

4. Inventory of Existing Activities (Private, Local, State, Federal)

4.1. Existing Legal Protection

Protected Areas

Hells Canyon National Recreation Area

Established in 1975, Hells Canyon National Recreation Area (HCNRA) encompasses 652,488 acres, of which 194,132 acres are designated as wilderness and 33,000 are privately owned (USDA 1999; Figure 31). HCNRA is administered as part of the Wallowa-Whitman National Forest.

Eagle Cap Wilderness Area

A very small portion of the Eagle Cap Wilderness Area is in this subbasin.

Research Natural Areas

Research natural areas are natural ecosystems that provide benchmarks for comparison with areas influenced by humans. These areas provide research areas for ecological studies and preserve gene pools for threatened and endangered plants and animals. Seven areas are proposed for designation as Research Natural Areas in the Lower Middle Snake subbasin (Figure 31). These areas were selected to represent particular plant associations, geological formations, or other needs outlined in state natural heritage plans. According to the Forest Plan "Proposed RNAs will be protected from uses which would reduce their suitability for RNA designation". Since their designation no logging has occurred in the proposed RNAs. Once officially established, an RNA management plan will be written and integrated into the Forest Plan (USDA 1999).

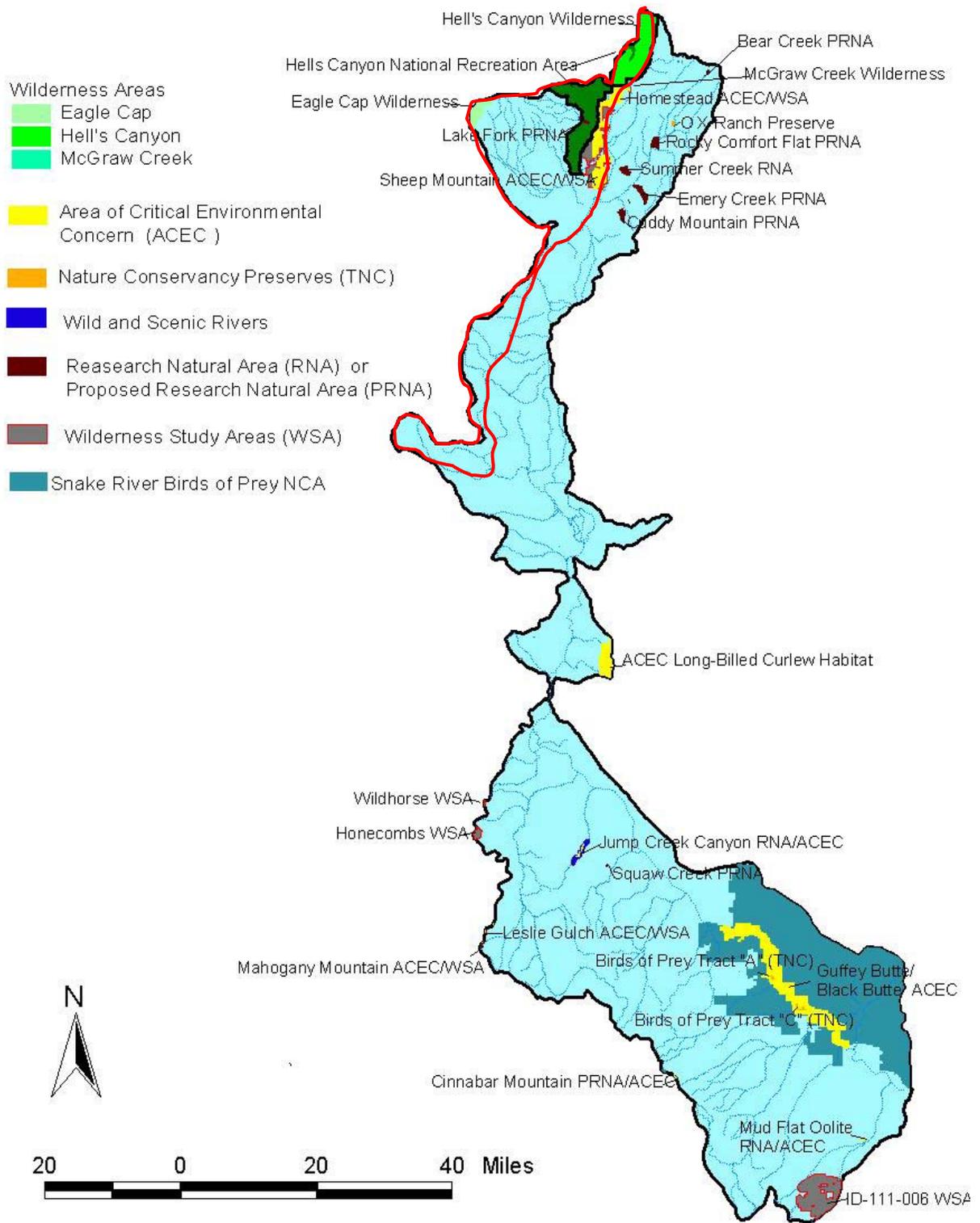


Figure 31. Areas in the Lower Middle Snake subbasin that are managed and/or protected using a conservation-based strategy. The Oregon Side LMS is outlined in red.

4.2. Existing Plans

☞ *US Forest Service and Bureau of Land Management*

The U.S. Forest Service is required to manage habitat to maintain viable populations of anadromous fish and other native and desirable non-native vertebrate species. A **Land and Resource Management Plan** (Forest Plan) was developed for the Wallowa-Whitman National Forest (USDA 1990). This Forest Plan guides all natural resource management activities, establishes forest-wide multiple-use goals and objectives, and establishes management standards and guidelines for the Wallowa Whitman National Forest. The forest plan is currently under revision.

The Bureau of Land Management, in accordance with the Federal Land Policy and Management Act of 1976, is required to manage public lands to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values. A **Resource Management Plan** was developed for the Vale District Office, Baker Resource Area (USDI 1989). Both the USFS and BLM are required by the Clean Water Act to ensure that activities on administered lands comply with requirements concerning the discharge or run-off of pollutants.

In the Columbia River Basin, the Forest Service and the Bureau of Land Management manage salmonid habitat under the direction of **PACFISH** (USDA and USDI 1994) and **INFISH** (Inland Native Fish Strategy; USDA 1995). These interim management strategies aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin, including the Oregon Side LMS subbasin. These strategies have also facilitated the ability of the federal land managers to meet requirements of the ESA and avoid jeopardy. PACFISH guidelines are used in areas east of the Cascade Crest for anadromous fish. INFISH is for the protection of habitat and populations of listed resident fishes outside anadromous fish habitat.

The **Interior Columbia Basin Ecosystem Management Project** (ICBEMP) is a regional-scale land-use plan that covers 63 million acres of federal lands in Oregon, Washington, Idaho, and Montana <http://www.icbemp.gov/>.

The Bureau of Land Management is developing the **Northeastern Oregon Assembled Land Exchange** (NOALE) for the retention, exchange, and disposal of public land (USDI 1998). The goal of the exchange is to enable the BLM to more effectively meet ecosystem management objectives, to consolidate BLM managed lands for more effective and efficient resource protection, enhancement, and use; and to ensure that retained lands have sufficient public benefit to merit the costs of management (Land Exchange Act).

☞ *US Fish and Wildlife Service*

The U.S. Fish and Wildlife Service administers the Endangered Species Act (ESA) for resident fish and wildlife. This act provides for the development of **Recovery Plans** and directs enforcement of federal protection laws.

The USFWS also administers the **Lower Snake River Fish and Wildlife Compensation Plan (LSRCP)** authorized by the Water Resources Development Act of 1976 (Public Law 94-587). The goal of the LSRCP is to mitigate and compensate for fish and wildlife resource losses caused by construction and operation of the four lower Snake River dams and navigation lock projects (FWS 1998).

➤ *NOAA Fisheries*

The National Oceanic and Atmospheric Administration administers the **ESA** as it pertains to anadromous fish only. NOAA Fisheries has jurisdiction over actions pertaining to Snake River spring and fall Chinook salmon and Snake River Basin Steelhead where they occur in the subbasin.

➤ *Environmental Protection Agency*

The U.S. Environmental Protection Agency is responsible for implementing and administering the **Clean Water Act (CWA)**. Accelerated and strengthened efforts to achieve clean water and aquatic habitats was the intent of the Clean Water Initiative (1998), the core of which is the **Clean Water Action Plan (CWAP)**, a federal partnership to promote and enhance locally based watershed improvements (the Unified Federal Policy for Ensuring a Watershed Approach to Federal Land and Resource Management). Restoration strategies called **Total Maximum Daily Loads (TMDL)** are being developed for the Columbia River mainstem and tributaries (including the Oregon Side LMS subbasin), based on court orders and negotiated agreements through CWA litigation. EPA serves an oversight and advisory role in development of TMDLs.

➤ *Senate Bill 1010*

Senate Bill 1010 gives the Oregon Department of Agriculture (ODA) management authority to develop Water Quality Management plans for agricultural lands where such actions are required by state or federal law, such as TMDL requirements. The **Water Quality Management Plan** should be crafted in such a way to assist landowners in the local area in prevention and control of water pollution resulting from agricultural activities.

➤ *Oregon Plan*

Passed into law in 1997 by Executive Order, the **Oregon Plan for Salmon and Watersheds** (<http://www.oregon-plan.org/>) and the **Steelhead Supplement to the Oregon Plan** outlines a statewide approach to ESA concerns based on watershed restoration and ecosystem management to protect and improve salmon and steelhead habitat in Oregon.

➤ *Oregon Department of Fish and Wildlife*

Oregon Department of Fish and Wildlife is responsible for protecting and enhancing Oregon fish and wildlife and their habitats for present and future generations. Management of the fish and wildlife and their habitats in the Oregon Side LMS subbasin is guided by ODFW policies and federal and state legislation. Direction for ODFW fish and wildlife management and habitat protection is based on the amendments and statutes passed by the Oregon Legislature. For example, **Oregon Administrative Rule (OAR) 635 Division 07 – Fish Management and Hatchery Operation** sets forth policies on general fish management goals, the **Natural Production Policy**, the **Wild Fish Management Policy**, and other fish management policies and **OAR 635 Division 008 – Department of Wildlife Lands** sets forth management goals for each State Wildlife Area. Another pertinent ODFW policy is the **Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources** (ODFW 1997b). In addition to the OAR's, ODFW has developed a variety of species-specific management plans.

<http://www.dfw.state.or.us/>

- Mule Deer Management Plan (2003)
- Elk Management Plan (2003)
- Bighorn Sheep and Rocky Mountain Goat Management Plan (2003)
- Cougar Management Plan (1993)
- Black Bear Management Plan (1987)
- Migratory Game Bird Program Strategic Management Plan (1993)
- Oregon Wildlife Diversity Plan (1999)
- Oregon's Trout Plan

- Warmwater Fish Plan
- Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout, Part III: Steelhead Plan
- Native Fish Conservation Policy

☉ *Oregon Department of Agriculture*

The Department of Agriculture has developed the **Oregon Noxious Weed Strategic Plan** to assist in controlling the spread of noxious weeds on public and private land.

☉ *Oregon Department of Forestry*

The Oregon Department of Forestry enforces the **Oregon Forest Practices Act** (OAR 629-Division 600 to 680 and ORS 527) regulating commercial timber production and harvest on state and private lands. The OFPA contains guidelines to protect fish bearing streams during logging and other forest management activities, which address stream buffers, riparian management, and road maintenance.

☉ *County Governments*

County Commissioners have established **Comprehensive Plans** for land use within each county in Oregon. The Plan is designed to establish certain regulatory control over specific activities to 1) ensure open space, 2) protect scenic, historic, and natural resources for future generations, and 3) promote healthy and visually attractive environments in harmony with the natural landscape. Big game winter range and certain sensitive species sites are offered some protection by county plans. Some counties also assist with funding of county watershed activities in collaboration with OWEB.

☉ *Powder Basin Watershed Council*

Under House Bill 2215 and its successor, HB 3441, the State of Oregon has authorized the formation of watershed councils in an attempt to include local knowledge and cooperation in addressing Oregon's environmental issues. Baker County has convened and legally recognizes this Council as empowered to shoulder the responsibility of retaining, restoring and enhancing the health of its watersheds. The Council's mission is to: Analyze watershed conditions, develop short and long-range plans and projects to protect or improve watershed conditions, educate the people in the community about the watershed conditions and function, enlist the people in the community to participate in the projects, develop peer and/or legislative partnerships when needed to achieve results and remain in compliance with legislative and legal requirements.

4.3. Existing Management Programs

☉ *Bonneville Power Administration*

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the **Fish and Wildlife Program** of the Northwest Power and Conservation Council as related to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinions and Assessments for recovery of threatened, endangered, and sensitive species. The recently released FCRPS Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands. BPA plans to rely on the Council's program as its primary implementation tool for the FCRPS BiOp off-site mitigation requirements.

☉ *U.S.D.A. Natural Resources Conservation Service*

Within the U.S. Department of Agriculture (USDA), the Natural Resources Conservation Service (NRCS) oversees the implementation of conservation programs to help solve natural resource concerns. The **Environmental Quality Incentives Program** (EQIP), established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious

threats to soil, water, and related natural resources. The **Conservation Reserve Program (CRP)** puts sensitive croplands under permanent vegetative cover. The **Conservation Reserve Enhancement Program (CREP)** helps to establish forested riparian buffers. The **Wetlands Reserve Program (WRP)** helps with wetland restoration efforts. The NRCS assists landowners to develop farm conservation plans and provides engineering and other support for habitat protection and restoration (PL 566). Additional programs administered by the NRCS include the **Grassland Reserve Program, Wildlife Habitat Incentives Program, Conservation Security Program, Forest Land Enhancement Program** and **Farm and Ranch Lands Protection Program**.

☞ *Oregon State Police*

The Fish and Wildlife Division of the Oregon State Police (OSP) is responsible for enforcement of fish and wildlife regulations in the State of Oregon. **The Coordinated Enforcement Program (CEP)** promotes effective enforcement by coordinating enforcement priorities and plans by and between OSP officers and ODFW biologists.

☞ *Blue Mountains Elk Initiative*

The **Blue Mountains Elk Initiative** is a federal, private, state and tribal partnership to improve elk habitat in the Blue Mountains of Oregon and Washington. The mission of the Initiative is to more effectively manage elk and elk habitat in the Blue Mountains with an emphasis on working closely with landowners to alleviate damage, using more than 90 percent of funding for on-the-ground projects and obtaining consensus on elk management from all partners and interested groups.

☞ *Baker County*

OWEB provides funding for locally administered **Small Grants Program** from the watershed improvement fund.

☞ *Baker County Noxious Weeds*

The **Baker County Noxious Weed Cost Share Program** provides assistance in control of specified weeds and it funded by a county weed levy.

☞ *Oregon Department of Agriculture*

The **Weed Board Grants Program** is tied to Oregon Lottery funds.

☞ *Bureau of Land Management*

Taylor Grazing Act **Rangeland Improvement Program** funds are administered by the BLM and funded from grazing fees.

4.4. Existing Restoration and Conservation Projects

In the Oregon Side LMS subbasin, there is no central location or database for tracking natural resource conservation and restoration projects. A request from the subbasin planning lead entity, the Baker County Association of Soil and Water Conservation Districts, to government agencies and private land owners for information on existing projects went unanswered. Therefore, no list of recent and ongoing projects is presented at this time.

4.5. Gap Assessment of Existing Protections, Plans, Programs and Projects

Without a centralized list of the projects under way and/or completed in the subbasin, an assessment of gaps in those projects and programs is problematic. Nevertheless, the aquatic and terrestrial assessments generally validate the direction of recent conservation and restoration activities in the subbasin and emphasize the need to continue these activities on a larger scale.

Much of the conservation and restoration work undertaken recently in the subbasin has been on private land. These projects are approached opportunistically, that is when funding and landowner willingness permit. Private landowners have participated in habitat restoration for a variety of reasons: a desire to improve habitat, fear of future regulation, testimonials from other

participating landowners, cost share opportunity, etc. Although there may have been higher priority actions, or higher priority reaches in which to pursue conservation and/or restoration, those actions or areas may have been inaccessible due to lack of landowner participation and/or funding.

We believe there are sufficient protective mechanisms, laws, management plans and programs to provide the framework for habitat protection and restoration in the subbasin. Additionally projects over the last decade have generally targeted the same limiting factors as have been identified in this assessment. The QHA model may assist subbasin planners to more precisely target restoration work to stream reaches, watersheds and fish populations where the work will be the most beneficial to aquatic habitats and fish populations.

5. Management Plan

5.1. Vision for the Subbasin

Our Vision:

"The Vision for the Oregon side of the Lower Middle Snake subbasin is to work through a collaborative process to achieve a healthy and sustainable ecosystem with diverse aquatic and terrestrial species and their habitats which also supports the social, cultural and economic well-being of the local communities within the subbasin for the benefit of present and future generations."

Goal:

Implementation of a partnership-driven Management Plan that protects and enhances the natural ecological functions, habitats and biological diversity while sustaining the economic and social vitality of the communities in the region.

5.2 Biological Objectives

Objectives:

1. Promote watershed and community health through innovation and cooperation by engaging all stakeholders through an open, assessable and collaborative process.
2. Maintain or improve watershed conditions for water quality and quantity by assessing water supply and use, and developing strategies for meeting current and future both in-stream and out-of-stream objectives..
3. Maintain or improve fish and wildlife habitats to support recovering populations of threatened or endangered species, diverse populations of native species and sustainable populations of recreationally valued species.
4. Use credible scientific information to understand, protect and improve the most critical aspects of a healthy watershed.

Guiding Principles:

1. Promote healthy ecosystems within the context of a natural resource based economy.
2. Encourage collaborative means to develop projects within small watershed areas (micro-watershed projects) and partnerships between private landowners and public agencies on mixed ownerships. This method will allow stakeholders and agencies to work together for the benefit of the watershed and create win-win situations.
3. Use methods that result in self-sustaining restoration compared to methods that require continued maintenance or periodic reestablishment.
4. Balance the use of passive and active restoration projects. Passive restoration aims at addressing the activities that are causing degradation or preventing recovery. Active restoration is used where past activities prevent natural processes (or cause slow recovery) from being effective.
5. Emphasize strategies aimed at restoring watershed processes and functions over treatment of conditions. Priority will be given to projects that benefit a number of factors.
6. Use principles of adaptive management to learn from experience compared to using inflexible standards and guides for restoration projects.

5.3. Prioritized Strategies

Generic aquatic and terrestrial strategies are listed below. The list is organized by general purpose and type of action or project. When combined with the spatial extent of limiting factors in the subbasin and in watersheds as summarized above in Section 3.5, this list constitutes the Aquatic and Terrestrial Strategies. Site-level projects can then be proposed to carry out the Oregon side of the Lower Middle Snake Subbasin Plan Strategies, and meet the needs of the NWPPC Columbia Fish and Wildlife Program.

The term “Improve” is being used to describe an action that will be set forth by standards of the agencies or landowners on a site specific basis and to a point ecologically, environmentally and economically practical and feasible.

5.3.1 Aquatic Species

- 1) Purpose: Improve Riparian and Wetland Habitats
 - a. Proper grazing management
 - b. Establish buffers and riparian fencing
 - c. Reestablish wetlands
 - d. Seeding and planting vegetation
 - e. Conservation Easements
- 2) Purpose: Improve Stream Channel Processes
 - a. Develop off-channel habitat
 - b. Remove/modify levies, berms, or dikes where appropriate
- 3) Purpose: Reduce Water Pollution
 - a. Irrigation and water management
 - b. Pesticide management
 - c. Nutrient management

- d. Sewage and stormwater
- 4) Purpose: Reduce Upland Erosion and Sedimentation
 - a. Agricultural lands – irrigated cropland, pasture and rangeland
 - b. Forest management
- 5) Purpose: Improve In-stream channel habitat
 - a. Large woody debris, boulder placement
 - b. Bank stabilization
- 6) Purpose: Improve habitat connectivity and fish passage
 - a. Fish passage at dams and irrigation water diversion structures
 - b. Barriers at roads (culverts)
 - c. Barriers created by dewatered reaches
 - d. Approved fish screens
- 7) Purpose: Minimize detrimental effects of exotic species
 - a. Education and enforcement to prevent illegal introductions
 - b. Exotic species management

5.3.2 Terrestrial Species

- 1) Purpose: Achieve healthy forest ecosystem function and processes
 - a. Prescribed fire
 - b. Selective thinning and fuels reduction
 - c. Road management and off-road travel
- 2) Purpose: Improve riparian habitat function
 - a. Develop site-specific grazing management prescriptions
 - b. Provide water developments in adjacent upland areas to encourage cattle/wildlife use of non-riparian habitats
 - c. Pasture and exclosure fencing
 - d. Encourage a diversity of shrub species
 - e. Identify areas with impaired function and prescribe restoration techniques that will restore hydrologic and ecologic functioning
- 3) Improve Sage-brush steppe habitats
 - a. Sage-brush control in appropriate areas
 - b. Encourage reestablishment of native vegetation
 - c. Noxious weed control

5.4. Consistency with ESA/CWA Requirements

These areas are addressed throughout the plan.

5.5 Research, Monitoring and Evaluation

Monitoring and Evaluation

The focus of our Monitoring and Evaluation program below is on the strategy level, not on the project level. It is not intended to be ‘field ready’, rather it is a first step in program development. Current or on-going projects frequently incorporate the Monitoring and Evaluation needs identified in this section.

A list of short-term indicators to measure the successful implementation of strategies that achieve desired objectives, and the expected long-term biological outcome, are provided to guide monitoring in the Oregon Side LMS subbasin (Table 35, Table 36).

Table 35. Indicators and expected biological outcomes used to evaluate success of implemented strategies in achieving aquatic objectives in the Oregon side of the Lower Middle Snake subbasin.

Objective	Strategy	Short-term Indicators to measure success	Long-term Biological Outcome
Maintain and increase bull trout abundance (greater than or equal to 500 adults) within each of the local population watersheds as identified by US Fish and Wildlife	Maintain existing local population levels by protecting or improving existing water temperature, stream flows, habitat quality and invasion from non-native species	Non-declining trends in water temperature, flow, habitat quality, passage	Non-declining population trends
	Increase populations to at least 500 adults within each defined watershed	Increased population	Increased population
	By 2020, assess and implement activities which will maintain or improve habitat within each defined watershed	Improved habitat	Expanded abundance
Ensure continued existence of redband trout populations at or near current levels	Expedite analysis of archived data and encourage additional genetic sampling	Genetic baseline and/or profiles of redband trout	Long-term population viability
	Improve degraded habitat to promote natural distribution of native resident fish	Improved habitat	Expanded abundance
Improve flow in limited reaches and spring complexes	Assessments for designation of adequate flow requirements where appropriate	Number of adequate flow designations	Improved populations, viability, distribution and abundance of aquatic species
	Continue and expand efforts aimed at increasing base flows and improve flow timing through riparian and wetland enhancements. Implement forest and agricultural Best Management Practices (BMP)	Increase base flows. Hydrograph improvements. Number of forest and agricultural BMPs implemented and acreage affected	Improved population and abundance of aquatic species

Reduce water temperatures to levels meeting applicable water quality standards for life stage specific needs of aquatic focal species	Improve riparian and wetland areas to restore hydrologic function and where impairment has impacted temperatures	Hydrograph improvement, increased flows, decreased stream temperatures	Improved population and abundance of aquatic species
	Promote efforts aimed at increasing streamside shading	Increased shading, increased miles of streams meeting shade and temperature criteria	Improved population and abundance of aquatic species
Reduce instream sedimentation to levels that meet applicable water quality standards and measures and establish and upward trend in the number of stream miles meeting such criteria	Reduce sediment inputs by cooperatively implementing practices that address problems from logging, mining, agriculture and other historic and current sediment-producing activities	Embeddedness	Improved population and abundance of aquatic species
By 2015, develop a nutrient allocation plan for the subbasin which investigates the potential benefits to fish and wildlife of nutrient additions or reductions	Target nutrient additions or reduction efforts accordingly to benefit aquatic and terrestrial species		
Reduce number of artificially blocked streams	Modify or remove, if possible, known barriers limiting aquatic species	Decreased number of barriers	Expanded population and diversity of species
	Modify or remove, if possible, human-caused barriers	Decreased number of barriers	Expanded population and diversity of species
Improve aquatic habitat diversity and complexity in tributary and mainstem where focal species populations are limited	Continue aquatic habitat improvement efforts consistent with existing federal, state and local habitat improvement plans and guidelines	Upward trend in habitat conditions including: Embeddedness/fines, temperature, riparian condition, high/low flows, bank stability, structure density/distribution, water quality	Improved population and abundance of aquatic species
	Address priority problems with protection and	Improved riparian condition, decreased temperature, decreased	Improved population and abundance of aquatic species

	restoration activities designed to promote development of more complex and diverse habitats through improved watershed condition and function. This will involve coordination of activities aimed at individual components such as temperature and sedimentation	embeddedness/fines, increased base flow	
	Improve ecosystem functions – identify and rehabilitate upland, riparian and wetland areas	Improved riparian condition, decreased temperature, decreased embeddedness/fines, increased base flow	Improved population and abundance of aquatic species

Table 36. Indicators and expected biological outcome used to evaluate success of implemented strategies in achieving TERRESTRIAL objectives in the Oregon side of the Lower Middle Snake subbasin.

