pennanti*)

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

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

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.

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 (USFWS 2004). Historically, fishers occurred throughout the forested habitats of western Washington, northeastern Washington and the Blue Mountains of southeastern Washington. Fishers were apparently extirpated from Washington by the mid-1900s as the result of historical overharvest, incidental capture, predator control campaigns, and loss and fragmentation of low and mid-elevation coniferous forests. A lack of incidental detections (e.g., road-kills, incidental captures) in the 1980s and the lack of detections during extensive carnivore surveys in the 1990s prompted a fisher status review in Washington. The status review concluded that: 1) the fisher had been extirpated from the state, 2) it should be listed as endangered within Washington, and 3) reintroductions would be required to restore the species. The listing of the fisher as endangered in Washington in 1998 lead to the development of a fisher reintroduction feasibility assessment (Lewis and Hayes 2004), a fisher recovery plan for the state (Hayes and Lewis 2006), and an implementation plan for a fisher reintroduction in Olympic National Park (2006). The reestablishment of self-sustaining fisher populations in the Olympic Recovery Area (Olympic National Park and Olympic National Forest) and Cascades Recovery Area (i.e., forested area of the Cascades Range in Washington) were 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 about 100 fishers from central

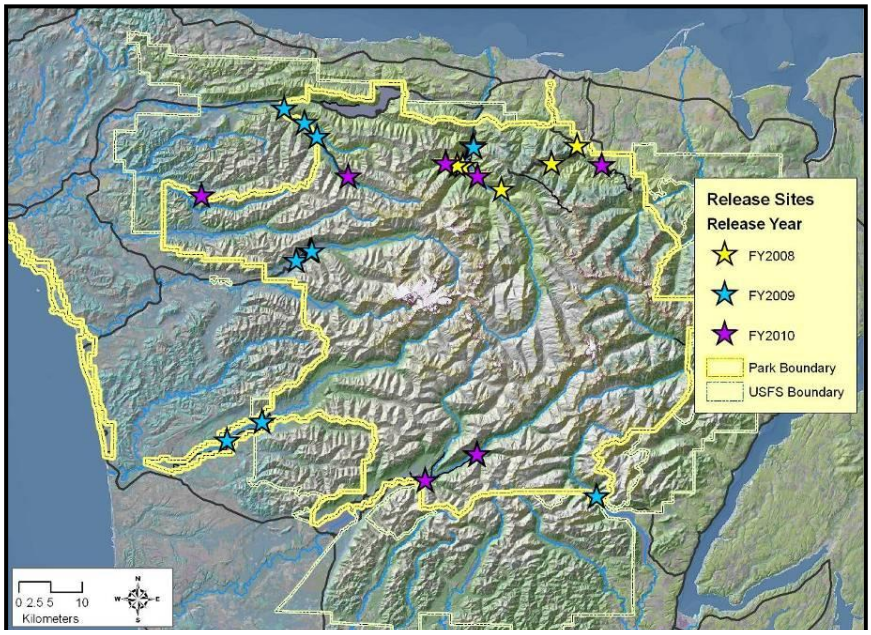



Figure 2. Release locations for fishers (n=90) in Olympic National Park in 2008 (yellow stars), 2009 (blue stars), and 2010 (purple stars).

British Columbia to Olympic National Park over 3 years.

Trapping efforts in British Columbia began in December 2007, and the first 11 fishers were released in Olympic National Park in January 2008. A total of 90 fishers (50 females, 40 males) were released at 9 locations in Olympic National Park from 2008 to 2010 (Figure 2).

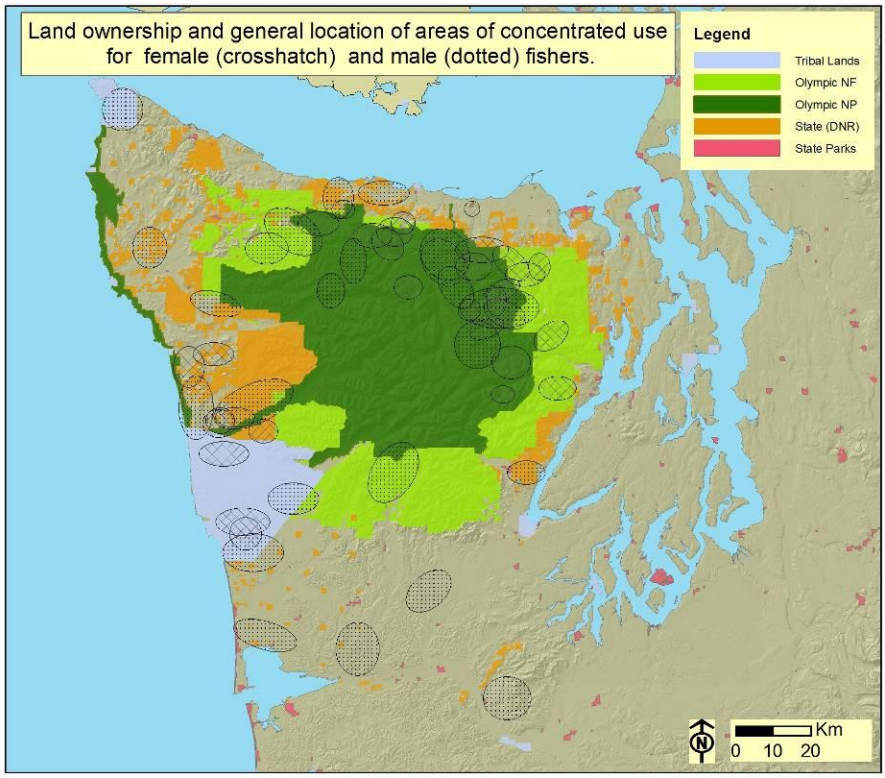



Figure 3. Approximate home ranges (areas of concentrated use) of radio-collared fishers released in Olympic National Park, 2008-2010.

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. The inaccessible nature of Olympic National Park, the rugged nature of the Park and surrounding environment, and the limited power of the radio-transmitters required WDFW and national park biologists to use aerial telemetry flights to get the bulk of the location data for released fishers. Ground telemetry and remote cameras were used to confirm that a female was occupying a den and caring for kits. 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 4 years, project biologists located 7 den sites by 7 females, with litter sizes that ranged from 1-4 kits. First year survival was 60% for released fishers, whereas the annual survival rate increased to 79% for fishers that survived their first year. Of the 30 fishers recovered, 8 (27%) died of unknown causes, 7 (23%) were killed by a predator, 6 (20%) were killed by a vehicle strike, 6 (20%) died of an unknown cause but possibly by a predator, 2 (7%) drowned, and 1 (3%) died after it was caught and escaped from a trap. Fishers moved extensively after being released but most fishers developed a home range by the end of their first summer (Figure 3). 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 on Olympic National Forest).

The initial monitoring project has been successful in tracking the reintroduced population. The success of the reintroduction project will be determined by long-term monitoring to assess fisher occupancy and population growth throughout the Olympic Recovery Area. A study design was developed in 2011 and funding is being sought to initiate a long-term monitoring project in summer 2012.

***Cascades fisher reintroduction project.*** Recovery criteria require that fisher populations be established

in the Cascade Recovery Area, as well as the Olympic Recovery Area. WDFW is now planning for a reintroduction effort in the Cascade Recovery Area. Biologists are conducting a habitat assessment of the Cascade Recovery Area to use new habitat data, information on fisher habitat use from the Olympic Recovery Area, and new analysis tools. This assessment will result in an updated habitat classification for fishers, and will: 1) identify concentrations of suitable habitat; 2) measure habitat connectivity among these concentration areas; and 3) identify the most suitable reintroduction areas in the Cascade Recovery Area. 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 2013.

**Partners and cooperators:** National Park Service, U.S. Geological Survey, British Columbia Ministry of Environment, British Columbia Trappers Association, Conservation Northwest, Doris Duke Foundation, Lower Elwha Klallam Tribe, U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Natural Resources, Washington's National Park Fund, Wildlife Conservation Society.

### Literature Cited

Lewis, J. C. 2006. Implementation plan for reintroducing fishers (*Martes pennanti*) to Olympic National Park. Washington Department of Fish and Wildlife, Olympia, Washington. http://wdfw.wa.gov/publications/pub.php?id=00230

Lewis, J. C., P. J. Happe, K. J. Jenkins, and D. J. Manson. 2011. Olympic fisher reintroduction project: 2010 progress report. Washington Department of Fish and Wildlife, Olympia, Washington. (available at: http://wdfw.wa.gov/wlm/diversty/soc/fisher/).

Lewis, J. C. and G. E. Hayes. 2004. Feasibility assessment for reintroducing fishers to Washington. Washington Department of Fish and Wildlife, Olympia, Washington.

Lewis, J. C. and D. W. Stinson. 1998. Washington state status report for the fisher. Washington Department of Fish and Wildlife, Olympia, Washington.

Hayes, G. E., and J. C. Lewis. 2006. Washington state recovery plan for the fisher. Washington Department of Fish and Wildlife, Olympia, Washington. 62 pp. http://wdfw.wa.gov/publications/pub.php?id=00228

National Park Service. 2007. Fisher reintroduction plan/environmental assessment. Olympic National Park, Port Angeles, Washington.

U.S. Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants; 12-month finding for a petition to list the west coast distinct population segment of the fisher (*Martes pennanti*). Federal Register 69(68):18770-18792.

## 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 coast from California to Japan, but was extirpated from most of its range by the early 1900s because of 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 steadily at 7.9% per year since 1989 to 1,154 animals in 2011 (Jameson and Jeffries 2011). 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.

***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

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

Tongue Point. The 2011 survey was made on 12-15 July and produced a total count of 1,154 sea otters (Figure 3; Jameson and Jeffries 2011). A high of 43 pups was counted, with a pup to independent otter ratio of 3.9:100. The single largest concentration (492) of sea otters was at Destruction Island. The southernmost otters were observed at Point Grenville and Willoughby Rock and the northeasternmost otter was sighted at Waadah Island near Neah Bay. Only two sea otters were observed in the Strait of Juan de Fuca east to Waadah Island. 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 2011, 62% of the population was south of La Push and 38% 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. No groups of multiple animals have been

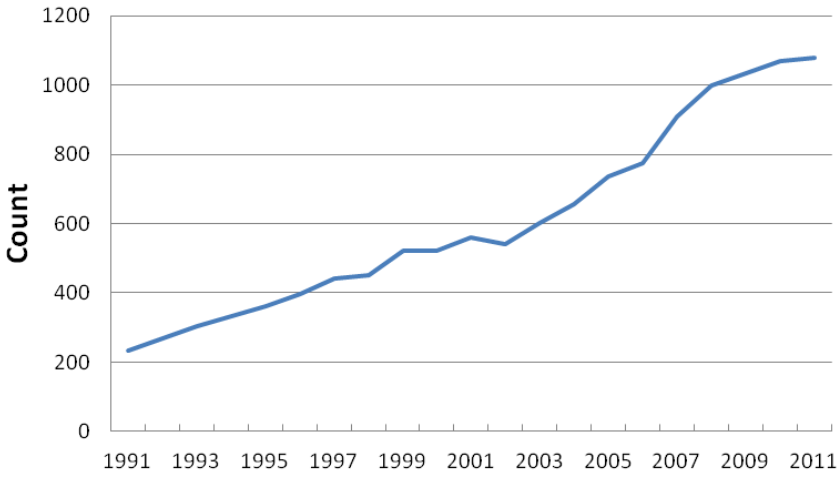



Figure 3. Growth of the sea otter population in Washington, showing the 3-year running average of counts, 1989-2011.

noted in these areas, thus the small number of sea otters in this region does not add significantly to the state's total population.

***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 new 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 was completed in 2009 (WDFW 2009). It provides guidance on the preferred methods for locating, recovering and rehabilitating sea otters injured by contact with oil during an oil spill.

**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.

## Literature cited

Bowlby, C. E., B. L. Troutman, and S. J. Jeffries. 1988. Sea otters in Washington: distribution, abundance, and activity patterns. Final report prepared for National Coastal Resources Research and Development Institute, Hatfield Marine Science Center, Newport, Oregon.

Estes, J. A. and D. O. Duggins. 1995. Sea otters and kelp forests in Alaska: generality and variation in a community ecological paradigm. Ecological Monographs 65:75-100.

Estes, J. A., R J. Jameson, and E. B. Rhode. 1982. Activity and prey selection in the sea otter: influence of population status on community structure. American Naturalist 120:242-258.

Jameson, R. J. and S. Jeffries. 2011. Results of the 2011 survey of the reintroduced sea otter population in Washington state. Washington Department of Fish and Wildlife, Lakewood, Washington.

Kenyon, K. W. 1969. The sea otter in the eastern Pacific Ocean. North American Fauna 68:1-352.

Kvitek, R. G., P. J. Iampietro, and C. E. Bowlby. 1998. Sea otters and benthic prey communities: a direct test of the sea otter as keystone predator in Washington state. Marine Mammal Science 14:895-902.

Laidre, K. L. and R. J. Jameson. 2006. Foraging patterns and prey selection in an increasing and expanding sea otter population. Journal of Mammalogy 87:799–807.

Laidre, K. L., R. J. Jameson, E. Gurarie, S. J. Jeffries, and H. Allen. 2009. Spatial habitat use patterns of sea otters in coastal Washington. Journal of Mammalogy 90:906-917.

Lance, M. M., S. Richardson, and H. Allen. 2004. Washington state recovery plan for the sea otter. Washington Department of Fish and Wildlife, Olympia, Washington.

Riedman, M. L. and J. A. Estes. 1990. The sea otter (*Enhydra lutris*): behavior, ecology, and natural history. U.S. Fish and Wildlife Service Biological Report 90(14):1-126.

Scheffer, V. B. 1940. The sea otter on the Washington coast. Pacific Northwest Quarterly 10:370-388.

WDFW (Washington Department of Fish and Wildlife). 2009. Oiled sea otter response handbook. Washington Department of Fish and Wildlife, Olympia, Washington. 66 pp.

## 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 of buck 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 individuals or more 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 (Refuge) mainland 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 Refuge 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 600 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 collisions, disease, flooding events, and hybridization with black-tailed deer, affect the population and

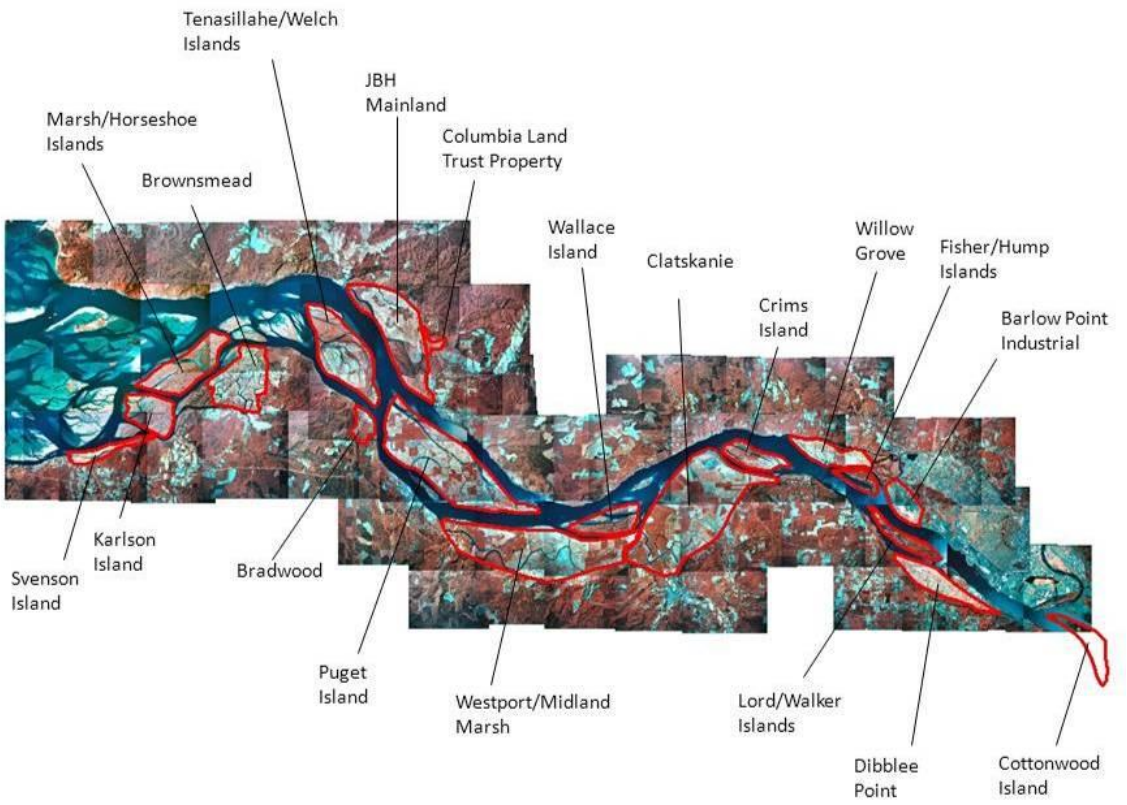



Figure 3. Current range of the Columbia River population of Columbian white-tailed deer along the lower Columbia River (USFWS and WDFW 2011).

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 Refuge. 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 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).

Table 1. Estimates of Columbia River subpopulations of Columbian white-tailed deer, 2011.

| Site | Population estimate |
|---|---|
| Julia Butler Hansen Refuge mainland[a] | 83 |
| Tenasillahe Island | 90 |
| Puget Island | 171 |
| Crims Island | 18 |
| Lord/Walker and Fisher/Hump islands | 10 |
| Cottonwood Island | 3 |
| Wallace Island/Westport | - |
| Nelson Creek | - |
| **Total** | 603[b] |

[a]Includes Hunting and Price islands.
[b]Includes estimates from residual populations in Clatskanie Flats, Brownsmead, Willow Grove and Barlow Point.

In 2006, translocation efforts began to augment the declining Refuge 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 Refuge mainland subpopulation, which currently supports about 83 deer. Of these translocation efforts, Tenahsillahe, Crims, and the Refuge mainland have shown the most success (Table 2). The USFWS is also actively restoring Refuge habitat to establish cover and provide forage for deer.

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

Table 2. Summary of land acquisitions and translocation activity for secured CWTD habitat.

| Site Name | Acres | Year Secured | Translocations | |
|---|---|---|---|---|
| | | | Year | No. of deer |
| Refuge 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.

## Literature Cited


Clark, A., G. Phillips, K. Kilbride, and T. Kollasch. 2010. Factors affecting Columbian white-tailed deer fawns in the lower Columbia River. Unpublished manuscript. 21 pp.

Cowlitz Tribe of Indians. 2010. Columbian white-tailed deer summary report. 7 pp.

Gavin, T. A. 1984. Pacific Northwest. Pages 487–496 *in* L. K. Halls, ed. White-tailed deer: ecology and management. Stackpole, Harrisburg, Pennsylvania.

Piaggio, A. and M. Hopken. 2009. Evolutionary relationships and population genetic assessment of Oregon white-tailed deer. Unpublished manuscript. 37 pp.

Piaggio, A. and M. Hopken. 2010. Genetic assessment of Columbian white-tailed deer (*Odocoileus virginianus leucurus)* and Columbian black-tailed deer (*Odocoileus hemionus columbianus*) hybridization on the Julia Butler Hansen Refuge. Unpublished manuscript. 34 pp.

USFWS (U.S. Fish and Wildlife Service). 1983. Revised Columbian white-tailed deer recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 86 pp.

USFWS (U.S. Fish and Wildlife Service). 2003. Final Rule To Remove the Douglas County Distinct Population Segment of Columbian White-Tailed Deer From the Federal List of Endangered and Threatened Wildlife. Federal Register 68(142):4364 -43659.

USFWS & WDFW (U.S. Fish and Wildlife Service and Washington Department of Fish and Wildlife). 2011. Columbia River Distinct Population Segment of the Columbian white-tailed deer (*Odocoileus virginianus leucurus*) 5-Year Review: Summary and Evaluation DRAFT. 44 pp.

Whitney, L. W., R. G. Anthony, and D. H. Jackson. 2011. Resource partitioning between sympatric Columbian white-tailed and black-tailed Deer in western Oregon. Journal of Wildlife Management 75:631–645.

## 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 Selkirks above 4,000 ft, and these caribou are often referred to as "mountain caribou". 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.

Selkirk Mountains 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.


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

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 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.

***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, which support abundant arboreal lichens on which they 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).

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.

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.*** Wakkinen et al. (1996) developed a census technique for the woodland 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 43 caribou in 2010, 41 in B.C. and 2 in the U.S. Recruitment in the South Selkirks continued to be low (7%), with only 3 calves observed (Table 1; Wakkinen et al. 2010).

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 11just 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.

Table 1. Winter census, South Selkirk Woodland Caribou, 2002-2010 (Wakkinen et al. 2010).

| 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) |

[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

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 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 (USFWS 2011).

***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.

**Literature Cited:**


Almack, J, A., 1998. Mountain Caribou Recovery in the southern Selkirk Mountains of Washington, Idaho, and British Columbia. Progress report, October 1995-September 1998. Washington Department of Fish and Wildlife, Olympia, 45 pp.

Mitchell, S. and D. Hamilton. 2007. Snowmobiling and Mountain Caribou: a Literature Review of stewardship Practices. Version 4.0. Nanuq Consulting Ltd. Nelson, BC. Prepared for: Eileen Fletcher, Tourism Action Society for the Kootenays, Revelstoke, BC.

Mountain Caribou Science Team. 2005. Mountain Caribou in British Columbia: A Situation Analysis. 19 May 2005.

Mountain Caribou Technical Advisory Committee. 2002. A Strategy for the Recovery of Mountain Caribou in British Columbia. British Columbia, Ministry of Water, Land and Air Protection. 85 pp.

Rettie, W.J. and F. Messier. 1998. Dynamics of woodland caribou populations at the southern limit of their range in Saskatchewan. Canadian Journal of Zoology, 76:251– 259.

Rominger, E.M. 1995. Late winter foraging ecology of woodland caribou. Ph.D. Dissertation, Washington State University, Pullman, Washington. 68 pp.

Rominger, E.M. and J.L. Oldemeyer. 1989. Early-winter habitat of woodland caribou, Selkirk Mountains, British Columbia. Journal of Wildlife Management 53: 238–243.

Rominger, E.M., Robins, C.T. and Evans, M.A. 1996. Winter foraging ecology of woodland caribou in northeastern Washington. Journal of Wildlife Management 60:719–728.

Seip, D. R., C. J. Johnson, and G. S. Watts. 2007. Displacement of Mountain Caribou from Winter Habitat by Snowmobiles. Journal of Wildlife Management 71:1539–1544.

USFWS. 1994. Recovery Plan for Woodland Caribou in the Selkirk Mountains. Portland, Oregon. 71 pp.

USFWS. 2011. Designation of Critical Habitat for the Southern Selkirk Mountains Population of Woodland Caribou (*Rangifer tarandus caribou*): Proposed rule. Federal Register 76(230):74018-74038.

Wakkinen, W., L. DeGroot, R. Clarke, and T. Hill. 2010. 2010 Woodland Caribou Census: South Selkirk Mountains. Idaho Fish & Game, British Columbia Ministry of Environment, and Fish and Wildlife

Compensation Program – Columbia Basin. 7 pp.
Wakkinen, W., Compton, B.B., Zager, P. and Skalski, J.R. 1996. A Census Technique for Monitoring Woodland Caribou. Idaho Department of Fish and Game, Bonners Ferry, ID.
Wilson, S. F., and Hamilton, D. 2003. Cumulative effects of habitat change and backcountry recreation on mountain caribou in the Central Selkirk Mountains. EcoLogic Report Series No. 10. Prepared for; BC Ministry of Sustainable Resource Management, Nelson, Canadian Mountain Holidays, Banff AB, and Pope & Talbot Ltd., Nakusp BC.
Wittmer, H. U. 2004. Mechanisms underlying the decline of mountain caribou (*Rangifer tarandus caribou*) in British Columbia. Ph.D. Dissertation. University of British Columbia, Victoria.
Wittmer, H. U., A. R. E. Sinclair, and B. N. McLellan. 2005. The role of predation in the decline and extirpation of woodland caribou. Oecologia 144:257–267.
Wittmer, H.U., B.N. McLellan, R. Serrouya, and C. D. Apps. 2007. Changes in landscape composition influence the decline of a threatened woodland caribou population. Journal of Animal Ecology 76:568–579.

## American White Pelican

(*Pelecanus erythrorhynchos*)

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

Figure 1. American white pelican, Grant County (*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). 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 stated that the Moses Lake colony continued 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 (Figure 2), and there is little use of Crescent Island. In 2010, white pelicans nested for the first time on Miller Sands, which is in Oregon in the upper Columbia River estuary; 64 large chicks were present in August (Roby and Collis 2010).

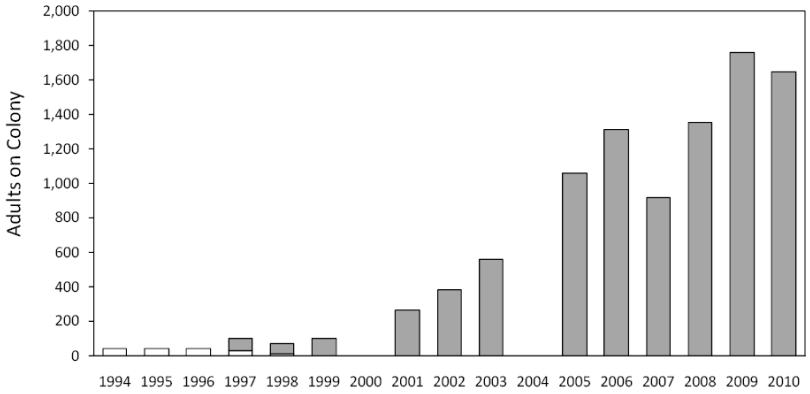



Figure 2. Numbers of American white pelicans counted in aerial photographs at Crescent Island (white bars), and Badger Island (gray bars), during the 1994-2010 breeding seasons (from Roby and Collis 2010).

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 (Figure 3), and 1,310 were counted from an aerial photo of the Badger Island colony.

***Limiting factors.*** 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.

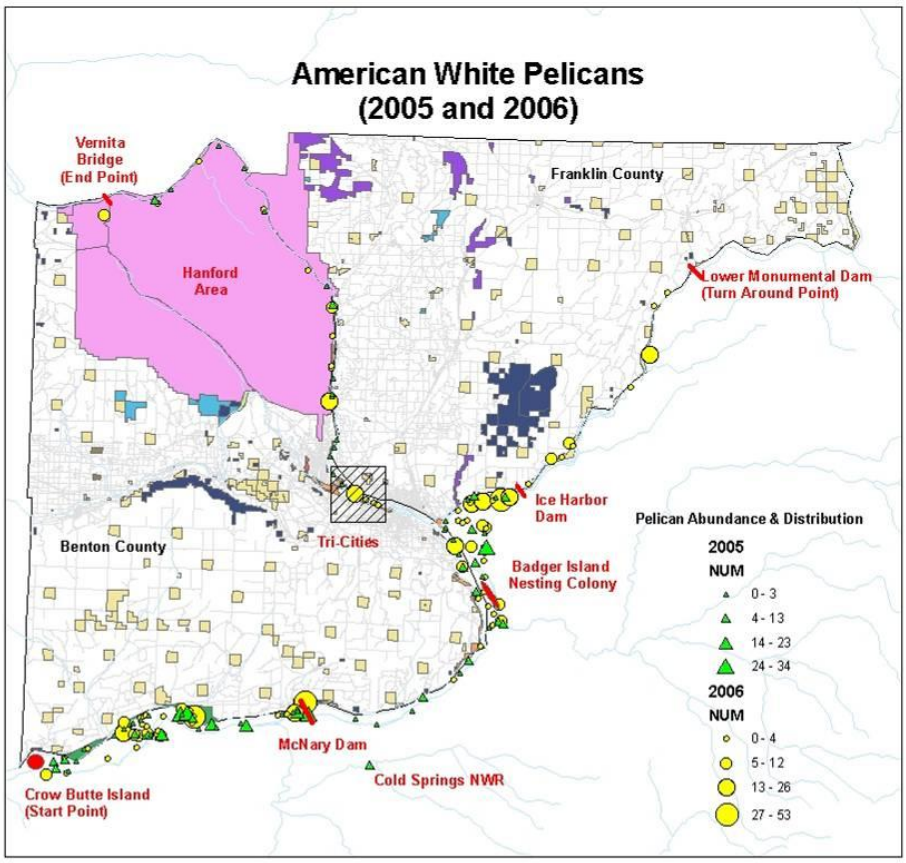



Figure 3. White pelican counts during aerial surveys of the Columbia and Snake Rivers in May 2005, 2006.

Pelicans nesting at Badger Island 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 2010). 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.

Many wetlands in the arid West are affected by insecticides, fertilizers, and other agricultural pollutants. Residues of DDE, (a breakdown product of the insecticide DDT), which caused eggshell thinning, remain in sediments. Large die-offs of pelicans in recent decades have been linked to toxaphene poisoning, an insecticide carried into marshes in waste irrigation water. Water diversion and draining of wetlands for agriculture, along with recreational boating, have destroyed or degraded many traditional feeding, breeding, and loafing areas. Although the U.S. population of white pelicans has recovered substantially, populations remain somewhat vulnerable to habitat degradation, contaminants, disturbance, and shooting.

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

## Literature Cited

Ackerman, S. M. 1994. American white pelicans nest successfully at Crescent Island, Washington. Washington Birds 3:44-49.

Ackerman, S. M. 1997. Update: American white pelican colony. WOSNews 51, October/November. Washington Ornithological Society.

Dawson, W. L., and J. H. Bowles. 1909. The birds of Washington. Volume II. Occidental Publishing Company, Seattle, Washington.

Evans, R. M., and F. L. Knopf. 1993. American white pelican (*Pelecanus erythrorhynchos*). No. 57 *in* A. Poole and F. Gill, editors. The Birds of North America. Academy of National Science and American Ornithologists Union, Philadelphia, Pennsylvania.

Jewett, S. G., W. P. Taylor, W. T. Shaw, and J. W. Aldrich. 1953. Birds of Washington State. University of Washington Press, Seattle, Washington.

Roby, D. and K. Collis. 2010. Research, Monitoring, and Evaluation of Avian Predation on Salmonid Smolts in the Lower and Mid-Columbia River. Draft 2010 Annual Report, prepared for Bonneville Power Administration and the U.S. Army Corps of Engineers.166 pp. Available at: http://www.birdresearchnw.org/Project-Info/publications-reports/default.aspx

## Brown Pelican

(*Pelecanus occidentalis*)

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

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

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 sardine, and northern anchovies (USFWS 2009).

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. 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).

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. The species will likely be proposed for down-listing to Sensitive in Washington. Brown pelicans are protected from 'take' by federal law (Migratory Bird Treaty Act), and would remain protected by state law (as 'protected wildlife') after down-listing to Sensitive.

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

**Literature Cited**

Shields, M. 2002. Brown Pelican (*Pelecanus occidentalis*). *In* The Birds of North America, No. 609 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington D.C.

USFWS. 2009. Removal of the Brown Pelican (*Pelecanus occidentalis*) from the federal list of endangered and threatened wildlife: Final Rule. Federal Register 74(220): 59444-59472 (November 17, 2009).

Wahl, T. R. 2005. Brown Pelican. Pages 96-97 *in* T. R. Wahl, B. Tweit, and S. G. Mlodinow, eds. Birds of Washington: status and distribution. Oregon State University Press, Corvallis. 436 pp.

## 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 use Washington habitats: 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 sandhills (Canadians [*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.

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 2011, at least 30 territorial pairs nested in Washington (Table 1); the total summer population of greater sandhills in Washington was 80 birds (not including young of the year). 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 State population has been growing slowly since monitoring began, excluding 1995, 2001 and 2002 (Stocking et al. 2008).

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

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.

***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

Table 1. Greater Sandhill Crane breeding pairs and production in Washington, 1995-2011(Stocking et al. 2008, and USFWS-Conboy NWR, data).

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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] |
| Pairs, nesting unconfirmed[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] |
| Recruitment[h] | 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).

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.

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. 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.

**Partners and cooperators:** U.S. Fish and Wildlife Service, Conboy Lake NWR, Ridgefield NWR, Yakama Nation, International Crane Foundation, Washington Department of Natural Resources, and the West Coast Crane Working Group.

**Literature Cited**

Engler, J. D, E. D. Anderson, and M. A. Stern. 2003. Population status of fall-migrant sandhill cranes along the lower Columbia River, 2003 report. U.S. Fish and Wildlife Service, Ridgefield National Wildlife Refuge Complex, and The Nature Conservancy of Oregon.

Stocking, J., J. D. Engler, and D. P. Anderson. 2007. Final 2007 status report on the breeding population of the

Washington state greater sandhill crane (*Grus canadensis tabida*) in Klickitat and Yakima Counties. North American Crane Working Group, U. S. Fish and Wildlife Service, and Washington Dept. of Fish and Wildlife.

Stocking, J., , D. P. Anderson and J. D. Engler. 2008. 2008 Greater Sandhill Crane breeding season at Conboy Lake NWR, Klickitat County, Washington: Final report. North American Crane Working Group, U. S. Fish and Wildlife Service, and Washington Dept. of Fish and Wildlife.

Hayes, M. A., G. L. Ivey, J. C. Palmer, M. L. Casazza, J. P. Fleskes, C. P. Herziger[3], B. D. Dugger, and M. E. Berres. In Prep. Population genetic structure of sandhill cranes in the Pacific Flyway of Western North America.

Ivey, G. L.,C. P. Herziger, and T. J. Hoffmann. 2005. Annual movements of Pacific Coast Sandhill Cranes. Proceedings North American Crane Workshop 9:25-35.

Littlefield, C. D., and G. L. Ivey. 2002. Washington State Recovery Plan for the Sandhill Crane. Washington Department of Fish and Wildlife, Olympia, Washington. 71 pp.

## 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. Perhaps never abundant, and apparently 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).

### Literature Cited

McAllister, K. R.1995. Washington state recovery plan for the upland sandpiper. Washington Department of Fish and Wildlife, Olympia, Washington. 50 pp.

Mlodinow, S. G. 2005. Upland sandpiper. Pp. 145 *in* T. R. Wahl, B. Tweit, and S. G. Mlodinow, eds. Birds of Washington: status and distribution. Oregon State University Press, Corvallis, Oregon.

## Snowy Plover

(*Charadrius nivosus*)

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

Figure 1. Snowy plover (*photo by Rod Gilbert)*.

The Pacific coast population of the snowy plover breeds from Damon Point, 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).

Historically, five areas supported nesting plovers in Washington (Figure 2; Richardson 1995), but that number has slowly declined to just two 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., planting of non-native and invasive beachgrasses; Richardson 1995).

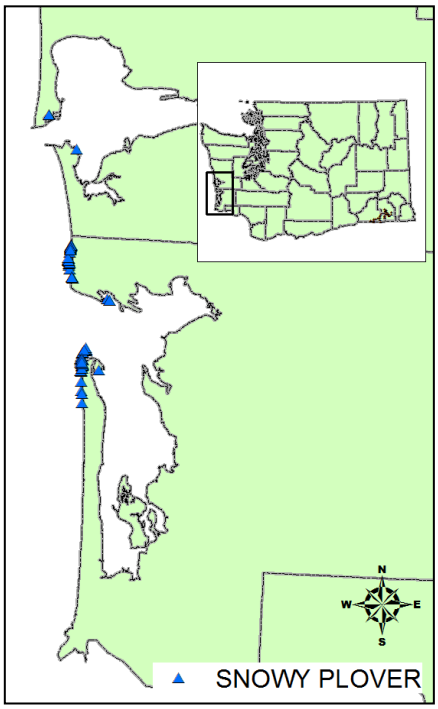



Figure 2. Snowy plover nesting areas in Washington.

***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.

During 2011, 26 surveys were conducted on 11 sites to assess occupancy or count the number of nesting adults. Snowy plovers were found nesting only on Leadbetter Point and Midway Beach. The adult breeding population estimate for Washington in 2011 was 40 birds. This represents a mean population decline of about 5 birds per year since 2006, when 65 plovers were counted (Table 1).

Table 1. Adjusted counts (95% CI) of breeding adults at four nesting sites in Washington, 2006-2011 (Pearson et al. 2010; S. Pearson, unpubl. data).

| Site | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| Damon Point | 1 (-1-3) | 0 | 0 | 0 | 0 | 0 |
| Graveyard | 2 (-1-6) | 2(-1-5) | 1(0-2) | 0 | 0 | 0 |
| Midway Beach | 23(15-30) | 19(16-23) | 16(11-22) | 16(14-19) | 17(13-21) | 24(10-38) |
| Leadbetter Pt. | 39(28-49) | 27(22-33) | 36(26-47) | 19(11-27) | 35(26-44) | 16(8-24) |
| Total | 65(53-77) | 48(39-58) | 54(38-69) | 35(26-44) | 43(39-46) | 40(20-60) |

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 2011, the estimated number of young fledged per adult male in Washington was 1.7 (95% CI = 0.9-2.7), which was higher than in the previous few years.

The population decline in Washington would likely be greater without immigration. The number of banded adult birds detected on adult population surveys at Leadbetter and Midway averaged 59% and 35% respectively in 2008, 40% and 44% respectively in 2009, and 61% and 60% respectively in 2010. Many of these birds were banded in Oregon and California, indicating that birds are moving into Washington. Immigration of Oregon birds into Washington likely results from Oregon's increasing plover population and high fledging success rate (≥ 1.0; Lauten et al. 2010).

During the 2011 nesting season, the probability of nest survivorship was 26% at Midway and Graveyard combined and 33% at Leadbetter (S. Pearson, unpubl. data). Three nests were exclosed at Midway Beach. Nest survivorship of unexclosed nests was 25%. 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 28% (including exclosed and unexclosed). The main sources of nest failure in 2011 were predation by coyotes and ravens, and abandonment.

***Recent management actions.*** 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). Thus, various management actions aimed at limiting human disturbance have been conducted to protect nesting snowy plovers in Washington in recent decades. In 2011, 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 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. 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 2011 to reduce the amount of human activity in active nesting areas at Leadbetter Point and Midway/Grayland Beach.

***Habitat restoration.*** Habitat improvement work by the U.S. Fish and Wildlife Service included maintaining and enhancing a 121-acre Habitat Restoration Area at Leadbetter Point. This was done primarily through the treatment on undesirable vegetation with herbicide.

**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.

## Literature Cited

Lauten, D. J., K. A. Castelein, J. D. Farrar, A. Kotiach, and E. P. Gaines. 2010. The distribution and reproductive success of the western snowy plover along the Oregon coast – 2010. The Oregon Natural Heritage Information Center, Institute for Natural Resources, Portland State University, Portland, Oregon.

Nur, N., G. W. Page, and L. E. Stenzel. 1999. Population viability analysis for Pacific coast snowy plovers. Point Reyes Bird Observatory, Stinson Beach, California.

Page, G. W., J. S. Warriner, J. C. Warriner, and P. W. C. Paton. 1995. Snowy plover (*Charadrius alexandrinus*). *In* The Birds of North America, No. 154 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Pearson, S. F., C. Sundstrom, and K. Gunther, D. Jaques, and K. Brennan. 2009a. Snowy plover population monitoring, research, and management actions: 2008 nesting season research progress report. Washington Department of Fish and Wildlife, Olympia, Washington.

Pearson, S. F., C. Sundstrom, and K. Gunther, W. Ritchie, and K. Gunther. 2009b. Snowy plover population monitoring, research, and management actions: 2009 nesting season research progress report. Washington Department of Fish and Wildlife, Olympia, Washington.

Pearson, S. F., C. Sundstrom, W. Ritchie, and K. Gunther. 2010. Washington State snowy plover population monitoring, research, and management: 2010 nesting season research progress Report. Washington Department of Fish and Wildlife, Olympia, Washington.

Richardson, S. A. 1995. Washington State recovery plan for the snowy plover. Washington Department of Fish and Wildlife, Olympia, Washington. 87 pp.

Ruhlen, T. D., A. Abbot, L. E. Stenzel, and G. W. Page. 2003. Evidence that human disturbance reduces snowy plover chick survival. Journal of Field Ornithology 74:300-304.

USFWS (U.S. Fish and Wildlife Service). 2007. Recovery plan for the Pacific coast population of the western snowy plover (*Charadrius alexandrinus nivosus*). 2 volumes. U.S. Fish and Wildlife Service, Sacramento, California.

Warriner, J. S., J. C. Warriner, G. W. Page, and L. E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. Wilson Bulletin 98:15-37.

## 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 lowland areas 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 used only rarely (Gutiérrez et al. 1995, Courtney et al. 2004).

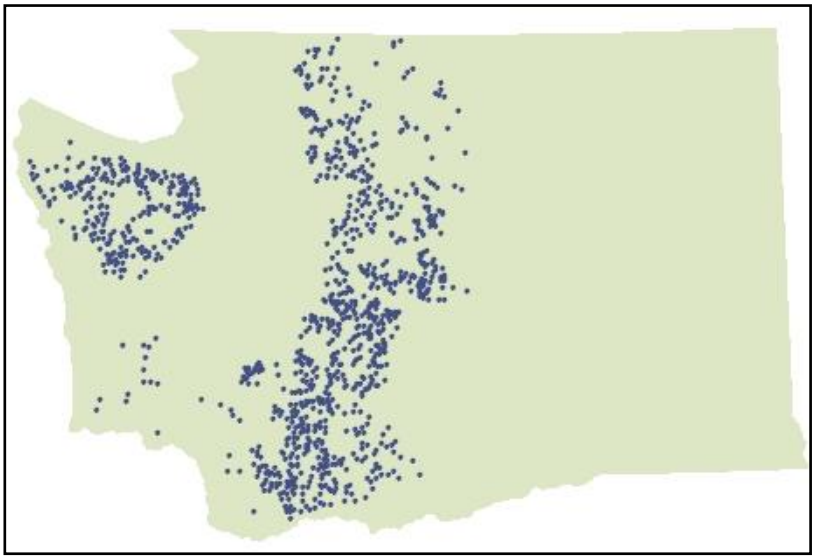


Figure 2. Cumulative distribution of 1,070 known spotted owl sites in Washington from 1976 to 2011. The number of currently occupied sites is unknown.

Forests used by spotted owls in the lower and mid-slopes of the eastern Cascade Range tend to be younger than forests used elsewhere in Washington, and

owls in those areas nest in abandoned northern goshawk (*Accipiter gentilis*) nests or clumps of branches infected by mistletoe (Buchanan et al. 1993). 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 and secure 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*) (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) suggest 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. 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: Cle Elum, the eastern Cascade Range, the Olympic Peninsula, and Mt. Rainier (Anthony et al. 2006). The eastern Cascade Range work was discontinued, but the others have continued. Results from the four studies have demonstrated population declines (Anthony et al. 2006). The most recent analysis for the three populations through 2008 indicated declines of 4.3 to 7.1% (Forsman et al. 2011). 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.).

***Habitat loss.*** The two most important limiting factors affecting spotted owls in Washington are habitat loss and negative competitive effects resulting from interactions 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 (Pierce et al. 2005).

Fire and wind events have destroyed or altered spotted owl habitat throughout the range of the species. In Washington, one of the most significant wind events was a 1921 cyclone (Mass and Dotson 2010) now commonly 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 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 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, but see Hanson et al. 2009). Insect outbreaks can also impact spotted owl habitat. An ongoing large area of spruce budworm outbreak in the eastern Cascade Range impacted large patches of spotted owl habitat in and near the

Teanaway River Basin.

***Competition with barred owls.*** The barred owl has recently expanded its range into the Pacific Northwest and California and is now found throughout most of the 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 spotted owl range. The greatest spotted owl population declines have been reported from Washington and northern Oregon, and the rate 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) and have influenced spotted owl vocalization behavior (Kroll et al. 2010, 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.).

***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, may moderate some of these concerns in that portion of the owl's range (Franklin et al. 2008).

***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. The proposals address the threats of habitat loss and competition from the encroaching barred owl (Buchanan et al. 2007); they are: 1) A proposed revised critical habitat designation for the spotted owl, 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 2012a, b).

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 also 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 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).

A plan completed in 2009 addresses forest management for Port Blakely's Morton tree farm (over 50,000 acres) combines federal and state aspects. It includes a Landowner Option Plan, authorized under the Washington State Forest Practices Rules, and a Safe Harbor Agreement, authorized under the federal Endangered Species Act (ICF Jones & Stokes 2009). The plan includes use of longer harvest rotations and recruitment of snags, and will allow the company to manage their forest in a manner that provides dispersal habitat while alleviating regulatory risk that would ordinarily result if spotted owls established a territory on the tree farm as a result of the company's management.

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

## Literature Cited


Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutiérrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid and S.G. Sovern. 2006. Status and trends in demography of northern spotted owls, 1985–2003. Wildlife Monograph 163:1-48.

Bevis, K.R., G.M. King, and E.E. Hanson. 1997. Spotted owls and 1994 fires on the Yakama Indian Reservation. Pages 117-122 *in* J.M. Greenlee, editor. Fire effects on rare and endangered species and their habitats. International Association of Wildland Fire, Fairchild, Washington.

Buchanan, J.B., R.J. Gutiérrez, R.G. Anthony, T. Cullinan, L.V. Diller, E.D. Forsman, and A.B. Franklin. 2007. A synopsis of suggested approaches to address potential competitive interactions between barred owls (*Strix varia*) and spotted owls (*S. occidentalis*). Biological Invasions 9:679-691.

Buchanan, J.B., L.L. Irwin, and E.L. McCutchen. 1993. Characteristics of spotted owl nest trees in the Wenatchee National Forest. Journal of Raptor Research 27:1-7.

Buchanan, J.B. and P. Swedeen. 2005. Briefing report to the Washington State Forest Practices Board on spotted owl status and Forest Practices Rules. Washington Department of Fish and Wildlife, Olympia, Washington.

Clark, D.A., R.G. Anthony, and L.S. Andrews. 2011. Survival rates of northern spotted owls in post-fire landscapes in southwest Oregon. Journal of Raptor Research 45:38-47.

Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, and L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owls. Sustainable Ecosystems Institute, Portland, Oregon.

Dark, S.J., R.J. Guttiérrez, and G.I. Gould, Jr. 1998. The barred owl (*Strix varia*) invasion in California. Auk 115:50-56.

Fenger, M., J.B. Buchanan, T.J. Cade, E.D. Forsman, S.M. Haig, K. Martin, and W.A. Rapley. 2007. Northern spotted owl population enhancement and recovery in British Columbia: proposed five-year action plan. Prepared by the Spotted Owl Population Enhancement Team for the government of British Columbia, Victoria, British Columbia, Canada.

Forsman, E.D., K.M. Dugger, E.M. Glenn, A.B. Franklin, G.C. White, C.J. Schwarz, K.P. Burnham, D.R. Anderson, J.D. Nichols, J.E. Hines, J.B. Lint, R.J. Davis, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, S.A. Gremel, D.R. Herter, J.M. Higley, R.B. Horn, J.A. Reid, J. Rockweit, J.P. Schaberl, T.J. Snetsinger, and S.G. Sovern. 2011. Population demography of northern spotted owls. Studies in Avian Biology 40:1-120.

Forsman, E.D., I.A. Otto, S.G. Sovern, M. Taylor, D.W. Hays, H. Allen, S.L. Roberts, and D.E. Seaman. 2001. Spatial and temporal variation in diets of spotted owls in Washington. Journal of Raptor Research 35:141-150.

Forsman, E.D., T.J. Kaminski, J.C. Lewis, K.J. Maurice, S.G. Sovern, C. Ferland, and E.M. Glenn. 2005. Home range and habitat use of northern spotted owls on the Olympic Peninsula, Washington. Journal of Raptor Research 39:365-377.

Franklin, J.F., M.A. Hemstrom, R. Van Pelt, and J.B. Buchanan. 2008. The case for active management of dry forest types in eastern Washington: perpetuating and creating old forest structures and functions. Washington

Department of Natural Resources, Olympia, Washington.
Gaines, W.L., R.A. Strand, and S.D. Piper. 1997. Effects of the Hatchery complex fires on northern spotted owls in the eastern Washington Cascades. Pages 123-129 *in* J.M. Greenlee, editor. Proceedings – Fire effects on rare and endangered species. International Association of Wildland Fire, Fairchild, Washington.
Gremel, S.A. 2005. Factors controlling distribution and demography of northern spotted owls in a reserved landscape. MS thesis. University of Washington, Seattle, Washington.
Gutiérrez, R.J., A.B. Franklin and W.S. LaHaye. 1995. Spotted owl (*Strix occidentalis*). *in* A. Poole and F. Gill (editors), The birds of North America, No. 179. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C.
Hanson, C.T., D.C. Odion, D.A. Dellasala, and W.L. Baker. 2009. Overestimation of fire risk in the northern spotted owl recovery plan. Conservation Biology 23:1314-1319.
ICF Jones & Stokes. 2009. Safe Harbor Agreement, Landowner Option Plan, and Cooperative Habitat Enhancement Agreement: Port Blakely Tree Farms, Morton Block (ICF J&S 00209.07), Olympia, Washington. Prepared for Port Blakely Tree Farms, L.P.
Kroll, A.J., T.L. Fleming and L.L. Irwin. 2010. Site occupancy dynamics of northern spotted owls in the eastern Cascades, Washington, USA, 1990-2003. Journal of Wildlife Management 74:1267-1274.
Littell, J.S., E.E. O'Neil, D. McKenzie, J.A. Hicke, J.A. Lutz, R.A. Norheim, and M.M. Elsner. 2009. Forest ecosystems, disturbances, and climatic change in Washington State, USA. Pages 255-284 in Littell, J.S., M.M. Elsner, L.C. Whitley Binder, and A.K. Snover, editors. The Washington climate change impacts assessment: evaluating Washington's future in a changing climate. Climate Impacts Group, University of Washington, Seattle, WA. Available at: http://cses.washington.edu/cig/outreach/waccia/.
Mass, C. and Dotson. 2010. Major extratropical cyclones of the northwest United States: historical review, climatology, and synoptic environment. Monthly Weather Review 138:2499-2527.
Mazur, K.M. and P.C. James. 2000. Barred owl (*Strix varia*). *In* A. Poole and F. Gill, editors. The birds of North America, No. 508. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C.
Pearson, R.R. and K.B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Journal of Raptor Research 37:265-275.
Pierce, D.J., J.B. Buchanan, B.L. Cosentino, and S. Snyder. 2005. An assessment of the status of spotted owl habitat on non-federal lands in Washington between 1996 and 2004. Washington Department of Fish and Wildlife, Olympia.
Singleton, P.H., J.F. Lehmkuhl, W.L. Gaines, and S.A. Graham. 2010. Barred owl space use and habitat selection in the eastern Cascades, Washington. Journal of Wildlife Management 74:285-294.
Spies, T.A., J.D. Miller, J.B. Buchanan, J.F. Lehmkuhl, J.F. Franklin, S.P. Healey, P.F. Hessburg, H.D. Safford, W.B. Cohen, R.S.H. Kennedy, E.E. Knapp, J.K. Agee, and M. Moeur. 2009. Underestimating risks to the northern spotted owl in fire-prone forests: response to Hanson et al. Conservation Biology 24:330-333.
U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants: determination of threatened status for the northern spotted owl. Federal Register 55:26114–26194.
U.S. Fish and Wildlife Service. 2011. Revised recovery plan for the northern spotted owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon.
U.S. Fish and Wildlife Service. 2012a. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Northern Spotted Owl. Federal Register 77:14062-14165
U.S. Fish and Wildlife Service. 2012b. Draft Environmental Impact Statement for Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls. Federal Register 77:14036-14039.
Wiens, J.D., R.G. Anthony, and E.D. Forsman. 2011. Barred owl occupancy surveys within the range of the northern spotted owl. Journal of Wildlife Management 75:531-538.

## Streaked Horned Lark

(*Eremophila alpestris strigata*)

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

Figure 1. Streaked horned lark (*Photo by Rod Gilbert*).

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). The streaked horned lark nests on grasslands and sparsely vegetated areas at airports, sandy islands and coastal spits. 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).

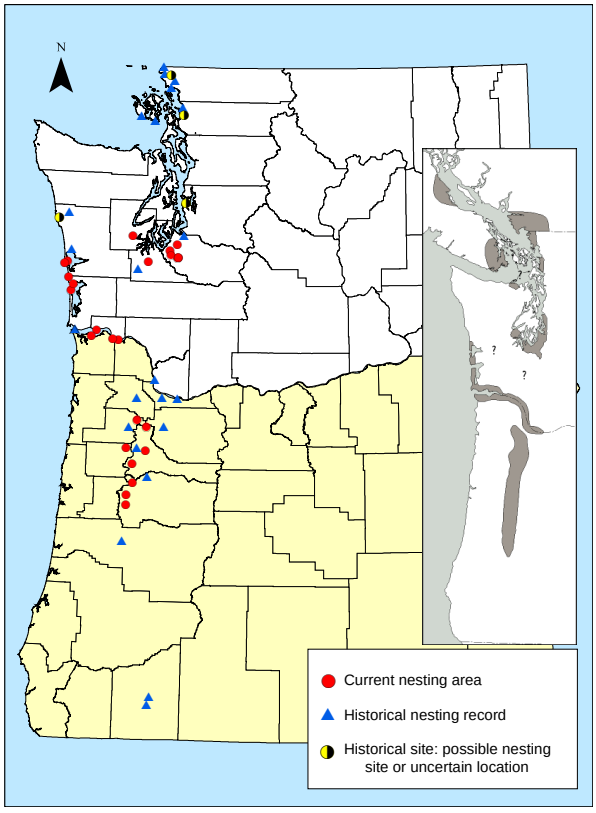



Figure 2. Historical and current breeding locations of the streaked horned lark in Washington and Oregon, and (inset) hypothesized historical breeding range (Stinson 2005).

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).

***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 Divisions; 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 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.

Figure 3. Streaked horned lark nest (*photo by Rod Gilbert*).

***Demographic study.*** 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). Streaked horned larks nest at five airports in Washington and one in Oregon. Improving nesting habitat away from active runways may reduce collisions and improve adult survival if enough suitable habitat exists away from the runway.

***Habitat restoration and nest exclosure trials.*** The Nature Conservancy and U.S. Army Corps of Engineers conducted management experiments during 2009-2010 on dredged material islands in the lower Columbia River to test methods of maintaining sparse vegetation for streaked horned lark nesting habitat. Also during 2009-2010, WDFW, and the USFWS-Willapa National Wildlife Refuge tested the efficacy of nest exclosures to reduce predation for improving fledging success, without increasing predation on adults. Willapa NWR removed introduced beachgrass (*Ammophila* spp.) from a 121 ac Habitat Restoration Area; 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.

***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 (formerly TNC's South Puget Sound Prairie group), Department of Defense, Joint Base Lewis-McChord, Oregon Dept Fish and Wildlife, Oregon State University, Willapa National Wildlife Refuge, and Washington State Parks.

### Literature Cited


Anderson, J. K. 2010. Comparing endangered Streaked Horned Lark (*Eremophila alpestris strigata*) fecundity to other grassland birds. M.S. Thesis, Evergreen State College, Olympia, Washington.

BASH (Bird/wildlife Aircraft Strike Hazard Team). 2009. Top 50 USAF Wildlife Strikes by Count. Aviation Safety Division, U.S. Air Force. http://www.afsc.af.mil/organizations/bash/statistics.asp

Beason, R.C. 1995. Horned Lark (*Eremophila alpestris*). Birds of North America No. 195. (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C., 24 pp.

Beauchesne, S. M., and J. M. Cooper 2003. COSEWIC assessment and update status report on the Horned Lark *strigata* subspecies *Eremophila alpestris strigata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 23 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

Camfield, A. F., S. F. Pearson, and K. Martin. 2011. A demographic model to evaluate population declines in the endangered streaked horned lark. Avian Conservation and Ecology 6(2):4. http://dx.doi.org/10.5751/ACE-00467-060204

Chappell, C. B., M. S. Mohn Gee, B. Stephens, R. Crawford, and S. Farone. 2001. Distribution and decline of native grassland and oak woodlands in the Puget Lowland and Willamette Valley Ecoregions, Washington. Pp. 124–139 *in* S. H. Reichard, P.W. Dunwiddie, J.G. Gamon, A. R. Kruckberg, and D. L. Salstrom (eds.). Conservation of Washington's Rare Plants and Ecosystems. Washington Native Plant Society, Seattle.

Drovetski, S.V., S. F. Pearson, and S. Rohwer. 2005. Implications of mitochondrial DNA diversity on the conservation status of the streaked horned lark *Eremophila alpestris strigata*. Conservation Genetics 6:875-883.

Foster, J. R., and S.E. Shaff. 2003. Forest colonization of Puget lowland grasslands at Fort Lewis, Washington. Northwest Science 77:283-296.

Pearson, S. 2010. Genetic Enhancement of Puget Lowland Streaked Horned Lark Populations. Unpublished proposal, Washington Department of Fish and Wildlife, Olympia, Washington.

Pearson, S. F., and B. Altman. 2005. Rangewide Streaked Horned Lark (*Eremophila alpestris strigata*) Assessment and Preliminary Conservation Strategy. Washington Department of Fish and Wildlife, Olympia, Washington. 25 pp.

Pearson, S.F., C. Sundstrom, W. Ritchie, and K. Gunther. 2010. Washington State Snowy Plover Population Monitoring, Research, and Management: 2010 Nesting Season Research Progress Report. Washington Department of Fish and Wildlife, Olympia, Washington.

Rogers, R. E., Jr. 2000. The Status and Habitat Selection of Streaked Horned Larks, Western Bluebird, Oregon Vesper Sparrow, and Western Meadowlark in Western Washington. M.S. Thesis, Evergreen State College, Olympia, WA. 185 pp.

## 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.

Figure 2. Young turtle at Woodland Park Zoo (*photo from Woodland Park Zoo*).

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, 3). 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 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.

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 330 head-starts 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 2011, 147 head-started juvenile turtles have been released (Table 1; Holman et al. 2012).

Table 1. Western pond turtles released at recovery sites in Washington, 1991-2011.

| | # Released | | |
|---|---|---|---|
| Population | 1991-2010 | 2011 | Total |
| Klickitat | 530 | 0 | 530 |
| Bergen | 266 | 11 | 277 |
| Pierce NWR | 321 | 9 | 330 |
| Beacon Rock | 127 | 20 | 147 |
| Pierce County | 195 | 19 | 214 |
| Mason County | 197 | 27 | 224 |
| Total | 1,636 | 86 | 1,722 |

Figure 3. Head-started western pond turtles ready for release (*photo by D. Stinson*).

The western pond turtle program in the Columbia Gorge continues to make progress. Since recovery efforts began in 1991, 1,284 head-started turtles have been released into suitable habitat within their historical range in the Gorge (Holman et al. 2012). 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 (Holman et al. 2012).

***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 214 turtles released by December 2011 (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.

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.

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 2011, 26 head-started turtles were released, bringing the total number of released turtles to 224 (Table 1). Annual survival has been high, with the probability of surviving from 2005–2010 estimated at 88%. Growth in all age classes has been excellent, suggesting ample food resources. The number of nests has increased from 1 in 2006 to 6 in both 2010 and 2011. 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.

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. The hauling in of soil for more suitable nesting habitat will be conducted in 2012. Predation of turtles by river otters and bald eagles was observed for the first time in 2011.

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

**Partners and cooperators:** Bonneville Power Administration, Woodland Park Zoo, Oregon Zoo, Pierce County Public Works, 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.

### Literature Cited

Hays, D. W., K. R. McAllister, S. A. Richardson, and D.W. Stinson. 1999. Washington state recovery plan for the western pond turtle. Washington Department of Fish and Wildlife, Olympia, Washington.

Holman, E., D. Anderson, M. Vander Haegen, G. Olson, W.-Y. Chang, and B. George. 2012. Western pond turtle project report, March 2011 – February 2012. BPA Project #2001-027-00, Contract #00052092. Washington Department of Fish and Wildlife, Vancouver, Washington.

Vander Haegen, W. M., S. L. Clark, K. M. Perillo, D. P. Anderson, and H. L. Allen. 2009. Survival and causes of mortality of head-started western pond turtles on Pierce National Wildlife Refuge, Washington. Journal of Wildlife Management 73:1402–1406.

## 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.

Adults have been sighted northward to the Gulf of Alaska and northern Europe (Figure 2). Leatherbacks prey mainly on jellyfish and consume 20-30% of their body weight daily (NMFS 2009). 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. Leatherbacks regularly occur off the coasts of Washington, 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, 2010).

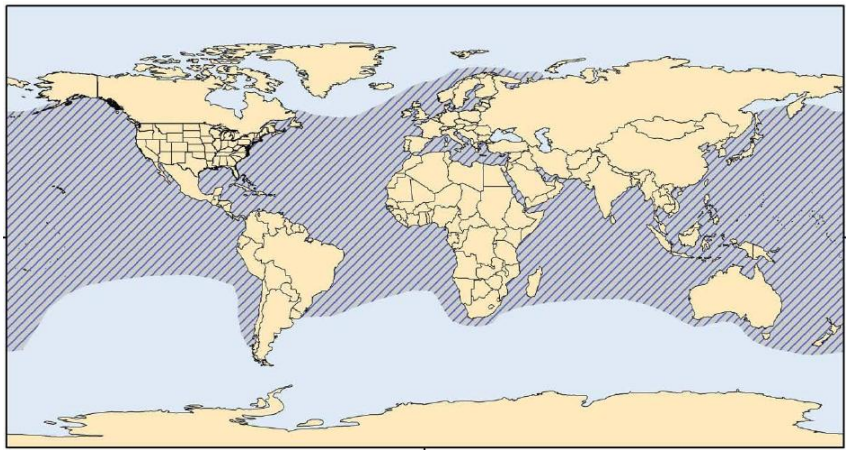


Figure 2. Range of leatherback sea turtles (*NMFS*).

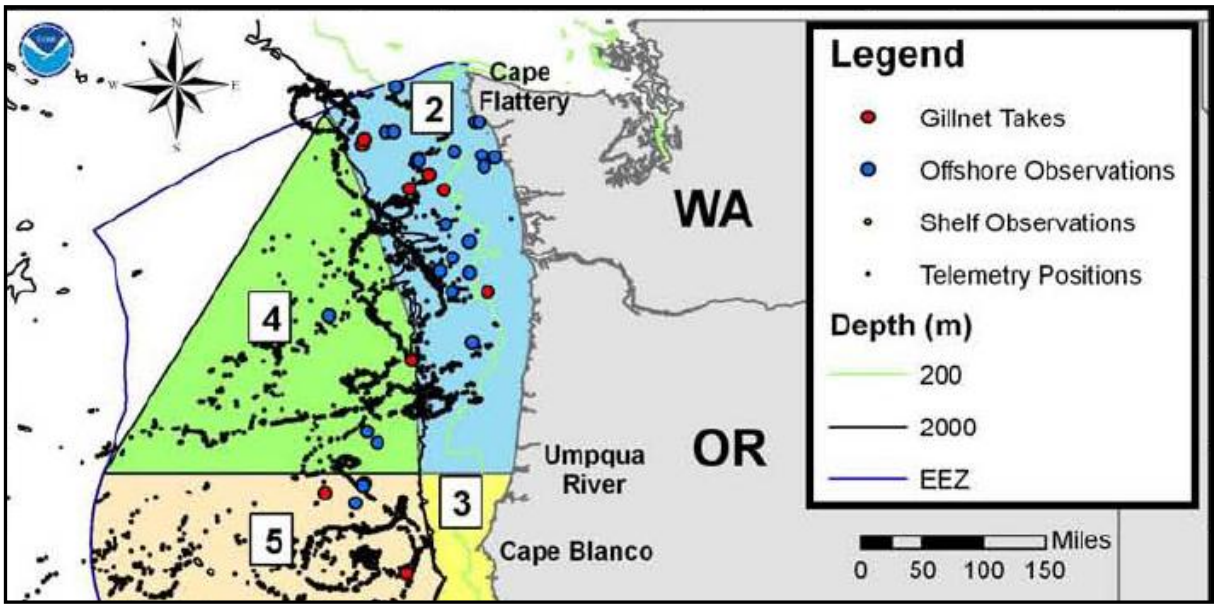



Figure 3. Observations, telemetry data, and gillnet captures of leatherbacks off Washington and Oregon. Area 2 (in blue) has been proposed as critical habitat (NMFS 2009).