Objective	Strategy	Short-term Indicators to measure success of Strategy	Long-term Biological Outcome
Protect and improve the quality, quantity and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction of noxious weeds and invasive exotic plants into native habitats	Prevent noxious weed infestations by conserving native ground cover and minimizing ground-disturbing activities in habitats highly susceptible to weed invasion through local cooperation and vegetation management techniques following disturbance	Reduction in the number of new infestations, decreasing number of acres that need to be treated each year. Reduction of acreage of incidents of invasive noxious plant infestations related to fire and other impacts.	Native plant communities without invasive noxious plant problems
	Prevent dispersal by encouraging the use of weed-free seeds and feeds. Limit the transportation of weed seeds and other	Programs implemented and policies enacted, such as establishment of weed-free regulations, posting of signs	Fewer opportunities for introductions

	propagules from vehicles and livestock	regarding weed-free seed use and others	
	Minimize establishment of new invaders by supporting early detection and eradication programs	Reduction in the number of new infestations, decreasing number of acres that need to be treated each year.	Native plant communities without invasive noxious plant problems
Reduce the extent and density of established noxious weeds and encourage perennial species and native habitats	Treat weed infestations using the area and species identified and prioritized by Baker County Weed Board/ Weed District	Number of infested acres treated. Number of infestations treated	Reduced number of infestations. Reduced acreage of infestations
	Control or mitigate for the adverse impact of invasive vegetation in reservoir drawdown zones	Number of infested acres in water-line and drawdown (net reduction in infestation)	Reduced acreage of infestations
	Reestablish native plant communities after successful weed eradication efforts	Acres of restored native habitat	Increase in native plant communities without invasive noxious weed problems
	Encourage BMP and land use that will decrease the likelihood of invasion. Use the most effective and environmentally appropriate biological, mechanical or chemical treatments for control	Implementation rates of BMPs and Integrated Pest Management (IPM) techniques	Native plant communities without invasive noxious weeds problems and more environmentally sound
Manage forest and shrub-steppe habitats that would allow ecosystem processes and succession	Increase fire suppression efforts in shrub-steppe to limit the size and intensity of wildfires to mimic the historic fire regime	Number of acres burned and long-term alterations to vegetative structure	Reduced risk of high intensity fires Reduction in coverage of non-native annuals
	Rehabilitate burned area following methods to increase seed germination success. Emphasize use of native shrub,	Number of acres successfully treated and restored to native sagebrush habitat	Increased shrub-steppe and forest habitat Improved shrub-steppe and forest

	grass and forb species in rehabilitation seed mixture, when possible		habitat quality and quantity
	Avoid damage, maintain and improve existing native species during rehabilitation efforts		Habitat fore perennial native species are not damaged in the long-term by rehabilitation efforts
Reduce the negative impacts of livestock grazing on the fish, wildlife and plant populations in the subbasin. Protect and improve riparian, wet meadow and native upland habitats	Reduce or limit grazing impacts by encouraging establishment of riparian pasture systems, exclusion fences (passable to wildlife), off-site watering areas, riparian conservation easements or consider retirement of grazing permits in priority areas. Adjust seasonal timing of livestock grazing to minimize soil compaction, erosion, noxious weed propagation and conflicts with wildlife	Update allotments management plans and adhere to standards and guidelines Number of acres exhibiting a change in the condition of the vegetation (e.g. from poor to fair, or fair to good range condition) Number of cooperators participating in conservation practices	Increased number of livestock operations compatible with resource objectives
	Identify concentrated feeding areas negatively impacting water quality and design management actions to minimize sediment inputs to streams	Number of concentrated feeding operations in existence with adequate safeguards to reduce water quality impacts Management actions taken to reduce impacts that result in measurable changes on the ground that improve water quality conditions	Improved water quality
Reduce conflicts between livestock and native wildlife and plant populations	Protect important plant populations by developing grazing management plans to limit adverse impacts to rare or culturally	Updates to allotment management plans on public lands	Maintenance or restoration of rare or culturally important plant populations

	important plant populations		
	Prevent seed dispersal by minimizing the potential for livestock to spread noxious weeds through weed-free hay programs, quarantine requirements and other actions	Special use permits on federal lands incorporate weed-free information	Fewer opportunities for introduction
	Alter grazing management to minimize livestock and native species conflicts	Updates to allotment management plans	Improved quality
Manage to promote pine/fir trees and stand habitats in appropriate locations and amount that meets structural goals	Maintain and develop mature stands and individual trees and encourage the planting of ponderosa pine in existing state, federal and private reforestation efforts	Acres of existing ponderosa pine communities that meet mature old growth goals	Increase in number of acres of ponderosa pine in old/mature communities
	Continue existing, and develop new, programs that work to improve low elevation pine/fir forests	Increase in acreage of low elevation pine/fir forests	Improved habitat quality
Protect existing shrub-steppe habitats from additional fragmentation and degradation.	Protect existing important habitats (particularly big game winter range and rare plant habitat) from conversion	Increase number of acres of winter range Increase in number of protected areas	Increased winter range available to big game
Prevent the additional loss of shrub-steppe habitats	Restore fragmented and degraded sagebrush habitats	Number of acres of restored shrub-steppe habitat	Increase in number of acres of functioning quality shrub-steppe habitat
Restore areas important for focal species	On private lands, when possible, assist private landowners in restoring native vegetation	Number of landowners participating in agricultural land programs	Increase in the number of protected acres of shrub-steppe habitat
Protect and improve remaining, historic native grassland remnants to natural conditions	Protect remaining native grassland remnants through appropriate management	Number of acres successfully treated and restored to native grassland habitat	Increase in number of acres of functioning quality grassland habitat

	<p>Restore native grassland habitats by actively improving or creating native grassland habitats through noxious weed control, cultural practices and seeding</p> <p>Encourage the use of native species in existing state and federal habitat programs</p>	Number of acres of restored grassland habitat	Increase in number of acres of functioning quality grassland habitat
Protect, enhance or restore wetlands and spring habitats or create new wetlands to mitigate for permanently lost wetlands	Protect wetland and springs habitats through public education, promotion of BMPs, promotion of alternative grazing strategies and the installation of alternative forms of water for livestock	Decreasing trend in number of acres of wetland habitat lost	Increase in number of protected acres of wetland habitat
	Restore wetland habitats by improving wetland function and quality	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
	Create and/or establish wetlands where it will help mitigate the impacts of point sources of pollution	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
	Where priority wetlands and springs exist on private land, collaborate with private landowners, communicate and cooperate with landowners to protect or improve wetland and spring habitats	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
	Continue effective activities, and develop new activities, that work to protect and restore wet meadow,	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat

	wetland and spring habitats		
Protect, enhance or restore riparian habitats	Restore prioritized degraded riparian areas in coordination with existing plans and programs addressing riparian habitats, when possible	Number of acres of restored habitat	Increase in number of acres of functioning quality riparian habitat
	Protect riparian communities through conservation easements, land exchanges, promotion of BMPs, land stewardship, promotion of alternative grazing strategies and the installation of alternative forms of water for livestock	Decreasing trend in number of acres of riparian habitat lost	Increase in the number of protected acres of riparian habitat
	Minimize road and other land use impacts in riparian areas	Miles of roads in riparian areas	Improved water quality
	Protect and restore riparian communities in agricultural lands through increased enrollment by landowners in the Conservation Reserve Program (CRP), conservation easements and other agricultural land programs	Number of landowners participating in agricultural land programs	Increase in the number of protected acres of riparian habitat
	Increase stewardship and public knowledge by increasing understanding of the importance of riparian habitat through education programs for the general public, irrigation districts, water users, land owners and land managers	Decreasing trend in number of acres of riparian habitat lost	Increase in number of acres of functioning quality riparian habitat

6 Appendices

6.1 Appendix 1: References

- Adamus, P. R., K. Larsen, G. Gillson, and C. R. Miller. 2001. Oregon Breeding Bird Atlas. Oregon Field Ornithologists. [www.oregonbirds.org], Eugene, OR.
- Allen, D.B., B.J. Flatter, J. Nelson and C. Medrow. 1998. Redband Trout *Oncorhynchus mykiss gairdneri* Population and Stream Habitat Surveys in Northern Owyhee County and the Owyhee River and Its Tributaries. 1997. Idaho BLM Technical Bulletin No. 98-14.
- American Ornithologists' Union. 1983. Check- list of North American birds. 6th edition. Am. Ornithol. Union. 877 pp.
- American Ornithologists' Union (AOU). 1998. Check-list of North American birds. 7th edition. American Ornithologists' Union, Baltimore, MD.
- AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2004. Berkeley, California: AmphibiaWeb. Available: <http://amphibiaweb.org/>. (Accessed: 2004).
- Anderson, J, P Brooks, M Evans, S Fletcher, E Kohrman, G Marden, D Mattson, C Quinby, T Schommer, J Szymoniak, E Weber, and K Wledenmann. 1999. Hells Canyon National Recreation Area Comprehensive Mgmt Plan: Revised Draft EIS. Wallowa-Whitman National Forest.
- Anderson, J. M. 1978. Protection and management of wading birds. Wading birds. Natl. Audubon SOC. Res. Rep. 7:99-103.
- Anthony, R. G., A. K. Miles, J. A. Estes, and F. B. Isaacs. 1999. Productivity, diets, and environmental contaminants in nesting Bald Eagles from the Aleutian archipelago. *Environmental Toxicologists and Chemists* 18: 2054-2062.
- Anthony, R. G., and F. B. Isaacs. 1989. Characteristics of Bald Eagle nest sites in Oregon. *Journal of Wildlife Management* 53: 148-159.
- Anthony, R. G., M. G. Garrett, and C. A. Schuler. 1993. Environmental contaminants in Bald Eagles in the Columbia River estuary. *Journal of Wildlife Management* 57:10-19.
- Anthony, R. G., R. L. Knight, G. T. Allen, B. R. McClelland, and J. I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. *Trans. N. Am. Wildlife Nat. Res. Conference* 47: 332-342.
- Arnett, E. B., R. J. Anderson, C. Sokol, F. B. Isaacs, R. G. Anthony, and W. P. Erickson. 2001. Relationships between nesting Bald Eagles and selective logging in southcentral Oregon. *Wildlife Society Bulletin* 29: 795-803.
- Baird, S. F. 1858. Explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean. War Department Vol. IX. Birds. Washington, D.C.
- Bates, K.K. 1997. Searches for Raptor Monitoring Sites During Autumn Migration in Southwestern and Southcentral Idaho in 1996. Idaho BLM Technical Bulletin 2000-04.
- Bayer, R. D. 1978. Aspects of an Oregon estuarine great blue heron population. Wading birds. Natl. Audubon SOC. Res. Rep. 7:213-217.
- Behle, W. H. 1958. The bird life of Great Salt Lake. Univ. Utah Press, Salt Lake City. 203 pp.
- Behnke, R. J. 1992. Native Trout of Western North America. Bethesda, MD: American Fisheries Society.

- Belding, L. 1890. Land birds of the Pacific District. California Academy of Sciences. Occasional paper 2.
- Bendell, J. F. and P. W. Elliott. 1967. Behavior and the regulation of numbers in Blue Grouse. Canadian Wildlife Service Report Series, No. 4.
- Bendire, C. E. 1892. Life histories of North American birds. U.S. Natl. Mus. Spec. Bulletin 1.
- Bent, A. C. 1953. Life histories of North American wood warblers. U.S. Natl. Mus. Bull. 203.
- Bent, A. C. 1926. Life histories of North American marsh birds. U. S. Natl. Mus. Bull. 135. 392 pp.
- Binford, L. C. 1989. A distributional survey of the birds of the Mexican state of Oaxaca. Ornithological Monographs No. 43.
- Birge, W.J., J.J. Just, A.G. Westerman, J.A. Black, and O.W. Roberts. 1975. Sensitivity of Vertebrate Embryos to Heavy Metals as a Criterion of Water Quality. Phase II. Bioassay Procedures Using Developmental Stages As Test . Water Resour. Res. Inst., Kentucky Univ., Lexington, KY; U.S. NTIS PB-240 987: 36 pp.
- Bjorkland, R. G. 1975. On the death of a midwestern heronry. Wilson Bull. 87(2):284-287.
- Black, J. H. 1969. The frog genus *Rana* in Montana. Northwest Science 43:191-195.
- Blair G.S., and G. Servheen. 1993. Species Conservation Plan for the White-headed Woodpecker (*Picoides albolarvatus*). US Dept. Agric. For. Serv. (R-1) and Idaho Dept. of Fish and Game.
- Blomquist, S. M., and J. C. Tull. 2002. *Rana luteiventris*: burrow use. Herpetological Review 33:131.
- Blood D.A. 1997. White-headed Woodpecker. Wildlife at Risk in British Columbia, Brochure. Province of British Columbia, Ministry of Environment, Lands and Parks.
- Boag, D. A. 1996. Population attributes of Blue Grouse in southwestern Alberta. Canadian Journal of Zoology 44: 799-814.
- Bowles, J. H. 1906. A list of the birds of Tacoma, Washington, and vicinity. Auk 23:138-148.
- Broley, C. L. 1958. The plight of the American bald eagle. Audubon 60:162-163.
- Brown, L. 1977. Eagles of the world. Universe Books, New York.
- Brown, L. 2002. Wildlife Biologist, Bureau of Land Management. Tonopah Field Station, Nevada, personal communication.
- Buck, J. 1999. Changes in productivity and environmental contaminants in Bald Eagles nesting along the lower Columbia River. Final Report, U.S. Fish and Wildlife Service, Portland, OR.
- Buckley, F. G., and C. A. McCaffrey. 1978. Use of dredged material islands by colonial sea birds and wading birds in New Jersey. U. S. Army Eng. Waterways Exp. Stn. Tech. Rep. D-78-1. Vicksburg, Miss.
- Buechner, M. K. 1953. Some biotic changes in the state of Washington, particularly during the century 1853-1953. Res. Stud. State Coll. Wash. 21:154-192.
- Buehler, D. A. 2000. Bald eagle (*Haliaeetus leucocephalus*). in The birds of North America, No. 506 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.
- Bull, E. L., and M. P. Hayes. 2001. Post-breeding season movements of Columbia spotted frogs (*RANA LUTEIVENTRIS*) in northeastern Oregon. Western North American Naturalist 61:119-123.
- Bull, J. and J. Farrand, Jr. 1977. The Audubon Society Field Guide to North American Birds. Alfred A. Knopf, New York. 784 pp.
- Burger, J. 1978. The pattern and mechanism of nesting in mixed-species heronries. Wading birds. Natl. Audubon SOC. Res. Rep. 7:45-58.
- Burleigh, T. D. 1958. Georgia birds. Univ. Oklahoma Press, Norman. 746 pp.
- Butler, Robert. 1997. The great blue heron. UBC Press. Vancouver.

- Campbell R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, M.C. Mcnall and G.E. John Smith. 1997a. Birds of British Columbia, Volume 2 of 4, Non-passerines, Diurnal Birds of Prey Through Woodpeckers. UBC Press with Environment Canada (Canadian Wildlife Service) and British Columbia Ministry of Environment, Lands and Parks. University of British Columbia, Vancouver, BC. 635pp.
- Cannings, R. J. 1992. Status Report on the White-headed Woodpecker *Picoides Albolarvatus*.
- Cannings, R. J. 1995. Status of the White-headed Woodpecker in British Columbia. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Bulletin No. B-80. 8pp.
- Cannings, R. J. 2000. Update COSEWIC Status Report on White-headed woodpecker (*Picoides albolarvatus*). 18pp.
- Cassirer, E. F., L. E. Oldenburg, V. L. Coggins, P. Fowler, K. Rudolph, D. L. Hunter, and W. J. Foreyt. 1996. Overview and preliminary analysis of Hells Canyon bighorn sheep die-off, 1995-96. Bienn. Symp. North. Wild Sheep and Goat Council 10:78-86.
- Chang, L.W., K.R. Reuhl, and A.W. Dudley, Jr. 1974. Effects of Methylmercury Chloride on *Rana pipiens* tadpoles. Environ. Res. 8(1):82-91.
- Cochnauer, T.G. 1983. Abundance, distribution, growth, and management of white sturgeon (*Acipenser transmontanus*) in the Middle Snake River, Idaho. Doctoral dissertation. University of Idaho, Moscow, Idaho.
- Collazo, J. A. 1981. Some aspects of the breeding ecology of the great blue heron at Heyburn State Park. Northwest Sci. 55(4): 293-297.
- Columbia River Basin System Operation Review. 1991. The Columbia River System: The Inside Story. DOE/BP-1689. Portland, Oregon.
- Columbia River Inter-Tribal Fish Commission. 1996a. Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon. Vol. I.
- Columbia River Inter-Tribal Fish Commission. 1996b. Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon. Vol. II: Subbasin Plans.
- Concannon, G. 1998. 1988-1998 wildlife studies summary report, Pelton Round Butte Hydroelectric Project, FERC NO. 2030. Portland General Electric Co., Portland, OR.
- Connolly, G. E. 1981. Trends in populations and harvests. Pp 225-243 *in* Mule and black-tailed deer of North America, O. C. Wallmo, ed. University of Nebraska Press, Lincoln, Nebraska, USA.
- Contreras, A. L. 2003. Black Rosy-Finch. Pp. 594-596 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Contreras, A., and R. Kindschy. 1996. Birds of Malheur County, Oregon, and the adjacent Snake River islands of Idaho. Oregon Field Ornithologists Special Publication 8, Eugene.
- Cottrille, W. P., and B.D. Cottrille. 1958. Great blue heron: Behavior at the nest. Univ. Michigan Mus. Zool., Ann Arbor. Misc. Publ. 102.15 PP
- Crawford, J. A., W. V. Van Dyke, S. M. Meyers, and T. F. Haensley. 1986a. Fall diet of Blue Grouse in Oregon. Great Basin Nat. 46: 745-748.
- Crawford, J. A., W. V. Van Dyke, V. Coggins, and M. St. Louis. 1986b. Hatching chronology of Blue Grouse in northeastern Oregon. Great Basin Nat. 46:745-748.
- Crawford, J.A. and V.L. Coggins. 2000. The Reestablishment of Columbian Sharp-tailed Grouse into Oregon
- Crescent Ranger District. 1998. Odell Lake Bald Eagle surveys – 1998. Unpublished report, Crescent Ranger District, Deschutes National Forest, Crescent, OR.
- Croxen, M. 2002. Range Conservation Specialist, U.S. Forest Service. Tonopah Ranger District, Nevada, personal communication.

- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History. Oregon State University Press. Corvallis, OR.
- Curtis, J. D. 1948. Animals that Eat Ponderosa pine Seed. Journal of Wildlife Management (12) 327-328.
- Custer, T. W., and R. G. Osborn. 1978. Feeding habitat use by colonially breeding herons, egrets, and ibises in North Carolina. Auk 95(4): 733-743.
- Daly, C., G.H. Taylor, and W.P. Gibson. 1997. The PRISM approach to mapping precipitation and temperature, In reprints: 10th Conf. on Applied Climatology, Reno, NV, American Meteorological Society, 10-12.
- Davidson C. 1995. Frog and Toad Calls of the Pacific Coast: Vanishing Voices. Ithaca, NY: Library of Natural Sounds, Cornell Laboratory of Ornithology. [Compact disc].
- Dawson, W. L. and J. H. Bowles. 1909. The birds of Washington. Volume II. Occidental Publ. Co., Seattle, WA.
- Dellasala, D. A., R. G. Anthony, T. A. Spies, and K. A. Engel. 1998. Management of Bald Eagle communal roosts in fire-adapted mixed-conifer forests. Journal of Wildlife Management 62: 322-333.
- Dennis, C. J. 1971. Observations on the feeding behavior of the great blue heron. Passenger Pigeon 33(3):166-172.
- Dennis, J. V. 1958. Some aspects of the breeding ecology of the Yellow-breasted Chat (*Icteria virens*). Bird-Banding 29:169-183.
- Department of the Air Force (DAF). 1998. Final Environmental Impact Statement: Enhanced Training in Idaho. Vols 1-3.
- DesGranges, J. L. 1979. Adaptative value of social behavior in the great blue heron (*Ardea herodias*). Proc. 1978 Conf. Colonial Waterbird Group 2:192-201.
- Dickinson, J. C. 1947. Unusual feeding habits of certain herons. Auk 64(2):306-307.
- Dixon, R. D. 1995b. Ecology of White-headed Woodpeckers in the Central Oregon Cascades. Masters Thesis, Univ. of Idaho, Moscow, ID. In Garrett. K. L., M.G. Raphael and R.D. Dixon. 1996. White-headed Woodpecker (*Picoides albolarvatus*). In The Birds of North America No. 252 (A. Poole and F. Gills, eds.) The Birds of North America Inc., Philadelphia, PA.
- Dixon. R.D. 1995a. Density, Nest-site and Roost-site Characteristics, Home-range, Habitat-use and Behaviour of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl. Nongame Report. 93-3-01.
- Dumas, P. C. 1964. Species-pair allopatry in the genera *Rana* and *Phrynosoma*. Ecology 45(1):178-181.
- Dumas, P. C. 1966. Studies of the *Rana* species complex in the Pacific Northwest. Copeia 1:60-74.
- Dunn, J. L. and K. L. Garrett. 1997. A field guide to warblers of North America. Houghton Mifflin Co., Boston, MA.
- Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted chat (*Icteria virens*). In The Birds of North America, No. 575 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Eckert, A.W. 1981. The Wading Birds of North America. Doubleday and Co. Publishers, New York. 252 pp.
- Edison Electric Institute. 1980. Compatability of fish, wildlife, and f loral resources with electric power facilities. Urban Wildl. Res. Cent., Ellicott City, MD. 130 pp.
- Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The birders guide to the natural history of North American birds. Simon & Schuster, New York, NY.

- Engle, J.C. 2004. Columbia Spotted Frog, Great Basin Population. Species profile on USFWS website: <http://idahoes.fws.gov/fact/spotfrog.html>.
- Engle, J.C. 2000. Columbia spotted frog Great Basin population (Owyhee Mountains subpopulation) long-term monitoring plan. Year 2000 Results. (draft). Boise, Idaho.
- Engle, J.C. 2001. Columbia spotted frog project: the translocation of 2 male Columbia spotted frogs between breeding sites within an element occurrence in the Owyhee subpopulation of the Great Basin population. Idaho Department of Fish and Game Report. Boise, Idaho. 19 pp.
- Engle, J.C. 2001. Wildlife Research Biologist, Idaho Department of Fish and Game, Boise, Idaho, personal communication.
- Engle, J.C. 2002. Columbia spotted frog Great Basin population (Owyhee subpopulation) longterm monitoring plan. Year 2001 results. Idaho Department of Fish and Game Report. Boise, Idaho. 64 pp.
- Engle, J.C. 2004. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office, Boise, Idaho.
- Engle, J.C. and C.E. Harris. 2001 Idaho Species of Special Concern Element State Ranking Reviews. Prepared for the Rare Animal Workshop of the Idaho Chapter of the Wildlife Society.
- Engle, J.C. and J.C. Munger. 2000. Population fragmentation of spotted frogs in the Owyhee Mountains. Field Report from a cost share agreement between Boise State University and the Bureau of Land Management (DBP990048). Boise, Idaho.
- English, S. M. 1978. Distribution and ecology of great blue heron colonies on the Willamette River, Oregon. Wading birds. Natl. Audubon SOC. Res. Rep. 7: 235-244.
- Environmental Systems Research Institute (ESRI), Inc. 1999. ESRI data and maps CDs. Redlands, California.
- Evanich, J. 1992. Birds of Northeast Oregon: an annotated checklist for Union and Wallowa counties, second ed. (revised). Oregon Field Ornithologists Special Publication No. 6, Eugene.
- Evanich, J. E., Jr. 1990. The birder's guide to Oregon. Portland Audubon Society, Portland, OR.
- Evermann, B. W. 1886. A list of the birds observed in Ventura County, California. Auk 5: 344-351.
- Federal Caucus. 2000. Basinwide Salmon Recovery Strategy. From <http://www.salmonrecovery.gov/overview.shtml>. on May 12, 2001.
- Fellers, G.M., D.E. Green, and J.E. Longcore. 2001. Oral chytridiomycosis in the mountain yellow-legged frog (*Rana muscosa*). Copeia 2001:945-953.
- Frederick G. P. and T.L. Moore. 1991. Distribution and Habitat of White-headed Woodpecker (*Picoides albolarvatus*) in West Central Idaho. Cons. Data Centre, Idaho Dept. of Fish and Game, Boise, ID. In Ramsay L. 1997. White-headed Woodpecker Survey in the South Okanagan, BC (1996 and 1997). Report to Ministry of Environment Lands and Parks, Wildlife Branch, Penticton, BC. 23pp.
- French, N. R. 1954. Life history and behavior of the Black Rosy-Finch. Ph.D. diss., University of Utah, Salt Lake City.
- Frenzel, R. W. 1985. Environmental contaminants and ecology of Bald Eagles in southcentral Oregon. Ph.D. dissertation, Oregon State University, Corvallis.
- Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis. (Reprinted in 1970 as Birds of the Pacific Northwest by Dover Publishing, New York).
- Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis. (Reprinted in 1970 as Birds of the Pacific Northwest by Dover Publishing, New York).

- Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis.
(Reprinted in 1970 as Birds of the Pacific Northwest by Dover Publishing, New York).
- Garcelon, D. K. President, Institute for Wildlife Research, Arcata, CA.
- Garcelon, D. K., G. L. Slater, and C. D. Danilson. 1995. Cooperative nesting by a trio of Bald Eagles. *Journal of Raptor Research* 29:210-213.
- Garrett, M. G., R. G. Anthony, J. W. Watson, and K. McGarigal. 1998. Ecology of Bald Eagles on the lower Columbia River. Final report, U.S. Army Corps of Engineers, Portland, OR. Contract No. DACW57-84-C-0071.
- Garrett, L. K., M. G. Raphael and R.D. Dixon. 1996. White-headed woodpecker (*Picoides albolarvatus*). In *The Birds of North America* No. 252 (A. Poole and F. Gill eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists Union, Washington D.C. 23pp.
- Gerber, M.F., J.C. Munger, A. Ames, J. Stewart. 1997. Reptiles and Amphibians in Deep Canyons: The Big Jacks and Little Jacks Creek Drainages of Owyhee County, Idaho. Idaho BLM Technical Bulletin NO. 97-1.
- Giles, L. W., and D. B. Marshall. 1954. A large heron and egret colony on the Stillwater Wildlife Management Area, Nevada. *Auk* 71(3):322-325.
- Godfrey, W.E. 1986. The birds of Canada. Rev. ed. National Museums of Canada. Ottawa.
- Gordin, J. G. 1977. A great blue heron preying on shiner perch in deep water. *Can. Field Nat.* 91:88-89.
- Gotelli, N.J. 1995. A primer of ecology, Sinauer and Associates, Sunderland, Massachusetts. 206 pp.
- Graber, J. W., R. R. Graber, and E. L. Kirk. 1978. Illinois birds: Ciconiiformes. I11. *Nat. Hist. Surv. Biol. Notes.* 109. 80 pp.
- Grande Ronde Bird Club. 1988. Birds of northeastern Oregon: Union, Baker and Wallowa counties (checklist). La Grande, OR.
- Green, D.M., H. Kaiser, T.F. Sharbel, J. Kearsley, and K.R. McAllister. 1997. Cryptic species of spotted frogs, *Rana pretiosa* complex, in Western North America. *Copeia* 1997 (1): 1-8.
- Green, D.M., T.F. Sharbel, J. Kearsley, and H. Kaiser. 1996. Postglacial range fluctuation, genetic subdivision and speciation in the western North American spotted frog complex, *Rana pretiosa*. *Evolution* 50(1):374-390.
- Greenhouse, G. 1976. Effects of Pollutants on Eggs, Embryos and Larvae of Amphibian Species University of California, Irvine, CA, Air Force Tech. Report AMRL-TR-76-31, U.S. NTIS AD-A025 403:24 p.
- Grier, J. W. 1982. Ban of DDT and subsequent recovery of reproduction in Bald Eagles. *Science* 218: 1232-1235.
- Grinnell, J. 1902. The Southern White-headed Woodpecker. *Condor* (4) 89-90.
- Griscom, L. 1923. Birds of the New York city region. American Museum of Natural History Handbook Series Number 9.
- Grubb, M. M. 1979. Effects of increased noise levels on nesting herons and egrets. *Proc. 1978 Conf. Colonial Waterbird Group* 2:49-54.
- Haas, J. B. 1965. Fishery problems associated with Brownlee, Oxbow, and Hells Canyon Dams on the middle Snake River. Fish Commission of Oregon, Investigational Report Number 4, Portland, OR 97208-3621.
- Hall, F. S. 1933a. Studies in the history of ornithology in the State of Washington (1792-1932) with special reference to the discovery of new species. *Murrelet* 14: 27-36.
- Hall, F.S. 1933b. Studies in the history of ornithology in the State of Washington (1792-1932) with special reference to the discovery of new species. Part II. *Murrelet* 14: 55-77.
- Hallock, L.A. and McAllister, K.R. 2002. Columbia Spotted Frog. *Washington Herp Atlas*. <http://www.dnr.wa.gov/nhp/refdesk/herp/>.

- Hancock, J., and J.A. Kushlan. 1984. The herons handbook. Harper and Row. New York.
- Haney A. 1998. White Headed Woodpecker (*Picoides albolarvatus*) Habitat Capability and Suitability Values, Modeling Guide. Draft Habitat Model for White-headed woodpecker for Ministry of Environment, Lands and Parks.
- Hanson, D.L., T.G. Cochnauer, J.D. DeVore, H.E. Forner, Jr., T.T. Kisanuki, D.W., Kolhorst, P. Lumley, G. McCabe, A.A. Nigro, S. Parker, D. Swartz, and A. Van Vooren. 1992. White sturgeon management framework plan. Pacific States Marine Fisheries Commission, Portland, Oregon.
- Hanson, Mary. 2001. Personal Communication. Email. 18 September 2001.
- Hargis, V. A. Saab, T. D. Rich, F. B. Samson, D. A. Newhouse and N. Warren. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: Broad scale trends and management implications. U. S. Department Agric., For. Serv., Pacific Northwest Res. Stat. Gen. Tech. Rep. PNW-GTR-xxx, Portland.
- Harmata, A. R., G. J. Montopoli, B. Oakleaf, P. J. Harmata, and M. Restani. 1999. Movements and survival of Bald Eagles banded in the Greater Yellowstone Ecosystem. *Journal of Wildlife Management* 63:781-793.
- Hatch, K. 2000. Researcher, University of Nevada, Reno, personal communication.
- Hatch, K. 2001. Researcher, University of Nevada, Reno, personal communication.
- Hayes, M.P. and M.R. Jennings. 1986. Decline of ranid frog species in western North America: are bullfrogs responsible? *Journal of Herpetology* 20:490-509.
- Hays D.W., and M.J. Tirhi and J.W. Stinson. 1998. Washington State Status Report for the Sharp-tailed grouse. Washington Department of Fish and Wildlife Olympia.
- Hays, R. L., C. Summers, and W. Seitz. 1981. Estimating wildlife habitat variables. U. S. Fish Wildl. Serv. FWS/OBS-81/77. 111 pp.
- Hells Canyon Bighorn Sheep Restoration Committee. 1997. Restoration of bighorn sheep to Hells Canyon: The Hells Canyon Initiative. Bureau of Land Management Technical Bulletin no. 97-14. 62pp.
- Henny, C. J. 1972. An analysis of the population dynamics of selected avian species with special reference to changes during the modern pesticide era. U. S. Fish Wildl. Serv. Wildl. Res. Rep. 1. 99 pp.
- Henny, C. J., and M. W. Nelson. 1981. Decline and present status of Peregrine Falcons in Oregon. *Murrelet* 62: 43-53.
- Henny, C. J., D. W. Anderson, and C. E. Knoder. 1978. Bald Eagles nesting in Baja California. *Auk* 95: 424.
- Hodge, R.P. 1976. Amphibians and reptiles in Alaska, the Yukon, and Northwest Territories. Pages 52-53 in Northwest Publishing Company.
- Hoffman, R. D. 1978. The diets of herons and egrets in southwestern Lake Erie. Wading birds. *Natl. Audubon SOC. Res. Rep.* 7:365-369.
- Hoffman, R. W. 1981. Population dynamics and habitat relationships of Blue Grouse. Federal Aid in Wildlife Restoration Report W-37-R-34, Colorado Division of Wildlife.
- Hollenbeck, R. R. 1974. Growth rates and movements within a population of *RANA PRETIOSA PRETIOSA* Baird and Girard in south central Montana. M.A. thesis, Montana State University, Bozeman.
- Hovingh, P. 1986. Biogeographic aspects of leeches, mollusks, and amphibians in the Intermountain Region. *Great Basin Naturalist*.
- Hovingh, P. 1990. Investigations of aquatic resources in the Great Basin and adjacent regions with respect to amphibians, mollusks and leeches: a preliminary report for the tri-state region of Idaho, Nevada, and Utah. March 1990. 12 pp. + appendices.
- Hubbard, C. R. 1956. Geology and Mineral Resources of Nez Perce County. Moscow: Idaho Bureau of Mines and Geology.

- IBIS. 2004. Interactive Biodiversity Information System (<http://ibis.nwhi.org>), Northwest Habitat Institute, Corvallis, OR.
- Idaho Conservation Data Center (ICDC). 2001. <http://www2.state.id.us/fishgame/info/cdc/cdc.htm>.
- Idaho Conservation Data Center. 2000. Spotted frog database. Idaho Department of Fish and Game, Boise, Idaho.
- Idaho Conservation Partnership Strategic Plan. 2001-NRCS, ISCC, RC&D, IASCD, IDEQ, IDA. Boise, ID.
- Idaho Department of Environmental Quality and Oregon Department of Environmental Quality. 2001. Draft Sub-Basin Assessment for the Snake River--Hells Canyon Total Maximum Daily Load (TMDL).
- Idaho Department of Environmental Quality. 2001. Idaho Department of Environmental Quality, 2002-2007 Strategic Plan. Boise, Idaho.
- Idaho Department of Fish and Game (IDFG). 1998. Idaho's anadromous fish stocks: Their status and recovery options. Technical Report 98-13. Idaho Department of Fish and Game. Boise, ID.
- Idaho Department of Fish and Game, Idaho Department of Parks and Recreation, Bureau of Land Management, Regions 1 and 4 of U.S. Forest Service, and U.S. Fish and Wildlife Service. 1995. Habitat Conservation Assessment and Conservation Strategy: Spotted Frog (*Rana pretiosa*). (Draft) Idaho State Conservation Effort.
- Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, U.S. Forest Service, Bureau of Land Management, Foundation of North American Wild Sheep 1997. Restoration of the Bighorn Sheep to Hells Canyon, The Hells Canyon Initiative. Technical Bulletin No. 97-14 .
- Idaho Geological Survey (IGS). Website accessed September, 2001. <http://www.idahogeology.org/>.
- Idaho Mining Association. 1998. Idaho Mining Association Homepage <http://www.idahomining.org/home.html>.
- Idaho Power Company (IPC). 2001. Energy Resources website. <http://www.idahopower.com/enrgyres/hydro.htm> > revised October, 2001.
- Idaho Rangeland and Resource Commission (IRRC). Website accessed May, 2001. <http://www.irrc.state.id.us/>.
- Idaho Soil and Water Conservation District. 2001. Annual work plan and five year resource conservation plan. Grangeville, ID.
- Idaho Soil Conservation Commission (ISSC). Website accessed May, 2001. <http://www.scc.state.id.us/>.
- Idaho State Department of Agriculture. 2001. Website accessed October, 2001. <http://www.agri.state.id.us/>
- Irving, R. and P. Cuplin. 1956. The effects of hydroelectric development on the fishery resources of the Snake River. Final Report, Project F-8-R. Idaho Department of Fish and Game, Boise, ID.
- Isaacs, F. B., and R. G. Anthony. 1983. Ecology of wintering bald eagles in the Harney Basin, Oregon, 1982-1983. Report for U.S. Dept. of Interior, Bureau of Land Management, Burns, OR. Unpublished Manuscript 21 pp.
- Isaacs, F. B., and R. G. Anthony. 2001. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1972 through 2001. Unpublished report, Oregon Cooperative Fish and Wildlife Resources Unit, Oregon State University, Corvallis.
- Isaacs, F. B., and R. G. Anthony. 2003a. Bald Eagle. Pp. 140-144 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

- Isaacs, F. B., and R. G. Anthony. 2003b. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2003, Oregon Cooperative Fish and Wildlife Resources Unit, Oregon State University, Corvallis.
- Isaacs, F. B., R. G. Anthony, M. Vander Heyden, C. D. Miller, and W. Weatherford. 1996. Habits of Bald Eagles wintering along the upper John Day River, Oregon. Northwest Science 70:1-9.
- Isaacs, F. B., R. Goggans, R. G. Anthony, and T. Bryan. 1993. Habits of Bald Eagles wintering along the Crooked River, Oregon. Northwest Science 67: 55-62.
- Isaacs, F. B., S. L. Reed, E. R. Reed, and R. G. Anthony. 1992. Habits of Bald Eagles wintering in northeastern Oregon and adjacent areas of Washington and Idaho. Unpublished report, Oregon Coop. Wildl. Res. Unit, Oregon State University, Corvallis.
- Jackman, Ron E. Wildlife Biologist, Predatory Bird Research Group, University of California, Santa Cruz, CA.
- Jaeger, E.C. 1947. White-headed Woodpecker Spends Winter at Palm Springs, California. Condor (49) 244-245.
- Jenkins, J. M., and R. E. Jackman. 1993. Mate and nest site fidelity in a resident population of Bald Eagles. Condor 95: 1053-1056.
- Jenkins, J. M., R. E. Jackman, and W. G. Hunt. 1999. Survival and movements of immature bald eagles fledged in northern California. Journal of Raptor Research 33:81-86.
- Johnson, J. 1989. Field notes: western Oregon, winter 1988-89. Oregon Birds 15: 188-196.
- Johnson, R. E. 1975. New breeding localities of *Leucosticte* in the contiguous western United States. Auk 92: 586-589.
- Johnson, R. E. 2002. Black Rosy-Finch, (*Leucosticte atrata*). In: The Birds of North America, No. 678 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Joy, J., R. Driessche and S. McConnell. 1995. 1995 White-headed Woodpecker Population and Habitat Inventory in the South Okanagan. Report For the BC Ministry of Environment, Lands and Parks. 21pp.
- Kauffman, J.B. and W.C. Krueger. 1984. Livestock impacts on riparian plant communities and stream-side management implications, a review. Journal of Range Management 37(5):430-437.
- Kauffman, J.B., W.C. Krueger, and M. Vavra. 1985. Impacts of cattle on streambanks in northeastern Oregon. Journal of Range Management 36(6):683-685.
- Kauffman, J.B., W.L. Krueger, and M. Vavra. 1982. Effects of late season cattle grazing on riparian plant communities. Journal of Range Management 36(6):685-691.
- Keister, G. P., Jr., R. G. Anthony, and E. J. O'Neill. 1987. Use of communal roosts and foraging areas by Bald Eagles wintering in the Klamath Basin. Journal of Wildlife Management 51:415-420.
- Kelsall, J. P., and K. Simpson. 1980. A three year study of the great blue heron in southwestern British Columbia. Proc. 1979 Conf. Colonial Waterbird Group 3: 69-74.
- Kerns, J. M., and J. F. Howe. 1967. Factors determining great blue heron rookery movement. J. Minn. Acad. Sci. 34(2): 80-83.
- Khangarot, B.S., A. Sehgal and M.K. Bhasin. 1985. Man and biosphere-studies on the Sikkim. Part 5: acute toxicity of selected heavy metals on the tadpoles of *Rana hexadactyla*. Acta Hydrochim. Hydrobiol. 13(2):259-263.
- Kingery, H. E. 1986. The spring migration: mountain west region. Am. Birds 40: 502-506.
- Kingery, H. E. 1988. The winter season: mountain west region. Am. Birds 42: 299-302.
- Kirkpatrick, C. M. 1940. Some foods of young great blue herons. Am. Midl. Nat. 24(3):594-601.
- Kitchin, E. A. 1939. A distributional checklist of the birds of Mount Rainier National Park. Murrelet 20: 27-37.

- Knapp, R. A. and K. R. Matthews. 2000. Non-native fish introductions and the decline of the mountain yellow-legged frog from within protected areas. *Conservation Biology* 14(2):428-438.
- Koch, E.D., G. Williams, C.R. Peterson, and P.S. Corn. 1997. A summary of the conference on declining and sensitive amphibians in the Rocky Mountains and Pacific Northwest. November 7-8, 1996, Boise Idaho. Meeting sponsored by U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Land Management, Idaho Herpetological Society, Declining Amphibian Population Task Force Rocky Mountain Working Group, U.S. Geological Survey - Biological Resources Division, Idaho Museum of Natural History, Idaho State University.
- Konermann, A. D., L. D. Wing, and J. J. Richard. 1978. Great blue heron nesting success in two Iowa reservoir ecosystems. *Wading birds. Natl. Audubon SOC. Res. Rep.* 7:117-129.
- Krebs, J. R. 1974. Colonial nesting and social feeding as strategies for exploiting food resources in the great blue heron (*Ardea herodias*). *Behav.* 51(1-2):99-134.
- Kushlan, J. A. 1976. Wading bird predation in a seasonally fluctuating pond. *Auk* 93(3):464-476.
- Lahrman, F. W. 1957. *Birds of the Isle of Bays, 1957.* *Blue Jay* 15(3):106-109.
- Lance, A.G.; Strong, C.J.; and Hensley, H.A. 2001. State of Idaho's Agencies' Comments and Proposed Terms and Conditions In The Matter Of Application For A Major New License By Idaho Power Company For C.J. Strike Project, Snake River, Idaho. Project No. 2055-010. Boise, ID.
- Lande, R. and G.F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management, pages 87-124, in *Viable Populations for Conservation*, M. E. Soul (ed.), Cambridge University Press, Cambridge, Great Britain.
- Lehman, R.N. and J.S. Barrett. 2000. Raptor Electrocutions and Associated Fire Hazards in the Snake River Birds of Prey National Conservation Area. BLM Technical Bulletin 2000-02.
- Leonard, W.P., Brown H.A., Jones, L.L.C., McAllister, Storm R.M. 1993. *Amphibians of Washington and Oregon.* Seattle, WA: Seattle Audubon Society. 168 p.
- Leonard, W.P., Leonard N.P., Storm R.M., and P.E. Petzel. 1996. *Rana pretiosa* (spotted frog). Behavior and reproduction. *Herpetological Review*, 27(4), 195.
- Lepla, K.B., J. A. Chandler, and P. Bates. 2001. Status and habitat use by white sturgeon associated with the Hells Canyon Complex. In progress. Idaho Power Company, Boise, ID.
- Licht, L.E. 1975. Comparative life history features of the western spotted frog, *rana pretiosa*, from low- and high-elevation populations. *Canadian Journal of Zoology* 53: 1254-1257.
- Ligon J. D. 1973. Foraging Behaviour of the White-headed Woodpecker in Idaho. *Auk* 90: 862 – 869.
- Littlefield, C. D. 1990. *Birds of Malheur National Wildlife Refuge, Oregon.* Oregon State University Press, Corvallis.
- Longley, W. H. 1960. Comment on the flight distance of the great blue heron. *Wilson Bull.* 72(3): 289.
- Lowther, P. E., C. Celada, N. K. Klein, C. C. Rimmer and D. A. Spector. 1999. Yellow warbler (*Dendroica petechia*) in *The birds of North America*, No. 454 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.
- Lukens, J.R. 1981. Snake River sturgeon investigations. Bliss Dam upstream to Shoshone Falls. Idaho Department of Fish and Game report to Idaho Power. 23 pp.
- Madigan, Richard L. Biologist, Oregon Department of Fish and Wildlife, Summer L. WA, Summer L. OR.

- Mannan, R. W. and E. C. Meslow. 1984. Bird Populations and Vegetation Characteristics in Managed and Old-growth Forests, Northeastern Oregon. *Journal of Wildlife Management* (48) 1219-1238.
- Markham, B. J., and S. H. Brechtel. 1979. Status and management of three colonial waterbird species in Alberta. *Proc. 1978 Conf. Colonial Waterbird Group* 2:55-64.
- Marshall, D. B. 1992. Sensitive vertebrates of Oregon. Oregon Department of Fish and Wildlife. Portland, OR.
- Marshall, D. B., M. W. Chilcote, and H. Weeks. 1996. Species at risk: sensitive, threatened and endangered vertebrates of Oregon, 2nd ed. Oregon Department of Fish and Wildlife, Portland, OR.
- Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants. McGraw-Hill Book Co. (Reprinted in 1961 by Dover Publishing, New York).
- Martinka, R. R. 1972. Structural characteristics of Blue Grouse territories in southwestern Montana. *Journal of Wildlife Management* 36: 498-510.
- Mathisen, J., and A. Richards. 1978. Status of great blue herons on the Chippewa National Forest. *Loon* 50(2):104-106.
- McAloney, K. 1973. The breeding biology of the great blue heron on Tobacco Island, Nova Scotia. *Can. Field Nat.* 87(2):137-140.
- McClelland, B. R., L. S. Young, P. T. McClelland, J. G. Crenshaw, H. L. Allen, and D. S. Shea. 1994. Migration ecology of Bald Eagles from autumn concentrations in Glacier National Park, Montana. *Wildlife Monographs* 125.
- McCrimmon, D. A. 1981. The status and distribution of the great blue heron (*Ardea herodias*) in New York State: Results of a two year census effort. *Colonial Waterbirds* 4:85-90.
- McDonald, M. 1996. Amphibian Inventory of the Jarbidge and Snake River Resource Areas. Idaho Bureau of Land Management Technical Bulletin No. 96-13. 23 pp.
- McGie, Alan. Retired: Oregon Department of Fish and Wildlife. Oregon Bird Records Committee.
- McNicholl, M. K. 1978. Behavior and social organization in a population of Blue Grouse on Vancouver Island. Ph.D. thesis, University of Alberta., Edmonton.
- Meier, T. I. 1981. Artificial nesting structures for the double-crested cormorant. *Wis. Dept. Nat. Resour. Tech. Bull.* 126. Madison. 13 pp.
- Mellison, C. 2004. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada.
- Merrill J. C. 1897. Birds of Fort Sherman, Idaho. *Auk* 14:347-357.
- Merrill, J. C. 1888. Notes on the birds of Fort Klamath, Oregon. *Auk* 5: 139-146.
- Meyerriecks, A. J. 1960. Comparative breeding behavior of four species of North American herons. *Nuttall Ornithol. Club Publ.* 2. 158 pp.
- Miller, R. F. 1943. The great blue herons: the breeding birds of the Philadelphia region (Part 11). *Cassinia* 33:1-23.
- Milne, K. A. and S. J. Hejl. 1989. Nest Site Characteristics of White-headed Woodpeckers. *J. Wildl. Manage.* 53 (1) pp 50 - 55.
- Morris, R. L. and W. W. Tanner. 1969. The ecology of the western spotted frog, *Rana pretiosa pretiosa* Baird and Girard, a life history study. *Great Basin Naturalist* 2:45-81.
- Mosely, E. L. 1936. Blue heron colonies in northern Ohio. *Wilson Bull.* 48(1):3-11.
- Munger, J.C., A. Ames, and B. Barnett. 1997. 1996 Survey for Columbia spotted frogs in the Owyhee Mountains of southwestern Idaho. Technical Bulletin No. 97-13. Idaho Bureau of Land Management. Boise, Idaho.
- Munger, J.C., M. Gerber, M. Carroll, K. Madric, and C. Peterson. 1996. Status and habitat associations of the spotted frog (*Rana pretiosa*) in southwestern Idaho. Bureau of Land Management Technical Bulletin No. 96- 1. Boise, Idaho.

- NACWCP. 2001. Review Draft II—North American Waterbird Conservation Plan. Volume One: Seabirds and Colonial Waterbirds, 23 October 2001, Waterbird Conservation Steering Committee, Washington DC (www.nacwcp.org/).
- National Water and Climate Center. 2001. Climate Analysis Data
<http://www.wcc.nrcs.usda.gov/wcc.html>
- National Water and Climate Center. 2001. Climate Data Sets.
http://www.wcc.nrcs.usda.gov/water/w_clim.html
- NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available
<http://www.natureserve.org/explorer>. (Accessed: February 2, 2004).
- Nelson, R. L.; McHenry, M. L. and Platts, W. S. 1991. Mining. In: Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. W. R. Meehan, Ed. Bethesda, MD: American Fisheries Society Special Publication, pp. 83-138.
- Niehuser, Jerry. Volunteer eagle observer, Oregon Eagle Foundation, Bend, OR.
- Northeastern Nevada Stewardship Group, Inc. 2001. Draft Elko County Sagebrush Ecosystem Conservation Plan.
- Northwest Power Planning Council. 1986. Compilation of information on salmon and steelhead research in the Columbia River Basin. Portland, OR.
- NPPC. (Northwest Power Planning Council). 2001. Walla Walla Subbasin Summary. Portland, OR.
- Nurnberg, G. and Brown and Caldwell. 2001. Assessment of Brownlee Reservoir water quality, 1999-2000 study period. Prepared for Boise City.
- 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. pp. 183-187.
- Ofelt, C. H. 1975. Food habits of nesting bald eagles in southeast Alaska. *Condor* 77:337-338.
- Ogden, J. C. 1978. Recent population trends of colonial wading birds on Atlantic and Gulf coastal plains. *Wading birds. Natl. Audubon SOC. Res. Rep.* 7:137-153.
- Ohlendorf, H. M., D. M. Swineford, and L. N. Locke. 1980. Organochlorine poisoning of herons. *Proc. 1979 Conf. Colonial Waterbird Group* 3:176-185.
- Opp, Ralph R. Retired, Oregon Dept. Fish and Wildlife, Klamath Falls, OR.
- Oregon Breeding Bird Atlas (OBBA). Oregon Breeding Bird Atlas data 1995-1999, prior to finalizing and publishing the CD (see Adamus et al. 2001).
- Oregon Department of Fish and Wildlife (ODFW). 1997. Oregon Department of Fish and Wildlife sensitive species. ODFW, Portland.
- Oregon Department of Fish and Wildlife (ODFW). 2004. Oregon Department of Fish and Wildlife online website -
http://www.dfw.state.or.us/south_willamette/upland_alt.html#Blue. Accessed 3-16-04.
- Oregon Department of Fish and Wildlife (ODFW). Undated checklist. Birds of Ladd Marsh Wildlife Area, La Grande, OR.
- Oregon Department of Fish and Wildlife. 1992. Oregon's bighorn sheep management plan, 1992 - 1997. Portland, OR. 30pp.
- Oregon Department of Fish and Wildlife. 1999. 1999 Game Bird Hunting Statistics. Portland.
- Oregon Department of Fish and Wildlife. 2000b. Oregon Fish and Wildlife Commission packet for Furbearer Trapping and Hunting Regulations for 2000-01 and 2001-02. Oregon Department of Fish and Wildlife. Portland.
- Oregon Department of Fish and Wildlife. 2000a. Oregon Department of Fish and Wildlife Sensitive Species. <http://ocelot.tnc.org/nhp/us/or/amph.htm>.
- Orr, E.L. and W.N. Orr. 1996. *Geology of the Northwest*. McGraw Hill Publishing Company. 409 pp.
- Ortega, J. C. and C. P. Ortega. 2000. Effects of brown-headed cowbirds on the nestling success of yellow warblers in southwestern Colorado. *Journal of Field Ornithology* 71:516-524.