***Habitat***. Leatherbacks forage in both pelagic (open ocean) and productive coastal waters. Although leatherbacks are capable of deep diving, most of their time is spent at or near the surface. Female leatherbacks lay clutches of about 100 eggs on sandy, tropical beaches. Females nest several times during a nesting season, typically at 8-12 day intervals. The distribution and developmental habitats of juvenile leatherbacks are poorly known. Leatherback turtles smaller than 100 cm carapace length have only been sighted in waters 26°C or warmer (Eckert 2002). After nesting, females migrate from tropical waters to more temperate latitudes.

***Population trends.*** 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 leatherback's 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 blocking the passage of food and likely cause death (Mrosovsky et al. 2009).

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 on U.S. nesting beaches and in U.S. waters 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 response to a 2007 petition, NMFS published a proposed rule in January 2010 to revise the critical habitat designation for leatherback turtles to include several areas off the U.S. West Coast, including the waters off Washington to a depth of 2,000 m (Figure 3; NMFS 2010). A final determination on this proposal will be made in early 2012. Strandings of this species are very rare in Washington (Bowlby et al. 1994), with none recorded from 2002-2011 (K. Wilkinson, unpublished data).

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

## Literature Cited


Bowlby, C.E., G. A. Green, and M.L. Bonnel. 1994. Observations of leatherback turtles offshore of Washington and Oregon. Northwestern Naturalist 75:33-35.

Eckert, S.A. 2002. Distribution of juvenile leatherback sea turtle, *Dermochelys coriacea*, sightings. Marine Ecology Progress Series 230:289-293.

Mrosovsky, N., G. D. Ryan, and M. C. James. 2009. Leatherback turtles: The menace of plastic. Marine Pollution Bulletin 58:287–289.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1998. Recovery plan for U.S. Pacific populations of the leatherback turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring MD.

NMFS (National Marine Fisheries Service). 2009. Revision of critical habitat for leatherback sea turtles: biological report. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA, and Northwest Science Center, Seattle, WA.

NMFS (National Marine Fisheries Service). 2010. Endangered and threatened species: Proposed rule to revise the critical habitat designation for the endangered leatherback sea turtle. Federal Register 75(2):319-335.

Sarti Martinez, A.L. 2000. *Dermochelys coriacea*. *In* IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 27 December 2011.

## Oregon Spotted Frog

(*Rana pretiosa*)

**State Status:** Endangered, 1997
**Federal Status:** Candidate, 1997
**Recovery Plans:** State, in prep.

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. Historically, it was distributed from southwestern British Columbia, Canada to northeastern California (Cushman and Pearl 2007). Today it is known from a total of approximately 45 populations in British Columbia, Washington and Oregon (USFWS 2010). 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 (Figure 2). 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 five Washington locations (Figure 2). Conboy Lake has the largest population in Washington, even with a 76% 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 in the South Fork Nooksack and Samish river drainages, areas that were not historically known to host the species.

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 2011 found a total of 3,608 egg masses, which corresponds to a total population estimate of 7,216 breeding adults for Washington (Table1).

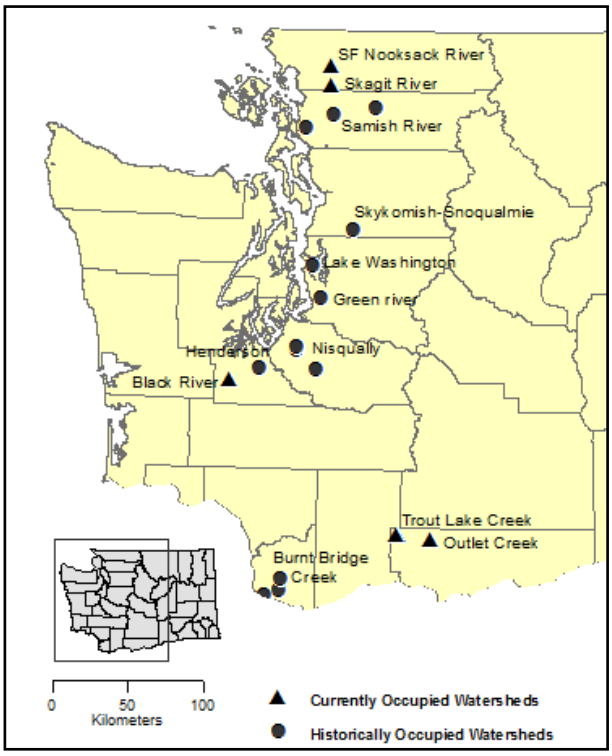



Figure 2. Watersheds in Washington known to have current or historical populations of Oregon spotted frogs.

Table 1. Population census results for the five known Oregon spotted frog sites in Washington, 2011.

| Population Sites | Egg masses | Population estimate of breeding adults |
|---|---|---|
| Black River | 1,169 | 2,338 |
| Trout Lake | 922 | 1,844 |
| Conboy Lake | 1,404* | 2,808 |
| South Fork Nooksack River | 46** | 92** |
| Samish River | 67** | 134** |
| **Total** | **3,608** | **7,216** |

*Census results based on survey of Conboy Lake National Wildlife Refuge and one site on private land.
**Full extent of population distribution and size is unknown as of 2011.

A draft state recovery plan for the Oregon spotted frog was initiated in 2010 (Hallock, in prep.), and will undergo scientific and public review and be completed in 2012. 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.

***Dailman Lake reintroduction project.*** A reintroduction project was started at Dailman Lake on Joint Base Lewis-McChord Military Reservation in Pierce County in 2008. To date, 3,543 frogs have been released at the site. 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. Young frogs are raised from these and released in the fall. 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. Inmates are also developing cricket-rearing capabilities to provide food for the frogs. Biologists from Joint Base Lewis-McChord and WDFW monitor the released frogs and survey for egg masses in the spring. In 2011, the fourth year of releases, a total of 1,180 frogs were released after rearing. 2011 also marked the first year captive raised frogs successfully bred and laid eggs at Dailman Lake.

***Protection, enhancement and management of significant habitat.*** Several properties are managed for Oregon spotted frogs, with most efforts focused on control of reed canarygrass in oviposition areas. These include the Trout Lake Natural Area Preserve in Skamania County, which was primarily established in 1996 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. Capitol Land Trust was instrumental in securing Oregon spotted frog occupied lands on Beaver Creek for purchase by WDFW. 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 is being restored 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 useful 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 examined the anti-predator behavior of Oregon spotted frogs at Black River and Conboy Lake 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.

### Literature Cited

Hallock, L. A. In prep. Draft Washington state recovery plan for the Oregon spotted frog. Washington Department of Fish and Wildlife, Olympia, Washington.

Padgett-Flohr, G. E., and M. P. Hayes. 2011. Assessment of the vulnerability of the Oregon spotted frog (*Rana pretiosa*) to the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*). Herpetological Conservation and Biology 6:99-106.

USFWS. 2010. U.S. Fish and Wildlife Service species assessment and listing priority assignment form for the Oregon Spotted Frog (*Rana pretiosa*). U.S. Fish and Wildlife Service, Lacey, Washington. 82 pp.

## 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.

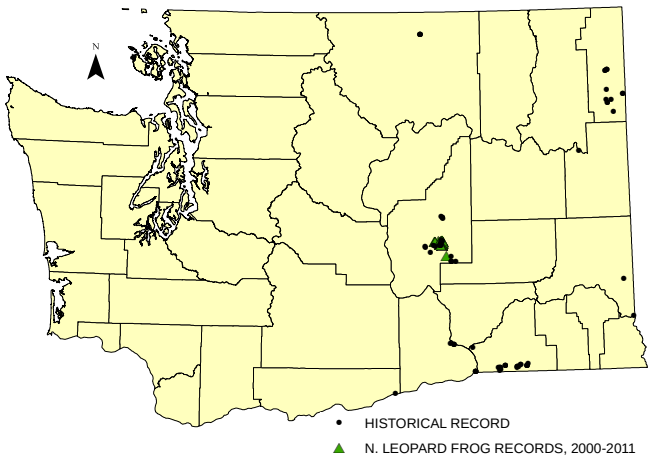



Figure 2. Historical and recent records of northern leopard frogs in Washington.

***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.

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

### Literature Cited

Germaine, S., and D. Hays. 2007. Distribution and post-breeding environmental relationships of northern leopard frogs (*Rana pipiens*) in Grant County, Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 29 pp.

Germaine, S. S., and D. W. Hays. 2009. Distribution and postbreeding environmental relationships of northern leopard frogs (*Rana* [*Lithobates*] *pipiens*) in Washington. Western North American Naturalist 69:537–547.

McAllister, K. R., Leonard, W. P., D. W. Hays, and R. C. Friesz. 1999. Washington state status report for the northern leopard frog. Washington Department of Fish and Wildlife, Olympia, Washington. 36 pp

Merrell, D. J. 1977. Life history of the leopard frog, *Rana pipiens*, in Minnesota. Bell Museum of Natural History, Occasional Paper No. 15, University of Minnesota.

USFWS (U.S. Fish and Wildlife Service). 2011. Endangered and threatened wildlife and plants; 12–month finding on a petition to list the northern leopard frog in the western United States as threatened. Federal Register. 76(193):61896-61931.

## 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.

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

***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 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.

**Literature cited:**

USFWS (U.S. Fish and Wildlife Service). 2001. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) revised recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 113 pp.

WDW (Washington Department of Wildlife). 1993. Status of the Oregon silverspot butterfly (*Speyeria zerene hippolyta*) in Washington. Washington Department of Wildlife, Olympia. Washington. 30 pp.

## 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).

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 2), marsh speedwell (*Veronica scutellata),* American brooklime *(V. beccabunga*), and non-natives including plantains (*Plantago lanceolata* 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). Extensive habitat management, including herbicide, mowing, prescribed burning, and nectar and host-plant enhancement, is needed 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

Figure 2. Harsh paintbrush, one of the host species fed on by Taylor's checkerspot larvae (*photo by D. Stinson*).

populations.

***Current conservation actions.*** WDFW has completed guidelines for protecting Taylor's checkerspot and its habitat, particularly where sites exist in a managed forest matrix (WDFW 2009). Current conservation actions include developing statistically robust monitoring methods, monitoring populations and recently occupied sites, and conducting surveys to determine if additional sites exist. 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. 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.

***Taylor's checkerspot butterfly captive rearing.*** A major part of WDFW's recovery program for Taylor's checkerspot involves captive rearing and translocation to re-establish additional populations on Puget Sound prairies. The goal of ongoing cooperative project is to establish at least three populations. Caterpillars and/or adult butterflies have been released at five sites in recent years. Captive rearing and reintroduction combined with intensive habitat management has met with preliminary success. Partners include the Oregon Zoo, Joint Base Lewis-McChord, Evergreen State College Sustainable Prisons Project, and Mission Creek Corrections Center for Women (Washington Department of Corrections). The Oregon Zoo has developed captive propagation techniques, and a second captive-rearing facility has been established at Mission Creek Corrections Center for Women.

***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.

**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, 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.

**Literature Cited**

Dornfeld, E. J. 1980. Butterflies of Oregon. Timber Press, Forest Grove, Oregon. 276 pp.

Hays, D. W. 2011. Conservation of Taylor's checkerspot on the Olympic Peninsula. Report submitted to the U.S. Fish and Wildlife Service, June 2011. 38pp.

Schultz, C. B., E. Henry, A. Carleton, T. Hicks, R. Thomas, A. Potter, M. Collins, M. Linders, C. Fimbel, S. Black, H. E. Anderson, G. Diehl, S. Hamman, R. Gilbert, J. Foster, D. Hays, D. Wilderman, R. Davenport, E. Steel,

N. Page, P. L. Lilley, J. Heron, N. Kroeker, C. Webb and B. Reader. 2011. Conservation of prairie-oak butterflies in Oregon, Washington, and British Columbia. Northwest Science 85:361–388.

Stinson, D. W. 2005. Washington State status report for the Mazama pocket gopher, streaked horned lark, and Taylor's checkerspot. Washington Department of Fish and Wildlife, Olympia, Washington. 129 pp.

USFWS (U.S. Fish and Wildlife Service). 2001. Endangered and threatened wildlife and plants; review of plant and animal species that Aare candidates or proposed for listing as endangered or threatened, annual notice of findings on recycles petitions, and annual description of progress on listing actions. Federal Register 66 (210):54808-54832.

WDFW (Washington Department of Fish and Wildlife). 2009. Guidelines for protecting the Taylor's checkerspot and its habitat. Washington Department of Fish and Wildlife, Olympia, Washington. 6 pp.

## Mardon Skipper

(*Polites mardon*)

**State status**: Endangered, 1999
**Federal status**: Candidate, 1999
**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. Mardon skippers exist in four disjunct areas in Washington, Oregon and California (Table 1), with the majority of sites in the southern Cascades of Washington. The species also occurs in South Puget Sound prairies. Almost all remaining Mardon skipper populations are small (less than 50 individuals), but a few host populations of hundreds, and one site on the Okanogan-Wenatchee National Forest may support >1,000 individuals.

Habitat loss and invasive species are the two primary threats to the Mardon skipper (USFWS 2010). Open, grassland habitat has declined dramatically in the past 150 years due to agricultural and residential sprawl, fire suppression, livestock grazing, and introduction of exotic species. As a result of fire suppression, conifers have encroached into native grasslands, reducing both habitats for skippers and connectivity between grassland habitats. Occupied habitats 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). Management efforts to control invasive plants and maintain grasslands (prescribed fire, mowing, and herbicides), can also result in direct mortality of Mardon skippers. Intensive grazing is an ongoing issue at many Mardon skipper sites resulting in the loss of adult nectar sources, larval food plants, and potentially 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.

In 1999, the Mardon skipper was known from a total of 14 sites in Washington, Oregon and California (Potter et al. 1999). By 2009, range-wide surveys found 139 sites representing 59 populations, with 107

Table 1. Numbers of known occupied sites and populations or site clusters of Mardon skippers in 2009 (USFWS 2010).

| Location | Number of occupied sites | Number of populations (site clusters) |
|---|---|---|
| **South Puget Sound** | 5 | 2 |
| **Southern Washington Cascades** | | |
| Okanogan-Wenatchee NF | 35 | 15 |
| Gifford Pinchot NF | 38 | 13 |
| Yakama Nation | 23 | 11 |
| Glenwood-Goldendale | 6 | 3 |
| **Southern Oregon** | 23 | 12 |
| **Northern California** | 9 | 3 |
| **Total** | 139 sites | 59 populations |

sites and 44 populations in Washington (Table 1; USFWS 2010). This increase was due to expanded survey effort at areas not previously surveyed rather than to increased habitat or expanding populations (see Kerwin and Huff 2007).

***Southern Washington Cascades.*** 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 102 occupied sites were known from federal, tribal, and private lands in this portion of the state in 2009 (Table 1; USFWS 2010). Surveys conducted on Gifford Pinchot National Forest since 2000 have documented a number of occupied sites in the general vicinity of Mt. Adams (Jepsen et al. 2008).

***South Puget Sound.*** Five Mardon skipper sites exist in the south Puget Sound region, including 3 on Joint Base Lewis-McChord where Mardon skippers occur on the Artillery Impact Area, apparently in low numbers. In this 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*).

***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).

Recent research on Mardon skippers has investigated oviposition site selection (Beyer 2009, Henry 2010). 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).

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 Join 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 (Linders 2007).

**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.

### Literature cited


Beyer, L. 2009. Oviposition selection by a rare grass skipper, *Polites mardon*, in montane habitats: Advancing ecological understanding for developing conservation strategies. MS Thesis. Washington State University, Vancouver, Washington. 56 pp.

Beyer, L. and S. Hoffman Black. 2007. Site utilization by adults and larvae of Mardon skipper butterfly (*Polites mardon*) at four sites in Washington and Oregon. Final report to the Forest Service and BLM. 72 pp.

Beyer, L.J., and C.B. Schultz. 2010. Oviposition selection by a rare grass skipper *Polites mardon* in montane habitats: advancing ecological understanding to develop conservation strategies. Biological Conservation 143:862-872.

Hays, D.W., A. Potter, C. Thompson, and P. Dunn. 2000. Critical habitat components for four rare south Puget Sound butterflies. Washington Department of Fish and Wildlife, Olympia, and The Nature Conservancy, Washington, Seattle. 35 pp.

Henry, E.H. 2010. A first step towards successful habitat restoration and reintroduction: understanding oviposition site selection of an imperiled butterfly, Mardon skipper. M.S. thesis. Washington State University.

Jepsen, S., L. Lauvray, S. H. Black. 2008. Xerces Society surveys for *Polites mardon mardon* in the Naches Ranger District (Wenatchee National Forest) of Washington (summer 2008). The Xerces Society for Invertebrate Conservation, Portland, Oregon.

Kerwin, A. E., and R. Huff. 2007. Conservation assessment for the Mardon skipper (*Polites mardon*). Version 1.0. May, 2007. USDA Forest Service Region 6, Oregon and Washington. USDI Bureau of Land Management, Oregon and Washington. 42 pp.

Linders, M. 2007. Captive rearing methods test for Mardon skipper (*Polites mardon*). Report to the Nature Conservation/Army Compatible Use Buffer Program at Joint Base Lewis-McChord.

Potter, A., J. Fleckenstein, S. Richardson, and D. Hays. 1999. Washington State status report for the Mardon skipper. Washington Department of Fish and Wildlife, Olympia, Washington. 39 pp.

Potter, A. and G. Olson. 2012. Monitoring Mardon skipper (*Polites mardon*) on the Scatter Creek Wildlife Area. Final Report (DRAFT). Report to Joint Base Lewis-McChord, ACUB Program. 47 pp.

Schultz, C. B., E. Henry, A. Carleton, T. Hicks, R. Thomas, A. Potter, M. Collins, M. Linders, C. Fimbel, S. Black, H. E. Anderson, G. Diehl, S. Hamman, R. Gilbert, J. Foster, D. Hays, D. Wilderman, R. Davenport, E. Steel, N. Page, P. L. Lilley, J. Heron, N. Kroeker, C. Webb, and B. Reader. 2011. Conservation of prairie-oak butterflies in Oregon, Washington, and British Columbia. Northwest Science 85:361–388.

St. Hilaire, J., J. Bernatowicz, and W. Moore. 2009. U.S. Forest Service and Washington Department of Fish and Wildlife Mardon skipper (*Polities mardon mardon*). Report Naches Ranger District, Okanogan-Wenatchee National Forest, Spring and summer 2009. Unpublished agency report to USDA Forest Service and Washington Department of Fish and Wildlife, Naches, Washington. 24 pp.

USFWS (U.S. Fish and Wildlife Service). 2010. Species assessment and listing priority assignment form: Mardon Skipper. U.S. Fish and Wildlife Service, Portland, Oregon. 35 pp.

## Western Gray Squirrel

(*Sciurus griseus*)

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

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).


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

Arboreal and generally solitary in their habits, western gray squirrels 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.

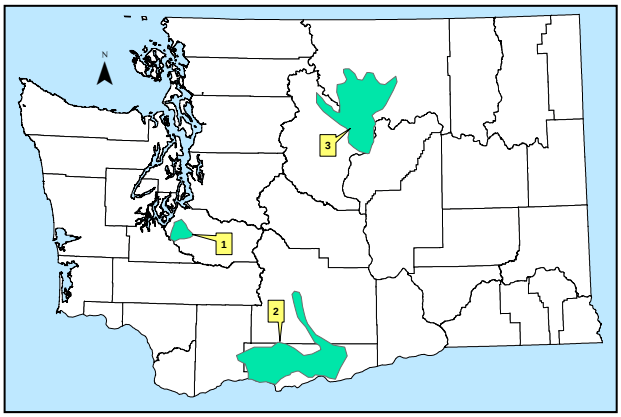



Figure 2. Current range of western gray squirrels in Washington (Linders and Stinson 2007).

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 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 (Yamamuro et al. 2011).

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.

***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

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

squirrels in 1999–2000 (Vander Haegen et al. 2004).

***Okanogan region research***. The University of Washington has conducted research in Chelan and Okanogan Counties with funding from WDFW and the National Park Service. During 2003-2005, Gregory et al. (2010) studied selection of nest sites and nest trees by radio-collared squirrels in Okanogan County. Another graduate student from the university is currently investigating habitat use in response to fire fuel reduction at Stehekin and the Methow Valley. Analysis and write-up will be completed in 2012.

***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. Preliminary data suggest that eastern and western gray squirrels occupied exclusive territories that differed in habitat structure and proximity to wetlands. This research is nearing completion with analysis and write-up expected to be completed in 2012.

***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

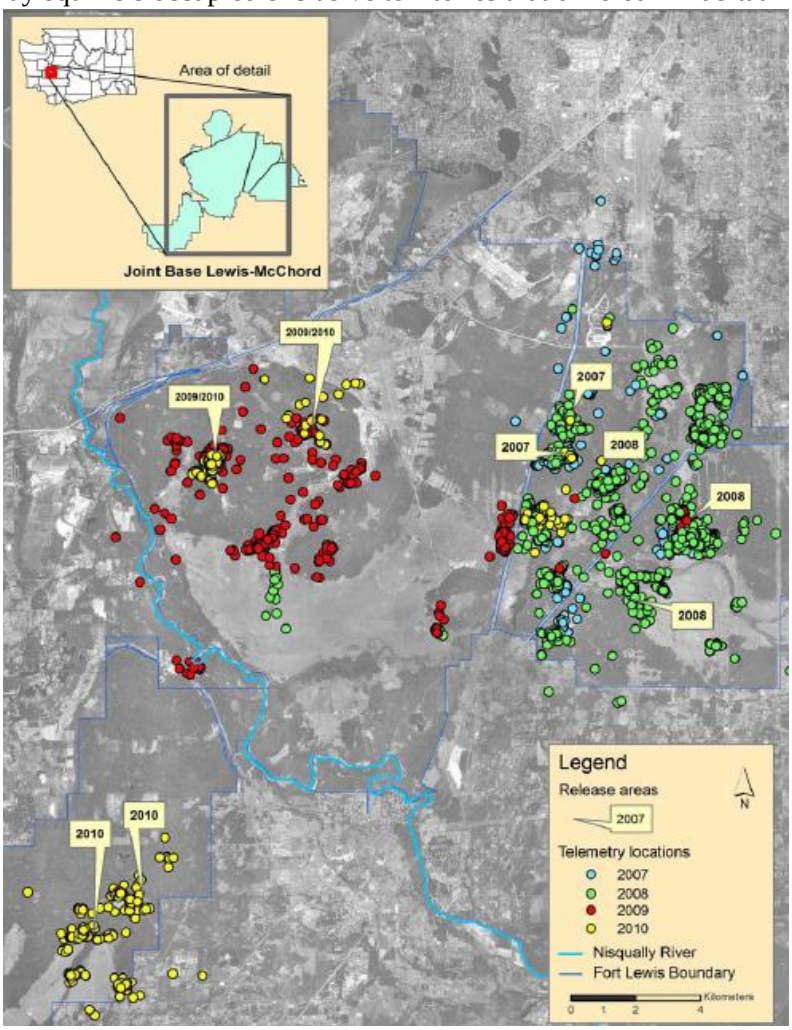



Figure 4. Telemetry locations for western gray squirrels translocated to JBLM, 2007-2010 (Vander Haegen et al. 2011).

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 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.

### Literature Cited


Bayrakçi, R., A. B. Carey, and T. M. Wilson. 2001. Current status of the western gray squirrel population in the Puget Trough, Washington. Northwest Science 75:333-341.

Carraway, L. N. and B. J. Verts. 1994. *Sciurus griseus*. Mammalian Species 474:1-7.

Devine, W., and C. Harrington. 2004. Garry oak woodland restoration in the Puget Sound Region: releasing oaks from overtopping conifers and establishing oak seedlings. 16th International Conference, Society for Ecological Restoration, August 24-26, Victoria, British Columbia.

Fimbel, C. 2004a. Monitoring squirrels on Fort Lewis. Draft Quarterly report April-June. The Nature Conservancy Olympia, Washington. 3 pp.

Fimbel, C. 2004b. Strategies for enhancing western gray squirrels on Fort Lewis. The Nature Conservancy, Olympia, Washington. 39 pp.

Gallie, J. A. 2010. Western gray squirrel hair-tube surveys in Chelan County, North Central Washington: 2010. Washington Department of Fish and Wildlife, Wenatchee, Washington.

Gregory, S. C., W. M. Vander Haegen, W. Y. Chang, and S. D. West. 2010. Nest site selection by western gray squirrels at their northern range terminus. Journal of Wildlife Management 74:18–25.

Linders, M. J. 2000. Spatial ecology of the western gray squirrel, (*Sciurus griseus*) in Washington: the interaction of season, habitat and home range. M.S. Thesis. University of Washington, Seattle, Washington. 99 pp.

Linders, M. J., S. D. West, and M. Vander Haegen. 2004. Seasonal variability in the use of space by western gray squirrels in southcentral Washington. Journal of Mammalogy 85:511-516

Linders, M. J., and D. W. Stinson. 2007. Washington State recovery plan for the western gray squirrel. Washington Department of Fish and Wildlife, Olympia, Washington. 131 pages.

Linders, M. J., W. M. Vander Haegen, J. M. Azerrad, R. Dobson, and T. Labbe. 2010. Management recommendations for Washington's priority species: western gray squirrel. Washington Department of Fish and Wildlife, Olympia, Washington.

Peter, D. and C. Harrington. 2002. Site and tree factors in Oregon white oak acorn production in western Washington and Oregon. Northwest Science 76:189-201.

Peter, D. and C. Harrington. 2004. Oregon white oak acorn production study: five-year report. USDA Forest Service, Pacific Northwest Research Station, Olympia, Washington. 30 pp.

Ryan, L. A. and A. B. Carey. 1995. Biology and management of the western gray squirrel and Oregon white oak woodlands: with emphasis on the Puget Trough. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-348. Portland, Oregon. 36 pp.

Vander Haegen, W. M. and G. R. Orth. 2011. Western gray squirrel ecology and augmentation of the population in the South Puget Trough. Progress report. Washington Department of Fish and Wildlife, Olympia, Washington. 16pp.

Vander Haegen, W. M., S. C. Gregory, and M. J. Linders. 2007. Implementation plan for augmentation of the western gray squirrel population, Fort Lewis, Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 34pp.

Vander Haegen, M., G.R. Orth, and L. M. Aker. 2005. Ecology of the western gray squirrel in south-central Washington. Progress Report, Washington Department of Fish and Wildlife, Olympia, Washington. 41 pp.

Yammer, A.Y., K. Romain-Bondi, and P.H. Morrison. 2011. Western gray squirrel distribution in the Upper Methow Valley, Washington. Pacific Biodiversity Institute, Winthrop, Washington. 58 pp. http://www.pacificbio.org/initiatives/wgs/gray_squirrel_background.html

## Mazama Pocket Gopher

(*Thomomys mazama*)

**State Status**: Threatened, 2006
**Federal Status**: Candidate, 2001
**Recovery Plans:** State, in prep.

Figure 1. Mazama pocket gopher (*photo by Bill Leonard)*.

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 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.

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).

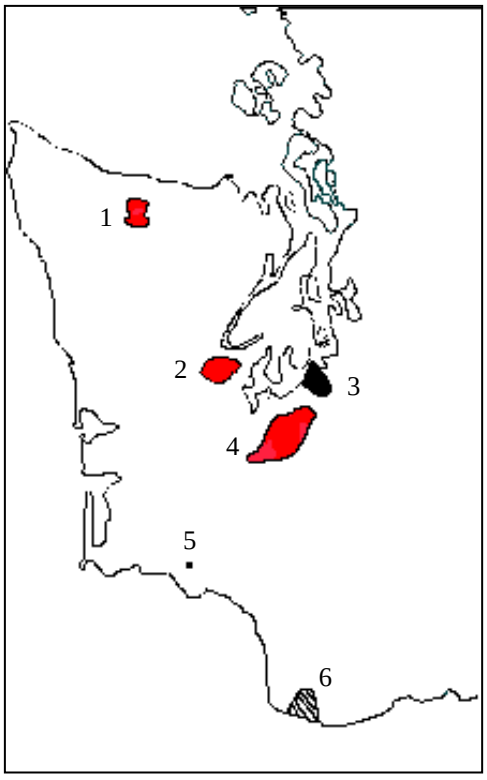



Figure 2. Distribution of six Mazama pocket gopher subspecies in Washington).

1. *Thomomys mazama melanops*
2. *Thomomys mazama couchi*
3. *Thomomys mazama tacomensis* (**extinct**)
4. *Thomomys mazama*
5. *Thomomys mazama louiei* (**may be extinct**)
6. *Thomomys mazama douglasii* (**status uncertain**)

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

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 and grasslands near the Columbia River in Clark County. 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.

The range of Mazama pocket gophers in Washington has contracted due to extinctions of populations in Tacoma, and possibly Vancouver, and two of the largest remaining populations (Olympia and Shelton airports) may be affected by plans for transportation-related development. Many of the areas with the best soils have been densely developed or are rapidly developing areas. The Olympia Airport and surrounding area is located on the best soil type for gophers, and probably contains the largest remaining population. The Mazama pocket gopher was state-listed as Threatened in 2006 and WDFW is developing a recovery plan for the species.

***Recent surveys.*** As part of the Growth Management Act, Thurston County has required surveys before granting development permits in areas known to have soils suitable for the state threatened pocket gophers. In response to development permit applications submitted to the county or cities, consultants and WDFW personnel surveyed approximately 129 sites on private lands with potentially suitable soils from June 2006 – November 2011. Of the 129 sites, 57 had gophers present, 65 did not have gophers, and 7 sites could not be determined at the time of survey. Only a small percentage of the acres surveyed were occupied by gophers.

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 several 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 and that they may be more widespread in the county than previously recorded. Additional surveys will be conducted in 2012 to more clearly delineate current distribution in Mason County.

***Research projects.*** Recent genetic investigations concluded that some subspecific designations in Thurston and Pierce counties were not warranted, and that populations in these counties likely represent a single evolutionary unit (Steinberg 1999, Welch and Kenagy, in prep.). The studies also confirmed the genetic distinctness of gophers in three isolated geographic areas of Clallam, Mason, and Thurston/Pierce counties.

An occupancy modeling study completed by WDFW in 2008 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.

A pilot translocation project, initiated in 2005, may 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 determine the feasibility of using translocations to establish new populations of gophers (Olson 2011a). 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 can require a significant, multi-year effort involving release of large numbers of animals (e.g., >200 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 2011c).

***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, Weir Prairie, and Tenalquot Prairie.

**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.

## Literature Cited

Linders, M. 2008. 2005-2007 Summary report on translocation of Mazama pocket gopher (*Thomomys mazama*) in South Puget Sound, Washington. Washington Department of Fish and Wildlife, Montesano, Washington.

Olson, G. 2011a. Mazama pocket gopher translocation study: progress report. Cooperative Agreement #13410-9-J015. Washington Department of Fish and Wildlife, Olympia, Washington.

Olson, G.S. 2011b. Mazama pocket gopher occupancy modeling. Washington Department of Fish and Wildlife, Olympia, Washington. 45pp.

Olson, G. 2011c. Mazama pocket gopher dispersal study: progress report. Cooperative Agreement #13410-9-J012. Washington Department of Fish and Wildlife, Olympia, Washington.