- Palmer, R.S. 1962. Handbook of North American birds. Vol. 1. Yale University Press. New Haven, Connecticut.
- Parnell, J. F. 1969. Habitat relations of the Parulidae during spring migration. *Auk* 86: 505-521.
- Parnell, J. F., and R. F. Soots. 1978. The use of dredge islands by wading birds. *Wading birds. Nat. Audubon SOC. Res. Rep.* 7:105-111.
- Parris, R. W., and G. A. Grau. 1979. Feeding sites of great blue herons in southwestern Lake Erie. *Proc. 1978 Conf. Colonial Waterbird Group* 2:110-113.
- Parrish, D. (1998). Jarbidge Key Watershed Bull Trout Problem Assessment. South West Basin Native Fish Watershed Advisory Group.
- Partridge, F.E. and C.D. Warren. 2000. Monitoring of Migratory Bull Trout in the Jarbidge River, 1999. BLM Technical Bulletin 2000-01.
- Patla, D.A. and C.R. Peterson. 1996. The effects of habitat modification on a spotted frog population in Yellowstone National Park in A summary of the conference on declining and sensitive amphibians in the Rocky Mountains and Pacific Northwest. Idaho Herpetological Society and U. S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho. 96 pp.
- Pearl, C.A. 2000. Amphibian survey and monitoring on the Baker District, Wallowa-Whitman National Forest: Summary of 1999 Findings. Prepared for the Wallowa-Whitman National Forest, Baker Ranger District.
- Peck, G. and R. James. 1987. Breeding birds of Ontario: nidiology and distribution. Volume 2. Passerines. R. Ontario Mus. Life Sci. Misc. Publ. Toronto, Ontario, Canada.
- Pelren, E. C. 1996. Blue Grouse winter ecology in northeastern Oregon. Ph.D. dissertation, Oregon State University, Corvallis.
- Pelren, E. C. 2003. Blue Grouse. Pp. 181-183 in *Birds of Oregon: A General Reference*. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Pelren, E. C. and J. A. Crawford. 1999. Blue Grouse nesting parameters and habitat associations in northeastern Oregon. *Great Basin Nat.* 59: 368-373.
- Perkins, J.M. and J.R. Peterson. 1997. Bat Distribution in the Juniper Woodlands of the Idaho Owyhee Mountains Summer 1996. Idaho BLM Technical Bulletin No. 97-4.
- Petrides, G. A. 1938. A life history study of the Yellow-breasted Chat. *Wilson Bulletin* 50:184-189.
- Phillips, A., J. Marshall, and G. Monson. 1964. The birds of Arizona. University of Arizona Press, Tucson.
- Pilliod, D., C.R. Peterson, and P. Ritson. 1996. Impacts of introduced fish on spotted frog populations in high mountain lakes of central Idaho. A Summary of the Conference on Declining and Sensitive Amphibians in the Rocky Mountains and Pacific Northwest Idaho Herpetological Society and U.S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho, November 7-8, 1996.
- Popper, K. J., E. C. Pelren, and J. A. Crawford. 1996. Summer of nocturnal roost sites of Blue Grouse in Oregon. *Great Basin Nat.* 56: 177-179.
- Portnoy, J. W. 1977. Nesting colonies of seabirds and wading birds – coastal Louisiana, Mississippi, and Alabama. U. S. Fish Wildl. Serv. FWS/OBS-77/07. 126 pp.
- Quigley, T. M. and Arbelbide, S. J., Eds. 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Portland: U. S. Department of Agriculture, Forest Service.

- Ramsay, L. 1997. White-headed Woodpecker Survey in the South Okanagan, BC (1996 and 1997). Report to Ministry of Environment, Lands and Parks, Wildlife Branch, Penticton, BC. 23pp.
- Raphael, M. G., M.L. Morrison and M.P. Yoder-Williams. 1987. Breeding Bird Populations During 25 Years of Postfire Succession in the Sierra Nevada. *Condor* (89) 614-626.
- Reaser, J. K. 2000. Demographic analyses of the Columbia spotted frog (*Rana luteiventris*): case study in spatiotemporal variation. *Canadian Journal of Zoology* 78:1158-1167.
- Reaser, J.K. 1996a. Conservation status of spotted frogs in Nevada: 1996 state-wide surveys. Cooperative Agreement between the U.S. Fish and Wildlife Service and the Center for Conservation Biology, Stanford University. Attachment A. August 9, 1996. 15 pp.
- Reaser, J.K. 1996b. Conservation of the spotted frog (*Rana pretiosa*) in Nevada: Multi-scale population status and trends assessment. A Summary of the Conference on Declining and Sensitive Amphibians in the Rocky Mountains and Pacific Northwest. Idaho Herpetological Society and U.S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho, November 7-8, 1996.
- Reaser, J.K. 1997. Amphibian declines: Conservation science and adaptive management. Doctoral Dissertation. Stanford University.
- Reaser, J.K. 1998. Jamie K. Reaser, private consultant, Springfield, Virginia, personal communication.
- Reed, J. M. 1992. A system for ranking conservation priorities for Neotropical migrant birds based on relative susceptibility to extinction. Pp. 524-536 *in* Ecology and conservation of Neotropical migrant landbirds (J. M. Hagan, III, and D. W. Johnson, eds.). Smithsonian Institution Press, Washington, D. C.
- Roberts, T. S. 1936. The birds of Minnesota. Vol. 1. 2nd ed. University Minnesota Press, Minneapolis. 718 pp.
- Robinson, G. 1957. Observations of Pair Relations of White-headed Woodpeckers in Winter. *Condor* (59) 339-340.
- Rodgers, J. A., and S. A. Nesbitt. 1980. Feeding energetics of herons and ibises at breeding colonies. Proc. 1979 Conf. Colonial Waterbird Group 3:128-132.
- Rogers, T. H. 1980. Northern Rocky Mountain-intermountain region. *American Birds* 34: 291-293.
- Ryder, R. A., W. D. Gaul, and G. C. Miller. 1980. Status, distribution, and movement of Ciconiiforms in Colorado. Proc. 1979 Conf. Colonial Waterbird Group 3:49-57.
- Sanders, T. A. and W. D. Edge. 1998. Breeding bird community composition in relation to riparian vegetation structure in the western United States. *Journal of Wildlife Management* 62:461-473.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.
- Schadd, C. A. 1995. Adult provisioning behavior and nestling begging behavior in the Yellow-breasted Chat (*Icteria virens*). M.S. Thesis, Eastern Kentucky University, Richmond.
- Schaffer, M. 1987. Minimum viable populations: coping with uncertainty, pages 69-86, in *Viable Populations for Conservation*, M. E. Soul (ed.), Cambridge University Press, Cambridge, Great Britain.
- Scheuring, R. W. 2003. Yellow warbler *Dendroica petechia* pages 507-509 *in* Marshall, D. B., M. G. Hunter and A. L. Contreras, eds. *Birds of Oregon: a General Reference*. Oregon State University Press, Corvallis, Oregon, USA.
- Schnepf, C. and Hasselstrom, K. 1995. Idaho soil conservation districts supervisor's handbook. 79 p. Boise, ID.

- Schnitzspahn, D., K. Fite, K. Moore, M. Medberry, A. Haak and E. Kingston. 2000. Owyhee-Bruneau Canyon Lands: Legacy Landscape Overview. Wilderness Society, American Lands, Committee for Idaho's High Desert, and Sierra Club.
- Schulz, T.T. and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. *Journal of Range Management* 43(4):295-299.
- Scott, O. 1966. Great Basin, central Rocky Mountain region. *Audubon Field Notes* 20: 589.
- Servheen, C. W. 1975. Ecology of the wintering bald eagles on the Skagit River, Washington. M.S. Thesis. University of Washington, Seattle. 96 pp.
- Shay, R. 1973. Oregon's rare or endangered wildlife. *Game Bulletin*. January: 3-8.
- Shipman, M. and S. Anderson. 1997. General survey of the Great Basin population of Columbia spotted frogs (*Rana luteiventris*) in the Jarbidge, Mountain City, and Santa Rosa Ranger Districts of Northern Nevada. Unpublished report prepared for the U.S. Forest Service, Humboldt-Toiyabe National Forest, September 1997.
- Short, H. L., and R. J. Cooper. 1985. Habitat suitability index models: Great blue heron. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.99). 23 pp.
- Sibley, D. A. 2000. National Audubon Society: The Sibley Guide to Birds. Chanticleer Press, Inc., New York.
- Simpson, K., and J. P. Kelsall. 1979. Capture and banding of adult great blue herons at Pender Harbour, British Columbia. *Proc. 1978 Conf. Colonial Waterbird Group* 2:71-78.
- Skovlin, J.M. 1984. Impacts of grazing on wetlands and riparian habitat: A review of our knowledge. Pages 1001- 1104, in *Developing strategies for rangeland management-a report prepared by the committee on developing strategies for rangeland management*. National Research Council/National Academy of Sciences. Westview Press, Boulder, Colorado.
- Soots, R. F., and J. F. Parnell. 1975. Ecological succession of breeding birds in relation to plant succession on dredge islands in North Carolina estuaries. *Univ. North Carolina Sea Grant Program Publ. UNC-75-27*. North Carolina State Univ., Raleigh. 9 1 pp.
- Soots, R. F., and M. C. Landin. 1978. Development and management of avian habitat on dredged material islands. U.S. Army Eng. Waterways Exp. Stn. Tech. Rep. DS-78-18. Vicksburg, Miss. 96 pp.
- Spendelow, J. A., and S. R. Patton. In prep. National atlas of coastal waterbird colonies:1976-1982. U. S. Fish Wildl. Serv. Biol. Rep.
- Sprunt, A. 1954. *Floridat birdlife*. Coward-McCann, New York. 527 pp.
- Sprunt, A., IV, W. B. Robertson, Jr., S. Postupalsky, R. J. Hensel, C. E. Knoder, and f. J. Ligas. 1973. Comparative productivity of six bald eagle populations. *Trnas. N. Am. Wildl. Nat. Res. Conf.* 38:96-105.
- St. John, A.D. 1994. The spotted frog in the Lakeview District of Oregon. Report to the Bureau of Land Management Lakeview District Office.
- Stalmaster, M. V. 1976. Winter ecology and effects of human activity on bald eagles in the Nooksack River Valley, Washington. M.S. Thesis. West Washington State College, Bellingham, WA. 100 pp.
- Stalmaster, M. V. 1987. *The Bald Eagle*. Universe Books, New York.
- Stalmaster, M. V. and J. R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. *Journal of Wildlife Management* 43:506-513.
- Stebbins, R.C. 1985. *A field guide to western reptiles and amphibians*. Houghton Mifflin Co., Boston. 336 pp.
- Steenhof, K., L. Bond, K.K. Bates and L.L. Leppert. 2002. Trends in midwinter counts of Bald eagles in the contiguous United States, 1986-2000. *Bird Populations* 6:21-32.
- Stevenson, H. M. and B. H. Anderson. 1994. *The birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA.

- Stokes, D.W., and L.Q. Stokes. 1989. A guide to bird behavior. Vol. III. Little, Brown and Co. Boston, Massachusetts.
- Storer, T. I. 1925. A synopsis of the Amphibia of California. University of California Press, Berkeley, California. 343 pp.
- Taylor, D. M. and C. D. Littlefield. 1986. Willow flycatcher and yellow warbler response to cattle grazing. *American Birds* 40:1169-1173.
- Thomas, J. W., Technical editor. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. U.S. Department of Agriculture, Forest Service, Agric. Handbook 553.
- Thompson, C. F. 1977. Experimental removal and replacement of territorial male Yellow-breasted Chats. *Auk* 94: 107-113.
- Thompson, C. F. and V. Nolan, Jr. 1973. Population biology of the Yellow-breasted Chat (*Icteria virens L.*) in southern Indiana. *Ecological Monographs* 43: 145-171.
- Thompson, D. H. 1979a. Declines in populations of great blue herons and great egrets in five midwestern States. *Proc. 1978 Conf. Colonial Waterbird Group* 2: 114-127.
- Tull, J. 1998. U.S. Forest Service, Ely Ranger District, Nevada, personal communication.
- Turner, F.B. 1960. Population structure and dynamics of the western spotted frog, *Rana pretiosa*. Baird and Girard, in *Yellowstone Park, Wyoming*. *Ecological Monographs* 30(3): 251-278.
- Turner, F.B. 1958. Life history of the western spotted frog in Yellowstone National Park. *Herpetologica* 14: 96-100.
- Turner, F.B. 1962. An analysis of geographic variation and distribution of *Rana pretiosa*. *American Philosophical Society Yearbook* 1962. Pp. 325-328.
- Turner, G.B. and P. C. Dumas. 1972. *Rana pretiosa*. Pages 119.1-119.4 in *Catalogue of North American Amphibians and Reptiles*. Society for the Study of Amphibians and Reptiles. U. S. Department of Agriculture. 2000. Conservation Reserve Program. Farm Service Agency. <http://www.fsa.usda.gov/crpstorpt/10approved/DEFAULT.HTM>.
- U.S. Fish and Wildlife Service. 1992. Notice: 12-month Petition Finding for the Spotted Frog. United States Department of the Interior, Nevada Fish and Wildlife Office, Reno, Nevada.
- U.S. Fish and Wildlife Service. 2001a. Deer Flat National Wildlife Refuge Home Page. <http://www.r1.fws.gov/deer>.
- U.S. Fish and Wildlife Service. 2001b. Draft Recovery Plan for Bull Trout in the Coterminous United States: Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River Distinct Population Segments. Portland, Oregon. In Press.
- U.S. Fish and Wildlife Service. 2002a. Section 7 Guidelines: Columbia Spotted Frog – Great Basin Population. United States Department of the Interior, Snake River Basin Office, Boise, Idaho.
- U.S. Fish and Wildlife Service. 2002b. Status Review for the Columbia Spotted Frog (*Rana luteiventris*) on the Wasatch Front, Utah. United States Department of the Interior
- U.S. Fish and Wildlife Service. 2002c. Candidate and Listing Priority Assignment Form: Columbia Spotted Frog. United States Department of the Interior, Nevada Fish and Wildlife Office, Reno, Nevada.
- U.S. Fish and Wildlife Service. 2000a. Endangered and Threatened Wildlife and Plants; Reopening of the Comment Period for the Columbian Sharp-Tailed Grouse Status Review. *Federal Register* Volume 65 Number 15 Page 3648-3649
- U.S. Fish and Wildlife Service. 2000b. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition To List the Columbian Sharp-Tailed Grouse as Threatened Volume 65 Number 197 Page 60391-60396

- U.S. Fish and Wildlife Service. 2000c. Endangered and Threatened Wildlife and Plants: determination of threatened status for the northern Idaho ground squirrel. Final Rule. Federal Register Volume 65(66): 17779-17786.
- U.S. Geological Service. Northern Prairie Wildlife Research Center. Website: <http://www.npwrc.usgs.gov/narcam/idguide/rpret.htm>. Accessed 2/2004.
- U.S. Geological Survey (USGS). 1999. 1:250,000 scale Land Use Land Cover by state. http://edcftp.cr.usgs.gov/glis/hyper/guide/1_250_lulcfig/states.html
- Umatilla National Forest. 1991. Birds of the Umatilla National Forest (checklist). U.S. Department of Agriculture, Forest Service, Umatilla National Forest, Pendleton, OR.
- United State Department of the Interior (USDI). 1978. Determinations of certain Bald Eagle populations as endangered or threatened. Federal Register 43: 6230-6233.
- United State Department of the Interior (USDI). 1999. Endangered and threatened wildlife and plants; proposed rule to remove the Bald Eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register 64: 36453-36464.
- United States Fish and Wildlife Service (USFWS). 1986. Recovery Plan for the Pacific Bald Eagle. USFWS, Portland, Oregon.
- United States Fish and Wildlife Service (USFWS). 2003. Oregon Fish and Wildlife Office website, Bald Eagle fact sheet: <http://oregonfwo.fws.gov/EndSpp/FactSheets/Birds/BaldEagle.dwt>.
- US Bureau of Reclamation (USBR). 1998. Snake River Resource Review: Resource Needs Assessment. Draft. Boise.
- US Census Bureau. 2000. United States Census 2000. <http://www.census.gov/>.
- USDA Forest Service and Bureau of Land Management. 2001. Interior Columbia Basin Ecosystem Management Project. <http://www.icbemp.gov/>.
- USDA Forest Service. 1981a. Appendix for final environmental impact statement: Hells Canyon National Recreation Area.
- USDA Forest Service. 1981b. Final environmental impact statement and comprehensive management plan : Hells Canyon National Recreation Area.
- USDA Forest Service. 1993. Wild and Scenic Snake River Recreation Management Plan Introduction: Summary Draft Environmental Impact Statement. Wallowa-Whitman National Forest.
- USDA Forest Service. 1996. Hells Canyon National Recreation Area Comprehensive Management Plan: Draft Environmental Impact Statement. Wallowa-Whitman National Forest.
- USDA Forest Service. 1999. Hells Canyon National Recreation Area Comprehensive Management Plan: Revised Draft Environmental Impact Statement. Wallowa-Whitman National Forest, Hells Canyon NRA.
- USDA Forest Service. 2000. Forest Roads: A synthesis of information. <http://www.fs.fed.us/news/roads/science.pdf>
- USDA Forest Service. 2001. Hells Canyon NRA. <<http://www.fs.fed.us/r6/w-w/hcnra.htm#snake>> on May 12, 2001. Wallowa Whitman National Forest.
- USDI Bureau of Land Management. 2001a. Allotment Assessments for the Brownlee Management Unit. Lower Snake River District. Boise, Idaho.
- Utah Department of Natural Resources. 1991. Distribution and status of the western spotted frog in central Utah. DRAFT progress Report to U. S. Fish and Wildlife Service. 29pp.
- Utah Division of Wildlife Resources. 1998. Conservation Strategy for the spotted frog.
- Vallier, T. L. 1998. Islands and Rapids: A geologic story of Hells Canyon. Confluence Press,
- Vallier, T. L. and Brooks, H. C., Eds. 1986. Geology of the Blue Mountains Region of Oregon, Idaho, and Washington: Geologic implications of Paleozoic and Mesozoic paleontology and biostratigraphy, Blue Mountains province, Oregon and Idaho. Denver, CO: U. S. Geological Survey Professional Paper 1435.

- Vallier, Tracy L. 1994. Geologic Hazards in Hells Canyon, Eastern Oregon and Western Idaho. Denver, CO: U.S. Geological Survey Open-File Report 94-213.
- Vermeer, K. 1969. Great blue heron colonies in Alberta. *Can. Field Nat.* 83(3): 237-242.
- Vos, D. K. 1984. Response of breeding great blue herons to human disturbance in north central Colorado. M. S. Thesis, Colorado State University, Fort Collins. 65 pp.
- Vroman, D. P. 2003. Yellow-breasted Chat. Pp. 529-530 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Wallowa-Whitman. 2001. Hells Canyon of the Snake River. <http://www.nps.gov/rivers/snake.html> on April 22, 2001.
- Walters, J., J. Hansen, J. Lockhart, C. Reighn, R. Keith, and J. Olson. 2001. Idaho supplementation studies five year report 1992-1996. Project Report, Idaho Department of Fish and Game Report 99-14, to Bonneville Power Administration, Contract DE-BI19-89BP01466, Portland, Oregon.
- Ward, P., and A. Zahavi. 1973. The importance of certain assemblages of birds as "information centers" for food finding. *Ibis* 115(4):517-534.
- Watson, J. W., M. G. Garrett, and R. G. Anthony. 1991. Foraging ecology of Bald Eagles in the Columbia River estuary. *Journal of Wildlife Management* 55: 492-499.
- Werschkul, D. F., E. McMahon, and M. Leitschuh. 1976. Some effects of human activities on the great blue heron in Oregon. *Wilson Bull.* 88(4):660-662.
- Whitaker, J.O., S.P. Cross, J.M. Skovlin, and C. Maser. 1982. Food habits of the spotted frog (*Rana pretiosa*) from managed sites in Grant County, Oregon. *Northwest Science* 57(2): 147-154.
- Whitehead, R.L. 1994. Ground water atlas of the United States. U.S. Geological Survey. <http://capp.water.usgs.gov/gwa/ch-h/>
- Wiese, J. H. 1978. Heron nest site selection and its ecological effects. *Wading birds. Natl. Audubon SOC. Res. Rep.* 7:27-34.
- Wilson, K. 2002. Wildlife Biologist, Utah Division of Wildlife Resources, Salt Lake City, Utah, personal communication.
- Wisdom, M. J.; Wales, B. C.; Holthausen, R. S.; Hargis, C. D.; Saab, V. A.; Hann, W. J.; Rich, T. D.; Lee, D. C. and Rowland, M. M. 1999. Wildlife Habitats in Forests of the Interior Northwest: History, Status, Trends, and Critical Issues Confronting Land Managers. Transactions of the 59th North American Wildlife and Natural Resources Conference.
- Witt, J. W. 1996. Long-term population monitoring of Osprey along the Umpqua River in western Oregon. *Journal of Raptor Research* 30: 62-69.
- Woodcock, A. R. 1902. An annotated list of the birds of Oregon. *Oregon Agric. Exp. Sta. Bull.* 68. 119 pp.
- Yom-Tov, Y. and A. Ar. 1993. Incubation and Fledgling Durations of Woodpeckers. *Condor* (95) 282-287.
- Zoellick, B.W. 1999. "Stream Temperatures and the Elevational Distribution of Redband Trout in Southwestern Idaho." *Great Basin Naturalist* 59(2): 136-143.
- Zwickel, F. C. 1992. Blue Grouse (*Dendragapus obscurus*). *In* The Birds of North America, No. 15 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Zwickel, F. C., D. A. Boag, and J. F. Bendell. 1989. Longevity in Blue Grouse. *North American Bird Bander* 14: 1-4.
- Zwickel, F. C., R. A. Lewis, and D. T. McKinnon. 1988. Nesting parameters in a high density, declining population of Blue Grouse. *Canadian Journal of Zoology* 66: 1736-1741.

6.2 Appendix 2: Species Tables

Appendix Table 1. Fish species currently inhabiting the Oregon Side LMS subbasin (USDI 1997, USDI 1999, USDI 2001a).

Common Name	Species	Origin ¹	Location ²	Status ³	Comments
Banded killifish	<i>Fundulus diaphanus</i>	N			
Black crappie	<i>Pomoxis salmoides</i>	E	R	C	
Blue gill	<i>Lepomis macrochirus</i>	E	R	U	
Bridgelip sucker	<i>Catostomus columbianus</i>	N	R	C	
Brook Trout	<i>Salvelinus fontinalis</i>	E	R		
Brown trout	<i>Salmo trutta</i>	E			
Bull trout	<i>Salvelinus confluentus</i>	N		ESA T	
Bullhead, black	<i>Pomoxis nigromaculatus</i>	E	R	U	
Bullhead, brown	<i>Ictalurus nebulosus</i>	E		R/I	
Bullhead, yellow		E			
Channel catfish	<i>Ictalurus natalis</i>	E	R	A	
Chiselmouth	<i>Acrocheilus alutaceus</i>	N	R and T	C	
Common carp	<i>Cyprinus carpio</i>	E	R	C,U	
Cutthroat trout (generic)	<i>Oncorhynchus clarki</i>	N		I	
Dace	<i>Rhinichthys spp</i>	N	R	C	
Flathead minnow	<i>Pimephales promelas</i>	E	R and T		
Flathead catfish	<i>Pylodictus olivaris</i>	E	R		
Largemouth bass	<i>Micropterus salmoides</i>	E	R	U	
Largescale sucker	<i>Catostomus macrocheilus</i>	N	R and T	A	
Longnose dace	<i>Rhinichthys cataractae</i>	N	R and T	C	
Mottled sculpin	<i>Cottus bairdi</i>	N	T	C	
Mountain sucker	<i>Catostomus platyrhynchus</i>	N			
Mountain whitefish	<i>Prosopium williamsoni</i>	N	R	O,U	
Northern pikeminnow	<i>Ptychocheilus oregonensis</i>	N	R and T	C	
Oriental weatherfish	<i>Misgurnus angullicaudatus</i>				Found in ditches
Paiute sculpin	<i>Cottus beldingi</i>	N			
Peamouth chub	<i>Mylocheilus caurinus</i>	N	R	U	
Pumpkinseed	<i>Lepomis gibbosus</i>	E	R and T	U	
Redband trout	<i>Oncorhynchus mykiss</i>	N	R and T	U/C	Redbands=U; RBT=C
Redside shiner	<i>Richardsonius balteatus</i>	N	R and T	A	
Shorthead sculpin	<i>Cottus confusus</i>	N		C	
Smallmouth bass	<i>Micropterus dolomieu</i>	E	R and T	A	
Speckled dace	<i>Rhinichthys osculus</i>	N	R and T	A	
Tadpole madtom	<i>Noturus gyrinus</i>	E	R	U	
Torrent sculpin	<i>Cottus rhotheus</i>	N	T	R	
Tui chub	<i>Gila bicolor</i>	E			
Warmouth	<i>Lipomis gulosus</i>	E	R and T	R	
White crappie	<i>Pomoxis annularis</i>	E	R and T	A	
White sturgeon	<i>Acipenser transmontanus</i>	N	R	U	Sensitive - BLM
Yellow perch	<i>Perca flavescens</i>	E	R	C	

¹ Origin: N=Native stock, E=exotic

² Location: R=mainstem Snake River, T=tributaries

³ Relative abundance: A=abundant, R=rare, U=uncommon, C=common, and I=insufficient data; ESA T=listed threatened under Endangered Species Act; ESA E=listed endangered under Endangered Species Act

Appendix Table 2. Wildlife Species in the Oregon Side LMS subbasin.

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Amphibians			
Tiger Salamander	<i>Ambystoma tigrinum</i>	occurs	breeds
Long-toed Salamander	<i>Ambystoma macrodactylum</i>	occurs	breeds
Western Red-backed Salamander	<i>Plethodon vehiculum</i>	occurs	breeds
Tailed Frog	<i>Ascaphus truei</i>	occurs	breeds
Great Basin Spadefoot	<i>Scaphiopus intermontanus</i>	occurs	breeds
Western Toad	<i>Bufo boreas</i>	occurs	breeds
Woodhouse's Toad	<i>Bufo woodhousii</i>	occurs	breeds
Pacific Chorus (Tree) Frog	<i>Pseudacris regilla</i>	occurs	breeds
Red-legged Frog	<i>Rana aurora</i>	occurs	breeds
Oregon Spotted Frog	<i>Rana pretiosa</i>	occurs	breeds
Columbia Spotted Frog	<i>Rana luteiventris</i>	occurs	breeds
Northern Leopard Frog	<i>Rana pipiens</i>	occurs	breeds
Bullfrog	<i>Rana catesbeiana</i>	non-native	breeds
Total Amphibians: 13			
Birds			
Common Loon	<i>Gavia immer</i>	occurs	non-breeder
Pied-billed Grebe	<i>Podilymbus podiceps</i>	occurs	breeds
Horned Grebe	<i>Podiceps auritus</i>	occurs	breeds
Red-necked Grebe	<i>Podiceps grisegena</i>	occurs	breeds
Eared Grebe	<i>Podiceps nigricollis</i>	occurs	breeds
Western Grebe	<i>Aechmophorus occidentalis</i>	occurs	breeds
Clark's Grebe	<i>Aechmophorus clarkii</i>	occurs	breeds
American White Pelican	<i>Pelecanus erythrorhynchos</i>	occurs	breeds
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	occurs	breeds
American Bittern	<i>Botaurus lentiginosus</i>	occurs	breeds
Least Bittern	<i>Ixobrychus exilis</i>	occurs	breeds
Great Blue Heron	<i>Ardea herodias</i>	occurs	breeds
Great Egret	<i>Ardea alba</i>	occurs	breeds
Snowy Egret	<i>Egretta thula</i>	occurs	breeds
Cattle Egret	<i>Bubulcus ibis</i>	occurs	breeds
Green Heron	<i>Butorides virescens</i>	occurs	breeds
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	occurs	breeds
White-faced Ibis	<i>Plegadis chihi</i>	occurs	breeds
Turkey Vulture	<i>Cathartes aura</i>	occurs	breeds
Greater White-fronted Goose	<i>Anser albifrons</i>	occurs	non-breeder
Snow Goose	<i>Chen Ccaerulescens</i>	occurs	non-breeder
Ross's Goose	<i>Chen rossii</i>	occurs	non-breeder
Canada Goose	<i>Branta canadensis</i>	occurs	breeds
Trumpeter Swan	<i>Cygnus buccinator</i>	occurs	breeds
Tundra Swan	<i>Cygnus columbianus</i>	occurs	non-breeder
Wood Duck	<i>Aix sponsa</i>	occurs	breeds
Gadwall	<i>Anas strepera</i>	occurs	breeds
Eurasian Wigeon	<i>Anas penelope</i>	occurs	non-breeder
American Wigeon	<i>Anas americana</i>	occurs	breeds
Mallard	<i>Anas platyrhynchos</i>	occurs	breeds
Blue-winged Teal	<i>Anas discors</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Cinnamon Teal	<i>Anas cyanoptera</i>	occurs	breeds
Northern Shoveler	<i>Anas clypeata</i>	occurs	breeds
Northern Pintail	<i>Anas acuta</i>	occurs	breeds
Green-winged Teal	<i>Anas crecca</i>	occurs	breeds
Canvasback	<i>Aythya valisineria</i>	occurs	breeds
Redhead	<i>Aythya americana</i>	occurs	breeds
Ring-necked Duck	<i>Aythya collaris</i>	occurs	breeds
Greater Scaup	<i>Aythya marila</i>	occurs	non-breeder
Lesser Scaup	<i>Aythya affinis</i>	occurs	breeds
Harlequin Duck	<i>Histrionicus histrionicus</i>	occurs	breeds
Surf Scoter	<i>Melanitta perspicillata</i>	occurs	non-breeder
Bufflehead	<i>Bucephala albeola</i>	occurs	breeds
Common Goldeneye	<i>Bucephala clangula</i>	occurs	non-breeder
Barrow's Goldeneye	<i>Bucephala islandica</i>	occurs	breeds
Hooded Merganser	<i>Lophodytes cucullatus</i>	occurs	breeds
Common Merganser	<i>Mergus merganser</i>	occurs	breeds
Red-breasted Merganser	<i>Mergus serrator</i>	occurs	non-breeder
Ruddy Duck	<i>Oxyura jamaicensis</i>	occurs	breeds
Osprey	<i>Pandion haliaetus</i>	occurs	breeds
White-tailed Kite	<i>Elanus leucurus</i>	occurs	breeds
Bald Eagle	<i>Haliaeetus leucocephalus</i>	occurs	breeds
Northern Harrier	<i>Circus cyaneus</i>	occurs	breeds
Sharp-shinned Hawk	<i>Accipiter striatus</i>	occurs	breeds
Cooper's Hawk	<i>Accipiter cooperii</i>	occurs	breeds
Northern Goshawk	<i>Accipiter gentilis</i>	occurs	breeds
Red-shouldered Hawk	<i>Buteo lineatus</i>	occurs	breeds
Swainson's Hawk	<i>Buteo swainsoni</i>	occurs	breeds
Red-tailed Hawk	<i>Buteo jamaicensis</i>	occurs	breeds
Ferruginous Hawk	<i>Buteo regalis</i>	occurs	breeds
Rough-legged Hawk	<i>Buteo lagopus</i>	occurs	non-breeder
Golden Eagle	<i>Aquila chrysaetos</i>	occurs	breeds
American Kestrel	<i>Falco sparverius</i>	occurs	breeds
Merlin	<i>Falco columbarius</i>	occurs	bred historically
Gyrfalcon	<i>Falco rusticolus</i>	occurs	non-breeder
Peregrine Falcon	<i>Falco peregrinus</i>	occurs	breeds
Prairie Falcon	<i>Falco mexicanus</i>	occurs	breeds
Chukar	<i>Alectoris chukar</i>	non-native	breeds
Gray Partridge	<i>Perdix perdix</i>	non-native	breeds
Ring-necked Pheasant	<i>Phasianus colchicus</i>	non-native	breeds
Ruffed Grouse	<i>Bonasa umbellus</i>	occurs	breeds
Sage Grouse	<i>Centrocercus urophasianus</i>	occurs	breeds
Spruce Grouse	<i>Falcapennis canadensis</i>	occurs	breeds
Blue Grouse	<i>Dendragapus obscurus</i>	occurs	breeds
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	reintroduced	breeds
Wild Turkey	<i>Meleagris gallopavo</i>	non-native	breeds
Mountain Quail	<i>Oreortyx pictus</i>	occurs	breeds
California Quail	<i>Callipepla californica</i>	occurs	breeds
Northern Bobwhite	<i>Colinus virginianus</i>	non-native	breeds
Virginia Rail	<i>Rallus limicola</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Sora	<i>Porzana carolina</i>	occurs	breeds
American Coot	<i>Fulica americana</i>	occurs	breeds
Sandhill Crane	<i>Grus canadensis</i>	occurs	breeds
Black-bellied Plover	<i>Pluvialis squatarola</i>	occurs	non-breeder
American Golden-Plover	<i>Pluvialis dominica</i>	occurs	non-breeder
Pacific Golden-Plover	<i>Pluvialis fulva</i>	occurs	non-breeder
Snowy Plover	<i>Charadrius alexandrinus</i>	occurs	breeds
Semipalmated Plover	<i>Charadrius semipalmatus</i>	occurs	non-breeder
Killdeer	<i>Charadrius vociferus</i>	occurs	breeds
Black-necked Stilt	<i>Himantopus mexicanus</i>	occurs	breeds
American Avocet	<i>Recurvirostra americana</i>	occurs	breeds
Greater Yellowlegs	<i>Tringa melanoleuca</i>	occurs	non-breeder
Lesser Yellowlegs	<i>Tringa flavipes</i>	occurs	non-breeder
Solitary Sandpiper	<i>Tringa solitaria</i>	occurs	non-breeder
Willet	<i>Catoptrophorus semipalmatus</i>	occurs	breeds
Spotted Sandpiper	<i>Actitis macularia</i>	occurs	breeds
Upland Sandpiper	<i>Bartramia longicauda</i>	occurs	breeds
Whimbrel	<i>Numenius phaeopus</i>	occurs	non-breeder
Long-billed Curlew	<i>Numenius americanus</i>	occurs	breeds
Marbled Godwit	<i>Limosa fedoa</i>	occurs	non-breeder
Red Knot	<i>Calidris canutus</i>	occurs	non-breeder
Sanderling	<i>Calidris alba</i>	occurs	non-breeder
Semipalmated Sandpiper	<i>Calidris pusilla</i>	occurs	non-breeder
Western Sandpiper	<i>Calidris mauri</i>	occurs	non-breeder
Least Sandpiper	<i>Calidris minutilla</i>	occurs	non-breeder
Baird's Sandpiper	<i>Calidris bairdii</i>	occurs	non-breeder
Pectoral Sandpiper	<i>Calidris melanotos</i>	occurs	non-breeder
Dunlin	<i>Calidris alpina</i>	occurs	non-breeder
Stilt Sandpiper	<i>Calidris himantopus</i>	occurs	non-breeder
Short-billed Dowitcher	<i>Limnodromus griseus</i>	occurs	non-breeder
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	occurs	non-breeder
Common Snipe	<i>Gallinago gallinago</i>	occurs	breeds
Wilson's Phalarope	<i>Phalaropus tricolor</i>	occurs	breeds
Red-necked Phalarope	<i>Phalaropus lobatus</i>	occurs	non-breeder
Franklin's Gull	<i>Larus pipixcan</i>	occurs	breeds
Bonaparte's Gull	<i>Larus philadelphia</i>	occurs	non-breeder
Mew Gull	<i>Larus canus</i>	occurs	non-breeder
Ring-billed Gull	<i>Larus delawarensis</i>	occurs	breeds
California Gull	<i>Larus californicus</i>	occurs	breeds
Herring Gull	<i>Larus argentatus</i>	occurs	non-breeder
Caspian Tern	<i>Sterna caspia</i>	occurs	breeds
Common Tern	<i>Sterna hirundo</i>	occurs	non-breeder
Forster's Tern	<i>Sterna forsteri</i>	occurs	breeds
Black Tern	<i>Chlidonias niger</i>	occurs	breeds
Rock Dove	<i>Columba livia</i>	non-native	breeds
Band-tailed Pigeon	<i>Columba fasciata</i>	occurs	breeds
Mourning Dove	<i>Zenaida macroura</i>	occurs	breeds
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	occurs	breeds
Barn Owl	<i>Tyto alba</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Flammulated Owl	<i>Otus flammeolus</i>	occurs	breeds
Western Screech-owl	<i>Otus kennicottii</i>	occurs	breeds
Great Horned Owl	<i>Bubo virginianus</i>	occurs	breeds
Snowy Owl	<i>Nyctea scandiaca</i>	occurs	non-breeder
Northern Pygmy-owl	<i>Glaucidium gnoma</i>	occurs	breeds
Burrowing Owl	<i>Athene cunicularia</i>	occurs	breeds
Barred Owl	<i>Strix varia</i>	occurs	breeds
Great Gray Owl	<i>Strix nebulosa</i>	occurs	breeds
Long-eared Owl	<i>Asio otus</i>	occurs	breeds
Short-eared Owl	<i>Asio flammeus</i>	occurs	breeds
Boreal Owl	<i>Aegolius funereus</i>	occurs	breeds
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	occurs	breeds
Common Nighthawk	<i>Chordeiles minor</i>	occurs	breeds
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	occurs	breeds
Black Swift	<i>Cypseloides niger</i>	occurs	breeds
Vaux's Swift	<i>Chaetura vauxi</i>	occurs	breeds
White-throated Swift	<i>Aeronautes saxatalis</i>	occurs	breeds
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	occurs	breeds
Calliope Hummingbird	<i>Stellula calliope</i>	occurs	breeds
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>	occurs	breeds
Rufous Hummingbird	<i>Selasphorus rufus</i>	occurs	breeds
Belted Kingfisher	<i>Ceryle alcyon</i>	occurs	breeds
Lewis's Woodpecker	<i>Melanerpes lewis</i>	occurs	breeds
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	occurs	breeds
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	occurs	breeds
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	occurs	breeds
Downy Woodpecker	<i>Picoides pubescens</i>	occurs	breeds
Hairy Woodpecker	<i>Picoides villosus</i>	occurs	breeds
White-headed Woodpecker	<i>Picoides albolarvatus</i>	occurs	breeds
Three-toed Woodpecker	<i>Picoides tridactylus</i>	occurs	breeds
Black-backed Woodpecker	<i>Picoides arcticus</i>	occurs	breeds
Northern Flicker	<i>Colaptes auratus</i>	occurs	breeds
Pileated Woodpecker	<i>Dryocopus pileatus</i>	occurs	breeds
Olive-sided Flycatcher	<i>Contopus cooperi</i>	occurs	breeds
Western Wood-pewee	<i>Contopus sordidulus</i>	occurs	breeds
Willow Flycatcher	<i>Empidonax traillii</i>	occurs	breeds
Least Flycatcher	<i>Empidonax minimus</i>	occurs	non-breeder
Hammond's Flycatcher	<i>Empidonax hammondii</i>	occurs	breeds
Gray Flycatcher	<i>Empidonax wrightii</i>	occurs	breeds
Dusky Flycatcher	<i>Empidonax oberholseri</i>	occurs	breeds
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	occurs	breeds
Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	occurs	breeds
Black Phoebe	<i>Sayornis nigricans</i>	occurs	breeds
Say's Phoebe	<i>Sayornis saya</i>	occurs	breeds
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	occurs	breeds
Western Kingbird	<i>Tyrannus verticalis</i>	occurs	breeds
Eastern Kingbird	<i>Tyrannus tyrannus</i>	occurs	breeds
Loggerhead Shrike	<i>Lanius ludovicianus</i>	occurs	breeds
Northern Shrike	<i>Lanius excubitor</i>	occurs	non-breeder

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Cassin's Vireo	<i>Vireo cassinii</i>	occurs	breeds
Hutton's Vireo	<i>Vireo huttoni</i>	occurs	breeds
Warbling Vireo	<i>Vireo gilvus</i>	occurs	breeds
Red-eyed Vireo	<i>Vireo olivaceus</i>	occurs	breeds
Gray Jay	<i>Perisoreus canadensis</i>	occurs	breeds
Steller's Jay	<i>Cyanocitta stelleri</i>	occurs	breeds
Western Scrub-Jay	<i>Aphelocoma californica</i>	occurs	breeds
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	occurs	breeds
Clark's Nutcracker	<i>Nucifraga columbiana</i>	occurs	breeds
Black-billed Magpie	<i>Pica pica</i>	occurs	breeds
American Crow	<i>Corvus brachyrhynchos</i>	occurs	breeds
Common Raven	<i>Corvus corax</i>	occurs	breeds
Horned Lark	<i>Eremophila alpestris</i>	occurs	breeds
Purple Martin	<i>Progne subis</i>	occurs	breeds
Tree Swallow	<i>Tachycineta bicolor</i>	occurs	breeds
Violet-green Swallow	<i>Tachycineta thalassina</i>	occurs	breeds
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	occurs	breeds
Bank Swallow	<i>Riparia riparia</i>	occurs	breeds
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	occurs	breeds
Barn Swallow	<i>Hirundo rustica</i>	occurs	breeds
Black-capped Chickadee	<i>Poecile atricapillus</i>	occurs	breeds
Mountain Chickadee	<i>Poecile gambeli</i>	occurs	breeds
Chestnut-backed Chickadee	<i>Poecile rufescens</i>	occurs	breeds
Oak Titmouse	<i>Baeolophus inornatus</i>	occurs	breeds
Juniper Titmouse	<i>Baeolophus griseus</i>	occurs	breeds
Bushtit	<i>Psaltriparus minimus</i>	occurs	breeds
Red-breasted Nuthatch	<i>Sitta canadensis</i>	occurs	breeds
White-breasted Nuthatch	<i>Sitta carolinensis</i>	occurs	breeds
Pygmy Nuthatch	<i>Sitta pygmaea</i>	occurs	breeds
Brown Creeper	<i>Certhia americana</i>	occurs	breeds
Rock Wren	<i>Salpinctes obsoletus</i>	occurs	breeds
Canyon Wren	<i>Catherpes mexicanus</i>	occurs	breeds
Bewick's Wren	<i>Thryomanes bewickii</i>	occurs	breeds
House Wren	<i>Troglodytes aedon</i>	occurs	breeds
Winter Wren	<i>Troglodytes troglodytes</i>	occurs	breeds
Marsh Wren	<i>Cistothorus palustris</i>	occurs	breeds
American Dipper	<i>Cinclus mexicanus</i>	occurs	breeds
Golden-crowned Kinglet	<i>Regulus satrapa</i>	occurs	breeds
Ruby-crowned Kinglet	<i>Regulus calendula</i>	occurs	breeds
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	occurs	breeds
Western Bluebird	<i>Sialia mexicana</i>	occurs	breeds
Mountain Bluebird	<i>Sialia currucoides</i>	occurs	breeds
Townsend's Solitaire	<i>Myadestes townsendi</i>	occurs	breeds
Veery	<i>Catharus fuscescens</i>	occurs	breeds
Swainson's Thrush	<i>Catharus ustulatus</i>	occurs	breeds
Hermit Thrush	<i>Catharus guttatus</i>	occurs	breeds
American Robin	<i>Turdus migratorius</i>	occurs	breeds
Varied Thrush	<i>Ixoreus naevius</i>	occurs	breeds
Gray Catbird	<i>Dumetella carolinensis</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Northern Mockingbird	<i>Mimus polyglottos</i>	occurs	non-breeder
Sage Thrasher	<i>Oreoscoptes montanus</i>	occurs	breeds
European Starling	<i>Sturnus vulgaris</i>	non-native	breeds
American Pipit	<i>Anthus rubescens</i>	occurs	breeds
Bohemian Waxwing	<i>Bombycilla garrulus</i>	occurs	non-breeder
Cedar Waxwing	<i>Bombycilla cedrorum</i>	occurs	breeds
Orange-crowned Warbler	<i>Vermivora celata</i>	occurs	breeds
Nashville Warbler	<i>Vermivora ruficapilla</i>	occurs	breeds
Yellow Warbler	<i>Dendroica petechia</i>	occurs	breeds
Yellow-rumped Warbler	<i>Dendroica coronata</i>	occurs	breeds
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	occurs	breeds
Townsend's Warbler	<i>Dendroica townsendi</i>	occurs	breeds
Hermit Warbler	<i>Dendroica occidentalis</i>	occurs	breeds
American Redstart	<i>Setophaga ruticilla</i>	occurs	breeds
Northern Waterthrush	<i>Seiurus noveboracensis</i>	occurs	breeds
Macgillivray's Warbler	<i>Oporornis tolmiei</i>	occurs	breeds
Common Yellowthroat	<i>Geothlypis trichas</i>	occurs	breeds
Wilson's Warbler	<i>Wilsonia pusilla</i>	occurs	breeds
Yellow-breasted Chat	<i>Icteria virens</i>	occurs	breeds
Western Tanager	<i>Piranga ludoviciana</i>	occurs	breeds
Green-tailed Towhee	<i>Pipilo chlorurus</i>	occurs	breeds
Spotted Towhee	<i>Pipilo maculatus</i>	occurs	breeds
American Tree Sparrow	<i>Spizella arborea</i>	occurs	non-breeder
Chipping Sparrow	<i>Spizella passerina</i>	occurs	breeds
Clay-colored Sparrow	<i>Spizella pallida</i>	occurs	non-breeder
Brewer's Sparrow	<i>Spizella breweri</i>	occurs	breeds
Vesper Sparrow	<i>Poocetes gramineus</i>	occurs	breeds
Lark Sparrow	<i>Chondestes grammacus</i>	occurs	breeds
Black-throated Sparrow	<i>Amphispiza bilineata</i>	occurs	breeds
Sage Sparrow	<i>Amphispiza belli</i>	occurs	breeds
Savannah Sparrow	<i>Passerculus sandwichensis</i>	occurs	breeds
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	occurs	breeds
Fox Sparrow	<i>Passerella iliaca</i>	occurs	breeds
Song Sparrow	<i>Melospiza melodia</i>	occurs	breeds
Lincoln's Sparrow	<i>Melospiza lincolni</i>	occurs	breeds
Swamp Sparrow	<i>Melospiza georgiana</i>	occurs	non-breeder
White-throated Sparrow	<i>Zonotrichia albicollis</i>	occurs	non-breeder
Harris's Sparrow	<i>Zonotrichia querula</i>	occurs	non-breeder
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	occurs	breeds
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	occurs	non-breeder
Dark-eyed Junco	<i>Junco hyemalis</i>	occurs	breeds
Lapland Longspur	<i>Calcarius lapponicus</i>	occurs	non-breeder
Snow Bunting	<i>Plectrophenax nivalis</i>	occurs	non-breeder
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	occurs	breeds
Lazuli Bunting	<i>Passerina amoena</i>	occurs	breeds
Bobolink	<i>Dolichonyx oryzivorus</i>	occurs	breeds
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	occurs	breeds
Tricolored Blackbird	<i>Agelaius tricolor</i>	occurs	breeds
Western Meadowlark	<i>Sturnella neglecta</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	occurs	breeds
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	occurs	breeds
Brown-headed Cowbird	<i>Molothrus ater</i>	occurs	breeds
Bullock's Oriole	<i>Icterus bullockii</i>	occurs	breeds
Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>	occurs	breeds
Black Rosy-finch	<i>Leucosticte atrata</i>	occurs	breeds
Pine Grosbeak	<i>Pinicola enucleator</i>	occurs	breeds
Purple Finch	<i>Carpodacus purpureus</i>	occurs	breeds
Cassin's Finch	<i>Carpodacus cassinii</i>	occurs	breeds
House Finch	<i>Carpodacus mexicanus</i>	occurs	breeds
Red Crossbill	<i>Loxia curvirostra</i>	occurs	breeds
White-winged Crossbill	<i>Loxia leucoptera</i>	occurs	non-breeder
Common Redpoll	<i>Carduelis flammea</i>	occurs	non-breeder
Pine Siskin	<i>Carduelis pinus</i>	occurs	breeds
Lesser Goldfinch	<i>Carduelis psaltria</i>	occurs	breeds
American Goldfinch	<i>Carduelis tristis</i>	occurs	breeds
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	occurs	breeds
House Sparrow	<i>Passer domesticus</i>	non-native	breeds
Total Birds: 294			
Mammals			
Virginia Opossum	<i>Didelphis virginiana</i>	non-native	breeds
Preble's Shrew	<i>Sorex preblei</i>	occurs	breeds
Vagrant Shrew	<i>Sorex vagrans</i>	occurs	breeds
Montane Shrew	<i>Sorex monticolus</i>	occurs	breeds
Water Shrew	<i>Sorex palustris</i>	occurs	breeds
Merriam's Shrew	<i>Sorex merriami</i>	occurs	breeds
Coast Mole	<i>Scapanus orarius</i>	occurs	breeds
California Myotis	<i>Myotis californicus</i>	occurs	breeds
Western Small-footed Myotis	<i>Myotis ciliolabrum</i>	occurs	breeds
Yuma Myotis	<i>Myotis yumanensis</i>	occurs	breeds
Little Brown Myotis	<i>Myotis lucifugus</i>	occurs	breeds
Long-legged Myotis	<i>Myotis volans</i>	occurs	breeds
Fringed Myotis	<i>Myotis thysanodes</i>	occurs	breeds
Long-eared Myotis	<i>Myotis evotis</i>	occurs	breeds
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	occurs	breeds
Western Pipistrelle	<i>Pipistrellus hesperus</i>	occurs	breeds
Big Brown Bat	<i>Eptesicus fuscus</i>	occurs	breeds
Hoary Bat	<i>Lasiurus cinereus</i>	occurs	non-breeder
Spotted Bat	<i>Euderma maculatum</i>	accidental	non-breeder
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	occurs	breeds
Pallid Bat	<i>Antrozous pallidus</i>	occurs	breeds
American Pika	<i>Ochotona princeps</i>	occurs	breeds
Pygmy Rabbit	<i>Brachylagus idahoensis</i>	occurs	breeds
Nuttall's (Mountain) Cottontail	<i>Sylvilagus nuttallii</i>	occurs	breeds
Snowshoe Hare	<i>Lepus americanus</i>	occurs	breeds
White-tailed Jackrabbit	<i>Lepus townsendii</i>	occurs	breeds
Black-tailed Jackrabbit	<i>Lepus californicus</i>	occurs	breeds
Least Chipmunk	<i>Tamias minimus</i>	occurs	breeds
Yellow-pine Chipmunk	<i>Tamias amoenus</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Yellow-bellied Marmot	<i>Marmota flaviventris</i>	occurs	breeds
White-tailed Antelope Squirrel	<i>Ammospermophilus leucurus</i>	occurs	breeds
Townsend's Ground Squirrel	<i>Spermophilus townsendii</i>	occurs	breeds
Merriam's Ground Squirrel	<i>Spermophilus canus</i>	occurs	breeds
Piute Ground Squirrel	<i>Spermophilus mollis</i>	occurs	breeds
Belding's Ground Squirrel	<i>Spermophilus beldingi</i>	occurs	breeds
Columbian Ground Squirrel	<i>Spermophilus columbianus</i>	occurs	breeds
Golden-mantled Ground Squirrel	<i>Spermophilus lateralis</i>	occurs	breeds
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>	non-native	breeds
Eastern Fox Squirrel	<i>Sciurus niger</i>	non-native	breeds
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	occurs	breeds
Douglas' Squirrel	<i>Tamiasciurus douglasii</i>	occurs	breeds
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	occurs	breeds
Northern Pocket Gopher	<i>Thomomys talpoides</i>	occurs	breeds
Botta's (Pistol River) Pocket Gopher	<i>Thomomys bottae</i>	occurs	breeds
Townsend's Pocket Gopher	<i>Thomomys townsendii</i>	occurs	breeds
Great Basin Pocket Mouse	<i>Perognathus parvus</i>	occurs	breeds
Little Pocket Mouse	<i>Perognathus longimembris</i>	occurs	breeds
Dark Kangaroo Mouse	<i>Microdipodops megacephalus</i>	occurs	breeds
Ord's Kangaroo Rat	<i>Dipodomys ordii</i>	occurs	breeds
Chisel-toothed Kangaroo Rat	<i>Dipodomys microps</i>	occurs	breeds
American Beaver	<i>Castor canadensis</i>	occurs	breeds
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	occurs	breeds
Deer Mouse	<i>Peromyscus maniculatus</i>	occurs	breeds
Canyon Mouse	<i>Peromyscus crinitus</i>	occurs	breeds
Pinon Mouse	<i>Peromyscus truei</i>	occurs	breeds
Northern Grasshopper Mouse	<i>Onychomys leucogaster</i>	occurs	breeds
Desert Woodrat	<i>Neotoma lepida</i>	occurs	breeds
Bushy-tailed Woodrat	<i>Neotoma cinerea</i>	occurs	breeds
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	occurs	breeds
Heather Vole	<i>Phenacomys intermedius</i>	occurs	breeds
Montane Vole	<i>Microtus montanus</i>	occurs	breeds
Long-tailed Vole	<i>Microtus longicaudus</i>	occurs	breeds
Water Vole	<i>Microtus richardsoni</i>	occurs	breeds
Sagebrush Vole	<i>Lemmings curtatus</i>	occurs	breeds
Muskrat	<i>Ondatra zibethicus</i>	occurs	breeds
Black Rat	<i>Rattus rattus</i>	non-native	breeds
Norway Rat	<i>Rattus norvegicus</i>	non-native	breeds
House Mouse	<i>Mus musculus</i>	non-native	breeds
Western Jumping Mouse	<i>Zapus princeps</i>	occurs	breeds
Common Porcupine	<i>Erethizon dorsatum</i>	occurs	breeds
Coyote	<i>Canis latrans</i>	occurs	breeds
Gray Wolf	<i>Canis lupus</i>	extirpated	bred-historically
Red Fox	<i>Vulpes vulpes</i>	occurs	breeds
Kit Fox	<i>Vulpes velox</i>	occurs	breeds
Gray Fox	<i>Urocyon cinereoargenteus</i>	occurs	breeds
Black Bear	<i>Ursus americanus</i>	occurs	breeds
Grizzly Bear	<i>Ursus arctos</i>	extirpated	bred-historically