Reichman, O. J., and E. W. Seabloom. 2002. The role of pocket gophers as subterranean ecosystem engineers. Trends in Ecology and Evolution 17:44-49.

Stinson, D. W. 2005. Washington state status report for the Mazama pocket gopher, streaked horned lark, and Taylor's checkerspot. Washington Department of Fish and Wildlife, Olympia, Washington. 129 pp.

Steinberg, E. K. 1999. Diversification of genes, populations, and species: evolutionary genetics of real and virtual pocket gophers (*Thomomys*). Ph.D. Dissertation, University of Washington, Seattle, Washington. 157 pp.

Vaughan, T. A. 1961. Vertebrates inhabiting pocket gopher burrows in Colorado. Journal of Mammalogy 42:171-174.

Vaughan, T. A. 1974. Resource allocation in some sympatric subalpine rodents. Journal of Mammalogy 55:764-795.

## 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 2011). 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 (Figure 2; S. Jeffries, unpubl. data).

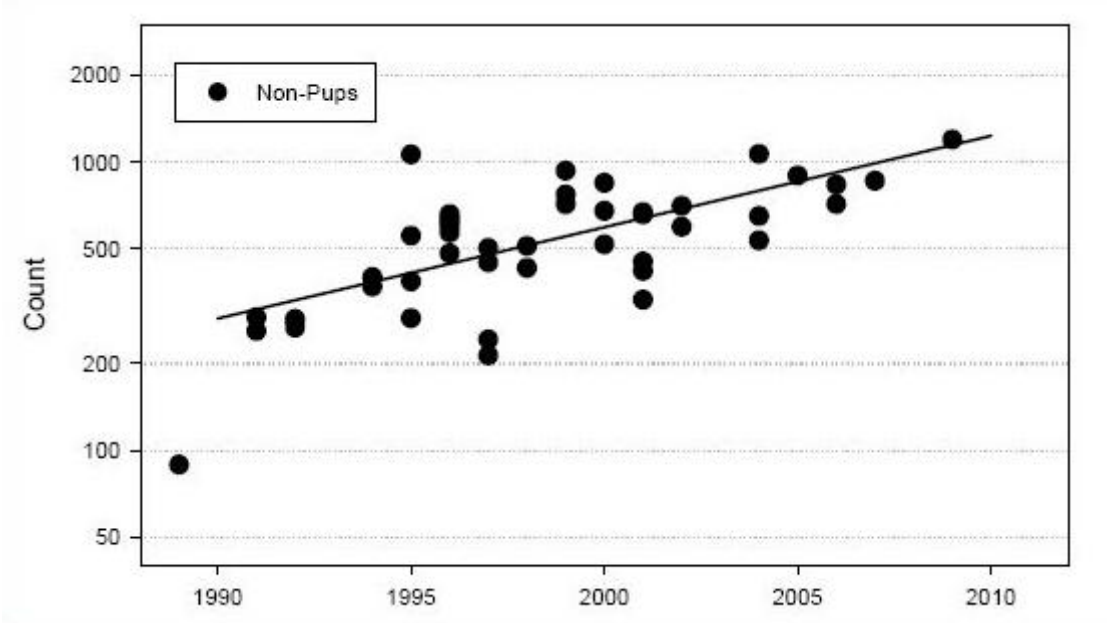



Figure 2. Trends in abundance of Steller sea lions in Washington based on aerial surveys conducted during the summer breeding season (WDFW unpublished survey data).

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. 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 2011). 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 2011). 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. None are currently considered serious threats (NMFS 2008, Allen and Angliss 2011). No mortalities have been reported for drift gillnet and set gillnet fisheries in Washington and Oregon this decade, although, mortalities have occurred in the past (Allen and Angliss 2011). Small numbers were killed during the WA/OR/CA groundfish trawl in the early 2000s. No data are available after 1998 for the northern Washington marine set gillnet fishery. There were no fishery-related strandings of Steller sea lions in Washington, Oregon, or California between 2004 and 2008. From 2004 to 2008, strandings of animals from this stock with gunshot wounds occurred in Oregon and Washington (one in 2004 and three in 2005).

A recovery plan for the species was recently revised (NMFS 2008). Critical habitat for the Eastern U.S. stock was designated in southeastern Alaska and southwestern Oregon, but not in Washington. NMFS has published a Federal Register Notice regarding the status review of the eastern stock and potential removal from listing under the federal Endangered Species Act (see http://www.fakr.noaa.gov/protectedresources/stellers/edps/status.htm).

***Columbia River sea lion management.*** Each year since 2002, California sea lions have eaten thousands of federally threatened and endangered salmon and steelhead migrating below the Bonneville Dam. Since about 2005, wildlife managers from WDFW and the Oregon Department of Fish and Wildlife have worked with federal and tribal partners to chase sea lions away from the area immediately below the dam. Steller sea lions have also have been feeding below Bonneville Dam, but their primary prey is white sturgeon rather than spring chinook (see http://www.nwr.noaa.gov/Marine-Mammals/Seals-and-Sea-Lions/States-MMPA-Request.cfm). While California sea lions have been removed, Steller sea lions have only been harassed in attempt to drive them from the area.

***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 2011). Steller sea lions surveys are being routinely done in the summer in Washington (Figure 2).

***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 has 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.).

***Biological opinion review.*** In 2011, WDFW and the state of Alaska jointly convened an independent scientific review (Bernard et al. 2011) of a recent federal biological opinion concerning the impact of groundfish fisheries on Steller sea lions in the Western U.S. stock (NMFS 2010). The two states assembled a panel of scientists to determine whether the National Marine Fisheries Service used all relevant scientific information and impartially considered those facts in its final Biological Opinion for Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries. This document was the basis for significant fishery closures and restrictions in the western Aleutians that went into effect January 1, 2011. The scientific panel concluded that 1) the biological opinion's support for nutritional stress to Steller sea lions from competition with fisheries was not well supported and that other scientific explanations were not adequately examined, and 2) that the biological opinion's recommendations were unlikely to contribute to sea lion recovery (Bernard et al. 2011).

**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.

## Literature cited


Allen, B. M. and R. P. Angliss. 2011. Alaska marine mammal stock assessments, 2010. NOAA Technical Memorandum NMFS-AFSC-223, Alaska Fisheries Science Center, Seattle, Washington.

Bernard, D. R., S. J. Jeffries, G. Knapp, and A. W. Trites. 2011. An independent, scientific review of the biological opinion (2010) of the fisheries management plan for the Bering Sea/Aleutian Islands management areas. Alaska Department of Fish and Game, Anchorage, Alaska, and Washington Department of Fish and Wildlife, Lakewood, Washington.

Hoffman, J. I., C. W. Matson, W. Amos, T. R. Loughlin, and J. W. Bickham. 2006. Deep genetic subdivision within a continuously distributed and highly vagile marine mammal, the Steller's sea lion (*Eumetopias jubatus*). Molecular Ecology 15:2821-2832.

Jeffries, S. J., P. J. Gearin, H. R. Huber, D. L. Saul, and D. A. Pruett. 2000. Atlas of seal and sea lion haulout sites in Washington. Washington Department of Fish and Wildlife, Olympia, Washington.

NMFS (National Marine Fisheries Service). 1995. Status review of the United States Steller sea lion (*Eumetopias jubatus*) population. National Marine Mammal Laboratory, National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2008. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, Maryland.

NMFS (National Marine Fisheries Service). 2010. Endangered Species Act - Section 7 Consultation, Biological Opinion. Authorization of groundfish fisheries under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. Alaska Region, National Marine Fisheries Service, Juneau, Alaska.

Olesiuk, P. F., S. J. Jeffries, M. M. Lance, A. W. Trites, P. J. Gearin, K. Miller-Saunders, A. Tabata, S. D. Riemer, and D. M. Lambourn. In prep. Prey requirements and salmon consumption by Steller sea lions (*Eumetopias jubatus*) in southern British Columbia and Washington State. Research Document, Canadian Science Advisory Secretariat.

Pitcher, K. W., P. F. Olesiuk, R. F. Brown, M. S. Lowry, S. J. Jeffries, J. L. Sease, W. L. Perryman, C. E. Stinchcomb, and L. F. Lowry. 2007. Status and trends in abundance and distribution of the eastern Steller sea lion (*Eumetopias jubatus*) population. Fisheries Bulletin 107:102-115.

Trujillo, R. G., T. R. Loughlin, N. J. Gemmell, J. C. Patton, and J. W. Bickham. 2004. Variation in microsatellites and mtDNA across the range of the Steller sea lion, *Eumetopias jubatus*. Journal of Mammalogy 85:338-346.

## North American Lynx

(*Lynx canadensis*)

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

Figure 1. A North American lynx captured in Okanogan County in 2011 (*photo by Jeff Heinlen)*.

Lynx are slightly larger than bobcats and smaller than cougars (Figure 1). Features that distinguish them from bobcats include longer legs, larger paws, fuller facial ruff, longer ear tufts, 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 about 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

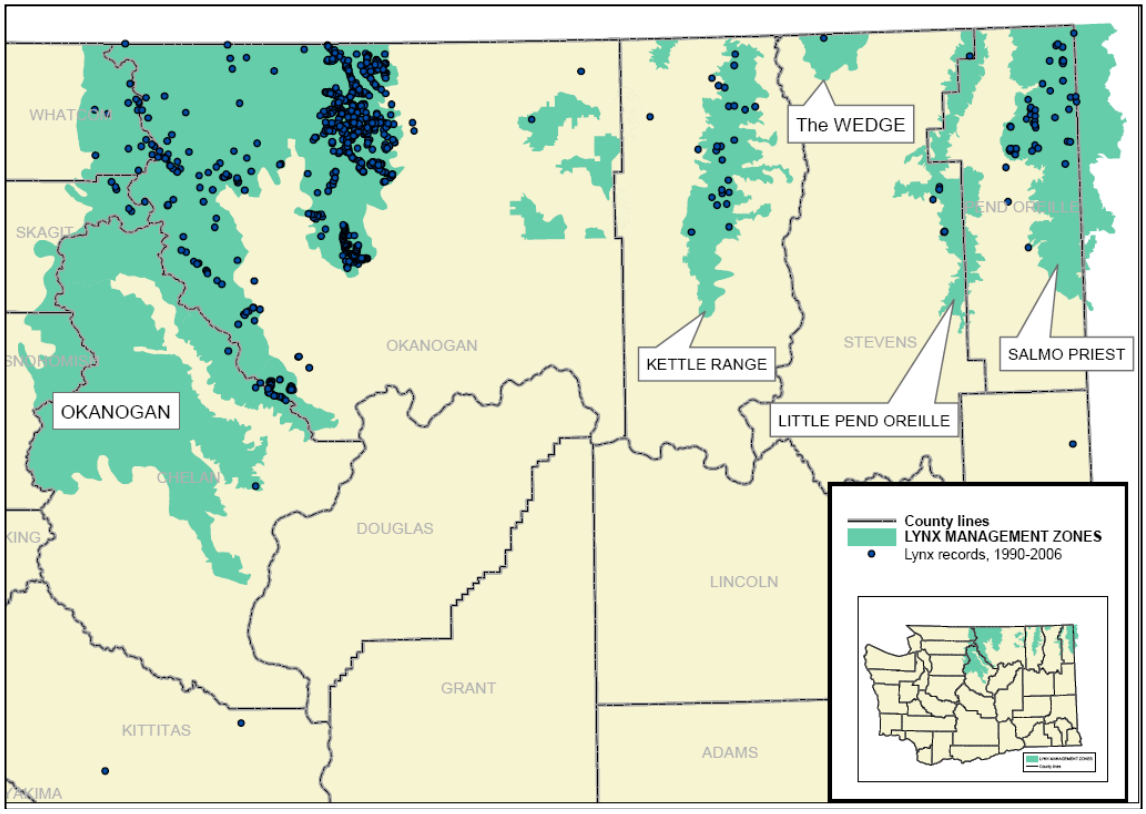



Figure 2. Lynx records and management zones in Washington (from Stinson 2001).

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 (Ruedigger et al. 2000, Gilbert 2006, Roloff 2007). WDFW completed a state recovery plan in 2001 (Stinson 2001). It identified Lynx Management Zones for Washington based on vegetation work done by the U.S. Forest Service (Figure 2).

***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. 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. 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.

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 (Figure 3), with >10,000 GPS

coordinates recorded from these animals (Koehler et al. 2011). An additional four new lynx were captured and marked during 2011.

During the summers of 2010 and 2011, fine scale vegetation and habitat data were collected for three collared males at summer and winter locations. These data are being analyzed to test the model of Maletzke (2004) and determine if lynx habitat selection differs between seasons. In 2010, a University of Washington PhD student began research on snowshoe hares in Loomis State Forest and Okanogan National Forest. Nearly 300 hares have been captured, with radio collars placed on >60. Data from 60 predation events were collected and DNA from saliva and hair has been used to identify the predators. Field work is expected to continue into summer 2012.

Figure 3. WDFW research scientist Gary Koehler with lynx captured in Okanogan County.

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.

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).

***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.

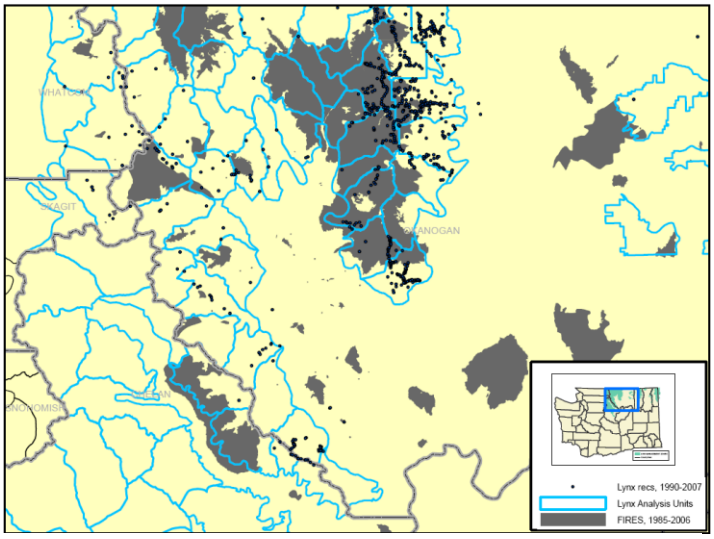



Figure 4. Recent fires, lynx detections, and Lynx Analysis Units in the Okanogan region of Washington.

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 long-term unless intensive natural resource management is conducted (Gonzales et al. 2007).

***Conservation activities.*** 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.

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

**Literature Cited**

Aubry, K. B., G. M. Koehler, and J. R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373–396 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. S. Squires, editors. Ecology and conservation of lynx in the United States. University Press of Colorado, Niwot, Colorado.

Gilbert, B. A. (2005). Predicting the availability of understory structural features important for Canadian lynx denning habitat on managed lands in northeastern Washington lynx ranges. Western Journal of Applied Forestry 20:224-227.

Gilbert, B. 2006. Stimson Lumber Company lynx habitat management plan biennial report 2003-2004. Prepared for Stimson Lumber Company, Newport, Washington.

Gonzalez, P. R. P. Neilson, K. S. McKelvey, J. M. Lenihan, and R.J. Drapek. 2007. Potential impacts of climate change on habitat and conservation priority areas for *Lynx canadensis* (Canada lynx). Report to: Watershed, Fish, Wildlife, Air, and Rare Plants Staff; National Forest System; U.S. Department of Agriculture Forest Service; Washington, DC, and NatureServe. The Nature Conservancy, Arlington, Virginia. 19 pp.

Interagency Lynx Committee. 1999. Lynx habitat field reference notebook. Washington Department of Natural Resources, Olympia, Washington.

Koehler, G. M., B. T. Maletzke, J. A. Von Kienast, K. B. Aubry, R. B. Wielgus, and R. H. Naney. 2008. Habitat fragmentation and the persistence of lynx populations in Washington state. Journal of Wildlife Management 72:1518–1524.

Koehler, G. M., R. Naney, S. Fisher, G. Bell, B. Maletzke. 2011. Lynx habitat and spatial use patterns post wildfires 1985-2007. Annual Report January 2011. Washington Department of Fish and Wildlife, U.S. Forest Service Okanogan-Wenatchee National Forest, Washington Department of Natural Resources, Washington State University. 3 pp.

Maletzke, B. T. 2004. Winter habitat selection of lynx (*Lynx canadensis*) in northern Washington. Thesis, Washington State University, Pullman, Washington.

Maletze, B. T., G. M. Koehler, R. B. Wielgus, K. B. Aubry, and M. A. Evans. 2008. Habitat conditions associated with lynx hunting behavior during winter in northern Washington. Journal of Wildlife Management 72:1473–1478.

Poelstra, J. L. 2007. A GIS planning tool for integrating lynx habitat conservation with timber production on state forestland in northeastern Washington. M.S. Thesis. Central Washington University, Ellensburg, Washington.

Raffa, K. F., B. H. Aukema, B. J. Bentz, A. L. Carroll, J. A. Hicke, M. G. Turner, and W. H. Romme. 2008. Cross-scale drivers of natural disturbances prone to anthropogenic amplification: the dynamics of bark beetle eruptions. BioScience 58:501-517.

Roloff, G. J. 2007. Lynx habitat management plan, Washington, 2007-2011. Prepared for Forest Capital Partners, LLC, Monmouth, Oregon.

Ruediger, B., J. Claar, S. Mighton, B. Naney, T. Rinali, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, and J. Trick. 2000. Canada lynx conservation assessment and strategy. U.S. Forest Service, Bureau of Land Management, National Parks Service, and U.S. Fish and Wildlife Service, Missoula, Montana.

Stinson, D. W. 2001. Washington state recovery plan for the lynx. Washington Department of Fish and Wildlife, Olympia, Washington. 78 pp.

U.S. Fish and Wildlife Service. 2000. Determination of threatened status for the contiguous U.S. distinct population segment of the Canada lynx and related rule; final rule. Federal Register 65:16051–16086.

von Kienast, J. A. 2003. Winter habitat selection and food habits of lynx on the Okanogan Plateau, Washington. M.S. Thesis, University of Washington, Seattle, Washington.

WDNR. 2006. Lynx habitat management plan for DNR-managed lands. Washington Department of Natural Resources, Olympia, Washington.

Walker, C. J. 2005. Influences of landscape structure on snowshoe hare populations in fragmented forests. M.S. Thesis, University of Montana, Missoula, Montana.

## Ferruginous Hawk

(*Buteo regalis*)

**State Status:** Threatened, 1983
**Federal Status:** Species of concern
**Recovery Plans:** State, 1996

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

The ferruginous hawk is the largest North American buteo (Figure 1). Adults have a wingspan of 48-56 in, with females averaging larger and heavier than males. Ferruginous hawks inhabit semi-arid and prairie ecosystems of western North America (Bechard and Schmutz 1995). 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 is on the northwestern edge of the species' breeding range (Bechard and Schmutz 1995). Nests in Washington have been found in shrub-steppe and grassland habitats. About 60% of known ferruginous hawk territories in the state occur in Franklin and Benton counties, with significant numbers of territories also present in Grant, Walla Walla, Adams, and Yakima counties.

***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 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 shrub-steppe 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 shrub-steppe mammals, such as black-tailed jackrabbits (*Lepus californicus*) and 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 survival (Leary et al. 1998, Richardson et al. 2001).

WDFW first surveyed all known ferruginous hawk territories in the state in 1981. Follow-up surveys and searches for additional nest sites were made in 1987 and again from 1992 to 1995. Surveys in 2003 found ferruginous hawks occupying 78 of 231 historical territories in the state, with an estimated 92 young produced (Table 1). The species 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 (Figure 2).

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 hawk populations can exhibit numeric responses to changes in cyclical prey such as ground squirrels (Schmutz and Hungle 1989) and jackrabbits (Woffinden and Murphy 1989). Woffinden and Murphy (1989) reported a ferruginous hawk population crash concurrent with a jackrabbit decline in Utah. They speculated that the proliferation of cheatgrass contributed to longer term declines of jackrabbits. Significant losses of rabbits and ground squirrel species in Washington and dietary shifts to insects and smaller mammals suggest population declines of ferruginous hawks may be persistent.

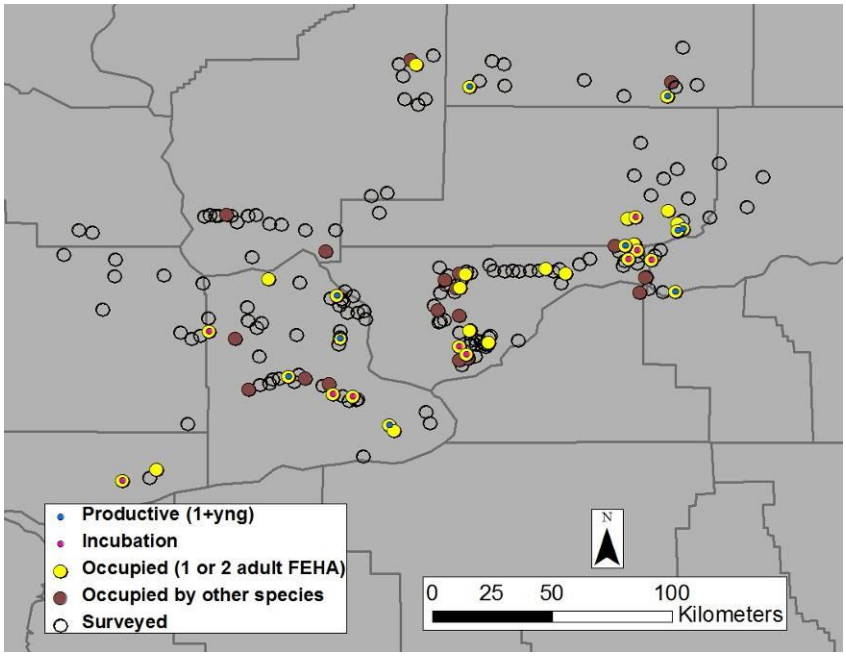



Figure 2. Occupancy and success of ferruginous hawk territories surveyed in Washington, 2010.

***Migration study.*** WDFW examined the migration, range use, and survival of ferruginous hawks between 1999 and 2003, when 13 adults and 15 juveniles were monitored with satellite telemetry (Watson 2003). The hawks generally migrated from Washington in two stages, often moving east to the front range of the Rocky Mountains by August and to the plains of North Dakota, Nebraska, and Oklahoma from early August to early October (Figure 3). Some individuals relocated to eastern Oregon by late fall. These movements suggest that ferruginous hawks from Washington migrate to regions with an abundance of ground squirrels and prairie dogs.

Six adults monitored for 2 years repeated similar migration patterns, and returned to the same wintering areas and breeding territories (Watson 2003). Young and adults from the same nests migrated independently and followed different migration patterns. In their first year, juveniles wandered an average of 6,139 km through western North America for three months prior to settling on winter ranges in California, the Central Plains, or Mexico. Two immatures migrated over 2,000 km less to winter ranges in their second year than in their first year.

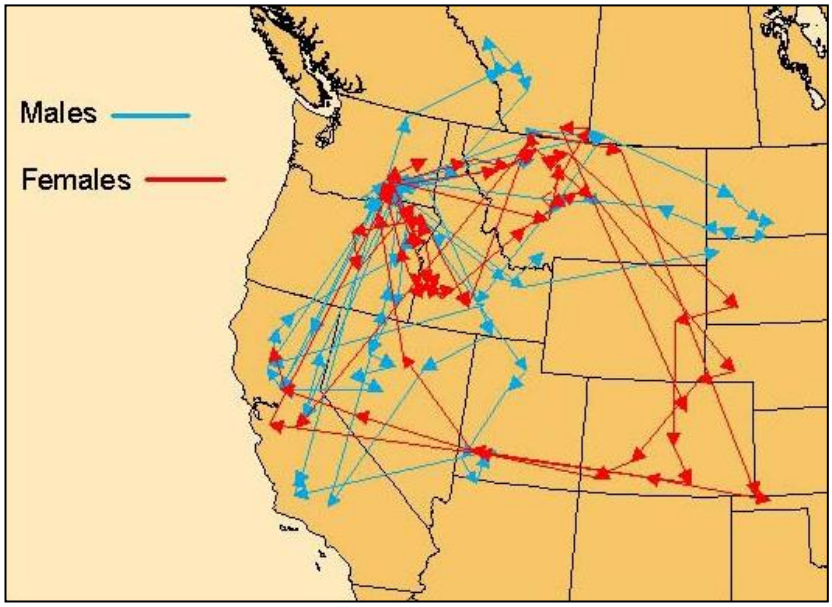



Figure 3. Migration patterns of 13 adult ferruginous hawks from south-central Washington (Watson 2003).

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, which probably result from depressed prey populations and drought. Wind farms represent a potential threat. Two ferruginous hawks have been killed at wind farms (both in Klickitat County) in Washington up through 2011 (T. Nelson, pers. comm.).

***Recovery plan.*** WDFW completed a recovery plan for the species in 1996 (Richardson 1996). The recovery objective for the state is 60 or more breeding pairs (measured annually by the number of nests with eggs) for a 5-year average, distributed throughout the historical range. However, surveys needed to compute the 5-year average have not been done annually due to other priorities and funding constraints.

**Partners and cooperators:** Woodland Park Zoo, BLM Spokane District, Hanford Reach National Monument.

### Literature Cited

Bechard, M. J. and J. K. Schmutz. 1995. Ferruginous hawk. *In* A. Poole and F. Gill, editors. The Birds of North America, No. 172. Academy of Natural Sciences, Philadelphia, Pennsylvania, and the American Ornithologists' Union, Washington, D.C.

Richardson, S. A. 1996. Washington state recovery plan for the ferruginous hawk. Washington Department of Fish and Wildlife, Olympia, Washington. 63 pp.

Richardson, S. A., A. E. Potter, K. L. Lehmkuhl, R. Mazaika, M. E. McFadzen, and R. Estes. 2001. Prey of ferruginous hawks breeding in Washington. Northwestern Naturalist 82:58–64.

Schmutz, J. K., and D. J. Hungle. 1989. Population of ferruginous and Swainson's hawks increase in synchrony with ground squirrels. Canadian Journal of Zoology 67:2596-2601.

Watson, J. W. 2003. Migration and winter ranges of ferruginous hawks from Washington. Washington Department of Fish and Wildlife, Olympia, Washington. http://wdfw.wa.gov/publications/00131/

Woffinden, N. D. and J. R. Murphy. 1989. Decline of a ferruginous hawk population: a 20-year summary. Journal of Wildlife Management 53:1127-1132.

## Marbled Murrelet

(*Brachyramphus marmoratus*)

**State Status:** Threatened, 1993
**Federal Status:** Threatened, 1992
**Recovery Plans:** 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 (Figures 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 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 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.

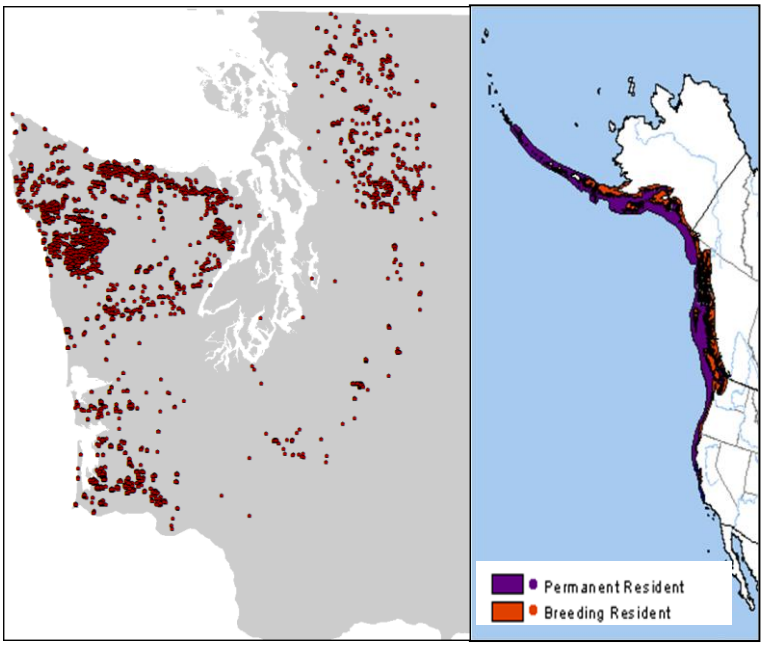



Figure 2. Range of the marbled murrelet (right, Ridgely et al. 2007), and breeding season occurrences in Washington, left.

Marbled murrelets prey primarily on near-shore forage fish such as Pacific sand lance, Pacific herring, northern anchovy, and capelin (S. Pearson, pers. comm.). Krill is also eaten when fish are scarce.

Populations of marbled murrelets from Washington to California have experienced sizable declines primarily because of habitat loss and

fragmentation caused by commercial timber harvesting. Only 5-20% of original old-growth forests remain in these states (USFWS 1997), most of which is in relatively small, fragmented patches or in forest parks and reserves.

***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 (USFWS 1992). Critical habitat considered essential to the conservation of the species in these states was designated in 1996. All critical habitat in Washington is located on federal lands. The primary goal of the federal recovery plan is to stabilize the population at or near 1997 levels by maintaining or increasing productivity and removing or minimizing threats to survivorship (USFWS 1997).

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

The murrelet was added to the state list of threatened species in 1993 (WAC 232-12-011) and in 1997, the Washington Department of Natural Resources enacted permanent State Forest Practices Rules for the species (WDNR 1997). The rules require forest landowners with more than 500 acres within 50 miles of marine waters to identify potential nesting habitat and conduct surveys to detect murrelets in suitable habitat before any modification or alteration of habitat can occur. If surveys determine there is a high likelihood of nesting in a stand, the contiguous suitable habitat is designated "occupied" and is protected from harvest (WDNR 1997).

***Habitat and population monitoring.*** Conservation of nesting habitat for marbled murrelets is one of the central goals of the federal 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 for marbled murrelets and northern spotted owls (FEMAT 1993). These are tracked over time to determine changes and the success of recovery management. Habitat changes are monitored over time and compared to the 1993 baseline level of nesting habitat (Huff et al. 2006a, Raphael et al. 2006, 2011). Population size and trends are monitored using standardized surveys for murrelets at sea during the breeding season (Miller et al. 2006, Raphael et al. 2007).

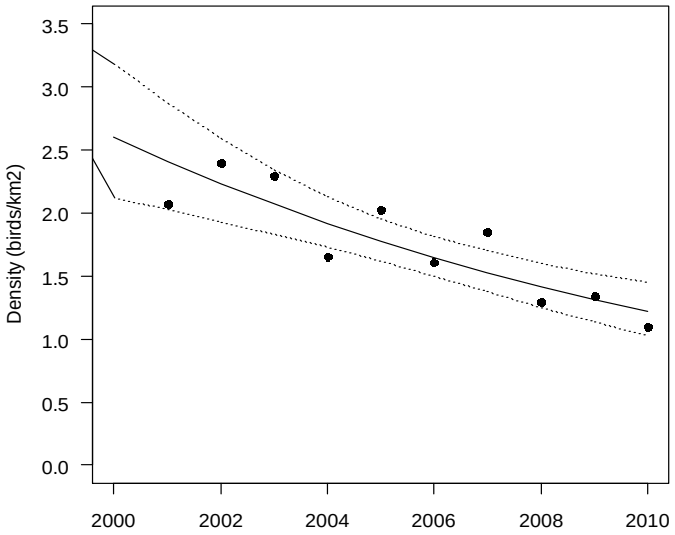



Figure 3. Washington marbled murrelet population density trend for 2001-2010 with 95% confidence intervals for all marine waters of Washington State (Pearson et al. 2011).

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 2010, the population estimate for Puget Sound and the Strait of Juan de Fuca was 4,393 birds, with the highest densities of murrelets occurring from Cape Flattery to the Quinault River mouth (Pearson et al. 2011). This represents a 46% population decline

from 2001–2010, which corresponds to an annual rate of 7.31% (Figure 3; Pearson et al. 2011).