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Raccoon	<i>Procyon lotor</i>	occurs	breeds
American Marten	<i>Martes americana</i>	occurs	breeds
Fisher	<i>Martes pennanti</i>	occurs	breeds
Ermine	<i>Mustela erminea</i>	occurs	breeds
Long-tailed Weasel	<i>Mustela frenata</i>	occurs	breeds
Mink	<i>Mustela vison</i>	occurs	breeds
Wolverine	<i>Gulo gulo</i>	occurs	breeds
American Badger	<i>Taxidea taxus</i>	occurs	breeds
Western Spotted Skunk	<i>Spilogale gracilis</i>	occurs	breeds
Striped Skunk	<i>Mephitis mephitis</i>	occurs	breeds
Northern River Otter	<i>Lutra canadensis</i>	occurs	breeds
Mountain Lion	<i>Puma concolor</i>	occurs	breeds
Lynx	<i>Lynx canadensis</i>	occurs	breeds
Bobcat	<i>Lynx rufus</i>	occurs	breeds
Feral Horse	<i>Equus caballus</i>	non-native	breeds
Rocky Mountain Elk	<i>Cervus elaphus nelsoni</i>	occurs	breeds
	<i>Odocoileus hemionus columbianus</i>	occurs	breeds
Black-tailed Deer (westside)		occurs	breeds
White-tailed Deer (eastside)	<i>Odocoileus virginianus ochrourus</i>	occurs	breeds
Moose	<i>Alces alces</i>	accidental	non-breeder
Pronghorn Antelope	<i>Antilocapra americana</i>	occurs	breeds
Mountain Goat	<i>Oreamnos americanus</i>	reintroduced	breeds
Bighorn Sheep	<i>Ovis canadensis</i>	occurs	breeds
Total Mammals: 99			
Reptiles			
Painted Turtle	<i>Chrysemys picta</i>	occurs	breeds
Western Pond Turtle	<i>Clemmys marmorata</i>	occurs	breeds
Southern Alligator Lizard	<i>Elgaria multicarinata</i>	occurs	breeds
Mojave Black-collared Lizard	<i>Crotaphytus bicinctores</i>	occurs	breeds
Long-nosed Leopard Lizard	<i>Gambelia wislizenii</i>	occurs	breeds
Short-horned Lizard	<i>Phrynosoma douglassii</i>	occurs	breeds
Desert Horned Lizard	<i>Phrynosoma platyrhinos</i>	occurs	breeds
Sagebrush Lizard	<i>Sceloporus graciosus</i>	occurs	breeds
Western Fence Lizard	<i>Sceloporus occidentalis</i>	occurs	breeds
Side-blotched Lizard	<i>Uta stansburiana</i>	occurs	breeds
Western Skink	<i>Eumeces skiltonianus</i>	occurs	breeds
Western Whiptail	<i>Cnemidophorus tigris</i>	occurs	breeds
Rubber Boa	<i>Charina bottae</i>	occurs	breeds
Racer	<i>Coluber constrictor</i>	occurs	breeds
Ringneck Snake	<i>Diadophis punctatus</i>	occurs	breeds
Night Snake	<i>Hypsiglena torquata</i>	occurs	breeds
Common Kingsnake	<i>Lampropeltis getula</i>	occurs	breeds
California Mountain Kingsnake	<i>Lampropeltis zonata</i>	occurs	breeds
Striped Whipsnake	<i>Masticophis taeniatus</i>	occurs	breeds
Gopher Snake	<i>Pituophis catenifer</i>	occurs	breeds
Western Ground Snake	<i>Sonora semiannulata</i>	occurs	breeds
Western Terrestrial Garter Snake	<i>Thamnophis elegans</i>	occurs	breeds
Common Garter Snake	<i>Thamnophis sirtalis</i>	occurs	breeds
Western Rattlesnake	<i>Crotalus viridis</i>	occurs	breeds

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
-------------	-----------------	---------------	--------------------

Total Reptiles: 24

Total Species: 430

Appendix Table 3. Terrestrial Focal Species Selection Matrix for the Oregon Side LMS subbasin indicating species with any state or federal special status, critical functional link and/or functional specialization with additional annotations for number of KEFs, habitat associations, Partners in Flight species (PIF) and Habitat Evaluation Procedure species (HEP). Focal species selected are highlighted.

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Long-toed Salamander				Yes	1	3	1				
Tailed Frog		SS-V				1	0				
Great Basin Spadefoot				Yes		3	1				
Western Toad		SV				3	1				
Woodhouse's Toad		SPN				3	1				
Oregon Spotted Frog	C	SC		Yes		2	0				
Columbia Spotted Frog	C	SUS				3	1				
Northern Leopard Frog		SC				3	1				
Mojave Black-collared Lizard		SV				0	0				
Desert Horned Lizard		SV				0	0				
Sagebrush Lizard		SV				0	0				
Western Ground Snake		SPN				0	0				
Western Rattlesnake		SV				0	0				
Horned Grebe		SPN				2	0				Yes
Red-necked Grebe		SC				2	0				Yes
American White Pelican		SV				1	0				Yes
Double-crested Cormorant				Yes		2	1				Yes
Great Blue Heron				Yes	3	4	1				Yes
Snowy Egret		SV				3	1				Yes
Turkey Vulture			Yes			0	0				Yes
Canada Goose				Yes	1	3	0	Game Bird			

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Eurasian Wigeon			Yes			1	0	Game Bird			
Redhead				Yes	1	2	0	Game Bird			
Greater Scaup				Yes	1	1	0	Game Bird			Yes
Harlequin Duck		SUS	Yes		1	2	1	Game Bird			Yes
Bufflehead		SUS				4	1	Game Bird			
Barrow's Goldeneye		SUS				2	0	Game Bird			Yes
Osprey			Yes			1	0				Yes
Bald Eagle	LT	LT				1	0				Yes
Northern Goshawk		SC				2	1				
Swainson's Hawk		SV				3	2		PIF		
Ferruginous Hawk		SC				2	2		PIF		
Merlin			Yes			0	0				
Gyrfalcon			Yes			0	0				Yes
Peregrine Falcon		LE	Yes			0	0				Yes
Sage Grouse		SV				3	2	Game Bird			
Spruce Grouse		SUS				0	0	Game Bird			
Mountain Quail		SUS				0	0	Game Bird			
Sandhill Crane		SV				2	0				

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Upland Sandpiper		SC				1	1				
Long-billed Curlew		SV				4	2				
Franklin's Gull		SPN				1	0				Yes
Mew Gull				Yes	2	1	0				Yes
Black Tern				Yes	1	1	0				
Yellow-billed Cuckoo	C	SC				1	1		PIF		
Flammulated Owl		SC				2	1		PIF		
Great Horned Owl				Yes		0	0				
Northern Pygmy-owl		SC	Yes			1	0				
Burrowing Owl		SC				2	2		PIF		
Great Gray Owl		SV				1	1		PIF		
Boreal Owl		SUS	Yes			0	0				
Common Nighthawk		SC	Yes			0	0				
Common Poorwill			Yes			0	0		PIF		
Black Swift		SPN	Yes			0	0		PIF		
Vaux's Swift			Yes			1	0		PIF		
White-throated Swift			Yes			0	0		PIF		
Black-chinned Hummingbird				Yes	1	0	0				
Rufous Hummingbird				Yes	2	0	0		PIF		
Lewis's Woodpecker		SC				0	0		PIF		
Williamson's Sapsucker		SUS		Yes		0	0		PIF		
White-headed Woodpecker		SC				1	1		PIF		
Three-toed Woodpecker		SC				0	0				
Black-backed Woodpecker		SC				0	0		PIF		
Pileated Woodpecker		SV				0	0		PIF		
Olive-sided Flycatcher		SV	Yes			2	0		PIF		
Western Wood-pewee			Yes			0	0		PIF		

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Willow Flycatcher		SV/US				1	1		PIF		Yes
Loggerhead Shrike		SV				3	1		PIF		
American Crow				Yes	2	2	0				Yes
Horned Lark	C	SC		Yes		1	1		PIF		
Bank Swallow		SUS				2	1		PIF		Yes
Pygmy Nuthatch		SV				2	2				
Brown Creeper			Yes			0	0		PIF		
Rock Wren			Yes			0	0				
Canyon Wren			Yes			0	0				
Winter Wren			Yes			0	0		PIF		Yes
American Dipper						2	1		PIF		Yes
Western Bluebird		SV				1	1		PIF		
Yellow-breasted Chat		SC				1	1		PIF		
Spotted Towhee				Yes		0	0				Yes
Vesper Sparrow		SC				4	2		PIF		
Black-throated Sparrow		SPN				0	0		PIF		
Sage Sparrow		SC				1	1		PIF		
Grasshopper Sparrow		SV/PN				2	1		PIF		
Bobolink		SV				1	0				
Western Meadowlark		SC				4	2		PIF		
Brown-headed Cowbird				Yes	1	1	0				
Black Rosy-finch		SPN				1	0				
House Finch				Yes	3	2	0				
Virginia Opossum				Yes	1	2	0				Yes
Preble's Shrew			Yes			0	0				
Montane Shrew			Yes			0	0				Yes
Western Small-footed Myotis		SUS				5	3				

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Long-legged Myotis		SUS				4	2				
Fringed Myotis		SV				0	0				
Long-eared Myotis		SUS	Yes			0	0				
Silver-haired Bat		SUS				2	1				
Western Pipistrelle			Yes			4	3				
Big Brown Bat				Yes	1	6	2				
Townsend's Big-eared Bat		SC				1	0				
Pallid Bat		SV				5	2				
American Pika				Yes	1	1	0				
Pygmy Rabbit		SV				1	1				
Nuttall's (Mountain) Cottontail				Yes		4	2				
Snowshoe Hare				Yes	1	3	1				
White-tailed Jackrabbit		SUS				1	1				
White-tailed Antelope Squirrel		SUS				1	1				
Golden-mantled Ground Squirrel				Yes	2	4	1				
Eastern Gray Squirrel						1	0				
Red Squirrel				Yes	1	1	0				
Douglas' Squirrel						0	0				Yes
Northern Flying Squirrel						2	0				Yes
Northern Pocket Gopher				Yes	1	4	2				
American Beaver				Yes	4	3	1	Game Mammal			
Deer Mouse				Yes	3	10	4				Yes
Bushy-tailed Woodrat				Yes	1	8	2				
Montane Vole				Yes	1	3	1				
Sagebrush Vole				Yes		2	1				

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Common Porcupine				Yes		4	2				
Gray Wolf	LT	LE				0	0				Yes
Kit Fox		LT				2	1				
Black Bear				Yes	6	0	0	Game Mammal			Yes
Grizzly Bear				Yes		0	0				Yes
Raccoon				Yes	2	4	1	Game Mammal			Yes
American Marten		SV				2	0	Game Mammal			Yes
Fisher		SC				2	0	Game Mammal			Yes
Mink				Yes	1	3	1	Game Mammal			Yes
Wolverine		ST	Yes			1	0				Yes
Mountain Lion				Yes		0	0	Game Mammal			Yes
Lynx	LT		Yes			1	0				
Feral Horse				Yes		0	0				
Rocky Mountain Elk				Yes	2	0	0	Game Mammal			
Mule Deer						0	0	Game Mammal			
White-tailed Deer						0	0				
Moose				Yes		2	0				
Pronghorn Antelope						3	2	Game Mammal			

Common Name	Federal Status ¹	Oregon State Status ²	Functional Specialist	Critical Functional Link Species	# of KEFs	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species	Species Associated with Salmonids
Mountain Goat						1	0	Game Mammal			
Rocky Mountain Bighorn Sheep						1	0	Game Mammal			

¹ Federal Status: C = Candidate; LT = Listed Threatened; LE = Listed Endangered

² State Status OR: SV = Sensitive-Vulnerable; SC = Sensitive-Critical; SUS = Sensitive-Unclear Status; SPN = Sensitive-Peripheral or Naturally Rare; LE = Listed Endangered; LT = Listed Threatened

6.3 Appendix 3: Comprehensive Species Accounts

6.3.1 Black Rosy Finch

Black Rosy-Finch (*Leucosticte atrata*). Keith Paul, USFWS, La Grande Oregon.

Introduction

The black rosy-finch (BRF) is a dark, medium sized finch with gray and pink highlights that is the darkest of the rosy-finches and one of Oregon's rarest breeding birds. It is found in summer in montane areas above timberline, where loose swarms of these birds seem to blow like leaves among isolated cirques, cliffs, and hanging snowfields (Contreras 2003).

Black Rosy-Finch Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

During the breeding season, BRFs take what insects that they can find, often ones frozen and exposed by melting snow (Csuti et al. 1997). BRFs use mainly open ground and snowfields for feeding (French 1954, Johnson 1989b, Contreras). Some insects are caught in flight. Seeds and green parts of alpine plants are an important part of the diet, especially after the breeding season (Csuti et al. 1997). At Steens Mountain, they have been observed picking insects from the edges of snowfields and removing seeds from various plants (Contreras 2003).

Reproduction

For BRF's breeding at higher elevations, breeding can be postponed until June. A nest cup of moss or grass is placed on a rock ledge or concealed in a crevice. The usual clutch is 4 or 5 (range 2-6) eggs, which are incubated for two weeks by the female. The young are fed by the parents for about five weeks and remain with the family group until fall (Csuti et al. 1997). In addition to crops, rosy-finches possess special paired sacs beneath the floor of the mouth, found only in one other North American genus (*Pinicola*), which allow parents to carry extra food with each trip to the young (Johnson 2002).

The population at Steens Mountain in Oregon may not return to breeding grounds until later in spring or early summer if snow is persistent at the higher elevations. In some years Steens Mountain may receive snow until early June (Contreras 2003). Johnson (1989a) found a nest with young "on northeast facing cliffs at the head of Kiger Gorge" on Steens Mountain on August 2, 1982. Family groups (birds showing recent feathering attended by adults) have been observed as late as the first week of September on Steens Mountain (Alan Contreras, personal observation) (Contreras 2003).

Migration

Little information on migration patterns are known for BRFs. Birds at Steens Mountain in fall are thought to move downslope and then return to breeding grounds in the spring (Contreras 2003). In Utah, French (1954) found that BRFs often move a few hundred miles southward in fall in addition to coming downslope (Contreras 2003). During winter, this finch is driven down to high deserts, parks and valleys that are often thinly or periodically covered by snow, where they forage on patches of bare ground and at feeders and cattle troughs or along freshly plowed highways (Johnson 2002).

Mortality

No Data

Habitat Requirements

General

The black rosy-finch has one of the most barren and specialized breeding habitats in Oregon (Contreras 2003). They use bare rock outcroppings, cliffs, and talus for breeding and mainly open ground and snowfields for feeding (French 1954, Johnson 1989b, Contreras, cited in Contreras 2003). In winter, BRFs typically roost in large communal roosts in caves, mine shafts, on rafters of barns, and in clusters of old cliff swallow (*Petrochelidon pyrrhonota*) nests (Johnson 2002).

Distribution

The black rosy-finch breeds locally from c. Idaho and w. Montana and Wyoming south and west to e. Oregon, Nevada, and Utah. Winters within and south of the breeding range at lower elevations, to n. Arizona and New Mexico (Contreras 2003).

In Oregon, black rosy-finches typically breed on Steens Mountain (Scott 1966, cited in Contreras 2003). They may breed occasionally in the Wallowa Mountains (Gabrielson and Jewett 1940, Johnson 1975, Evanich 1992a, cited in Contreras 2003), but not proven and birds are not always found when sought. They are rarely found in central Wallowa County (Evanich 1990, cited in Contreras 2003).

Detection

In Oregon, the only reliable place to find black rosy-finches is along the edges of snowfields on the summit ridges of Steens Mountain, especially in late summer and early fall (Contreras 2003).

Population Status and Conservation

The black rosy-finch is considered a Sensitive Species by Oregon Department of Fish and Wildlife because of its very small, geographically isolated population. Its breeding habitat is unlikely to be affected by humans because of its inaccessibility. There is no data available that allows comparison of population size for Oregon (Contreras 2003), so no short- or long-term trends can be determined.

Threats

Previous studies have shown that adult BRFs were tolerant of visits by researchers, thus are probably undisturbed by recreational activity (hiking, rock climbing, early-summer skiing and snowboarding) (Johnson 2002).

BRFs are most vulnerable during the winter, when concentrated at feeders, roosts, and along highways. Urban expansion into foothills and mountain valleys could benefit populations by providing more feeding stations, but could also increase accidental mortality through window kills (Kingery 1986), electrocution on wires (Kingery 1988), collision with automobiles, and predation by domestic cats (*Felis catus*) (Johnson 2002).

References

- Contreras, A. L. 2003. Black Rosy-Finch. Pp. 594-596 in *Birds of Oregon: A General Reference*. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. *Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History*. Oregon State University Press. Corvallis, OR.
- Evanich, J. E., Jr. 1990. *The birder's guide to Oregon*. Portland Audubon Society, Portland, OR.
- Evanich, J. 1992. *Birds of Northeast Oregon: an annotated checklist for Union and Wallowa counties, second ed. (revised)*. Oregon Field Ornithologists Special Publication No. 6, Eugene.
- French, N. R. 1954. *Life history and behavior of the Black Rosy-Finch*. Ph.D. diss., University of Utah, Salt Lake City.
- Gabrielson, I. N., and S. G. Jewett. 1940. *Birds of Oregon*. Oregon State College, Corvallis. (Reprinted in 1970 as *Birds of the Pacific Northwest* by Dover Publishing, New York).
- Johnson, J. 1989. Field notes: western Oregon, winter 1988-89. *Oregon Birds* 15: 188-196.
- Johnson, R. E. 1975. New breeding localities of *Leucosticte* in the contiguous western United States. *Auk* 92: 586-589.

- Johnson, R. E. 2002. Black Rosy-Finch, (*Leucosticte atrata*). *In*: The Birds of North America, No. 678 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Kingery, H. E. 1986. The spring migration: mountain west region. *Am. Birds* 40: 502-506.
- Kingery, H. E. 1988. The winter season: mountain west region. *Am. Birds* 42: 299-302.
- Scott, O. 1966. Great Basin, central Rocky Mountain region. *Audubon Field Notes* 20: 589.

6.3.2 Blue Grouse

Blue Grouse (*Dendragapus obscurus*) Keith Paul, USFWS

Introduction

The blue grouse is found singly in mature pine or fir forests, generally in open woods or clearings. It is larger and more wary than the spruce grouse (*Falci pennis Canadensis*). The two populations of grouse integrate broadly where ranges meet.

The blue grouse is the largest of Oregon's three forest grouse. This grouse is known for its distinctive hooting call emitted by courting males in the spring and its extravagant courtship display. The hooting is created by air expelled from large yellow air sacs located on the sides of their throat (ODFW 2004).

Blue grouse can attain high population densities and are still distributed throughout most of their historic range. Occupation of relatively inaccessible montane forests during much of the year contributes to a healthy current status in most areas (Zwickel 1992).

Description, Life History, and Habitat Requirements

Description

The blue grouse is a heavy-bodied grouse with moderately long, rounded wings and a moderately long unspecialized tail (Zwickel 1992). In the Pacific range, the male averages darker overall, tail is slightly rounded or wedge-shaped, and tail feathers are round tipped with narrow, light gray tips. In display, Pacific range males show warty, bright yellow air sacs on their neck with a less extensive white-feathered border (Sibley 2000). Males are predominantly dull gray, while females are mottled brown (Pelren 2003).

Life History

Diet

During the summer, blue grouse eat the leaves and flowers of herbs, leaves, flowers, and berries of shrubs, conifer needles and invertebrates (Zwickel 1992, Csuti 1997, Pelren 2003). Arthropods compose virtually 100% of the diet of the precocial chicks, but the young birds also begin to eat vegetation in late summer and fall (Pelren 2003). In early fall in eastern Oregon, blue grouse diet increasingly include conifer seeds, western larch needles and the berries of deciduous shrubs (Pelren 2003). Mike Denny reported that huckleberries are a common food source July-September in the Blue Mountains (Pelren 2003). Crawford et al. (1986a) found early fall diets of blue grouse in northeastern Oregon were composed of over 50 plant and animal species, but primarily contained short-horned grasshoppers, prickly lettuce, yellow salsify, wild buckwheat, and snowberry (Pelren 2003). During the winter months blue grouse generally rely heavily on needles, seeds, and buds of conifers, including firs, pine, hemlock, and larch (Csuti 1997, Zwickel 1992, Pelren 2003). In eastern Oregon, needles from Douglas-fir and needles and buds from ponderosa pine composed the majority of the diet during the winter (Pelren 2003).

Reproduction

Blue grouse typically begin breeding in April, and young are fledged by September (Csuti et al. 1997). In eastern Oregon, male breeding behavior usually increases in March and peaks in April (Pelren 2003). Blue grouse are polygamous and will usually mate with several females. After copulation, females move to isolated locations to nest (Pelren 2003). The average number of eggs per clutch in northeast Oregon was 7.7, which represents the largest mean clutch size for any blue grouse population for which such data exists (Pelren and Crawford 1999). Egg laying occurs at the approximate rate of one egg every 1.5 days and when all eggs have been laid incubation begins and hatching occurs

approximately 26 days later (Zwicker 1992). Hatch dates in northeast Oregon range from May 1 to July 8 (Crawford et al. 1986b), while mean hatch date was May 31 (Pelren and Crawford 1999). Chicks are precocial and gain rudimentary flight in approximately two weeks (Pelren 2003).

Females choose the nest site and the nest is almost always outside male territories (Zwicker 1992), perhaps to avoid repeated courtship advances. Nests are rarely within about 164 ft (50 m) of one another, suggesting spacing (Zwicker 1992). The nest is a scrape filled with grass and leaves, built in cover at the forest edge, and usually near water (Csuti et al. 1997). Pelren and Crawford (1999) observed the greatest nesting success among nests beneath logs (Pelren 2003).

Breeding Territory/Home Range

As cited in Zwicker (1992) in spring/summer, average size and range in size of territories of adult males: southeast Alberta averaged 1.48 ac (0.6 ha) (Boag 1966); Montana averaged 1.98 ac (0.8 ha) (Martinka 1972); Colorado averaged 3.71 ac (1.5 ha) (Hoffman 1981); and coastal British Columbia averaged 5.19 ac (2.1 ha) (McNicholl 1978). Female home range size varies widely and seasonally among females (Bendell and Elliot 1967, Zwicker 1992).

Survivorship

The first year survival of blue grouse is low (Zwicker 1992). As few as 10% of the previous year's hatchlings are recruited; the highest rate of mortality is in the first two weeks of life (Zwicker and Bendell 1967). Maximum known longevity for adult male BG is ≥ 14 years, and for females ≥ 11 years (Zwicker et al. 1989).

Mortality

Most nest failures result from predation (Zwicker et al. 1988). Nest predation is carried out by both mammals and birds. Known adult predators include northern goshawk (*Accipiter gentiles*), red-tailed hawk (*Buteo jamaicensis*), prairie falcon (*Falco mexicanus*), great-horned owl (*Bubo virginianus*), and Canada lynx (*Lynx Canadensis*). Other birds and mammals are likely predators also.

Habitat Requirements

Breeding/Foraging

Blue grouse may occur in shrub/steppe and grassland communities out to 1.2+ mi (2+ km) from the forest edge; in or along edge of virtually all montane forest communities with relatively open tree canopies; and in alpine/subalpine ecotones (Zwicker 1992). They also use regenerating clearcuts and riparian habitats with dense deciduous cover (Pelren 2003). From south to north, they may occupy some of the hottest and most xeric to some of the coldest (but dry) montane habitats in North America (Zwicker 1992).

Nesting habitat ranges from nearly bare ground with no overhead cover to dense vegetation beneath full forest canopies (Zwicker 1992, Pelren and Crawford 1999, Pelren 2003). Individuals in northeast Oregon were found predominantly on the ground during summer (Popper et al 1996, Pelren 2003).

Migration

The distance between winter and spring range varies from none to several miles (kilometers) (Pelren 2003). While most upland game birds migrate down from higher elevations in the winter, blue grouse actually migrate up in elevation in the winter (ODFW 2004). An adult female in the Wallowa Mountains moved 7.5 mi (12 km) between winter and spring range (Pelren 1996, 2003). Elevational movements between winter and spring range have been documented in numerous studies (Zwicker 1992), and likely occur in response to spatially separated spring and winter habitats in some areas (Pelren 2003).

Wintering/Foraging

Winter range includes conifer forests from sea level to subalpine elevations (Pelren 2003). In eastern Oregon this species occurs principally in association with forests dominated by ponderosa pines (Pelren 1996, 2003). Commonly uses subalpine fir and witches brooms in dwarf-mistletoe-infested Douglas-firs for thermal protection while roosting in winter (Pelren 1996, 2003). Individuals may remain in the same tree continuously for several weeks. Both sexes and age groups in northeast Oregon selected open park-like stands of mature ponderosa pine and Douglas-fir rather than more heavily forested stands (Pelren 1996, 2003). Blue grouse occasionally roost beneath the surface of snow in winter; this aids in Thermoregulation and/or predator-avoidance, and likely occurs in Oregon where snow depths are adequate (Pelren 2003).

Population and Distribution

Distribution

The blue grouse is a local short-distance migrant throughout the coniferous forests of the North American Cordillera (Zwickel 1992, Pelren 2003). Blue grouse are residents of the southeastern corner of the Northwest Territories, south Yukon, British Columbia, western Alberta, and the islands of Alaska’s southeastern panhandle. The range extends south through the Coast Range, Cascades, and Olympic Mountains in Washington, the contiguous mountains of western and northeastern Oregon, and the Sierra Nevada mountains of Idaho, Montana, Wyoming, Utah, and Colorado, with fragmented populations in Arizona and New Mexico (Pelren 2003).

In Oregon, *Dendragapus obscurus fuliginosus* is a fairly common resident in coniferous forests from the Cascade crest to the coast, with broad areas of absence around low-elevation urban and unforested valley areas (Pelren 2003). *D. o. sierrae* is limited primarily to the east slope of the Cascades (Pelren 2003). *D. o. pallidus* occupies coniferous forests of the Blue and Wallowa Mountains (Johnsgard 1983b, Pelren 2003).

Population

Historic

Blue grouse still occupy most of their original range, though historical accounts suggest densities in some areas were greater than now (Zwickel 2003). There is has been a decrease in suitable habitat due to agricultural conversion.

Population

Historic

There is no historic population data for blue grouse.

Current Population and Status

According to Zwickel (1992), densities of adult male blue grouse in eastern Oregon and other interior populations have ranged from 5-50/mi² (2-19/km²). Oregon Department of Fish and Wildlife (ODFW) has been performing telemetry studies since the 1980’s to better understand blue grouse populations and habitat needs (Pelren 2003). In eastern Oregon, harvest data from the late 1970’s to the mid-1990’s, indicate that the approximate number of hunters declined from 10,000 to 5,000, while the number of blue grouse harvested declined from 25,000 to under 15,000 (Pelren 2003). Oregon upland game bird harvest data (1993-2002) is shown below (Table 1). Despite intensive study of blue grouse over the last 40 years, ability to predict population levels and trends remain poor (Zwickel 1992).

Table 1. Source - ODFW Upland Game Bird Harvest 1993-2002.

Year	Blue Grouse	Year	Blue Grouse
1993	15,734	1998	28,664
1994	20,380	1999	38,405
1995 ¹	22,895	2000	31,775

1996	33,120	2001	42,429
1997 ¹	33,382	2002	42,301

¹ Concern for integrity of data collected in 1997. 1995 survey conducted by OSU.

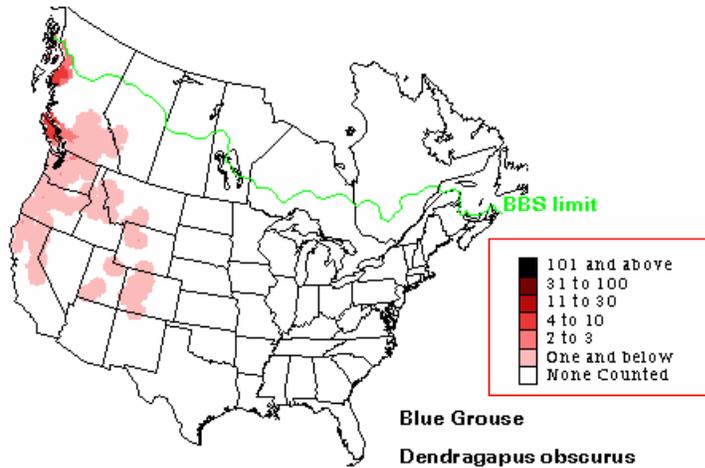


Figure 1. Blue Grouse breeding distribution from BBS data (1982-1996) (Sauer et al. 2001)

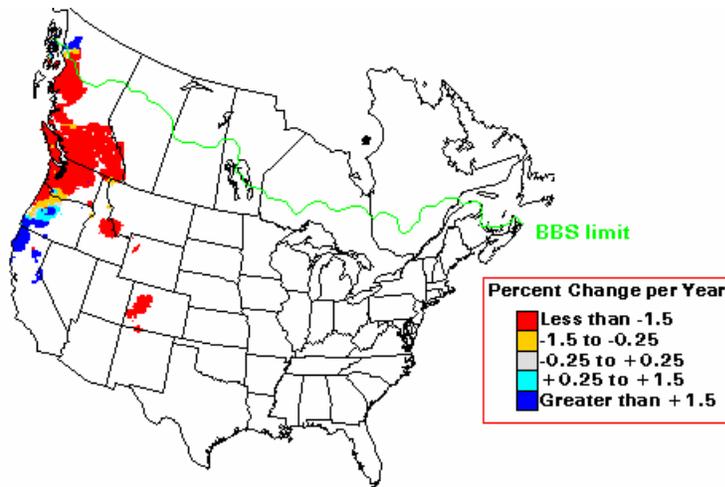


Figure 2. Blue Grouse trend from BBS data (1966-1996) (Sauer et al. 1996)

Factors Affecting Population Status

Local extirpations have occurred in areas taken over by agriculture and cities. Rugged mountainous habitat has helped to protect blue grouse, so the long-term outlook for many populations is good. However, logging, grazing of domestic livestock and urbanization remain threats (Zwickel 1992).

References

Bendell, J. F. and P. W. Elliott. 1967. Behavior and the regulation of numbers in Blue Grouse. Canadian Wildlife Service Report Series, No. 4.
 Boag, D. A. 1996. Population attributes of Blue Grouse in southwestern Alberta. Canadian Journal of Zoology 44: 799-814.
 Crawford, J. A., W. V. Van Dyke, S. M. Meyers, and T. F. Haensley. 1986a. Fall diet of Blue Grouse in Oregon. Great Basin Nat. 46: 745-748.

- Crawford, J. A., W. V. Van Dyke, V. Coggins, and M. St. Louis. 1986b. Hatching chronology of Blue Grouse in northeastern Oregon. *Great Basin Nat.* 46:745-748.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. *Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History*. Oregon State University Press. Corvallis, OR.
- Hoffman, R. W. 1981. Population dynamics and habitat relationships of Blue Grouse. Federal Aid in Wildlife Restoration Report W-37-R-34, Colorado Division of Wildlife.
- Martinka, R. R. 1972. Structural characteristics of Blue Grouse territories in southwestern Montana. *Journal of Wildlife Management* 36: 498-510.
- McNicholl, M. K. 1978. Behavior and social organization in a population of Blue Grouse on Vancouver Island. Ph.D. thesis, University of Alberta., Edmonton.
- Oregon Department of Fish and Wildlife. 2002. Oregon Upland Game Bird Harvest 1993-2002. Website: http://www.dfw.state.or.us/ODFWhtml/InfoCntrWild/upland_harvest_summary_1993_2002.pdf. Accessed 4/23/04.
- Oregon Department of Fish and Wildlife (ODFW). 2004. Oregon Department of Fish and Wildlife online website -http://www.dfw.state.or.us/south_willamette/upland_alt.html#Blue. Accessed 3-16-04.
- Pelren, E. C. 1996. Blue Grouse winter ecology in northeastern Oregon. Ph.D. dissertation, Oregon State University, Corvallis.
- Pelren, E. C. 2003. Blue Grouse. Pp. 181-183 *in* *Birds of Oregon: A General Reference*. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Pelren, E. C. and J. A. Crawford. 1999. Blue Grouse nesting parameters and habitat associations in northeastern Oregon. *Great Basin Nat.* 59: 368-373.
- Popper, K. J., E. C. Pelren, and J. A. Crawford. 1996. Summer of nocturnal roost sites of Blue Grouse in Oregon. *Great Basin Nat.* 56: 177-179.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1*, USGS Patuxent Wildlife Research Center, Laurel, MD. <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>
- Sibley, D. A. 2000. *National Audubon Society: The Sibley Guide to Birds*. Chanticleer Press, Inc., New York.
- Zwicker, F. C. 1992. Blue Grouse (*Dendragapus obscurus*). *In* *The Birds of North America*, No. 15 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Zwicker, F. C., D. A. Boag, and J. F. Bendell. 1989. Longevity in Blue Grouse. *North American Bird Bander* 14: 1-4.
- Zwicker, F. C., R. A. Lewis, and D. T. McKinnon. 1988. Nesting parameters in a high density, declining population of Blue Grouse. *Canadian Journal of Zoology* 66: 1736-1741.

6.3.3 Columbia Spotted Frog

Columbia Spotted Frog (*Rana luteiventris*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

The Columbia spotted frog (CSF) is olive green to brown in color, with irregular black spots. They may have white, yellow, or salmon coloration on the underside of the belly and legs (Engle 2004). The hind legs are relatively short relative to body length and there is extensive webbing between the toes on the hind feet. The eyes are upturned (Amphibia Web 2004). Tadpoles are black when small, changing to a dark then light brown as they increase in size. CSFs are about one inch in body length at metamorphosis (Engle 2004). Females may grow to approximately 100 mm (4 inches) snout-to-vent length, while males may reach approximately 75 mm (3 inches) snout-vent length (Nussbaum et al. 1983; Stebbins 1985; Leonard et al. 1993).

Columbia Spotted Frog Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

The CSF eats a variety of food including arthropods (e.g., spiders, insects), earthworms and other invertebrate prey (Whitaker et al. 1982). Adult CSFs are opportunistic feeders and feed primarily on invertebrates (Nussbaum et al. 1983). Larval frogs feed on aquatic algae and vascular plants, and scavenged plant and animal materials (Morris and Tanner 1969).

In a study by Whitaker et al. (1982) in Grant County, OR (Blue Mountains) CSFs ate a wide variety of food items covering 98 food categories. Seventy-three categories consisted of insect materials, which represented 90.7% of the food by volume. Other invertebrates formed seven categories, and plant material formed three categories, representing 3.9% of the total volume. Frogs from the four variously managed sites displayed different dietary habits, indicating that land management practices may have caused changes in the abundance or composition of local insect populations.

Reproduction

The timing of breeding varies widely across the species range owing to differences in weather and climate, but the first visible activity begins in late winter or spring shortly after areas of ice-free water appear at breeding sites (Licht 1975; Turner 1958; Leonard et al 1996). Breeding typically occurs in late March or April, but at higher elevations, breeding may not occur until late May or early June (Amphibia Web 2004). Great Basin population CSFs emerge from wintering sites soon after breeding sites thaw (Engle 2001).

Adults exhibit a strong fidelity to breeding sites, with oviposition typically occurring in the same areas in successive years. Males arrive first, congregating around breeding sites, periodically vocalizing “advertisement calls” in a rapid series of 3-12 “tapping” notes that have little carrying power (Davidson 1995; Leonard et al. 1996). As a female enters the breeding area, she is approached by and subsequently pairs with a male in a nuptial embrace referred to as amplexus. From several hours to possibly days later, the female releases her complement of eggs into the water while the male, still clinging to the female, releases sperm upon the ova (Amphibia Web 2004). Breeding is explosive (as opposed to season-long), occurring only in the

first few weeks following emergence (USFWS 2002a). After breeding is completed, adults often disperse into adjacent wetland, riverine and lacustrine habitats (Amphibia Web 2004).

CSF's have a strong tendency to lay their eggs communally and it is not uncommon to find 25 or more egg masses piled atop one another in the shallows (Amphibia Web 2004). Softball-sized egg masses are usually found in groups, typically along northeast edges of slack water amongst emergent vegetation (USFWS 2002a). After a few weeks thousands of small tadpoles emerge and cling to the remains of the gelatinous egg masses. Newly-hatched larvae remain clustered for several days before moving throughout their natal site (USFWS 2002a). In the Columbia Basin tadpoles may grow to 100 mm (4 in) total length prior to metamorphosing into froglets in their first summer or fall. At high-elevation montane sites, however, tadpoles barely reach 45 mm (1.77 in) in total length prior to the onset of metamorphosis in late fall (Amphibia Web 2004). As young-of-the-year transform, many leave their natal sites and can be found in nearby riparian corridors (USFWS 2002a).

Females may lay only one egg mass per year; yearly fluctuations in the sizes of egg masses are extreme (Utah Division of Wildlife Resources 1998). Successful egg production and the viability and metamorphosis of CSF's are susceptible to habitat variables such as temperature, depth, and pH of water, cover, and the presence/absence of predators (e.g., fishes and bullfrogs) (Morris and Tanner 1969; Munger et al. 1996; Reaser 1996).

Migration

David Pilliod observed movements of approximately 2,000 m (6,562 ft) linear distance within a basin in montane habitats (Reaser and Pilliod, in press). Pilliod et al. 1996 (in Koch et al. 1997) reported that individual high mountain lake populations of *R. luteiventris* in Idaho are actually interdependent and are part of a larger contiguous metapopulation that includes all the lakes in the basin. In Nevada, Reaser (1996; in Koch et al. 1997) determined that one individual of *R. luteiventris* traveled over 5 km (3.11 mi) in a year (NatureServe 2003).

In a three-year study of *R. luteiventris* movement within the Owyhee Mountain subpopulation of the Great Basin population in southwestern Idaho, Engle (2000) PIT-tagged over 1800 individuals but documented only five (of 468) recaptures over 1,000 m (3,281 ft) from their original capture point. All recaptures were along riparian corridors and the longest distance between capture points was 1,765 m (5,791). Although gender differences were observed, 88 percent of all movement documented was less than 300 m (984 ft) from the original capture point (NatureServe 2003).

Though movements exceeding 1 km (0.62 mi) and up to 5 km (3.11 mi) have been recorded, these frogs generally stay in wetlands and along streams within 0.6 km (0.37 mi) of their breeding pond (Turner 1960, Hollenbeck 1974, Bull and Hayes 2001). Frogs in isolated ponds may not leave those sites (Bull and Hayes 2001) (NatureServe 2003).

In the Toiyabe Range in Nevada, Reaser (2000) captured 887 individuals over three years, with average mid-season density ranging from 2 to 24 frogs per 150 m (492 ft) of habitat (NatureServe 2003).

Mortality

Based on recapture rates in the Owyhee Mountains, some individuals live for at least five years. Skeletochronological analysis in 1998 revealed a 9-year old female (Engle and Munger 2000).

Mortality of eggs, tadpoles, and newly metamorphosed frogs is high, with approximately 5% surviving the first winter (David Pilliod, personal communication, cited in Amphibia Web 2004).

Habitat Requirements

General

This species is relatively aquatic and is rarely found far from water. It occupies a variety of still water habitats and can also be found in streams and creeks (Hallock and McAllister 2002). CSF's are found closely associated with clear, slow-moving or ponded surface waters, with little shade (Reaser 1997). CSF's are found in aquatic sites with a variety of vegetation types, from grasslands to forests (Csuti 1997). A deep silt or muck substrate may be required for hibernation and torpor (Morris and Tanner 1969). In colder portions of their range, CSF's will use areas where water does not freeze, such as spring heads and undercut streambanks with overhanging vegetation (IDFG et al. 1995). CSF's may disperse into forest, grassland, and brushland during wet weather (NatureServe 2003). They will use stream-side small mammal burrows as shelter. Overwintering sites in the Great Basin include undercut banks and spring heads (Blomquist and Tull 2002).

Breeding

Reproducing populations have been found in habitats characterized by springs, floating vegetation, and larger bodies of pooled water (e.g., oxbows, lakes, stock ponds, beaver-created ponds, seeps in wet meadows, backwaters) (IDFG et al. 1995; Reaser 1997). Breeding habitat is the temporarily flooded margins of wetlands, ponds, and lakes (Hallock and McAllister 2002). Breeding habitats include a variety of relatively exposed, shallow-water (<60 cm), emergent wetlands such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species such as grasses, sedges (*Cares* spp.) and rushes (*Juncus* spp.) (Amphibia Web 2004).

Columbia Spotted Frog Population and Distribution

Distribution

Populations of the CSF are found from Alaska and British Columbia to Washington east of the Cascades, eastern Oregon, Idaho, the Bighorn Mountains of Wyoming, the Mary's, Reese, and Owyhee River systems of Nevada, the Wasatch Mountains, and the western desert of Utah (Green et al. 1997). Genetic evidence (Green et al. 1996) indicates that Columbia spotted frogs may be a single species with three subspecies, or may be several weakly-differentiated species.

The FWS recognizes four distinct population segments (DPS) based on disjunct distribution: the Wasatch Front DPS (Utah), West Desert DPS (White Pine County, NV and Toole County Utah), Great Basin DPS (southeast Oregon, southwest Idaho, and northcentral/northeast Nevada), and the Northern DPS (includes northeastern Oregon, eastern Washington, central and northern parts of Idaho, western Montana, northwestern Wyoming, British Columbia and Alaska) (C. Mellison, J. Engle, pers. comm., 2004).

There is still some uncertainty about whether the northeast Oregon frogs and the southeastern Washington frogs are part of the Great Basin or Northern population. This group of frogs (Blue and Wallowa Mountains) is isolated from the Great Basin population based on geography. Their habitat in the Blue and Wallowa Mountains is more like that of the Northern

population (montane) than the Great Basin (high desert). Until more genetic work is completed, this account will refer to the Blue and Wallowa Mountain populations as part of the Northern DPS.

Two populations of CSFs are found within the Columbia River Basin: Northern DPS and Great Basin DPS. The Great Basin DPS is further divided into five subpopulations: southeastern Oregon, Owyhee, Jarbidge-Independence, Ruby Mountains, and Toiyabe (J. Engle, C. Mellison, pers. comm., 2004). Of the five subpopulations, only the eastern Oregon, Owyhee, and the Jarbidge-Independence occur in the Columbia River subbasin.

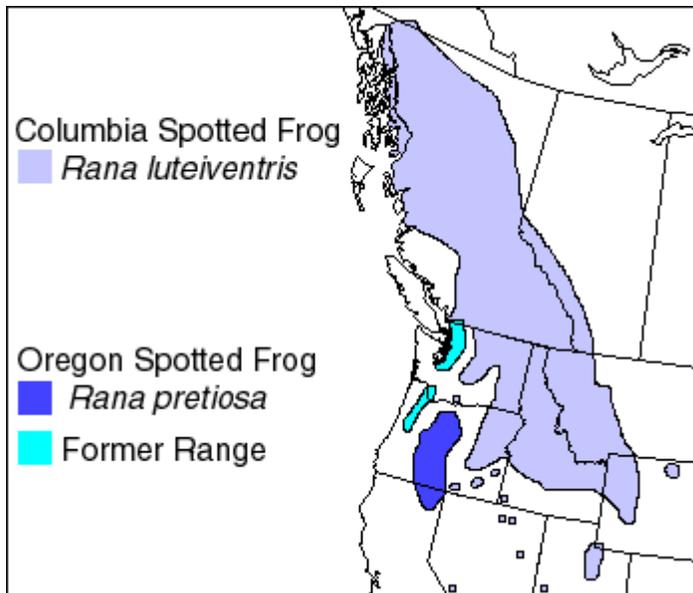
Historic

The historic range of the spotted frog includes Alaska, California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming, and Alberta and British Columbia, Canada (Turner and Dumas 1972, Nussbaum et al. 1983, Hovingh 1986).