An estimated 3.8 million acres of marbled murrelet nesting habitat was present in Washington and Oregon in 1994 and in California in 1996, with 36% of this habitat occurring on nonfederal lands. About 13% of all nesting habitat was lost in these states by 2006-2007 (Raphael et al. 2011). Fire was the major cause of this loss on federal lands in Oregon and California, whereas timber harvest was the primary cause on nonfederal lands (Raphael et al. 2011). From 1996 to 2006, high quality potential nesting habitat in Washington declined by an estimated 11%, with about 252,600 acres of 2.3 million acres lost. Most (>90%) of this loss was attributed to timber harvest (Raphael et al. 2011). Severe windstorms have also contributed to habitat losses on state and private lands 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). Adjacent forestlands on the Olympic Peninsula and Vancouver Island provide potential nesting sites for murrelets, especially older forests in or near Olympic National Park 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 (in the Strait of Juan de Fuca, Washington outer coast, and San Juan Islands), radio-tagged, and tracked to inland breeding locations. 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 marine waters, land areas, and travel corridors were measured (Bloxton and Raphael 2009). Birds with nests located farther from the ocean had larger home ranges. The same birds had marine home ranges of 13 to 3,215 $km^2$.

***Population threats.*** Low murrelet nest success in recent years (Peery et al. 2004, Bloxton and Raphael 2009) is a major concern. 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 garbage and other human-related foods 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 simulated 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 and not documented to have "occupied" murrelet behavior. Unintended losses of habitat have occurred when Washington Forest Practices-defined habitat is unreported or is not correctly identified on state or private land applications under the Washington Forest Practices (WDFW, unpublished data). Outside of federal and some WDNR and WDFW state lands, no incentive exists for landowners to develop new 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 U.S. Fish and Wildlife Service assembled a team of scientists in October 2011 to investigate causes for the continued decline in murrelet populations. The outcome of these discussions is forthcoming in spring 2012. The Pacific Seabird Group is currently reviewing aspects of the 2003 standard terrestrial survey protocol for clarifying delineation of forest habitat, definitions, and survey effort.

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.

**Literature Cited**

Bloxton, T. D., and M. G. Raphael. 2009. Breeding ecology of the marbled murrelet in Washington State: five year project summary (2004-2008). USDA Forest Service, Pacific Northwest Research Station, Olympia, Washington.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management: an ecological, economic, and social assessment. U.S. Department of Agriculture, U.S. Department of the Interior, National Oceanic and Atmospheric Administration, and U.S. Environmental Protection Agency, Portland, Oregon.

Hamer, T. E., and S. K. Nelson. 1995. Characteristics of marbled murrelet nest trees and nesting stands. Pages 69-82 *in* C. J. Ralph, G. L. Hunt, M. G. Raphael, and J. F. Piatt, editors. Ecology and conservation of the marbled murrelet. General Technical Report PSW-GTR-152, USDA Forest Service, Pacific Southwest Research Station, Albany, California.

Huff, M. H., M. G. Raphael, S. L. Miller, S. K. Nelson, and J. Baldwin, technical coordinators. 2006. Northwest Forest Plan—the first 10 years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. General Technical Report PNW-GTR-650, USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Leschner, L. L., and E. B. Cummins. 1992. Breeding records, inland distribution, and threats of the marbled murrelet in Washington from 1905 to 1987. Proceedings Western Foundation of Vertebrate Zoology 5:42-47.

Marzluff, J.M., and E. A. Neatherlin. 2006. Corvid response to human settlements and campgrounds: causes, consequences, and challenges for conservation. Biological Conservation 130:301-314.

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, S. K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report, EDAW, Inc., Seattle, Washington..

Miller, S. L., C. J. Ralph, M. G. Raphael, G. Strong, C. Thompson, J. Baldwin, and H. M. Huff. 2006. At-sea

monitoring of marbled murrelet population status and trend in the Northwest Forest Plan area. Pages 31-60 *in* M. Huff, M. G. Raphael, S. L. Miller, S. K. Nelson, and J. Baldwin, technical coordinators. Northwest Forest Plan—the first 10 years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. Gen. Tech. Rep. PNW-GTR-650, USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Nelson, S. K. 1997. Marbled murrelet (*Brachyramphus marmoratus*). *In* The Birds of North America, No. 276. A. Poole and F. Gill, editors. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists Union, Washington, D.C.

Nelson, S. K., M. H. Huff, S. L. Miller, and M. G. Raphael. 2006. Marbled murrelet biology: habitat relations and populations in Northwest Forest Plan—the first 10 Years (1994-2003): status and trends of populations and nesting habitat for the marbled murrelet. General Technical Report PNW-GTR-650, USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Pearson, S. F., M. G. Raphael, M. M. Lance, and T. D. Bloxton, Jr. 2011. Washington 2010 at-sea marbled murrelet population monitoring. Research Progress Report, Washington Department of Fish and Wildlife and USDA Forest Service Pacific Northwest Research Station, Olympia, Washington.

Peery, M. Z., S. R. Beissinger, S. H. Newman, E. B. Burkett, and T. D. Williams. 2004. Applying the declining population paradigm: diagnosing causes of poor reproduction in the marbled murrelet. Conservation Biology 18:1088–1098.

Piatt, J. F., K. J. Kuletz, A. E. Burger, S. A. Hatch, V. L. Friesen, T. P. Birt, M. L. Arimitsu, G. S. Drew, A. M. A. Harding, and K. S. Bixler. 2007. Status review of the marbled murrelet (*Brachyramphus marmoratus*) in Alaska and British Columbia. U.S. Geological Survey Open-File Report 2006-1387.

Ralph, C. J., G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt. 1995. Ecology and conservation of the marbled murrelet in North America: an overview. Pages 3-22 *in* C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, editors. Ecology and conservation of the marbled murrelet. General Technical Report PSW-GTR-152, USDA Forest Service, Pacific Southwest Research Station, Albany, California.

Raphael, M. G., D. E. Mack, and B. A. Cooper. 2002a. Use of radar to investigate landscape-scale relationships between abundance of marbled murrelets and nesting habitat. Condor 104:331-342.

Raphael, M. G., D. E. Mack, J. M. Marzluff, and J. M. Luginbuhl. 2002b. Effects of forest fragmentation on populations of the marbled murrelet. Studies in Avian Biology 25:221-235

Raphael, M. G., G. A. Falxa, K. M. Dugger, B. M. Galleher, D. Lynch, S. L. Miller, S. K. Nelson, and R. D. Young. 2011. Northwest Forest Plan—the first 15 years (1994–2008): status and trend of nesting habitat for the marbled murrelet. Gen. Tech. Rep. PNW-GTR-848, USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Ridgely, R. S., T. F. Allnutt, T. Brooks, D. K. McNicol, D. W. Mehlman, B. E. Young, and J. R. Zook. 2007. Digital distribution maps of the birds of the Western Hemisphere, version 3.0. NatureServe, Arlington, Virginia.

USFWS (U.S. Fish and Wildlife Service). 1992. Endangered and threatened wildlife and plants: determination of threatened status for the Washington, Oregon, and California population of the marbled murrelet. Federal Register 57:45328-45337.

USFWS (U.S. Fish and Wildlife Service). 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2009. Marbled murrelet *(Brachyramphus marmoratus)* 5-year status review. Final, June 12, 2009. U.S. Fish and Wildlife Service, Lacey, Washington.

WDNR (Washington Department of Natural Resources). 1997. Washington forest practices rules. Washington Forest Practices Board and Department of Natural Resources, Olympia, Washington

WDNR (Washington Department of Natural Resources). 2008. Report on windthrow in southwestern Washington following the 2006-2007 storms. Washington Department of Natural Resources, Olympia, Washington.

## 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 displaying on a lek (*photo by R.E. Bennetts*).

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.

Greater sage-grouse inhabit shrub-steppe and, as their name implies, are closely associated with sagebrush. 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.

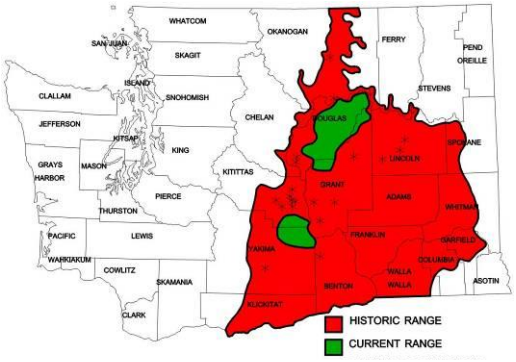



Figure 2. Recent and historical range of sage-grouse in Washington.

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

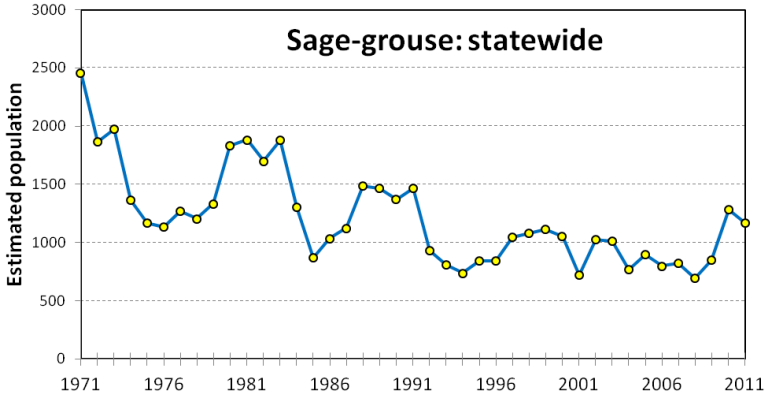



Figure 3. Statewide population estimate of sage-grouse in Washington, 1981-2011.

being reestablished in Lincoln County.

Based on changes in number of males counted on lek complexes, the sage-grouse population size in Washington declined by 50% from 1970 to 2011 (Figure 3; Schroeder et al. 2011). The 2011 spring population was estimated to be about 1,165 birds, with 213 at the YTC, 926 in Douglas County, and 26 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.

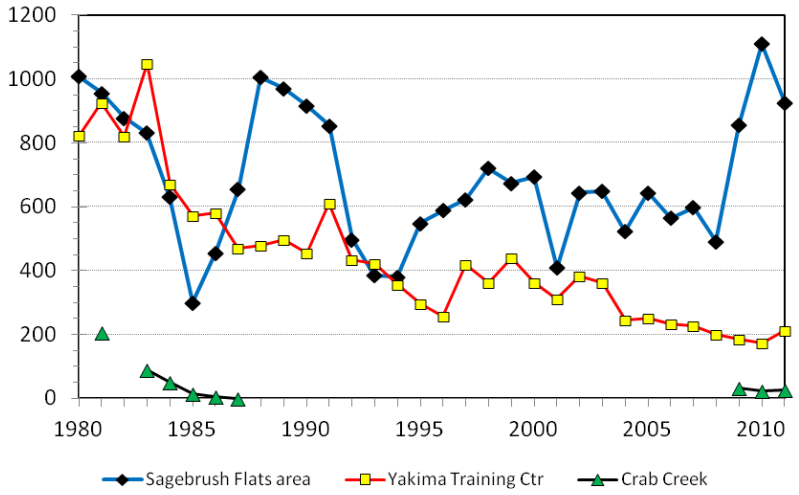



Figure 4. Estimates for three populations of sage-grouse in Washington, 1980-2011.

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.

***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 2011, 143 greater sage-grouse were translocated from southern Oregon to the release area (Table 1). The

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 | Total |
|---|---|---|---|---|---|---|
| Male | 10 | 7 | 15 | 23 | 19 | 74 |
| Female | 7 | 17 | 13 | 15 | 17 | 69 |
| Total | 17 | 24 | 28 | 38 | 36 | 143 |

movements, productivity, habitat use, and survival of these birds have been monitored. In 2011, males established a lek in spring and about 26 birds were being monitored with telemetry by the end of the year.

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.

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 enrolled 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. A total of 356 conservation plans covering 56,918 acres have been written since October 2010.

***Wind power effects on sage-grouse.*** A research project was started to examine the potential impacts of the proposed Withrow Wind Power Project (WWPP) in shrub-steppe-dominated habitat north of Withrow, Douglas County. A major goal of this research was to assess the effects of turbines and related infrastructure on use of habitats by sage-grouse in the study area and attendance at leks by sage-grouse. Pre-construction baseline data were collected, but the wind project is now on hold.

***Landscape management.*** The Washington Wildlife Habitat Connectivity Working Group (WHCWG) is addressing connectivity patterns for numerous focal species, including greater sage-grouse. An analysis of statewide connectivity patterns was published in 2010 (WHCWG 2010) and an ecoregional analysis for the Columbia Plateau will be completed in 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 (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, Wenatchee Sportsmen, Inland Northwest Wildlife Council, Spokane Audubon, Lincoln County Conservation District, The Nature Conservancy, Washington Department of Natural Resources.

### Literature Cited

Cadwell, L. L., J. L. Downs, M. A. Simmons, C. J. Murray, Y. J. Chien, R. N. Kickert, and R. K. Zufelt. 2001. Sage-grouse on the Yakima Training Center: Part III – habitat/decision support modeling to anticipate impacts from military training activities. Contract #DE¬AC06-76RL01830, Pacific Northwest National Laboratory, Richland, Washington.

Schroeder, M. A., M. Atamian, H. Ferguson, M. Finch, and D. W. Stinson. 2011. Reintroduction of greater sage-grouse to Lincoln County, Washington. Progress Report. Washington Department of Fish and Wildlife, Olympia, Washington.

Schroeder, M. A., D. W. Hays, M. F. Livingston, L. E. Stream, J. E. Jacobson, and D. J. Pierce. 2000. Changes in the distribution and abundance of sage grouse in Washington. Northwestern Naturalist 81:104-112.

Schroeder, M. A., and W. M. Vander Haegen. 2006. Use of Conservation Reserve Program fields by greater sage-grouse and other shrubsteppe-associated wildlife in Washington state. Technical report prepared for U.S. Department of Agriculture Farm Service Agency. Washington Department of Fish and Wildlife, Olympia, Washington.

Schroeder, M. A., and M. Vander Haegen. 2011. Response of greater sage-grouse to the Conservation Reserve Program in Washington State. Pages 517-529 *in* S. T. Knick and J. W. Connelly, (eds.). Greater sage-grouse: ecology and conservation of a landscape species and its habitats. Studies in Avian Biology No. 38.

Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage grouse (*Centrocercus urophasianus*). *In* A. Poole and F. Gill, (eds.). The Birds of North America, No. 425. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and the American Ornithologists' Union, Washington, D.C.

Stinson, D. W., D. W. Hays, and M. A. Schroeder. 2004. Washington State recovery plan for the greater sage-grouse. Washington Department of Fish and Wildlife, Olympia, Washington. 109 pp.

U.S. Fish and Wildlife Service. 2001. 12-month finding for a petition to list the Washington population of western sage grouse (*Centrocercus urophasianus phaios*). Federal Register 66(88):22984-22994.

WHCWG (Washington Wildlife Habitat Connectivity Working Group). 2010. Washington Connected Landscapes Project: Statewide Analysis. Washington Departments of Fish and Wildlife, and Transportation, Olympia, Washington. Available from http://waconnected.org

## Columbian Sharp-tailed Grouse

(*Tympanuchus phasianellus columbianus*)

**State Status**: Threatened, 1998
**Federal Status**: Species of concern
**Recovery Plans:** State, in prep.

Figure 1. Sharp-tailed grouse wintering at Scotch Creek Wildlife Area (*photo by Gregg Thompson*).

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. Riparian areas with deciduous trees and shrubs that provide cover, berries, seeds, buds, and catkins when the ground is snow-covered provide critical winter habitat. The most important trees and shrubs include water birch, serviceberry, chokecherry, rose, hawthorn, snowberry, cottonwood, and aspen. 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 2001. Annual changes in attendance at leks suggest a 74% decline during this period. The current distribution of sharp-tailed grouse covers about 2,173 km$^2$, which is only 2.8% of

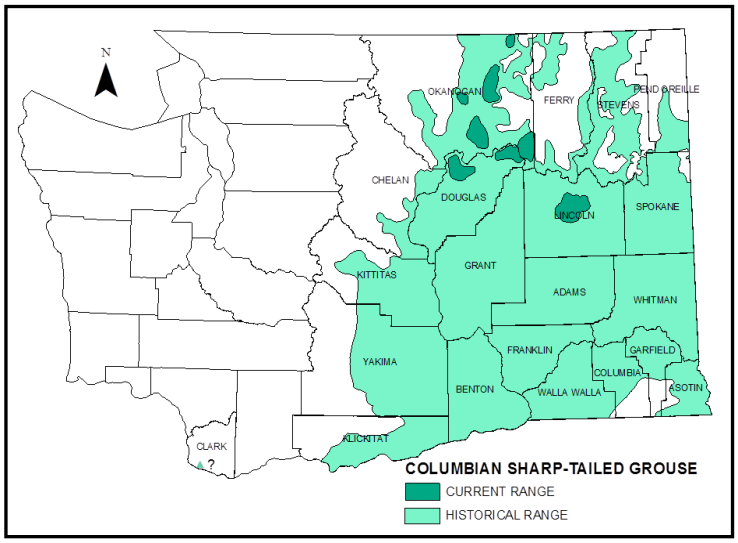



Figure 2. Historical and current range of Columbian sharp-tailed grouse in Washington (*modified from Schroeder et al. 2000*).

the historical range in Washington.

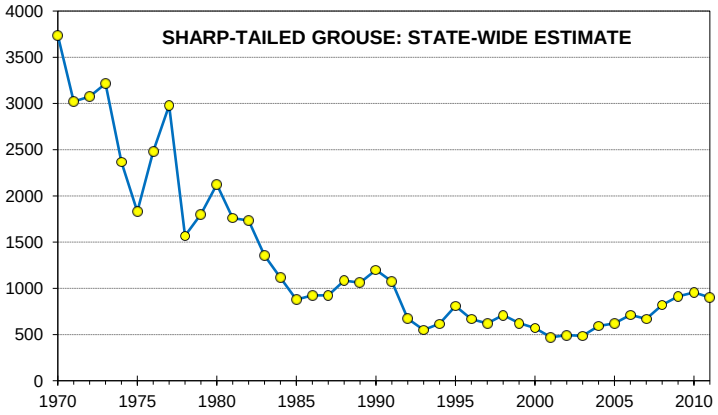



Figure 3. Estimated total population of Columbian sharp-tailed grouse in Washington, 1970-2011.

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. At least one population appears to have gone extinct since 2000. The total population estimate dipped to a low of 472 in 2001, then increased to 956 in 2010, probably in response to translocations and habitat restoration (Figure 3). The 2011 estimate was 902 birds.

***Population augmentations.*** The small remaining subpopulations in Washington will not persist unless they are able to increase in size. Sharp-tailed grouse from healthy populations outside the state have been translocated to Washington to improve the vigor of local populations (Schroeder et al. 2010). Population augmentation in the 1990s apparently prevented extirpation of the population at Scotch Creek Wildlife Area. Since 1998, a total of 358 sharp-tailed grouse have been translocated and released in areas with declining populations (Figure 4). 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 295 birds from Idaho, Utah, and British Columbia were released during 2005-2011 at sites in Okanogan, Douglas, and Lincoln counties. Additional releases are planned in future years to stabilize existing populations and eventually establish additional populations.

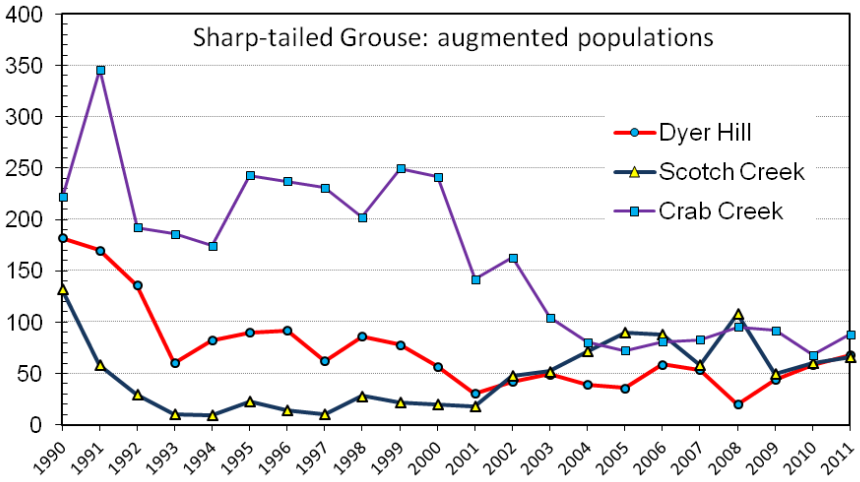



Figure 4. Sharp-tailed grouse population estimates for three sites augmented with translocations.

***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 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 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 enrolled in 2010 for sage-grouse and sharp-tailed grouse habitat in northern Douglas County.

***Habitat restoration and acquisition.*** Work is currently underway to restore 413 ac of old grain fields in northern Douglas County to shrub-steppe. In 2007, 113 ac of former wheat fields were planted to native vegetation, and during 2011, 70 ac of crested wheatgrass was reseeded to native vegetation with funding from the U. S. Bureau of Land Management (BLM). Reseeding of an additional 400 ac of older CRP is a high priority for needed funds. In 2011, WDFW acquired two groups of properties that may benefit sharp-tailed grouse. These included 3,075 acres in the Okanogan-Similkameen watershed and 473 acres in Douglas County. The Wenatchee Sportsmen marked 28 miles of fences on WDFW lands to reduce grouse collision mortalities in Douglas County in 2011. Also 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. 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.

***Landscape management.*** The Washington Wildlife Habitat Connectivity Working Group (WHCWG) is addressing connectivity patterns for numerous focal species, including sharp-tailed grouse. An analysis of statewide connectivity patterns was published in 2010 (WHCWG 2010) and an ecoregional analysis for the Columbia Plateau will be completed in 2012. The latter analysis is modeling habitat concentration areas and movement corridors for sharp-tailed grouse.

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.

### Literature Cited

Connelly, J. W., M. W. Gratson, and K. P. Reese. 1998. Sharp-tailed grouse (*Tympanuchus phasianellus*). The Birds of North America, No. 354. A. Poole and F. Gill, editors. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and the American Ornithologists' Union, Washington, D.C.

Schroeder, M., M. Atamian, H. Ferguson, M. Finch, D. Stinson, M. Berger, and R. Whitney. 2010. Re-establishment of viable populations of Columbian sharp-tailed grouse in Washington: progress report. Washington Department of Fish and Wildlife, Olympia, Washington. Available from http://wdfw.wa.gov/publications/pub.php?id=01147

Schroeder, M. A., D. W. Hays M. A. Murphy, and D. J. Pierce. 2000. Changes in the distribution and abundance of Columbian sharp-tailed grouse in Washington. Northwestern Naturalist 81:95-103.

Stinson, D. W., and M. A. Schroeder. 2010. Draft Washington state recovery plan for the Columbian sharp-tailed grouse. Washington Department of Fish and Wildlife, Olympia, Washington. 150 pp.

WHCWG (Washington Wildlife Habitat Connectivity Working Group). 2010. Washington connected landscapes project: statewide analysis. Washington Department of Fish and Wildlife and Washington State Department of Transportation, Olympia, Washington. Available from http://waconnected.org

## Green Sea Turtle
(*Dermochelys coriacea*)

**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 between 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.

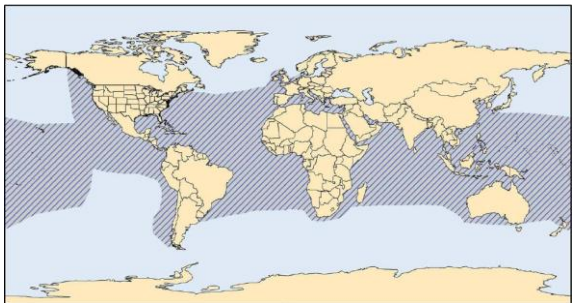


Figure 2. Range of green sea turtles (*NMFS, Office of Protected Resources*)

Adult females return every 2-4 years to the same sandy beaches where they were born to lay eggs. 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 2002-2011, with the most recent of these occurring in November 2010 (K. Wilkinson, 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 major ocean basins (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 20-30 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, 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 2002-2011 (K. Wilkinson, unpublished data).

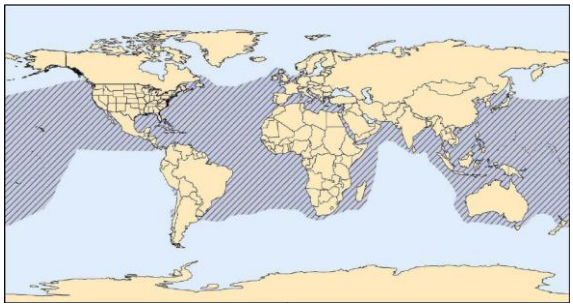


Figure 3. Range of loggerhead sea turtles (*NMFS, Office of Protected Resources*).

***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 loggerhead declines 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.

## Literature Cited


Conant, T. A., P. H. Dutton, T. Eguchi, S. P. Epperly, C. C. Fahy, M. H. Godfrey, S. L. MacPherson, E. E. Possardt, B. A. Schroeder, J. A. Seminoff, M. L. Snover, C. M. Upite, and B. E. Witherington. 2009. Loggerhead sea turtle *(Caretta caretta)* 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service. 222 pages.

Finkbeiner, E. M., B. P. Wallace, J. E. Moore, R. L. Lewison, L. B. Crowder, and A. J. Read. 2011. Cumulative estimates of sea turtle bycatch and mortality in USA fisheries between 1990 and 2007. Biological Conservation 144: 2719-2727.

NMFS and USFWS (National Marine Fisheries Service and United States Fish and Wildlife Service). 1998a. Recovery plan for U.S. Pacific populations of the east Pacific green turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS (National Marine Fisheries Service and United States Fish and Wildlife Service). 1998b. Recovery plan for U.S. Pacific populations of the loggerhead turtle (*Caretta caretta*). National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS (National Marine Fisheries Service and United States Fish and Wildlife Service). 2007. Green sea turtle (*Chelonia mydas*) 5-year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland, and U. S. Fish and Wildlife Service, Jacksonville, Florida. 105 pp.

NMFS and USFWS (National Marine Fisheries Service and United States Fish and Wildlife Service). 2011. Determination of nine distinct population segments of loggerhead sea turtles as endangered or threatened. Federal Register 76(184): 58868-58952.

## Gray Whale

(*Eschrichtius robustus*)

**State Status:** Sensitive, 1981
**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 (Allen and Angliss 2011). 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 (Lang et al. 2011). Additionally, a few members of the Western North Pacific stock have been detected visiting waters off Vancouver Island, Washington, and Oregon since 2004 (MMI 2011, Weller et al. 2011).

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; Allen and Angliss 2011). 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 (Allen and Angliss 2011). Subsistence hunting in Russia, where an average of 121 whales was taken per

year from 2003 to 2007, 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 an estimated 10 whales killed annually in U.S. waters (Allen and Angliss 2011). Reports of deaths from ship strikes average about one 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.

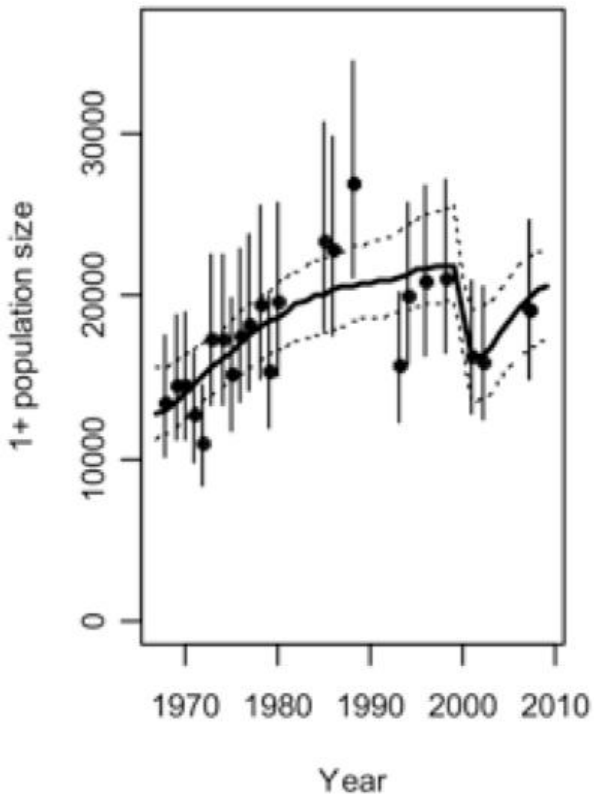



Figure 2. Estimated abundance of gray whales in the Eastern North Pacific stock from counts of whales migrating past Granite Canyon, California (error bars indicated 90% probability intervals; solid line represents the estimated trend of the population with 90% intervals as dashed lines; *from* Allen and Angliss 2011).

***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#recent). Research is underway on a number of aspects of the species' population biology.

***Makah Tribe's proposed whale hunt.*** The Makah Tribe was given 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 population, particularly members regularly occurring off northern Washington and southern Vancouver Island. A draft environmental impact for the hunt was prepared to meet NEPA requirements in 2008 (NMFS 2008). At this time, NOAA Fisheries continues its review of the proposal.

***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). Cascadia Research samples or necropsies many of these animals 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.

## Literature cited


Allen, B. M., and R. P. Angliss. 2011. Alaska marine mammal stock assessments, 2010. NOAA Technical Memorandum NMFS-AFSC-223, Alaska Fisheries Science Center, Seattle, Washington.

Berzin, A. A. 1984. Soviet studies on the distribution and numbers of the gray whale in the Bering and Chukchi Seas from 1968 to 1982. Pages 409-419 *in* M. L. Jones, S. L. Swartz, and S. Leatherwood, editors. The gray whale, *Eschrichtius robustus*. Academic Press, Orlando, Florida.

Bluhm, B. and R. Gradinger. 2008. Regional variability in food availability for arctic marine mammals. Ecological Applications 18:S77-S96.

Calambokidis, J., J. D. Darling, V. Deeke, P. Gearin, M. Gosho, W. Megill, C. M. Tombach, D. Goley, C. Toropova and B. Gisbourne. 2002. Abundance, range and movements of a feeding aggregation of gray whales (*Eschrichtius robustus*) from California and southeastern Alaska in 1998. Journal of Cetacean Research and Management 4:267-276.

Calambokidis, J., J. R. Evenson, G. H. Steiger, and S. J. Jeffries. 1994. Gray whales of Washington state: natural history and photographic catalog. Cascadia Research Collective, Olympia, Washington.

Calambokidis, J., J. L. Laake, and A. Klimek. 2010. Abundance and population structure of seasonal gray whales in the Pacific Northwest, 1998-2008. Report SC/62/BRG32 submitted to the International Whaling Commission Scientific Committee.

Darling, J. D. 1984. Gray whales off Vancouver Island, British Columbia. Pages 267-287 *in* M. L. Jones, S. L. Swartz, and S. Leatherwood, editors. The gray whale, *Eschrichtius robustus*. Academic Press, Orlando, Florida.

Hovelsrud, G. K., M. McKenna, and H. P. Huntington. 2008. Marine mammal harvests and other interactions with humans. Ecological Applications 18:S135-S147.

Lang A. R., B. L. Taylor, J. C. Calambokidis, V. L. Pease, A. Klimek, J. Scordino, K. M. Robertson, D. Litovka, V. Burkanov, P. Gearin, J. C. George, and B. Mate. 2011. Assessment of stock structure among gray whales utilizing feeding grounds in the Eastern North Pacific. Report of the International Whaling Commission SC/M11/AWMP4.

MMI (Marine Mammal Institute). 2011. Western Pacific gray whale, Sakhalin Island 2010. Marine Mammal Institute, Oregon State University, Newport, Oregon. <http://mmi.oregonstate.edu/Sakhalin2010>

Moore, S. E. and H. P. Huntington. 2008. Arctic marine mammals and climate change: impacts and resilience. Ecological Applications 18:S157–S165.

Moore, S. E., K. M. Wynne, J. C. Kinney, and J. M. Grebmeier. 2007. Gray whale occurrence and forage southeast of Kodiak, Island, Alaska. Marine Mammal Science 23:419–428.

NMFS (National Marine Fisheries Service). 2008. Draft environmental impact statement for proposed authorization of the Makah whale hunt. NOAA Fisheries Northwest Region, Seattle, Washington.

Norman, S. A., C. E. Bowlby, M. S. Brancato, J. Calambokidis, D. Duffield, P. J. Gearin, T. A. Gornall, M. E. Gosho, B. Hanson, J. Hodder, S. J. Jeffries, B. Lagerquist, D. M. Lambourn, B. Mate, B. Norberg, R. W. Osborne, J. A. Rash, S. Riemer, and J. Scordino. 2004. Cetacean strandings in Oregon and Washington between 1930 and 2002. Journal of Cetacean Research and Management 6:87-99.

Orca Network. 2011. Gray whale tutorial. Orca Network, Greenbank, Washington. <http://www.orcanetwork.org/nathist/graywhales.html>

Reilly, S. B., D. W. Rice, and A. A. Wolman. 1980. Preliminary population estimate for California gray whales based upon Monterey shore censuses, 1967/68 to 1978/79. Report of the International Whaling Commission 30:359-368.

Rice, D. W., and A. A. Wolman. 1971. The life history and ecology of the gray whale, *Eschrichtius robustus*. American Society of Mammalogy Special Publication 3.

Rice, D. W., A. A. Wolman, and H. W. Braham. 1984. The gray whale, *Eschrichtius robustus*. Marine Fisheries Review 46(4):7-14.

Rice, D. W., A. A. Wolman, D. E. Withrow, and L. A. Fleischer. 1981. Gray whales on the winter grounds in Baja California. Report of the International Whaling Commission 31:477-493.

Rugh, D. J., K. E. W. Shelden, and A. Schulman-Janiger. 2001. Timing of the southbound migration of gray whales. Journal of Cetacean Research and Management 3:31-39.

Weller, D. W., A. Klimek, A. L. Bradford, J. Calambokidis, A. R. Lang, B. Gisborne, A. M. Burdin, W. Szaniszlo, and R. L. Brownell, Jr. 2011. Movements of western gray whales from the Okhotsk Sea to the eastern North Pacific. Report of the International Whaling Commission SC/63/BRG6.

## Common Loon

(*Gavia immer*)

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

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.

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

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. Of the northwestern U.S., common loons are 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; and subadults often remain in the marine environment all summer. Common loons winter on Washington's coastal and inland marine waters, with 3,000-4,000 usually present in Puget Sound and the Strait of Juan de Fuca; most of these wintering birds nest in Canada and Alaska

***Diet.*** Loons feed mainly on fish, typically of a size between 0.35 to 2.45 ounces. In freshwater, 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, and dragonflies; and in n 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 19-7,800 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. Pollution, such as oil spills, may be the greatest threat to wintering loons where they concentrate in shallow marine waters.

Natural sources of mortality include predation, especially of young, and 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 factors 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, collisions with boats, powerlines and vehicles, and shooting.

***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. In 2011, volunteers and WDFW staff monitored 14 sites in western Washington and 16 in eastern Washington to determine common loon nesting status. A minimum of 11 nests were initiated, producing at least 12 chicks surviving to fledging.

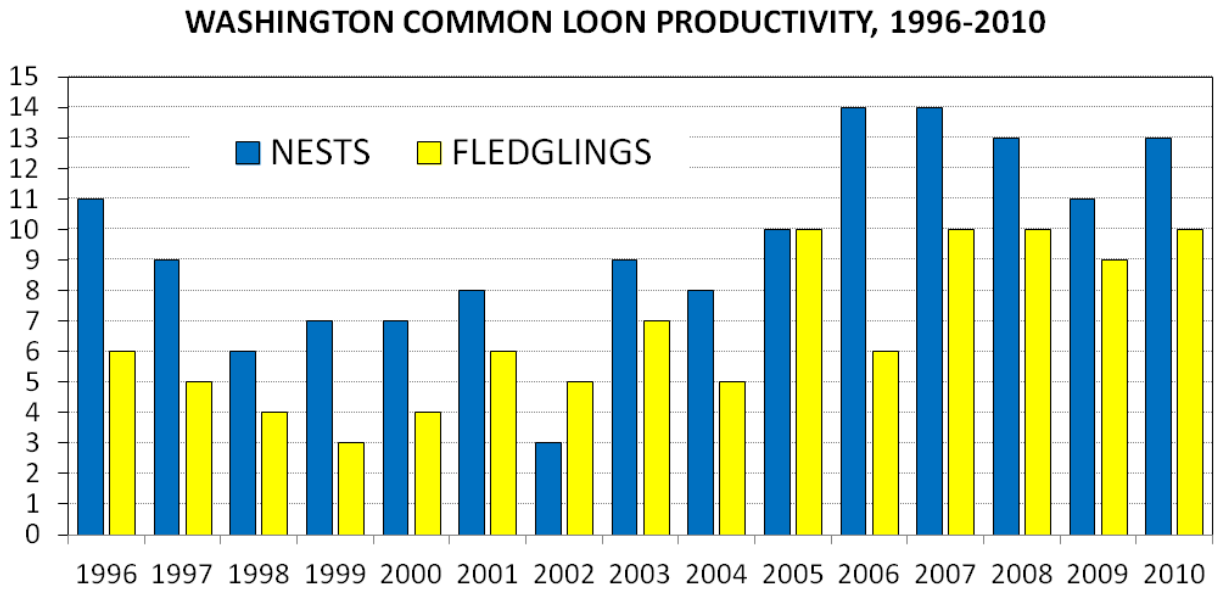



Figure 2. Number of active nests and fledglings produced in Washington, 1996-2010 (data compiled by D. Poleschook).

Productivity data for 2004-2009 for 13 sites had ten sites that averaged 0.78 fledglings/territory/year and 3 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 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, 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 Institute, and WDFW banded an adult male and a chick on Bonaparte Lake in 2011.

***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 3).

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 1 ½ 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/ ).

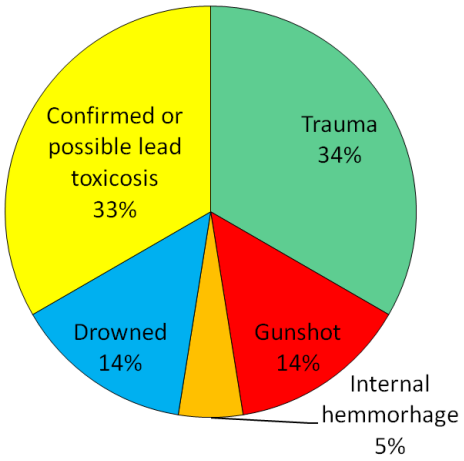



Figure 3. Causes of death for 21 common loons in Washington, 1999-2010.

***Land acquisitions.*** WDFW acquired two groups of properties in 2011 that may benefit common loons. These included 198 acres in Puget Sound and 156 acres of outer coastal estuaries.

**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.

## Literature Cited

Evers, D. C. 2007. Status assessment and conservation plan for the common loon (*Gavia immer*) in North America. BRI Report 2007-20. U.S. Fish and Wildlife Service, Hadley, MA.

McIntyre, J. W., and J. F. Barr. 1997. Common loon. *In* A. Poole and F. Gill, editors. The Birds of North America, No. 313. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington D.C.

Pokras, M. A., and R. M. Chafel. 1992. Lead toxicosis from ingested fishing sinkers in adult common loons (*Gavia immer*) in New England. Journal of Zoo and Wildlife Medicine 23(1): 92-97.

Poleschook, D., Jr. and V. R. Gumm. 2001. Preliminary assessment of food requirements needed for common loon chick development, and comparison of average growth rates of stocked, natural, and hand-reared chicks, Ferry Lake, Washington. Unpublished U. S. Forest Service Report, Colville, Washington.

Poleschook, D., Jr., and V. R. Gumm. 2004. Determination of common loon (*Gavia immer*) chick food requirements, feeding interruptions, and initial migration, Ferry Lake, Washington, and Washington common loon exposure to lead and mercury. Unpublished report, U.S. Forest Service, Colville, Washington.

Poleschook, D., Jr. and V. R. Gumm. 2006. Summary of status and conservation of common loons in Washington. Wetland Ventures 8:3 (May 2006).

Poleschook, D., Jr. and V. R. Gumm. 2007. Conservation success and continued threats for common loons *(Gavia immer)* in Washington.

Poleschook, D., Jr. and V. R. Gumm. 2009. 2009 Washington common loon information and data sheet. 2 pp.

Richardson, S., D. Hays, R. Spencer, and J. Stofel. 2000. Washington State status report for the common loon. Washington Department of Fish and Wildlife, Olympia, Washington. 53 pp.

Sidor, I. F., M. A. Pokras, A. R. Major, R. H. Poppenga, K. M. Taylor, and R. M. Miconi. 2003. Mortality of common loons in New England 1987 to 2000. Journal of Wildlife Disease 39:306-315.

## 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

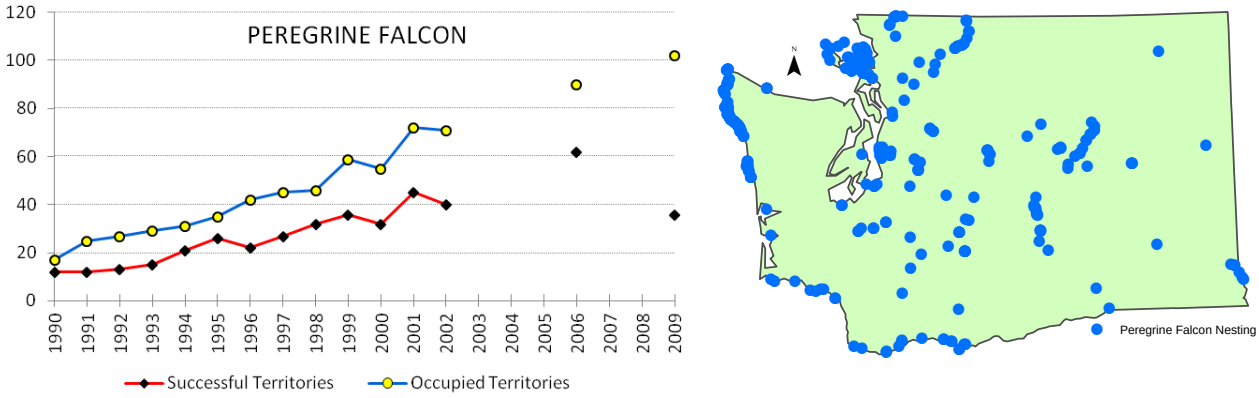
Figure 1. Peregrine falcon (*photo by Brian Caven*).

The peregrine falcon is a medium-sized (15 –21 inches long, 40 inch wingspan) raptor 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 nest 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.

Restriction on DDT use, along with captive breeding and reintroduction programs, 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. 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, Figure 2), with the final two post-delisting monitoring surveys scheduled for 2012 and 2015.

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.




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

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 the demand for falcons 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 2011, the Washington Forest Practices Board proposed removing peregrine falcon Critical Habitat from state forest practices rules (WAC 222-16-080). This rule may be approved and become effective in 2012. WDFW acquired two groups of properties in 2011 that may benefit peregrine falcons: 198 acres in Puget Sound and 156 acres of outer coastal estuaries.

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.

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

## Literature Cited

Guerra, P., K. Fernie, B. Jiminez, G. Pacepavicius, E. Reiner, E. Eljarrat, D. Barcelo, and M. Alaee. 2011. Dechlorane Plus and related compounds in peregrine falcon (*Falco peregrines*) eggs from Canada and Spain. Environmental Science and Technology 45:1284-1290.

Hayes, G. E. and J. B. Buchanan. 2002. Washington state status report for the peregrine falcon. Washington Dept. Fish and Wildlife, Olympia, Washington. 77 pp.

Washington Department of Ecology (2011) What are PBDEs? **http://www.ecy.wa.gov/programs/swfa/pbt/pbde.html**

Washington Department of Health(2011). PBDEs (Flame Retardants). **http://www.doh.wa.gov/ehp/oehas/pbde/pbde.htm**

## 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).

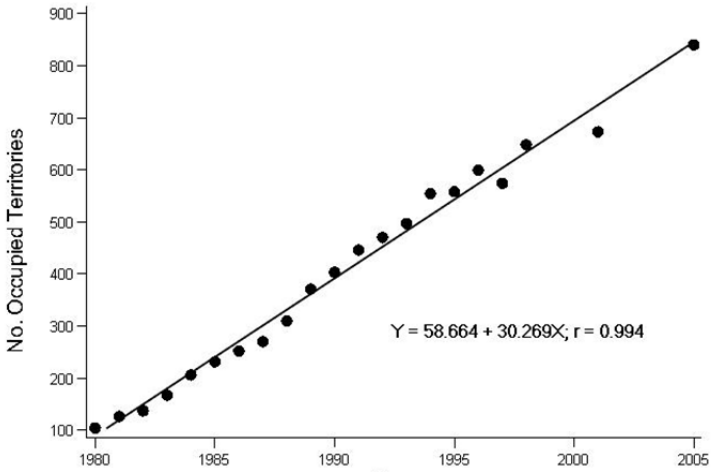



Figure 2. Number of occupied bald eagle nests in Washington, 1980-2005.

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 prey supplies and as a result, may have increased late winter eagle mortality.

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 more arid 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 a management plan 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.

***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 into peoples' homes 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.

### Literature Cited

Elliott, K. H, J. E. Elliott, L. K. Wilson, I. Jones, and K. Stenerson. 2011. Density-dependence in the survival and reproduction of bald eagles: linkages to chum salmon. Journal of Wildlife Management 75:1688-1699.

Seavey, J. R. 2005. Bald eagle. Pages 111-112 *in* T. R. Wahl, B. Tweit, and S. G. Mlodinow, eds. Birds of Washington: status and distribution. Oregon State University Press, Corvallis, Oregon. 436 pp.

Stinson, D. W., J. W. Watson, and K. R. McAllister. 2007. Washington state status report for the bald eagle. Washington Department of Fish and Wildlife, Olympia, Washington. 86 pp.

Stalmaster, M. V. 1987. The Bald Eagle. Universe Books. New York. 227 pp.

Watson, J. W. 2002. Comparative home ranges and food habits of bald eagles nesting in four aquatic habitats in western Washington. Northwestern Naturalist 83:101-108.

Watson, J. W., and D. J. Pierce. 2001. Skagit River bald eagles: movements, origins, and breeding population status. Washington Dept. of Fish and Wildlife, Olympia, Washington. 80 pp.

Watson, J. W., D. W. Stinson, K. R. McAllister, and T. E. Owens. 2002. Population status of bald eagles in Washington at the end of the 20th century. Journal of Raptor Research. 36:161-169.

## Pygmy Whitefish

(*Prosopium coulteri*)

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

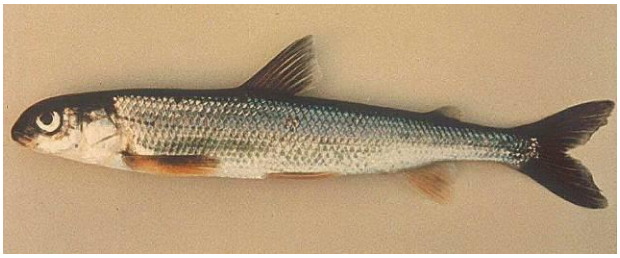


Figure 1. Pygmy whitefish (*photo from Wydoski and Whitney 2003)*.

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. Food items consumed by pygmy whitefish include crustaceans, aquatic insect larvae and pupae, fish eggs, and small mollusks.

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. Pygmy whitefish, particularly in smaller lakes, are vulnerable to exotic fish species introductions and declining water quality. Because of the very limited range of the pygmy whitefish in Washington, they are vulnerable to additional extirpations without cooperative management.

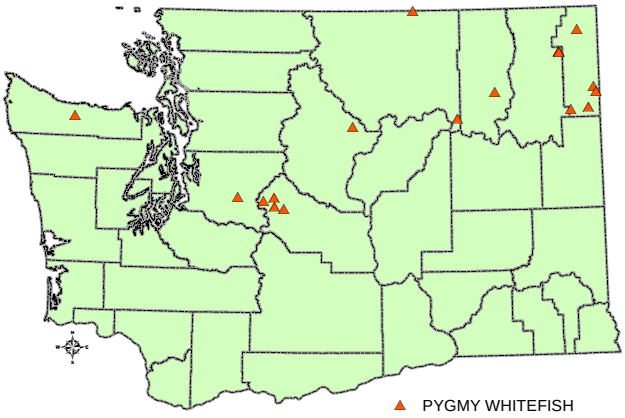



Figure 2. Lakes where pygmy whitefish have been collected.

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.

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 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).

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

## Literature Cited

EES. 2010. Entrainment investigations and study of fish presence in the vicinity of Sullivan Lake Dam (draft). Prepared for Public Utility District No. 1 of Pend Oreille County Newport, Washington. EES Consulting, Bellingham, Washington. 35 pp.

Hallock, M., and P.E. Mongillo. 1998. Washington state status report for the pygmy whitefish. Washington Department of Fish and Wildlife, Olympia. 20 pp.

USBOR. 2011.Keechelus Reservoir fish entrainment 2010 monitoring report, Yakima Project. U.S. Bureau of Reclamation, Columbia-Cascades Area Office, Yakima, Washington. 34 pp.

Wydoski, R.S., and R.R. Whitney. 2003. Inland Fishes of Washington.2nd ed. American Fisheries Society and University of Washington Press, Seattle, Washington. 322 pp.

## 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 both native and 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.

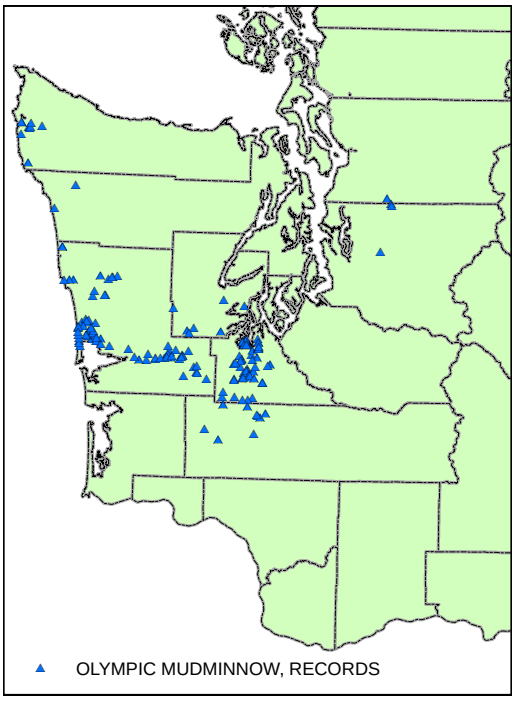



Figure 2. Sites where Olympic mudminnows have been recorded through 2011.

Most Olympic mudminnow populations monitored seem to be stable. However, the species is completely dependent on healthy wetlands for its survival. Because of this and the mudminnow's restricted range, the species is vulnerable and requires habitat protection and cooperative management.

In 2010-2011, many 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 represents a real decline or this 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.

During the 2010-2011 surveys, fin clips were collected for genetic testing to help determine the relative uniqueness of each Olympic mudminnow population. Samples will be processed by the U.S. Fish and Wildlife Service.

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

## Literature Cited

Mongillo, P. E. and M. Hallock. 1999. Washington state status report for the Olympic mudminnow. Washington Department of Fish and Wildlife, Olympia, Washington. 36 pp.

Trotter, P. C., B. McMillan, and D. Kappes. 2000. Occurrence of Olympic mudminnow in the east side of the Puget Trough. Northwestern Naturalist 81:59-63.

## 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, they occur 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*).

***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.

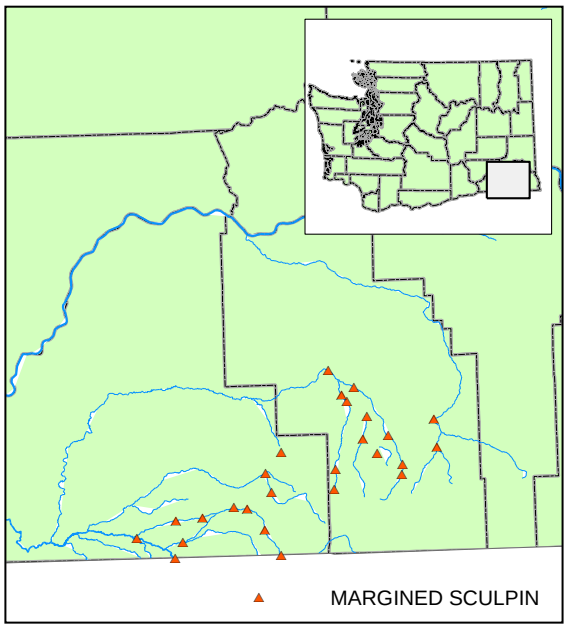



Figure 2. Sites in Washington where margined sculpins have been recorded.

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.

**Partners and cooperators:** U.S. Fish and Wildlife Service, Bonneville Power Administration, U.S. Department of Energy, Whitman College.

## Literature Cited

Hagan, C. N. 2006. A phylogenetic analysis of a freshwater stream fish, *Cottus marginatus*, to address taxonomic status and conservation. B. S. thesis, Whitman College, Walla Walla, Washington. 36 pp.

Johnson, M. B. 2007. Summer distribution and habitat selection of margined sculpin (*Cottus marginatus*), in the Walla Walla River Basin. B. S. thesis, Whitman College, Walla Walla, Washington. 28 pp.

Mendel, G., J. Trump, and M. Gembala. 2005. Assessment of salmonids and their habitat conditions in the Walla Walla River Basin within Washington: 2004 annual report. Report to BPA. Project 199802000. 178 pages.

Mongillo, P. E. and M. Hallock. 1998. Washington state status report for the margined sculpin. Washington Department of Fish and Wildlife, Olympia, Washington. 15 pp.

Wydoski, R. S., and R. R. Whitney. 2003. Inland Fishes of Washington.2nd ed. American Fisheries Society and University of Washington Press, Seattle, Washington. 322 pp.

## 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 that is 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. Plethodons have direct development (no tadpole) and the females guard the eggs (Wells 2007).

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.

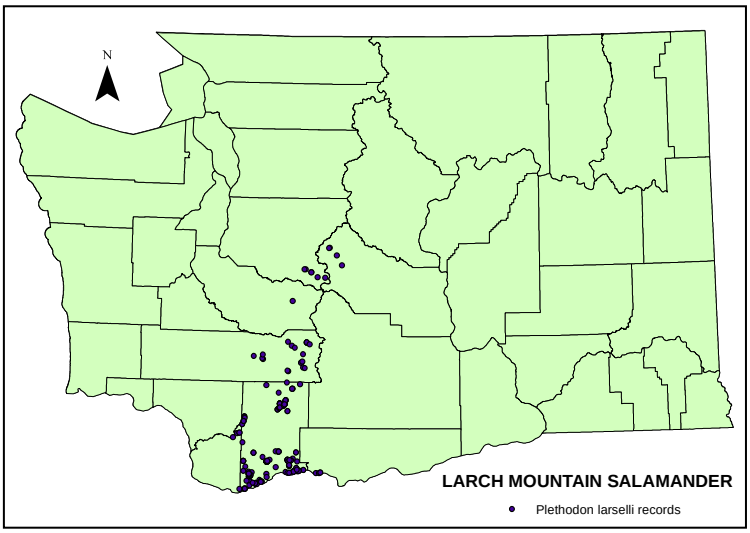



Figure 2. Locations of Larch Mountain salamander records in Washington through 2011.

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 construction, development of trails and roads, 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.

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. About 70% of currently known sites on federal lands occur in areas with special management designations, such as late seral reserves.

**Partners and cooperators:** U.S. Forest Service.

### Literature Cited

Crisafulli, C. M., D. R. Clayton, and D. H. Olson. 2008. Conservation assessment for the Larch Mountain salamander (*Plethodon larselli*). Version 1. USDA Forest Service Region 6, and USDI BLM, Interagency Special Status and Sensitive Species Program. 36 pp.

Jones, L. L. C., W. P. Leonard, and D. H. Olson, eds. 2005. Amphibians of the Pacific Northwest. Seattle Audubon Society, Seattle, Washington. 227 pp.

Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.

Wells, K. D. 2007. The Ecology and Behavior of Amphibians. Chicago University Press, Chicago, Illinois. 1,148 pp.

## Townsend's Big-eared Bat

(*Corynorhinus townsendii*)

**State Status**: Candidate, 1991
**Federal Status**: Species of concern
**Recovery Plans:** None

Figure 1. Townsend's big-eared bat (*photo by Bat Conservation International*).

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 (Figure 1). Five subspecies are recognized, with only one (*C. t. townsendii*) present in Washington.

Townsend's big-eared bats occur from south-central 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 much of the Columbia Basin (Figure 2; WDFW data). Within its range, distribution is often linked to the presence of suitable maternity roosts and hibernacula located near suitable foraging habitat (Gruver and Keinath 2006).

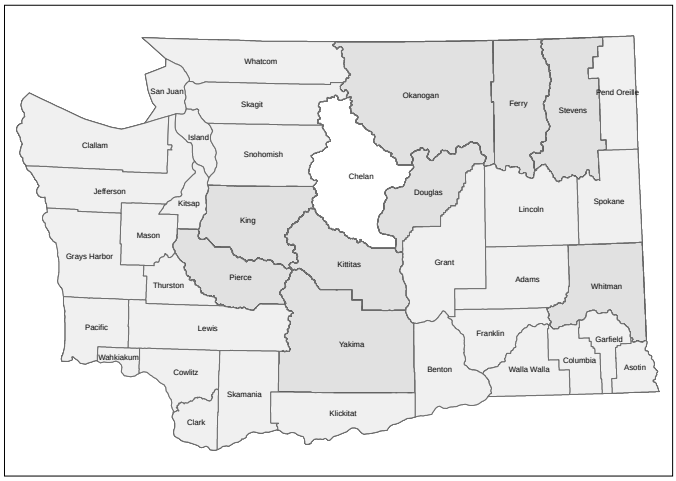



Figure 2. Counties in Washington where Townsend's big-eared bats have been recorded (gray shading).

Townsend's big eared bats occupy a broad range of moist and arid habitats. In Washington, they occur in westside 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, concrete bunkers, and bridges are commonly used as day roosts in Washington (Senger and Crawford 1984, Woodruff and Ferguson 2005; G. Falxa, pers. comm.), with rock crevices and very large trees with basal hollows also occupied outside the state (Pierson et al. 1999, WBWG 2005). Temperatures, roost dimensions, sizes of roost openings, light quality, and extent of airflow are important factors in the selection of roosts (Pierson et al. 1999, Gruver and Keinath 2006). Hibernacula occur mainly in caves, mines, lava tubes, and occasionally in buildings. 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*b*, Gruver and Keinath 2006).

The species generally occurs at low densities across its 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 use of multiple roosts under some conditions (Ellison et al. 2003, Sherwin et al. 2003, Gruver and Keinath 2006). Long-term count data are available

for only a small number of roosts in Washington. Six hibernacula in the state have long-term count data: four showed increases from counts made during the 1970s-1980s compared with those in the 1990s-2000s, and two were stable during this period (WDFW data). However, two of the sites with 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 and the 1990s-2000s are available for two maternity colonies in the state, with one showing an increase and one a decrease (WDFW data). A third site that held a major maternity roost into the 1930s was abandoned by the 1960s and remains unoccupied (St. Hilaire 2010).

***Surveys and monitoring.*** Because this species is difficult to capture in mist nets and has quiet echolocation (WBWG 2005*b*), standard capture and acoustic surveys are poorly suited for measuring abundance; however, Townsend's big-eared bats have been detected on rare occasions during capture and acoustic surveys at several locations in Washington.

A small number of known maternity roosts and hibernacula are surveyed annually or less frequently. During 2010-2011, three new colonies of Townsend's big-eared bats were found near the towns of Oakville (maternity site), Northport (maternity site), and Cusick (fall roost). The Bureau of Land Management concluded a survey of bats in abandoned mines on its lands in 2010, with evidence of Townsend's big-eared bats detected at several sites.

Recent inventories and monitoring of bat populations in Washington, including Townsend's bat-eared bats, have been conducted in many areas of the state as part of the Bat Grid project and through other survey efforts. Some of this work has been conducted on Department of Defense and Nature Conservancy lands. The Bat Grid involves surveys of bats using a grid-based sampling frame of 10-km square sample units that cover the Pacific Northwest and other parts North America (Ormsbee 2008). Within specific grid squares, bats are captured or acoustically detected through a standardized protocol and are identified based on their physical, acoustic, and genetic traits.

***Roost protection.*** Two major threats to Townsend's big-eared bats are human disturbance of roosts by recreational cavers and vandals and closure or reuse of abandoned mines (Senger and Crawford 1984, Pierson et al. 1999, WBWG 2005, Gruver and Keinath 2006). The species is highly sensitive to disturbance and 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.

In recent decades, caves and mines have been gated and buildings maintained to protect Townsend's big-eared bat maternity roosts, breeding colonies and hibernacula in Washington. In 2011, staff from The Nature Conservancy, Cascadia Research Collective, and Joint Base Lewis-McChord built an artificial "bat barn" structure on the base to provide an alternative roost for a nearby colony of Townsend's big-eared bats that roosted in an unprotected site in the town of Roy.

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 the food base for Townsend's big-eared bats. Degradation or loss of foraging and roosting habitat from timber harvest practices, land conversion, and livestock grazing also likely adversely affect the species.

***Research.*** Cascadia Research Collective is conducting a study of Townsend's big-eared bat winter roosting behavior and roost selection in southern Thurston and eastern Grays Harbor counties.

***White-nose syndrome.*** This fungal disease has killed large numbers of bats in eastern North America since 2006 and is spreading across the continent. An interagency working group is currently preparing a Pacific Northwest White-Nose Syndrome Plan. The plan will provide regional guidance on: 1) white-nose syndrome prevention, surveillance, response, and management; 2) collaboration between agencies; 3) rapid dissemination of information; 4) streamlined data collection; 5) public outreach; and 6) agency contacts. During 2011, educational signs about the disease were placed at the entrances of several caves used by Townsend's big-eared bats in Washington. The signs inform cave visitors of the risks of white-nose syndrome to bats and precautions visitors can take to avoid spreading the disease.

***Bat conservation and management plan.*** WDFW is preparing a conservation and management plan for bats in Washington, which will be completed in 2012. 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.

**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.

## Literature cited


Doering, R. W. 1996. Thermal implications of roost site selection in hibernating *Plecotus townsendii*. Thesis, Idaho State University, Pocatello, Idaho.

Ellison, L. E., T. J. O'Shea, M. A. Bogan, A. L. Everette, and D. M. Schneider. 2003. Existing data on colonies of bats in the United States: summary and analysis of the U.S. Geological Survey's bat population database. Pages 127-237 *in* T. J. O'Shea and M. A. Bogan, editors. Monitoring trends in bat populations in the United States and territories: problems and prospects. U.S. Geological Survey, Biological Resources Discipline, Information and Technology Report USGS/BRD/ITR –2003-0003.

Gruver, J. C. and D. A. Keinath. 2004. Townsend's big-eared bat (*Corynorhinus townsendii*): a technical conservation assessment. Rocky Mountain Region, USDA Forest Service, Golden, Colorado.

Johnson, R. E. and K. M. Cassidy. 1997. Terrestrial mammals of Washington State: location data and predicted distributions. Pages 67-97 *in* K. M. Cassidy, C. E. Grue, M. R. Smith, and K. M. Dvornich, editors. Washington State Gap Analysis – Final Report. Volume 3. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, Washington.

Nagorsen, D. W. and R. M. Brigham. 1993. Bats of British Columbia. UBC Press, Vancouver, British Columbia.

NatureServe. 2009. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>

Ormsbee, P. 2008. The Bat Grid: a unique approach to reliable data. Bats 26(1):8-9.

Pierson, E. D., M. C. Wackenhut, J. S. Altenbach, P. Bradley, P. Call, D. L. Genter, C. E. Harris, B. L. Keller, B. Lengus, L. Lewis, B. Luce, K. W. Navo, J. M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallascens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho.

Senger, C. and R. L. Crawford. 1984. Biological inventory, Mt. St. Helens Cave Basalt Flow Area. Report to Gifford Pinchot National Forest, Vancouver, Washington.

Sherwin, R. E., W. L. Gannon, and J. S. Altenbach. 2003. Managing complex systems simply: understanding inherent variation in the use of roosts by Townsend's big-eared bat. Wildlife Society Bulletin 31:62-72.

St. Hilaire, J. 2010. Description of Boulder Cave & bat use. Okanogan-Wenatchee National Forest, Wenatchee, Washington.

WBWG (Western Bat Working Group). 2005. Species accounts. <http://www.wbwg.org/speciesinfo/species_accounts/species_accounts.html>

Woodruff, K. and H. Ferguson. 2005. Townsend's big-eared bat, *Corynorhinus townsendii*. *In* J. M. Azerrad, editor. Management recommendations for Washington's priority species. Volume V: mammals. Washington Department of Fish and Wildlife, Olympia, Washington.

## Keen's Myotis

(*Myotis keenii*)

**State Status**: Candidate, 2000
**Federal Status**: None
**Recovery Plans:** None

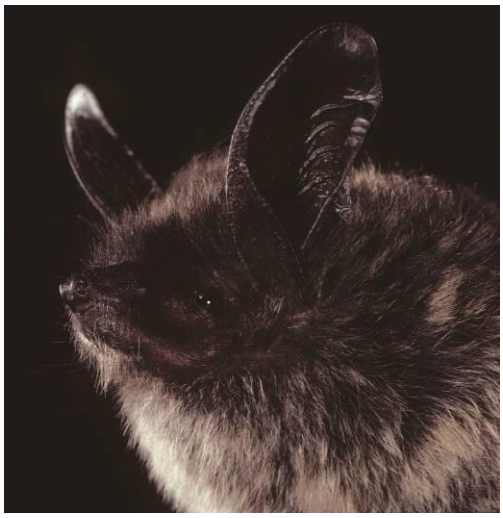


Figure 1. Keen's myotis (photo by Bat Conservation International).

Keen's myotis (Figure 1) is one of three long-eared *Myotis* species in Washington. Because of the similarities among the three, simple field identification is impossible where they overlap in western Washington and southwestern British Columbia (Burles and Nagorsen 2003). Keen's 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); and mid-elevation caves are used for hibernation.

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 and Puget Sound in Washington (Burles and Nagorsen 2003, Boland et al. 2009a). 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.

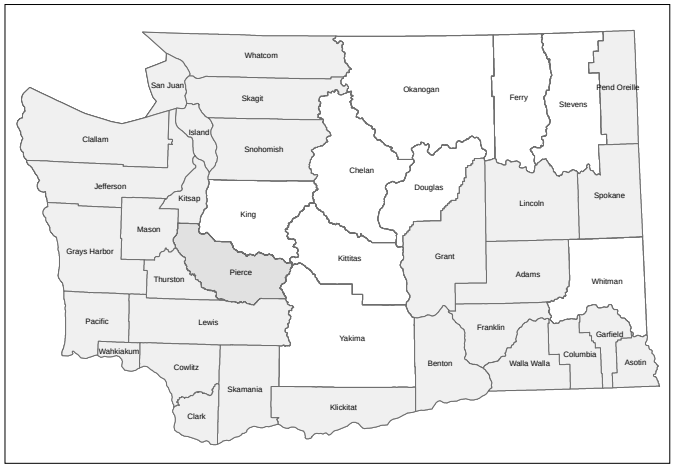



Figure 2. Five counties in Washington where Keen's myotis has been recorded (gray shading).

Threats or potential threats include loss and fragmentation of habitat caused by clearcutting of old-growth coastal forests and possibly forest fires; 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).

***Monitoring and surveys.*** Recent inventories and monitoring of bat populations in Washington, including Keen's myotis, have been conducted in many areas of the state as part of the Bat Grid project and through other survey efforts. Some of this work has been conducted on Department of Defense and Nature Conservancy lands. The Bat Grid involves surveys of bats using a grid-based sampling frame of 10-km square sample units that cover the Pacific Northwest and other parts North America (Ormsbee 2008). Within specific grid squares, bats are captured or acoustically detected through a standardized protocol and are identified based on their physical, acoustic, and genetic traits.

***White-nose syndrome plan.*** This fungal disease has killed large numbers of bats in eastern North America since 2006 and is spreading across the continent. An interagency working group is currently preparing a Pacific Northwest White-nose Syndrome Plan. The plan will provide regional guidance on: 1) white-nose syndrome prevention, surveillance, response, and management; 2) collaboration between agencies; 3) rapid dissemination of information; 4) streamlined data collection; 5) public outreach; and 6) agency contacts.

***Bat conservation and management plan.*** WDFW is preparing a conservation and management plan for bats in Washington, which will be completed in 2012. 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.

**Partners and cooperators:** U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, Oregon Department of Fish and Wildlife.

## Literature cited

Burles, D. W. and D. W. Nagorsen. 2003. COSEWIC assessment and update status report on Keen's long-eared bat *Myotis keenii* in Canada. Canadian Wildlife Service, Ottawa, Ontario. <http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr%5Fkeens%5Flongeared%5Fbat%5Fe%2Epdf>

Boland, J. L., J. P. Hayes, W. P. Smith, and M. M. Huso. 2009b. Selection of day-roosts by Keen's myotis (*Myotis keenii*) at multiple spatial scales. Journal of Mammalogy 90:222-234.

Boland, J. L., W. P. Smith, and J. P. Hayes. 2009a. Survey of bats in southeast Alaska with emphasis on Keen's myotis (*Myotis keenii*). Northwest Science 83:169-179.

Firman, M., M. Getty, and R. M. R. Barclay. 1993. Status of Keen's long-eared Myotis in British Columbia. British Columbia Ministry of Environment, Lands and Parks Wildlife Working Report WR-59.

NatureServe. 2009. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>.

Ormsbee, P. 2008. The Bat Grid: a unique approach to reliable data. Bats 26(1):8-9.

## 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 only active for 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.

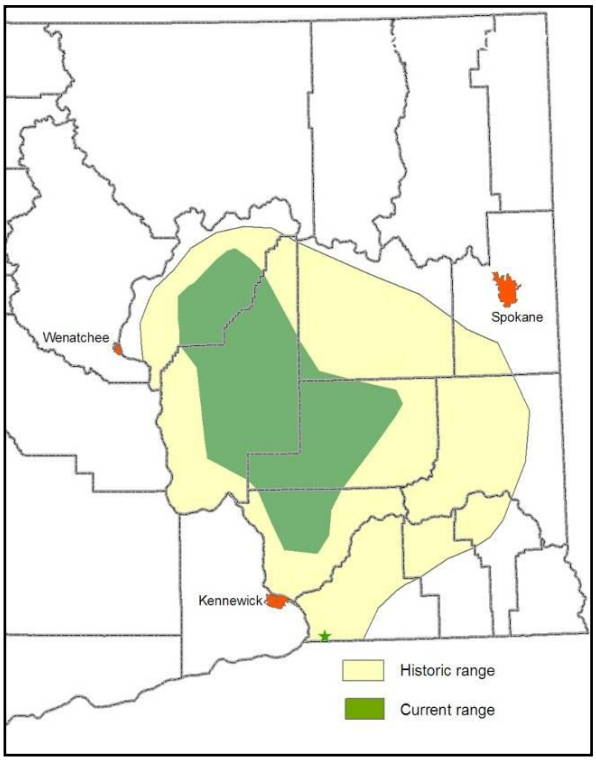



Figure 2. Approximate historical and current ranges of Washington ground squirrels in eastern Washington.

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.

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.

Figure 3. Washington ground squirrels released after marking and weighing.

***Translocations.*** WDFW has conducted a series of Washington ground squirrel translocations since 2006 in an attempt to reestablish new populations in unoccupied areas of suitable habitat (Figure 3). Squirrels were removed primarily from a golf course outside Warden, where golf course managers were seeking to control a large population and limit damage caused by burrowing and foraging. Most animals were released at sites on the Columbia Basin National Wildlife Refuge and adjoining Seep Lakes Unit of the WDFW Columbia Basin Wildlife Area, with small numbers also moved to other public land sites in Grant, Douglas, and Lincoln counties. Initial translocations through 2009 had mostly poor results, primarily because they relied on hard releases of squirrels in May. This methodology appeared to result in nearly all squirrels dispersing away from release locations. Soft release methods were used in 2010 and 2011, with pregnant females placed into wire enclosures to keep them on site for longer periods (Figure 4). This technique greatly improved results, with about 70% of females remaining on site and producing litters at one location. Use of this method will be expanded to new locations in the future.

***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 2005 have located 188 new ground squirrel sites, with 73 of these found as part of a study (Odessa Subarea Special Study) of the proposed route of a new irrigation canal system that may be built in eastern Grant County and western Adams County (BOR and WSDOE 2010).


Figure 4. One type of soft release enclosure used during translocations of Washington ground squirrels in 2011 (*photo by Rich Finger*).

***Research.*** Two research projects involving Washington ground squirrels are being conducted. The first is developing a site occupancy model to improve detection and future long-term monitoring methodologies for squirrel populations across the landscape (Watson et al. 2009). From 2008-2011, data was collected at four study areas. In 2011, pilot work was initiated to apply and test the survey protocol developed in the 2008-2011 study. The protocol will be useful for conducting periodic (e.g., 5 years) surveys at established locations throughout the species' range in Washington to assess trend, status, and extinction/colonization probabilities over time. The second research project examined demography and social and reproductive behavior over a multi-year period (Sherman and Shellman Sherman 2005-2010).

***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. In 2011, WDFW acquired 473 acres of land in Douglas County to benefit shrub-steppe species, including Washington ground squirrels.

***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. A statewide connectivity analysis was completed in 2010 (WHCWG 2010) and a regional analysis for the Columbia Basin is currently being conducted and should be completed by 2012. The latter analysis is modeling habitat concentration areas and movement corridors for Washington 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. Washington ground squirrels have been identified as 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.

## Literature Cited

BOR and WSDOE (Bureau of Reclamation and Washington State Department of Ecology). 2010. Draft environmental impact statement: Odessa subarea special study, Columbia Basin Project, Washington. Ecology Publication No. 10-12-006, Bureau of Reclamation, Yakima, Washington, and Washington Department of Ecology, Wenatchee, Washington.

Finger, R., G. J. Wiles, J. Tabor, and E. Cummins. 2007. Washington ground squirrel surveys in Adams, Douglas, and Grant counties, Washington, 2004. Washington Department of Fish and Wildlife, Olympia, Washington.

Klein, K. J. 2005. Dispersal patterns of Washington ground squirrels in Oregon. M.S. thesis, Oregon State University, Corvallis, Oregon.

Sherman, P. W. and J. Shellman Sherman. 2005-2010. Distribution, demography, and behavioral ecology of Washington ground squirrels (*Spermophilus washingtoni*) in central Washington. Unpublished reports, Cornell University, Ithaca, New York.

USFWS (U. S. Fish and Wildlife Service). 2010. Species assessment and listing priority assignment form: *Urocitellus washingtoni*, Washington ground squirrel. U.S. Fish and Wildlife Service, Portland, Oregon.

Watson, J. W., M. W. Vander Haegen, and W.-Y. Chang. 2009. Occupancy modeling and detection of Washington ground squirrels (*Spermophilus washingtoni*). Progress Report, Washington Department of Fish and Wildlife, Olympia, Washington.

WHCWG (Washington Wildlife Habitat Connectivity Working Group). 2010. Washington connected landscapes project: statewide analysis. Washington Departments of Fish and Wildlife, and Transportation, Olympia, Washington. http://waconnected.org

## 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, with one additional colony known in Pasco, Franklin County (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 only active for 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).

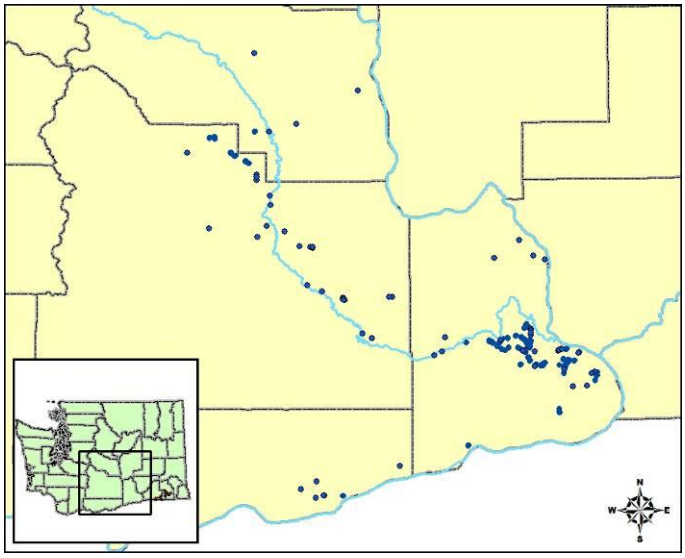


Figure 2. Distribution of Townsend's ground squirrel records.

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, prairie falcons, weasels, and others (Yensen 2001). Historically, they were also important prey for badgers (*Taxidea taxus*) (Scheffer 1941).

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.

***Land acquisitions.*** A WDFW land acquisition east of Ellensburg in 2006 and 2007 permanently protected about 17,500 acres of shrub-steppe, including some habitat for Townsend's ground squirrels. WDFW is also in the process of acquiring 14,000 acres on Rattlesnake Mountain in Benton County, where Townsend's ground squirrels and a considerable amount of suitable habitat are present.

***Landscape management.*** The Washington Wildlife Habitat Connectivity Working Group is addressing the conservation and restoration of habitat connectivity for numerous focal species, including Townsend's ground squirrels. A statewide connectivity analysis was completed in 2010 (WHCWG 2010) and a regional analysis for the Columbia Basin is currently being conducted and should be completed by 2012. The latter analysis is modeling 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. Townsend's ground squirrels have been identified as 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.

## Literature Cited

Johnson, M. K.1977. Food of Townsend ground squirrels on the Arid Land Ecology Reserve (Washington). Great Basin Naturalist 37:128.

Nadler, C. F. 1968. The chromosomes of *Spermophilus townsendii* (Rodentia: Sciuridae) and report of a new subspecies. Cytogenetics 7:144-157.

Richardson, S. A., A. E. Potter, K. L. Lehmkuhl, R. Mazaika, M. E. McFadzen, and R. Estes. 2001. Prey of ferruginous hawks breeding in Washington. Northwestern Naturalist 82:58–64.

Rogers, L. E., and K. A. Gano 1980. Townsend ground squirrel diets in the shrub-steppe of southcentral Washington. Journal of Range Management 33:463-465.

Scheffer, T. H., 1941. Ground squirrel studies in the four-rivers country, Washington. Journal of Mammalogy 22:270-279.

Yensen, E. 2001. The ecological role of ground squirrels and a "field guide" to Northwestern species. Pp 1-3 *in* Conservation Biology of Ground Squirrels and the Shrub-steppe Ecosystem. A symposium presented in conjunction with the Idaho Academy of Science Meeting, Albertson College of Idaho. Idaho Academy of Science. 33 pp.

Yensen, E., D. L. Quinney, K. Johnson, K. Timmerman, and K. Steenhof. 1992. Fire, vegetation changes, and population fluctuations of Townsend's ground squirrels. American Midland Naturalist 128:299-312.

Yensen, E. and P. W. Sherman. 2001. Demise of the small-eared ground squirrels. Pp. 31-33 *in* Conservation Biology of Ground Squirrels and the Shrub-steppe Ecosystem. A symposium presented in conjunction with

the Idaho Academy of Science Meeting, Albertson College of Idaho. Idaho Academy of Science. 33 pp.
Yensen, E. and P.W. Sherman. 2003. Ground-dwelling squirrels of the Pacific Northwest. U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office, and Bureau of Land Management, Spokane District and Oregon State Offices.
WHCWG (Washington Wildlife Habitat Connectivity Working Group). 2010. Washington connected landscapes project: statewide analysis. Washington Departments of Fish and Wildlife, and Transportation, Olympia, Washington. http://waconnected.org

## 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 the 3,700-$km^2$ 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.

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. 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 in 2010-2011, the monitoring involved more than 80 volunteers each year and was supported by Washington's National Park Fund. Monitoring is again planned in 2012.

Data from 250 ear-tagged and 100 radio-telemetered animals indicated that the species was declining at about 10%/year at still-occupied sites through 2006. 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 been in high elevation areas of the Olympic Peninsula for around 60 years, but they were rare or absent from the Olympics historically when wolves were widespread in western Washington (Taylor and Shaw 1929, Dalquest 1948, Scheffer 1995). In 2006, 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.

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.

**Partners and cooperators:** Olympic National Park, Washington's National Park Fund, and University of Montana.

### Literature Cited

Dalquest, W. W. 1948. Mammals of Washington. University of Kansas, Lawrence, Kansas.

Edelman, A. J. 2003. *Marmota olympus*. Mammalian Species 736:1-5.

Griffin, S. C. 2007. Demography and ecology of a declining endemic: the Olympic Marmot. Ph.D. dissert., University of Montana, Missoula.190 pp.

Griffin, S. C., M. L. Taper, R. Hoffman, and L. S. Mills. 2008. The case of the missing marmots: are metapopulation dynamics or range-wide declines responsible? Biological Conservation 141:1293-1309.

Griffin, S. C., T. Valois, M. L. Taper, and L. S. Mills. 2007. Effects of tourists on behavior and demography of Olympic marmots. Conservation Biology 21:1070-1081.

Scheffer, V. B. 1995. Mammals of the Olympic National Park and vicinity. 1949. Northwest Fauna 2:5-133.

Taylor, W. P. and W. T. Shaw. 1929. Provisional list of the land mammals of Washington. Occasional Papers of the Charles R. Conner Museum 2:1-32.

Witczuk, J. J. 2007. Monitoring program and assessment of coyote predation for Olympic Marmots. M.S. Thesis, University of Montana, Missoula, Montana. 75 pp.

## Wolverine

(*Gulo gulo*)

**State Status**: Candidate, 1998
**Federal Status**: Candidate, 2010
**Recovery Plans:** None

Figure 1. Automated camera image of male wolverine near Mt. Adams, Washington, February 2010 (J. Akins, Cascades Carnivore Project).

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). Its 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.

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 (Figure 2). 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 (Figures 1, 2; J. Akins, Cascades Carnivore Project). 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 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). Wolverines may require persistent spring snow cover for successful reproduction (Copeland et al. 2010).

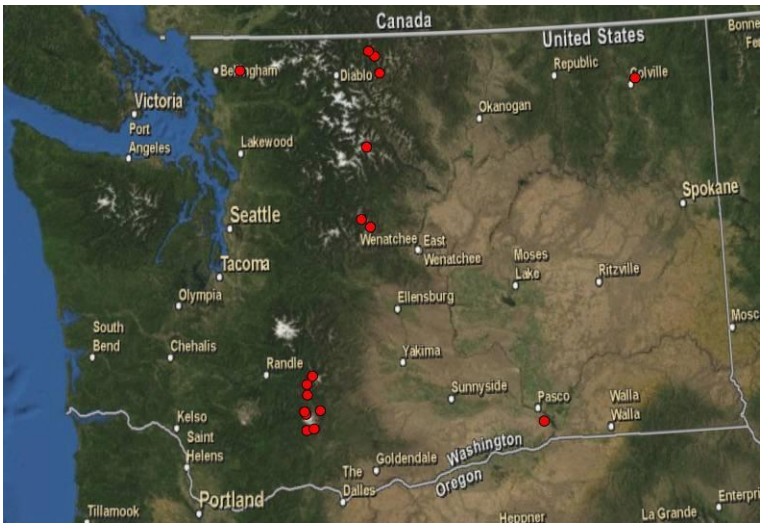



Figure 2. Wolverine detections in Washington,1991-2010.

Since 2006, researchers with the U.S. Forest Service, Washington Department of Fish and Wildlife and British Columbia Ministry of Environment have conducted a study of wolverines that occur in the Cascades

of northern Washington and southern British Columbia. From 2006 to 2011, 7 wolverines (5F, 2M) were captured, radio-collared and tracked in an effort to understand how wolverines move and use this region of the Cascades. The wolverines moved extensively, used large home ranges, and moved back and forth between Washington and British Columbia (Figure 3).

**Partners and cooperators:** U.S. Forest Service-PNW Research Station, U.S. Fish and Wildlife Service, British Columbia Ministry of Environment, Cascades Carnivore Project, University of California- Davis.

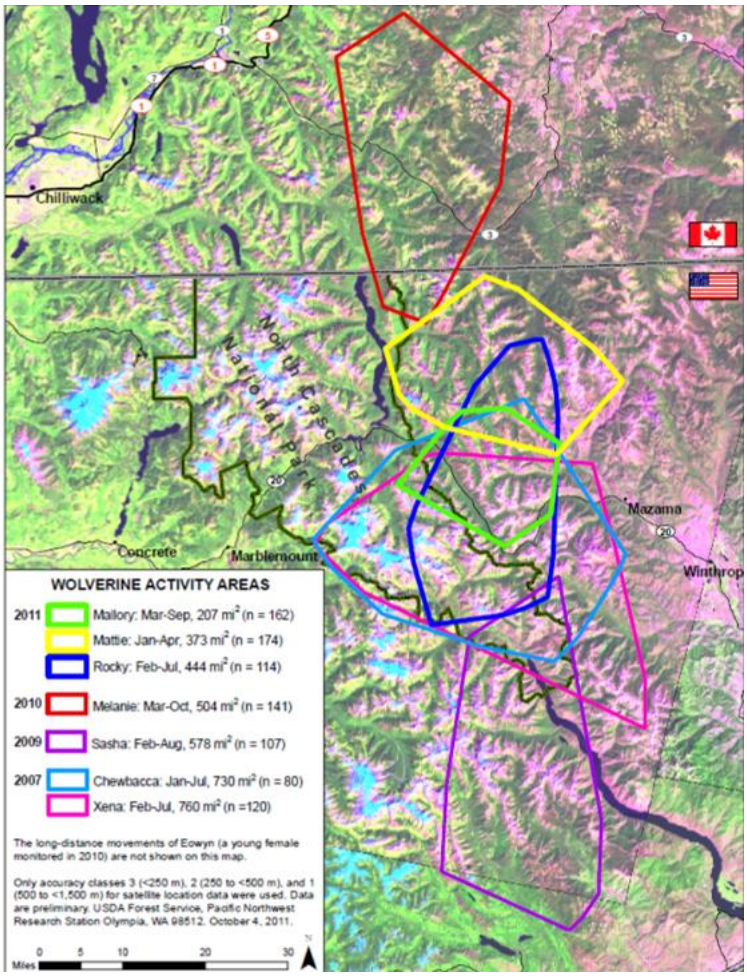



Figure 3. Activity areas of 7 radio-collared wolverines captured in the North Cascades of Washington (K. Aubry and C. Raley, U.S. Forest Service, unpubl. data).

## Literature Cited

Copeland, J. P., K. S. Mckelvey, K. B. Aubry, A. Landa, J. Persson, R. M. Inman, J. Krebs, E. Lofroth, H. Golden, J. R. Squires, A. Magoun, M. K. Schwartz, J. Wilmot, C. L. Copeland, R. E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology 88:233-246.

Copeland, J. P. and J. S. Whitman. 2003. Wolverine. Pages 672-682, *in* G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, eds. Wild mammals of North America. Biology, Management, and Economics. Johns Hopkins University Press, Baltimore, Maryland.

Pasitschniak-Arts, M., and S. Lariviere. 1995. *Gulo gulo*. Mammalian Species 499:1-10.

USFWS. 2010. 12-month finding on a petition to list the North American wolverine as endangered or threatened. Federal Register 75(239):78030-78061.

## Cascade Red Fox

(*Vulpes vulpes cascadensis*)

**State Status:** Candidate, 2010
**Federal Status:** None
**Recovery Plans:** None

Figure 1. Cascade red fox in Mt. Rainier National Park (*photo by Joe Higbee*).

The Cascade red fox is a rare, possibly extremely rare, isolated Washington endemic subspecies (Figure 1). It is known to occur in alpine and subalpine habitats on Mt. Rainier and Mt. Adams, and there is some verifiable evidence of their presence in the central Cascades. 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 foxes during forest carnivore surveys (camera sets, hair snares, etc.) conducted in the 1990s. The population size at Mt. Rainier and Mt. Adams is unknown, and the fox's status elsewhere in its range is unknown. A population size of less than a few thousand individuals would put the subspecies at risk of inbreeding depression and other genetic issues that could affect its future existence.

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).

Systematic surveys are needed in Washington's central and northern Cascades to determine the current status and distribution of Cascade red foxes. Research involving telemetry and/or non-invasive sampling through collection of DNA samples in the Mt. Rainier and Mt. Adams areas would contribute to a better understanding of the status, genetic health, and ecological relationships of foxes occupying those areas. 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.

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. Foxes at Mt. Rainier National Park are increasingly becoming habituated to humans, which may put them at greater risk of vehicle collisions. 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.

**Partners and cooperators:** U.S. Forest Service-PNW Lab, National Park Service, University of California-Davis.

### Literature Cited

Aubry, K. B. 1984. The recent history and present distribution of the red fox in Washington. Northwest Science 58:69–79.

Aubry, K. B. M. J. Statham, B. N. Sacks, J. D. Perrine and S. M. Wisely. 2009. Phylogeography of the North American red fox: vicariance in Pleistocene forest refugia. Molecular Ecology 18:2668–2686.

Kamler J. F., and W. B. Ballard. 2002. A review of native and nonnative red foxes in North America. Wildlife Society Bulletin 30:370–379.

Sacks, B. N., M. J. Statham, J. D. Perrine, S. M. Wisely, and K. B. Aubry. 2010. North American montane red foxes: expansion, fragmentation, and the origin of the Sacramento Valley red fox. Conservation Genetics 11:1523–1539.

Statham, M. J., B. N. Sacks, K. B. Aubry, J. D. Perrine, and S. M. Wisely. 2012. The origin of recently established red fox populations in the United States: translocations or natural range expansions? Journal of Mammalogy, in press.

Swanson, B. J., R. T. Fuhrmann, and R. L. Crabtree. 2005. Elevational isolation of red fox populations in the Greater Yellowstone ecosystem. Conservation Genetics 6:123–131.

## Tufted Puffin

(*Fratercula cirrhata*)

**State Status:** Candidate, 1998
**Federal Status:** Species of concern
**Recovery Plans:** None

Figure 1. Tufted Puffin (*WDFW photo*).

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 more than 40 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 17 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 two decades (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. In 2009, data from 1,380 km of boat-based surveys for marbled murrelets (*Brachyramphus marmoratus*) and other seabirds (Raphael et al. 2007, Falxa et al. 2011) generated an estimate of 2,958 tufted puffins in the on-the-water population between Cape Flattery and the mouth of the Columbia River (S. Pearson, unpubl. data). These surveys were made within 8 km of shore from mid-May to late July. The results 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.

***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

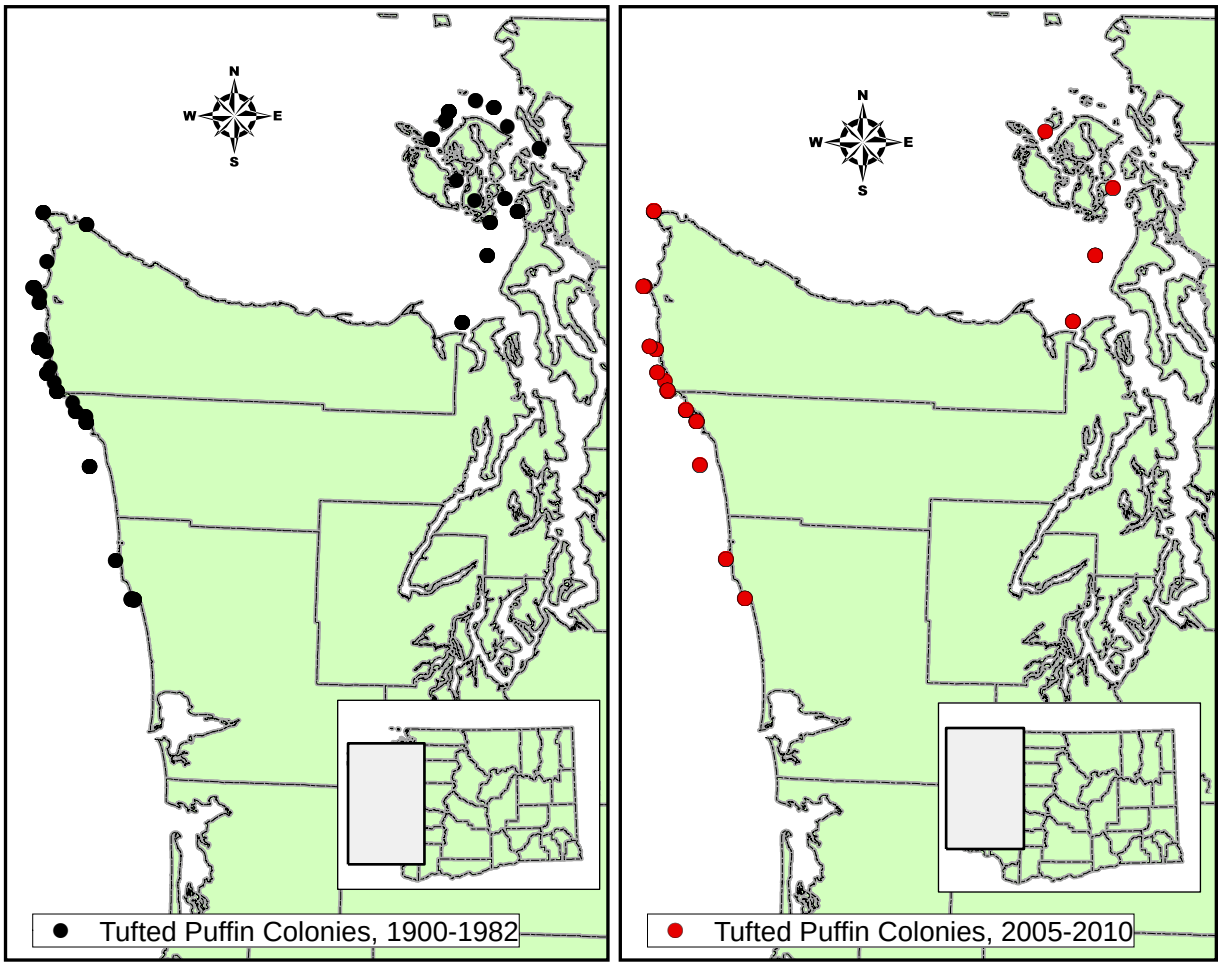



Figure 2. Locations of historical and current tufted puffin colonies in Washington.

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.).

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 puffins.

**Partners and cooperators:** U.S. Fish and Wildlife, University of Washington, SeaDoc Society, University of Puget Sound, NOAA Fisheries, Makah Tribe, Quinault Tribe, Quileute Tribe, National Park Service.

## Literature Cited

Falxa, G., J. Baldwin, D. Lynch, S. L. Miller, S. K. Nelson, S. F. Pearson, M. G. Raphael, C. Strong, T. Bloxton, B. Galleher, B. Hogoboom, M. Lance, and R. Young. 2011. Marbled murrelet effectiveness monitoring, Northwest Forest Plan: 2009 and 2010 summary report. 26 pp.

Jewett, S. G., W. P. Taylor, W. T. Shaw, and J. W. Aldrich. 1953. Birds of Washington State. University of

Washington Press, Seattle, Washington.
Piatt, J. F., and A. S. Kitaysky. 2002. Tufted puffin: *Fratercula cirrhata*. Birds of North America 708:1-31.
Raphael, M. G., J. Baldwin, G. A. Falxa, M. H. Huff, M. Lance, S. L. Miller, S. F. Pearson, C. J. Ralph, C. Strong, and C. Thompson. 2007. Regional population monitoring of the marbled murrelet: field and analytical methods. Gen. Tech. Rep. PNW-GTR-716, Pacific Northwest Research Station, U.S. Forest Service, Portland, Oregon.
Speich, S. M., and T. R. Wahl. 1989. Catalog of Washington seabird colonies. U.S. Fish Wildl. Service. Biol. Rep. 88(6), 510 pp.
USFWS (U.S. Fish and Wildlife Service). 2007. Washington Islands National Wildlife Refuges - Flattery Rocks, Quillayute Needles, and Copalis National Wildlife Refuges: comprehensive conservation plan and environmental assessment. U.S. Fish and Wildlife Service, Sequim, Washington, and Portland, Oregon.
USFWS (U.S. Fish and Wildlife Service). 2010. Protection Island and San Juan Islands National Wildlife Refuges comprehensive conservation plan and San Juan Islands Wilderness stewardship plan. U.S. Fish and Wildlife Service, Port Angeles, Washington, and Sherwood, Oregon.
Wahl, T. R., and B. Tweit. 2000. Seabird abundances off Washington, 1972-1998. Western Birds 31:69-88.

## 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 occasionally interbreed (Konter 2011). Clark's grebe was recognized as a distinct species in 1985 (AOU 1985). Survey data often combine the two species because they often cannot be distinguished at longer distances. Numbers of both species seem to have declined and both are affected by several of the same factors. Due to these similarities and historical data that combine both species, a draft status report for both is currently being written for WDFW with support from the SeaDoc Society.


Figure 1. Clark's grebe, left, is similar to the western grebe, right, but has white around the eye and a brighter yellow bill.

In summer, these species are found on inland freshwater lakes in Washington. In winter, western grebes occupy nearshore marine waters of the state and 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.

Systematic surveys of western and Clark's grebe nesting numbers and reproductive success have not been conducted, but available data suggest declines in both species. A small population of western and Clark's grebes breeds on eastern Washington lakes; however, current breeding sites are considered of marginal quality compared to those historically available. Western and Clark's grebes make floating nests from emergent and submergent vegetation, and require a certain composition of fish for prey.

***Breeding populations.*** The combined numbers of western and Clark's grebes summering in eastern Washington in recent years likely total less than 2,500-3,000 birds, with most of these (1,500-2000) in the Potholes Reservoir area based on partial observations for Grant County (Table 1). However, a large percentage of the adult grebes (mostly western grebes) at Potholes Reservoir do not attempt to nest and nesting success appears to be low (<30%). 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 et al. 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. The birds moved to Potholes Reservoir, then moved again to the westernmost and more remote pothole lakes, perhaps because of boat wakes and major water level fluctuations that swamped or left nests high and dry. Breeding Bird Survey trends (http://www.mbr-pwrc.usgs.gov/bbs/bbs.html) suggest a decline for western and Clark's grebes in Washington, although the decline is not statistically reliable due to 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).

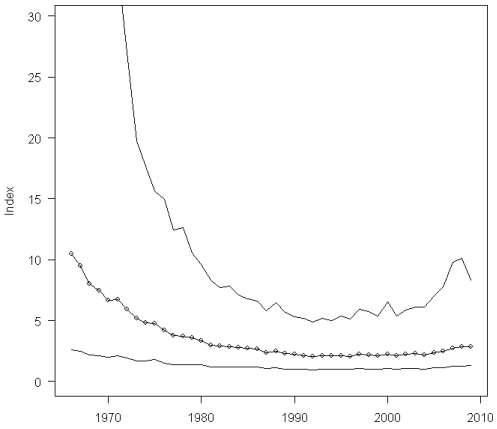



Figure 2. Trend in summer numbers of western and Clark's grebes in the western North American Breeding Bird Survey region (Sauer et al. 2011).

Table 1. Recent survey results at breeding locations of western (WE) and Clark's (CL) grebes in eastern Washington, 1988-2011.

| Site | County | Species | Year and numbers |
|---|---|---|---|
| Lower Spokane River (east end of Long Lake) | Spokane | WE | 2006: up to 40 pairs;<br>2007: at least 12 nests<br>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<br>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<br>2011: 12 adults |
| Moses Lake (Goat, Gailey's, Marsh and Crest Islands) | Grant | CL, WE | 1990: 344 adults (270 CL)<br>2011: 56 adults |
| Potholes Reservoir (multiple locations) | Grant | CL, WE | 1990-91: 850-1270 adults; 425-635 nests CL 5-10%<br>2011: 524 ad (12% CL); 222 nests; most sites failed due to water drop |
| 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<br>2009: 64 nests (Osborne Bay)<br>2010: 4 nests<br>2011: 35 adults |

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 likely occurred there. In 2009, at least 63 nests (mostly Clark's) were recorded at Banks Lake. 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.

***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 3). 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.

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 harmful 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.

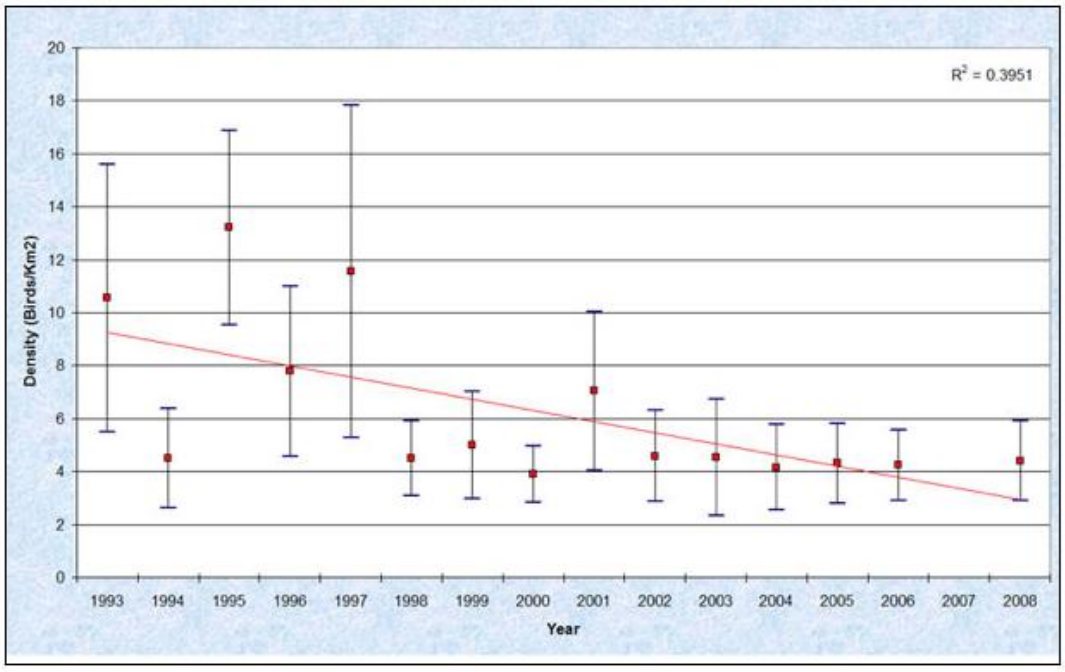



Figure 3. Winter trends in western grebe densities in the inner marine waters of Washington, 1993-2008 (WDFW 2011).

***Land acquisitions.*** In 2011, WDFW acquired two groups of properties that may benefit western grebes. These included 198 acres in Puget Sound and 156 acres of outer coastal estuaries.

**Partners and cooperators:** U. S. Fish and Wildlife Service, SeaDoc Society, Puget Sound Partnership.

### Literature Cited

AOU (American Ornithologist's Union). 1985. Thirty-fifth supplement to the American Ornithologists' Union check-list of North American birds. Auk 102:680-686.

Hoenes, B., and R. Finger. 2011. Summary of Washington Department of Fish and Wildlife colonial waterbird surveys in Grant and Adams Counties. Washington Department of Fish and Wildlife, Region 2, Ephrata, Washington.

Konter, A. 2011. Interbreeding of *Aechmorphus* grebes. Wilson Journal of Ornithology 123:132–136.

Phillips, E. M., J. E. Zamon, H. M. Nevins, C. M. Gibble, R. S. Duerr, and L. H. Kerr. 2011. Summary of birds killed by a harmful algal bloom along the south Washington and north Oregon coasts during October 2009. Northwestern Naturalist 92:120-126.

Puget Sound Action Team. 2007. 2007 Puget Sound update: ninth report of the Puget Sound Ambient Monitoring Program. Puget Sound Action Team. Olympia, Washington.

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 3.23.2011. USGS Patuxent Wildlife Research Center, Laurel, Maryland.

WDFW (Washington Department of Fish and Wildlife). 2011. Marine bird densities from the inland marine waters of Washington as captured by PSAMP efforts 1992-2006, 2008-2010. Marine Bird and Mammal Component, Puget Sound Ambient Monitoring Program (PSAMP), Washington Department of Fish and Wildlife, Olympia, Washington. http://fortress.wa.gov/dfw/gispublic/apps/psampdensity/viewer.htm

## Burrowing Owl

(*Athene cunicularia*).

**State Status:** Candidate, 1991
**Federal Status:** Species of Concern
**Recovery Plans:** None

Figure 1. Burrowing owl at nest burrow in Grant County (*photo by D. Stinson*).

The burrowing owl is a small owl of open grassland and shrub-steppe habitats found in eastern Washington and throughout the western U.S. in appropriate habitat (Figure 1). There are breeding records from nearly all 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 status report for the species was initiated, but has been 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).

Analysis of Breeding Bird Survey data for Washington indicates an estimated 1.5% annual decline since 1968 (Figure 3), which equates to an overall decline of 45% since then (Conway and Pardieck 2006). Burrowing owls most often use the abandoned burrows of mammals for nesting, food caching, and

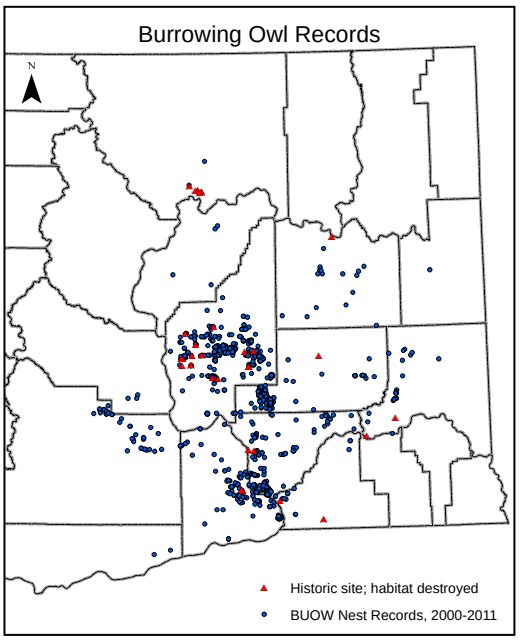



Figure 2. Burrowing owl records in Washington through 2011.

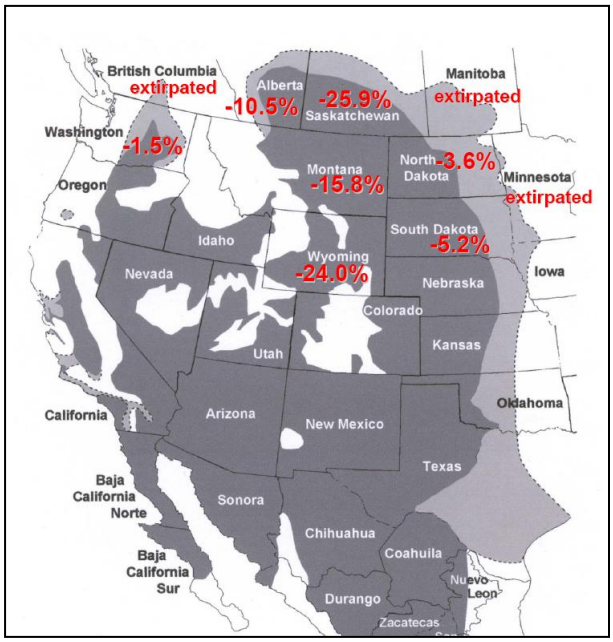



Figure 3. Changes in burrowing owl range and numbers detected during Breeding Bird Surveys.

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, and 1 was found dead in San Francisco. Another juvenile was killed by a train in Havre, Montana (Conway et al. 2005). In February 2011, a burrowing owl was found dead beneath a wind turbine in Klickitat County; it was banded as a juvenile in July 2010 near Kamloops, British Columbia.

***Artificial burrow project.*** In 2010 and 2011, WDFW installed 61 artificial burrows in the Tri-Cities area. An earlier project in Washington 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.

***Research.*** A cooperative project to identify migratory routes of Washington and Oregon burrowing owls was initiated in 2010 by the USFWS-Mid-Columbia National Wildlife Refuge, the Global Owl Project, and the Umatilla Army Depot near Hermiston, Oregon. Geolocators were attached to 20 burrowing owls in 2010 at the Umatilla Depot. Geolocators are a small device that records light levels, and when recovered from a bird after migration, the data can be used to determine, within 150 km, the bird's location during the intervening days (Figure 4). 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.).

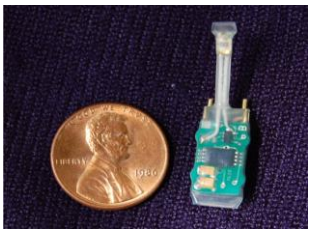


Figure 4. Geolocator used on burrowing owls in a study of migration routes and wintering areas.

***Burrowing owl cam.*** Burrowing owls have been the subject of one of WDFW's Wildwatch video cameras since 2006. In 2011, WDFW and volunteer videographer Gaylord Mink started a new effort to document what goes on inside a burrowing owl burrow by installing a camera inside an artificial 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 National Wildlife Refuge, Global Owl Project, Department of Defense-Umatilla Depot, Lower Columbia Basin Audubon Society, Tree Top, Inc.

## Literature Cited

Conway, C. J., V. Garcia, M. D. Smith, and L. A. Ellis. 2002. Population Ecology and Habitat Use of Burrowing Owl in Eastern Washington: 2002 Annual Report. USGS Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona. 50 pp.

Conway, C. J., L. A. Ellis, V. Garcia, and M. D. Smith. 2005. Population Ecology and Habitat Use of Burrowing Owl in Eastern Washington: 2004 Annual Report. Wildlife Research Report #2005-02. Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona. 52 pp.

Conway, C. J., V. Garcia, M.D. Smith, L. A. Ellis, and J. L. Whitney. 2006. Comparative demography of burrowing owls in agricultural and urban landscapes in southeastern Washington. Journal of Field Ornithology 77:280–290.

Conway, C. J., and K. L. Pardieck. 2006. Population trajectory of Burrowing Owls (*Athene cunicularia*) in eastern Washington. Northwest Science 80:292–297.

Klute, D. S., L. W. Ayers, M. T. Green, W. H. Howe, S. L. Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status assessment and conservation plan for the western burrowing owl in the United States. U.S. Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing owl (*Speotyto cunicularia*). *In* A. Poole and F. Gill, editors. The Birds of North America, No. 61. Academy of Natural Sciences, Philadelphia, Pennsylvania, and American Ornithologists' Union, Washington, D. C.

Johnson, D. H., D. C. Gillis, M. A. Gregg, J. L. Rebholz, J. L. Lincer, and J. R. Belthoff. 2010. Users guide to installation of artificial burrows for burrowing owls. Tree Top, Inc., Selah, Washington. 34 pp. Pdf available from: www.globalowlproject.com, or www.wildlife-research.org

Moulton, C. E., R. S. Brady, and J. R. Belthoff. 2006. Association between wildlife and agriculture: underlying mechanisms and implications in burrowing owls. Journal of Wildlife Management 70:708–716.

Smith, M. R., P. W. Mattocks Jr., and K. M. Cassidy. 1997. Breeding Birds of Washington State Location Data and Predicted Distribution. Volume 4. Cassidy, K. M., C. E. Grue, M. R. Smith, and K. M. Dvornich, eds. Washington State Gap Analysis - Final Report. Seattle Audubon Society, Seattle, Washington. 538 pp.

## Golden Eagle

(*Aquilla chryseatos*)

**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, open areas dominated by shrub-steppe communities, but also may nest 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 Steenhoff 2002), surveys of less than ten years may not detect long-term changes 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.

Lead poisoning is a concern for golden eagles in parts of their western range, including Washington, where elevated lead levels in blood have been detected in more than half the birds tested (Watson and Davies 2009). Four of the 14 birds tested had lead levels indicative of toxicosis. Individuals likely ingest lead by feeding on injured or dead waterfowl, small mammals, or deer shot by hunters.

Electrocution continues to be a major source of mortality, particularly for immature birds, and the species is 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. Two golden eagles have been killed at wind farms (both in Klickitat County) in Washington up through 2011 (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 (A. Duff and J. Watson, unpubl. data).

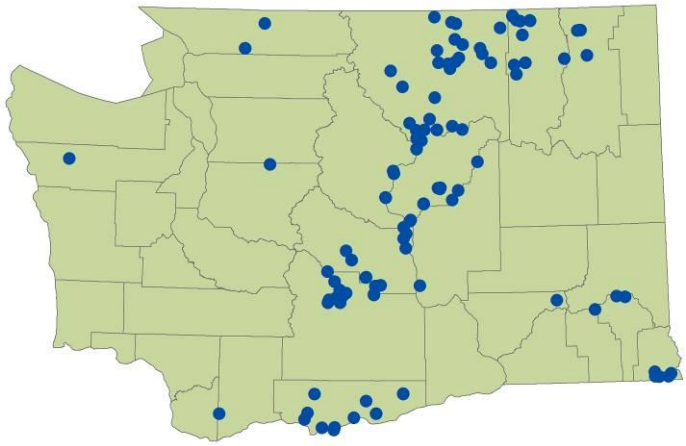


Figure 2. Occupied golden eagle breeding areas in Washington, 2004-2005.

Declining prey bases are another threat to golden eagles and are commonly caused by habitat loss, alteration, and fragmentation. 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).

***Conservation actions and research.*** WDFW is completing research on range use characteristics and lead contaminant levels of adult golden eagles conducted cooperatively with the Woodland Park Zoo. Ongoing and future research 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. In 2011, WDFW acquired 3,075 acres of land in the Okanogan-Similkameen watershed that may benefit golden eagles.

**Partners and cooperators:** U.S. Fish and Wildlife Service, Woodland Park Zoo, U.S. Forest Service, U.S. Army-Yakima Training Center.

## Literature cited

Franson, J. C., L. Sileo, and N. J. Thomas. 1995. Causes of eagle deaths. Page 68 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P.D. Doran, and M. J. Mac, eds. Our living resources. U.S. Department of Interior, National Biological Service, Washington, D.C.

Harness, R. E. and K. R. Wilson. 2001. Electric-utility structures associated with raptor electrocutions in rural areas. Wildlife Society Bulletin 29:612-623.

Knight, R. L. and A. W. Erickson. 1978. Marmots as a food source of golden eagles along the Columbia River. Murrelet 59:28-30.

Kochert, M. N. and K. Steenhoff. 2002. Golden eagles in the U.S. and Canada: status, trends and conservation challenges. Journal of Raptor Research 36 (Supplement 1):32-40.

Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden eagle (*Aquila chrysaetos*). The Birds of North America No. 684. Academy of Natural Sciences, Philadelphia, Pennsylvania, and American Ornithologists' Union, Washington, D. C.

Lehman, R. N. 2001. Raptor electrocution on power lines: current issues and outlook. Wildlife Society Bulletin 29:804-813.

Lehman, R. N., P. L. Kennedy, and J. A. Savidge. 2007. The state of the art in raptor electrocution research: a global review. Biological Conservation 136:159-174.

Lehman, R. N., J. A. Savidge, P. L. Kennedy, and R. E. Harness. 2010. Raptor electrocution rates for a utility in the Intermountain Western United States. Journal of Wildlife Management 74:459-470.

Nielson, R. M., T. Rintz, L. L. McDonald, and T. L. McDonald. 2011. Results of the 2010 survey of golden eagles (*Aquila chrysaetos*) in the western United States. Western EcoSystems Technology, Inc. Cheyenne, WY.

Watson, J. 2010. The golden eagle. Yale University Press, New Haven, Connecticut.

Watson, J. W. and R. W. Davies. 2009. Range use and contaminants of golden eagles in Washington. Washington Department of Fish and Wildlife, Olympia, Washington.

## 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 (Hallock 2006). Known Washington sites are limited to the central Columbia Basin that receive less than 8 inches of precipitation annually. All Washington occurrences are below 1,500 ft elevation (Figure 2).

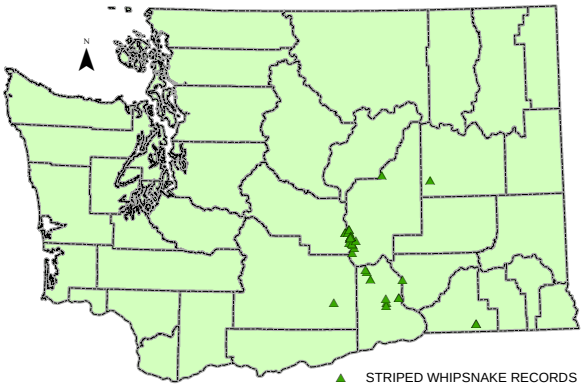



Figure 2. Locations of historical records of striped whipsnakes in Washington through 2011.

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 highway mortalities, quarrying of basalt, construction of new transmission lines, and collecting.

This species moves to communal 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 (Woodbury et al. 1951) and a population has been extirpated when a local hibernaculum was destroyed (Brown and Parker 1982). Identification of hibernacula is essential information 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 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 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 the site and to evaluate the status of the species in Washington (Hallock 2006).

The most efficient way to locate occupied sites is by searching for shed skins. This method has been used at historically occupied sites and other areas thought to be suitable for the species. These surveys and additional work have produced only two locations in Washington (about 7-8 km apart) known to be occupied by striped whipsnakes. A corridor of native habitat supporting healthy lizard populations still remains between the two sites (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. WDFW has continued to conduct these surveys annually at both occupied sites to monitor the populations and also at other sites to search for additional populations. The Yakima Training Center has also conducted annual shed skin surveys.

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 programs are working to secure funding for land acquisition.

**Partners and cooperators:** Bureau of Land Management Wenatchee Office, Washington Department of Natural Resources, U.S. Army-Yakima Training Center, U.S. Geological Survey.

## Literature Cited

Brown, W. S. and W. S. Parker. 1982. Niche dimensions and resource partitioning in a Great Basin Desert snake community. Pages 59-81*in* N. J. Scott, ed. Herpetological communities. U.S. Fish and Wildlife Service, Wildlife Research Report 13.

Hallock, L. A. 1998a. Herpetofauna of the Hanford Nuclear Reservation, Grant, Franklin and Benton counties, Washington. Unpublished report submitted to The Nature Conservancy, Seattle, Washington. 43 pp.

Hallock, L. A. 1998b. Herpetofauna inventory of Bureau of Land Management sites in Douglas, Franklin, Grant, Lincoln, and Klickitat counties, Washington. Unpublished report, Natural Heritage Program, Washington Department of Natural Resources, Olympia, Washington. 14 pp.

Hallock, L. A. 1999. Herpetofauna inventory of northern Moses Coulee, Douglas County, Washington. Unpublished report, Natural Heritage Program, Washington Department of Natural Resources, Olympia, Washington. 15 pp.

Hallock, L. A. 2006. Summary report on the striped whipsnake (*Masticophis taeniatus*) in Washington. Washington Natural Heritage Report 2006-05, Washington Department of Natural Resources, Olympia, Washington. 47 pp.

Nussbaum, R. A., E. D. Brodie, Jr., and R. M. Storm. 1983. Amphibians and Reptiles of the Pacific Northwest. University of Idaho Press, Moscow, Idaho. 332 pp.

Stebbins. R. C. 2003. A Field Guide to Western Reptiles and Amphibians. 3rd edition. Houghton Mifflin Company, Boston, Massachusetts. 533 pp.

Woodbury, A. M. et al. 1951. Symposium: a snake den in Tooele County, Utah. Herpetologica 7:1-51.

## Island Marble

(*Euchloe ausonides insulanus*)

**State Status**: Candidate, 2002
**Federal Status**: Species of concern
**Recovery Plans:** None

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 currently considered a subspecies of the much more widely distributed large marble (*E. ausonides*; Guppy and Shepard 2001). 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 in 1998 (Fleckenstein and Potter 1999).

Figure 1. Island marble perched on the host, field mustard (*Brassica campestris)* (*photo by Thor Hanson*).

WDFW, partners, and researchers in British Columbia have conducted surveys annually since 2005 to locate new populations. After hundreds of surveys at potential locations in the San Juan Islands, Gulf Islands, Vancouver Island, Olympic Peninsula, and northern coastal Puget Sound, only a few populations have been found on San Juan and Lopez islands. WDFW annually monitors the species and habitat status at the known sites in cooperation with landowners, which are primarily private, but also include the National Park Service, BLM, Washington Department of Natural Resources, and San Juan County.

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 National Historic Park. For the first time, no island marbles were detected on Lopez Island. Several additional patches of potential habitat were also searched. An estimated total of only 200-300 individuals was counted at the four sites. These data, along with survey results from recent years, suggest an ongoing decline in island marble abundance, numbers of habitat patches, and numbers of occupied sites.

Data from the survey efforts have helped expand knowledge of the island marble's range, flight period, host plant requirements, and natural history, as well as threats to its conservation. Adult island marbles generally appear from April- June. Females select specific plants and species within the mustard family (Brassicaceae) to lay their eggs. 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.

A significant loss of island marble habitat has occurred since 2005. Host plants have decreased in abundance at several key island marble sites and at sites that supported small and large patches. 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.

In response to a petition filed in 2002, the U.S. Fish and Wildlife Service conducted a status review and published a 12-month finding of 'not warranted' for listing under the Endangered Species Act (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 non-native food plants through ground disturbance and that this is generally compatible with conservation of the 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.

***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. In 2011, WDFW staff gave a presentation on the island marble at the *Island Prairie Symposium*, an event providing information on prairies to the San Juan Islands community and those interested and concerned with management of San Juan Island National Historical Park, which supports the last remaining sizable population of this butterfly.

**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.

**Literature Cited**

Fleckenstein, J. and A. Potter. 1999. 1997, 1998 project summary Puget prairie butterfly surveys. Washington Department of Natural Resources and Washington Department of Fish and Wildlife, Olympia, Washington.

Guppy, C. and J. Shepard. 2001. Butterflies of British Columbia: including Western Alberta, Southern Yukon, the Alaska Panhandle, Washington, Northern Oregon, Northern Idaho, and Northwestern Montana. University of British Columbia Press, Vancouver, B.C.

Potter, A., T. Hanson, and S. Vernon. 2011. Surveys for the island marble butterfly (*Euchloe ausonides insulanus*) in San Juan County, Washington, 2010. Washington Department of Fish and Wildlife, Olympia, Washington.

Shepard, J. H. 2000. Status of five butterflies and skippers in British Columbia. BC Ministry of the Environment, Wildlife Working Report No. WR-101.

USFWS (U.S. Fish and Wildlife Service). 2006. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the island marble butterfly (*Euchloe ausonides insulanus*) as threatened or endangered. Federal Register 71(219):66292- 66298.

## 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 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).

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.

Surveys efforts in Washington have been greatly expanded, with the Natural Heritage Program, Washington Department of Natural Resources conducting surveys in the eastern Cascades since 2010; this work will continue in 2012. 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.

**Partners and cooperators:** Washington Department of Natural Resources, U.S. Fish and Wildlife Service, University of Idaho, Palouse Prairie Foundation, Palouse Audubon, Idaho Department of Fish and Game, Soil Biology Associates.

## Literature cited

Fauci, M. F. and D. F. Bezdicek. 2002. Lumbricid earthworms in the Palouse region. Northwest Science 76:257-260.

Hendrix, P. F., and P. J. Bohlen. 2002. Exotic earthworm invasions in North America: ecological and policy implications. BioScience 52(9):801-811.

Hendrix P. F. 2006. Biological invasions belowground – earthworms as invasive species. Biological Invasions 8:1201–1204.

James, S. 2000. Earthworms (Annelida: Oligochaeta) of the Columbia River Basin Assessment Area. Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. GTR PNW-GTR-491. U.S. Forest Service, Pacific Northwest Research Station, Portland, Oregon. 13 pp.

Sanchez-de Leon, Y. L. and J. L. Johnson-Maynard. 2009. Dominance of an invasive earthworm in native and non-native grassland ecosystems. Biological Invasions 11:1393-1401.

Smith, F. 1897. Upon an undescribed species of Megascolides from the United States. American Naturalist 31:202-204.

Smith, F. 1937. New North American species of earthworms of the family Megacolidae. Proceeding of the U.S. National Museum 84:157-181.

USFWS (U.S. Fish and Wildlife Service). 2011. 12-month finding on a petition to List the giant Palouse earthworm (*Drilolerius americanus*) as threatened or endangered. Federal Register 76(143):44547-44564.

## Merlin

(*Falco columbarius*)

**State Status:** Removed from candidate list, 2010
**Federal Status:** 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.

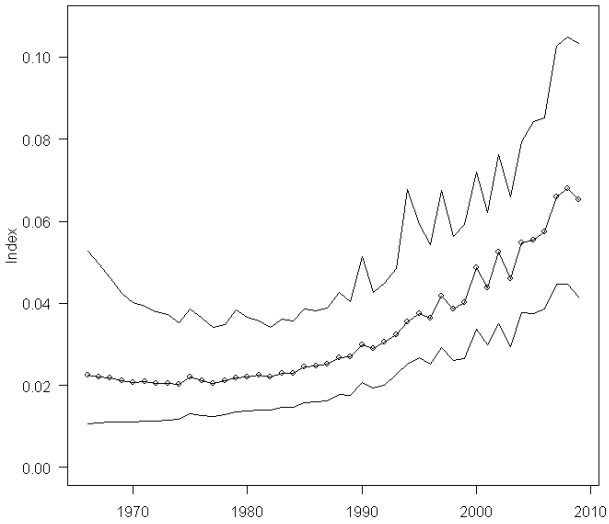



Figure 2. Trend in Breeding Bird Survey detections of merlins in western North American, 1966-2009 (Sauer et al. 2011).

**Literature Cited**

Gleason, T., T. L. Fleming, and J. B. Buchanan. 2005. Merlin. Pages 123-125, *in* T. R. Wahl, B. Tweit, and S. G. Mlodinow, editors. Birds of Washington: status and distribution. Oregon State University Press, Corvallis, Oregon. 436 pp.

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

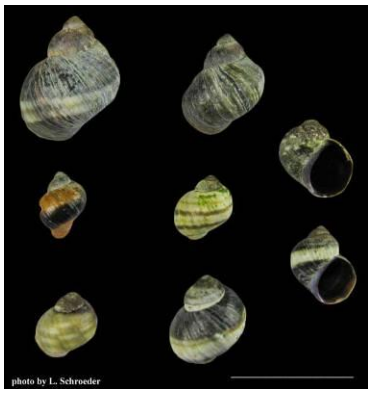



Figure. 1. *Littorina subrotundata (photo by L. Schroeder)*.

Newcomb's littorine snail (Figure 1), also known as the saltmarsh 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).

### Literature Cited

Kyle, C. J. and E. G. Boulding. 1998. Molecular genetic evidence for parallel evolution in a marine gastropod, *Littorina subrotundata*. Proceedings Royal Society London B, 265:303-308.

# APPENDIX A. Washington laws: Washington Administrative Code 232-12- 011. Wildlife classified as protected shall not be hunted or fished; Washington Administrative Code 232-12-014. Wildlife classified as endangered species; Washington Administrative Code 232-12-297. Endangered, threatened and sensitive wildlife species classification; and Washington Administrative Code 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 | |

√ Posted on WDFW website: http://wdfw.wa.gov/publications/search.php?Cat=Wildlife Research and Management&SubCat=Status Reports and Recovery Plans