In Alaska, the historic distribution was restricted to southeast Alaska (Hodge 1976). Historic distributions in California include the Warner Mountains in Modoc County and a few locations in Lassen and Siskiyou County (Storer 1925). In Idaho, the historic range primarily occurred in the northern and central part of the state, where it is still considered common (Dumas 1964, 1966; Nussbaum et al. 1983), with scattered populations in the southwestern portion of the state. In Montana, the historical distribution occurred in the intermountain region of western Montana and extended east to the Rocky Mountain Front (Black 1969). The historical distribution in Nevada consisted of the north-central region of the state. In Oregon, spotted frogs were reported to have occurred throughout much of the state (Dumas 1966, Shay 1973, Marshall 1992). In Utah between 1930 and 1977, spotted frogs were recorded from 25 locations in Sanpete, Juab, Utah, Salt Lake, Wasatch, and Summit Counties and various locations along the western Utah/Nevada border (Utah Department of Natural Resources 1991). In Washington, spotted frogs were historically abundant throughout western Washington, including the Cascades and portions of eastern Washington. In Wyoming, the historical range included the northwest part of the state. In Canada, the spotted frog was historically found throughout British Columbia and the western edge of Alberta (USFWS 1992).

Historic range of the Northern population is most likely similar to that of the current range. Moving south into the southern populations (Great Basin, Wasatch Front, and West Desert) the range was most likely larger in size. Due to habitat loss and alteration, fragmentation, water diversion, dams, and loss of beaver the current distribution and abundance of CSF and suitable habitat has dramatically decreased.

Current



USGS, Northern Prairie Wildlife Research Center; range acquired from Green et al. 1997.

Wasatch Front DPS

Spotted frog populations in Utah represent the southern extent of the species range (Stebbins 1985). The Wasatch Front population occurs in isolated springs or riparian wetlands in Juab, Sanpete, Summit, Utah, and Wasatch counties in Utah. These counties are located within the Bonneville Basin of Utah. The Bonneville Basin encompasses the area that was covered by ancient Lake Bonneville and which, today, lies within the Great Basin province. The largest known concentration is currently in the Heber Valley; the remaining six locations are Jordanelle/Francis, Springville Hatchery, Holladay Springs, Mona Springs Complex/Burraston Ponds, Fairview, and Vernon (USFWS 2002b).

West Desert DPS

The West Desert spotted frog population occurs mainly in four large spring complexes. One new population, Vernon, was recently discovered in the eastern-most portion of the West Desert geographic management unit (GMU). CSFs in the West Desert DPS can be found along the eastern border of White Pine County, NV and Toole County, Utah. Populations have been extirpated from the northern portions of the West Desert range (USFWS 2002b).

Northern DPS

The Northern DPS includes northeastern Oregon, eastern Washington, central and northern parts of Idaho, western Montana, northwestern Wyoming, British Columbia and Alaska (J. Engle, C. Mellison, pers. comm., 2004). Populations within the Blue and Wallowa Mountains are found within this DPS.

Great Basin DPS

Nevada

The Great Basin population of Columbia spotted frogs in Nevada is geographically separated into three distinct subpopulations; the Jarbidge-Independence Range, Ruby Mountains, and Toiyabe Mountains subpopulations (USFWS 2002c).

The largest of Nevada's three subpopulation areas is the Jarbidge-Independence Range in Elko and Eureka counties. This subpopulation area is formed by the headwaters of streams in two major hydrographic basins. The South Fork Owyhee, Owyhee, Bruneau, and Salmon Falls drainages flow north into the Snake River basin. Mary's River, North Fork of the Humboldt, and Maggie Creek drain into the interior Humboldt River basin. The Jarbidge-Independence Range subpopulation is considered to be genetically and geographically most closely associated with Columbia spotted frogs in southern Idaho (Reaser 1997)(USFWS 2002c).

Columbia spotted frogs occur in the Ruby Mountains in the areas of Green Mountain, Smith, and Rattlesnake creeks on lands in Elko County managed by the U.S. Forest Service (Forest Service). Although geographically, Ruby Mountains spotted frogs are close to the Jarbidge-Independence Range subpopulation, preliminary allozyme evidence suggests they are genotypically different (J. Reaser, pers. comm., 1998). The Ruby Mountains subpopulation is considered discrete because of this difference (J. Reaser, pers. comm., 1998) and because it is geographically isolated from the Jarbidge-Independence Range subpopulation area to the north by an undetermined barrier (e.g., lack of suitable habitat, connectivity, and/or predators), and from the Toiyabe Mountains subpopulation area to the southwest by a large gap in suitable Humboldt River drainage habitat (USFWS 2002c).

In the Toiyabe Range, spotted frogs are found in seven drainages in Nye County, Nevada; the Reese River (Upper and Lower), Cow and Ledbetter Canyons, and Cloverdale, Stewart, Illinois, and Indian Valley Creeks. Although historically they also occurred in Lander County, preliminary surveys have found them absent from this area (J. Tull, Forest Service, pers. comm., 1998). Toiyabe Range spotted frogs are geographically isolated from the Ruby Mountains and Jarbidge-Independence Range subpopulations by a large gap in suitable habitat and they represent *R. luteiventris* in the southern-most extremity of its range. Genetic analyses of Great Basin Columbia spotted frogs from the Toiyabe Range suggest that these frogs are distinctive in comparison to frogs from the Ruby Mountains and Jarbidge-Independence Range subpopulation areas (Green et al. 1996, 1997; J. Reaser, pers. comm., 1998). Genetic (mtDNA) differences between the Toiyabe Range frogs and the Ruby Mountains frogs are less than those between the Toiyabe Range frogs and the Jarbidge-Independence Range frogs, but this may be because of similar temporal and spatial isolation (J. Reaser, pers. comm., 1998) (USFWS 2002c).

Idaho and Oregon

Surveys conducted in the Raft River and Goose Creek drainages in Idaho failed to relocate spotted frogs (Reaser 1997; Shipman and Anderson 1997; Turner 1962). In 1994 and 1995, the Bureau of Land Management (BLM) conducted surveys in the Jarbidge and Snake River Resource Areas in Twin Falls County, Idaho. These efforts were also unsuccessful in locating spotted frogs (McDonald 1996). Only six historical sites were known in the Owyhee Mountain range in Idaho, and only 11 sites were known in southeastern Oregon in Malheur County prior to 1995 (Munger et al. 1996) (USFWS 2002c).

Currently, Columbia spotted frogs appear to be widely distributed throughout southwestern Idaho (mainly in Owyhee County) and eastern Oregon, but local populations within this general area appear to be isolated from each other by either natural or human induced habitat disruptions. The largest local population of spotted frogs in Idaho occurs in Owyhee

County in the Rock Creek drainage. The largest local population of spotted frogs in Oregon occurs in Malheur County in the Dry Creek Drainage (USFWS 2002c).

Columbia Spotted Frog Population, Status, and Abundance Trends

Nevada

Declines of Columbia spotted frog populations in Nevada have been recorded since 1962 when it was observed that in many Elko County localities where spotted frogs were once numerous, the species was nearly extirpated (Turner 1962). Extensive loss of habitat was found to have occurred from conversion of wetland habitats to irrigated pasture and spring and stream dewatering by mining and irrigation practices. In addition, there was evidence of extensive impacts on riparian habitats due to intensive livestock grazing. Recent work by researchers in Nevada have documented the loss of historically known sites, reduced numbers of individuals within local populations, and declines in the reproduction of those individuals (Hovingh 1990; Reaser 1996a, 1996b, 1997). Surveys in Nevada between 1994 and 1996 indicated that 54 percent of surveyed sites known to have frogs before 1993 no longer supported individuals (Reaser 1997) (USFWS 2002c).

Little historical or recent data are available for the largest subpopulation area in Nevada, the Jarbidge-Independence Range. Presence/absence surveys have been conducted by Stanford University researchers and the Forest Service, but dependable information on numbers of breeding adults and trends is unavailable. Between 1993 and 1998, 976 sites were surveyed for the presence of spotted frogs in northeastern Nevada, including the Ruby Mountains subpopulation area (Shipman and Anderson 1997; Reaser 2000). Of these, 746 sites (76 percent) that were believed to have characteristics suitable for frogs were unoccupied. For these particular sites there is no information on historical presence of spotted frogs. Of 212 sites that were known to support frogs before 1992, 107 (50 percent) sites no longer had frogs, while 105 sites did support frogs. At the occupied sites, surveyors observed more than 10 adults at only 13 sites (12 percent). Frogs in this area appear widely distributed (Reaser 1997). No monitoring or surveying has taken place in northeastern Nevada since 1998. The Forest Service is planning on surveying the area during the summer of 2002 (USFWS 2002c).

Between 1993 and 1998, 339 sites were surveyed for the presence of Columbia spotted frogs in the Toiyabe Range. Surveyors visited 118 sites (35 percent) with suitable habitat characteristics where no frogs were present. Ten historical frog sites no longer had frogs when surveyed by Reaser between 1993 and 1996 (Reaser 1997). However, at 211 other historical sites, frogs were still present during this survey period. Of these 211 sites, surveyors reported greater than 10 adult frogs at 133 sites (63 percent) (Reaser 1997). In 2000, frog mark-recapture surveys of the Toiyabe Range subpopulation was conducted by the University of Nevada, Reno. Preliminary estimates of frog numbers in the Indian Valley Creek drainage were around 5,000 breeding individuals, which is greater than previously believed (K. Hatch, pers. comm., 2001). However, during the 2000-2001 winter, Hatch (2002) noted a large population decrease, ranging between 66 and 86.5 percent at several sites. Research is currently being conducted to help understand this apparent winterkill. Lack of standardized or extensive monitoring and routine surveying has prevented dependable determinations of frog population numbers or trends in Nevada (USFWS 2002c).

Idaho and Oregon

Extensive surveys since 1996 throughout southern Idaho and eastern Oregon, have led to increases in the number of known spotted frog sites. Although efforts to survey for spotted frogs have increased the available information regarding known species locations, most of these data suggest the sites support small numbers of frogs. Of the 49 known local populations in southern Idaho, 61 percent had 10 or fewer adult frogs and 37 percent had 100 or fewer adult frogs (Engle 2000; Idaho Conservation Data Center (IDCDC) 2000). The largest known local population of spotted frogs occurs in the Rock Creek drainage of Owyhee County and supports under 250 adult frogs (Engle 2000). Extensive monitoring at 10 of the 46 occupied sites since 1997 indicates a general decline in the number of adult spotted frogs encountered (Engle 2000; Engle and Munger 2000; Engle 2002). All known local populations in southern Idaho appear to be functionally isolated (Engle 2000; Engle and Munger 2000) (USFWS 2002c).

Of the 16 sites that are known to support Columbia spotted frogs in eastern Oregon, 81 percent of these sites appear to support fewer than 10 adult spotted frogs. In southeastern Oregon, surveys conducted in 1997 found a single population of spotted frogs in the Dry Creek drainage of Malheur County. Population estimates for this site are under 300 adult frogs (Munger et al. 1996). Monitoring (since 1998) of spotted frogs in northeastern Oregon in Wallowa County indicates relatively stable, small local populations (less than five adults encountered) (Pearl 2000). All of the known local populations of spotted frogs in eastern Oregon appear to be functionally isolated (USFWS 2002c).

Legal Status

In 1989, the U.S. Fish and Wildlife Service (USFWS) was petitioned to list the spotted frog (referred to as *Rana pretiosa*) under ESA (Federal Register 54[1989]:42529). The USFWS ruled on April 23, 1993, that the listing of the spotted frog was warranted and designated it a candidate for listing with a priority 3 for the Great Basin population, but was precluded from listing due to higher priority species (Federal Register 58[87]:27260). The major impetus behind the petition was the reduction in distribution apparently associated with impacts from water developments and the introduction of nonnative species.

On September 19, 1997 (Federal Register 62[182]:49401), the USFWS downgraded the priority status for the Great Basin population of Columbia spotted frogs to a priority 9, thus relieving the pressure to list the population while efforts to develop and implement specific conservation measures were ongoing. As of January 8, 2001 (Federal Register 66[5]:1295-1300), however, the priority ranking has been raised back to a priority 3 due to increased threats to the species. This includes the Great Basin DPS Columbia spotted frog populations

Factors Affecting Columbia Spotted Frog Population Status Key Factors Inhibiting Populations and Ecological Processes

The present or threatened destruction, modification, or curtailment of its habitat or range

Spotted frog habitat degradation and fragmentation is probably a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development, urbanization, and mining activities. These activities eliminate vegetation necessary to protect frogs from predators and UV-B radiation; reduce soil moisture; create undesirable changes in water temperature, chemistry and water availability; and can cause restructuring of habitat zones through trampling, rechanneling, or degradation which in turn can negatively affect the available invertebrate food source (IDFG et al. 1995; Munger et al. 1997; Reaser 1997; Engle and Munger

2000; Engle 2002). Spotted frog habitat occurs in the same areas where these activities are likely to take place or where these activities occurred in the past and resulting habitat degradation has not improved over time. Natural fluctuations in environmental conditions tend to magnify the detrimental effects of these activities, just as the activities may also magnify the detrimental effects of natural environmental events (USFWS 2002c).

Springs provide a stable, permanent source of water for frog breeding, feeding, and winter refugia (IDFG et al. 1995). Springs provide deep, protected areas which serve as hibernacula for spotted frogs in cold climates. Springs also provide protection from predation through underground openings (IDFG et al. 1995; Patla and Peterson 1996). Most spring developments result in the installation of a pipe or box to fully capture the water source and direct water to another location such as a livestock watering trough. Loss of this permanent source of water in desert ecosystems can also lead to the loss of associated riparian habitats and wetlands used by spotted frogs. Developed spring pools could be functioning as attractive nuisances for frogs, concentrating them into isolated groups, increasing the risk of disease and predation (Engle 2001). Many of the springs in southern Idaho, eastern Oregon, and Nevada have been developed (USFWS 2002c).

The reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994). Beaver trapping is still common in Idaho and harvest is unregulated in most areas (IDFG et al. 1995). In some areas, beavers are removed because of a perceived threat to water for agriculture or horticultural plantings. As indicated above, permanent ponded waters are important in maintaining spotted frog habitats during severe drought or winter periods. Removal of a beaver dam in Stoneman Creek in Idaho is believed to be directly related to the decline of a spotted frog subpopulation there. Intensive surveying of the historical site where frogs were known to have occurred has documented only one adult spotted frog (Engle 2000) (USFWS 2002c).

Fragmentation of habitat may be one of the most significant barriers to spotted frog recovery and population persistence. Recent studies in Idaho indicate that spotted frogs exhibit breeding site fidelity (Patla and Peterson 1996; Engle 2000; Munger and Engle 2000; J. Engle, IDFG, pers. comm., 2001). Movement of frogs from hibernation ponds to breeding ponds may be impeded by zones of unsuitable habitat. As movement corridors become more fragmented due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000; Engle 2001). Vegetation and surface water along movement corridors provide relief from high temperatures and arid environmental conditions, as well as protection from predators. Loss of vegetation and/or lowering of the water table as a result of the above mentioned activities can pose a significant threat to frogs moving from one area to another. Likewise, fragmentation and loss of habitat can prevent frogs from colonizing suitable sites elsewhere (USFWS 2002c).

Though direct correlation between spotted frog declines and livestock grazing has not been studied, the effects of heavy grazing on riparian areas are well documented (Kauffman et al. 1982; Kauffman and Kreuger 1984; Skovlin 1984; Kauffman et al. 1985; Schulz and Leininger 1990). Heavy grazing in riparian areas on state and private lands is a chronic problem throughout the Great Basin. Efforts to protect spotted frog habitat on state lands in Idaho have been largely unsuccessful because of lack of cooperation from the State. In northeast Nevada, the

Forest Service has completed three riparian area protection projects in areas where spotted frogs occur. These projects include altering stocking rates or changing the grazing season in two allotments known to have frogs and constructing riparian fencing on one allotment. However, these three sites have not been monitored to determine whether efforts to protect riparian habitat and spotted frogs have been successful. In the Toiyabe Range, a proposal to fence 3.2 kilometers (km) (2 miles (mi)) of damaged riparian area along Cloverdale Creek to protect it from grazing is scheduled to occur in the summer of 2002. In addition to the riparian enclosure, BLM biologists located a diversion dam in 1998 on Cloverdale Creek which was completely de-watering approximately 1.6 km (1 mi) of stream. During the summer of 2000, this area was reclaimed and water was put back into the stream. This area of the stream is not currently occupied by spotted frogs but it is historical habitat (USFWS 2002c).

The effects of mining on Great Basin Columbia spotted frogs, specifically, have not been studied, but the adverse effects of mining activities on water quality and quantity, other wildlife species, and amphibians in particular have been addressed in professional scientific forums (Chang et al. 1974; Birge et al. 1975; Greenhouse 1976; Khangarot et al. 1985) (USFWS 2002c).

Disease or predation

Predation by fishes is likely an important threat to spotted frogs. The introduction of nonnative salmonid and bass species for recreational fishing may have negatively affected frog species throughout the United States. The negative effects of predation of this kind are difficult to document, particularly in stream systems. However, significant negative effects of predation on frog populations in lacustrine systems have been documented (Hayes and Jennings 1986; Pilliod et al. 1996, Knapp and Matthews 2000). One historic site in southern Idaho no longer supports spotted frog although suitable habitat is available. This may be related to the presence of introduced bass in the Owyhee River (IDCDC 2000). The stocking of nonnative fishes is common throughout waters of the Great Basin. The Nevada Division of Wildlife (NDOW) has committed to conducting stomach sampling of stocked nonnative and native species to determine the effects of predation on spotted frogs. However, this commitment will not be fulfilled until the spotted frog conservation agreements are signed. To date, NDOW has not altered fish stocking rates or locations in order to benefit spotted frogs (USFWS 2002c).

The bull frog (*Rana catesbeiana*), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c).

Although a diversity of microbial species is naturally associated with amphibians, it is generally accepted that they are rarely pathogenic to amphibians except under stressful environmental conditions. Chytridiomycosis (chytrid) is an emerging panzootic fungal disease in the United States (Fellers et al. 2001). Clinical signs of amphibian chytrid include abnormal posture, lethargy, and loss of righting reflex. Gross lesions, which are usually not apparent, consist of abnormal epidermal sloughing and ulceration; hemorrhages in the skin, muscle, or eye; hyperemia of digital and ventrum skin, and congestion of viscera. Diagnosis is by identification of characteristic intracellular flask-shaped sporangia and septate thalli within the epidermis. Chytrid can be identified in some species of frogs by examining the oral discs of tadpoles which may be abnormally formed or lacking pigment (Fellers et al. 2001) (USFWS 2002c).

Chytrid was confirmed in the Circle Pond site, Idaho, where long term monitoring since 1998 has indicated a general decline in the population (Engle 2002). It is unclear whether the

presence of this disease will eventually result in the loss of this subpopulation. Two additional sites may have chytrid, but this has yet to be determined (J. Engle, pers. comm., 2001). Protocols to prevent further spread of the disease by researchers were instituted in 2001. Chytrid has also been found in the Wasatch Columbia spotted frog distinct population segment (K. Wilson, pers. comm., 2002). Chytrid has not been found in Nevada populations of spotted frogs (USFWS 2002c).

The inadequacy of existing regulatory mechanisms

Spotted frog occurrence sites and potential habitats occur on both public and private lands. This species is included on the Forest Service sensitive species list; as such, its management must be considered during forest planning processes. However, little habitat restoration, monitoring or surveying has occurred on Forest Service lands (USFWS 2002c).

In the fall of 2000, 250 head of cattle were allowed to graze for 45 days on one pasture in the Indian Valley Creek drainage of the Humboldt-Toiyabe National Forest in central Nevada for the first time in 6 years (M. Croxen, pers. comm., 2002). Grazing was not allowed in this allotment in 2001. Recent mark-recapture data indicated that this drainage supports more frogs than previously presumed, potentially around 5,000 individuals (K. Hatch, pers. comm., 2000). Perceived improvements in the status of frog populations in the Indian Valley Creek area may be a result of past removal of livestock grazing. The reintroduction of grazing disturbance into this relatively dense area of frogs has yet to be determined (USFWS 2002c).

BLM policies direct management to consider candidate species on public lands under their jurisdiction. To date, BLM efforts to conserve spotted frogs and their habitat in Idaho, Oregon, and Nevada have not been adequate to address threats (USFWS 2002c).

The southernmost known population of spotted frogs can be found on the BLM San Antone Allotment south of Indian Valley Creek in the Toiyabe Range. Grazing is allowed in this area from November until June (L. Brown, pers. comm., 2002). The season of use is a very sensitive portion of the spotted frog annual life cycle which includes migration from winter hibernacula to breeding ponds, breeding, egg laying and hatching, and metamorphosing of young. Additionally, the riparian Standards and Guidelines were not met in 1996, the last time the allotment was evaluated (USFWS 2002c).

The status of local populations of spotted frogs on Yomba-Shoshone or Duck Valley Tribal lands is unknown. Tribal governments do not have regulatory or protective mechanisms in place to protect spotted frogs (USFWS 2002c).

The Nevada Division of Wildlife classifies the spotted frog as a protected species, but they are not afforded official protection and populations are not monitored. Though the spotted frog is on the sensitive species list for the State of Idaho, this species is not given any special protection by the State. Columbia spotted frogs are not on the sensitive species list for the State of Oregon. Protection of wetland habitat from loss of water to irrigation or spring development is difficult because most water in the Great Basin has been allocated to water rights applicants based on historical use and spring development has already occurred within much of the known habitat of spotted frogs. Federal lands may have water rights that are approved for wildlife use, but these rights are often superceded by historic rights upstream or downstream that do not provide for minimum flows. Also, most public lands are managed for multiple use and are subject to livestock grazing, silvicultural activities, and recreation uses that may be incompatible with spotted frog conservation without adequate mitigation measures (USFWS 2002c).

Other natural or manmade factors affecting its continued existence

Multiple consecutive years of less than average precipitation may result in a reduction in the number of suitable sites available to spotted frogs. Local extirpations eliminate source populations from habitats that in normal years are available as frog habitat (Lande and Barrowclough 1987; Schaffer 1987; Gotelli 1995). These climate events are likely to exacerbate the effects of other threats, thus increasing the possibility of stochastic extinction of subpopulations by reducing their size and connectedness to other subpopulations (see Factor A for additional information). As movement corridors become more fragmented, due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000). Increased fragmentation of the habitat can lead to greater loss of populations due to demographic and/or environmental stochasticity (USFWS 2002c).

References

- AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2004. Berkeley, California: AmphibiaWeb. Available: <http://amphibiaweb.org/>. (Accessed: 2004).
- Birge, W.J., J.J. Just, A.G. Westerman, J.A. Black, and O.W. Roberts. 1975. Sensitivity of Vertebrate Embryos to Heavy Metals as a Criterion of Water Quality. Phase II. Bioassay Procedures Using Developmental Stages As Test . Water Resour. Res. Inst., Kentucky Univ., Lexington, KY; U.S. NTIS PB-240 987: 36 pp.
- Black, J. H. 1969. The frog genus *Rana* in Montana. Northwest Science 43:191-195.
- Blomquist, S. M., and J. C. Tull. 2002. *Rana luteiventris*: burrow use. Herpetological Review 33:131.
- Brown, L. 2002. Wildlife Biologist, Bureau of Land Management. Tonopah Field Station, Nevada, personal communication.
- Bull, E. L., and M. P. Hayes. 2001. Post-breeding season movements of Columbia spotted frogs (*RANA LUTEIVENTRIS*) in northeastern Oregon. Western North American Naturalist 61:119-123.
- Chang, L.W., K.R. Reuhl, and A.W. Dudley, Jr. 1974. Effects of Methylmercury Chloride on *Rana pipiens* tadpoles. Environ. Res. 8(1):82-91.
- Croxen, M. 2002. Range Conservation Specialist, U.S. Forest Service. Tonopah Ranger District, Nevada, personal communication.
- Csuti, B., A.J. Kimmerling, T.A. O'Neil, M.M. Shaughnessy, E.P. Gaines, and M.M.P. Huso. 1997. Atlas of Oregon Wildlife. Oregon State University Press. 492 pp.
- Davidson C. 1995. Frog and Toad Calls of the Pacific Coast: Vanishing Voices. Ithaca, NY: Library of Natural Sounds, Cornell Laboratory of Ornithology. [Compact disc].
- Dumas, P. C. 1964. Species-pair allopatry in the genera *Rana* and *Phrynosoma*. Ecology 45(1):178-181.
- Dumas, P. C. 1966. Studies of the *Rana* species complex in the Pacific Northwest. Copeia 1:60-74.
- Engle, J.C. 2004. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office, Boise, Idaho.

- Engle, J.C. 2004. Columbia Spotted Frog, Great Basin Population. Species profile on USFWS website: <http://idahoes.fws.gov/fact/spotfrog.html>.
- Engle, J.C. 2002. Columbia spotted frog Great Basin population (Owyhee subpopulation) longterm monitoring plan. Year 2001 results. Idaho Department of Fish and Game Report. Boise, Idaho. 64 pp.
- Engle, J.C. 2001. Columbia spotted frog project: the translocation of 2 male Columbia spotted frogs between breeding sites within an element occurrence in the Owyhee subpopulation of the Great Basin population. Idaho Department of Fish and Game Report. Boise, Idaho. 19 pp.
- Engle, J.C. 2001. Wildlife Research Biologist, Idaho Department of Fish and Game, Boise, Idaho, personal communication.
- Engle, J.C. 2000. Columbia spotted frog Great Basin population (Owyhee Mountains subpopulation) long-term monitoring plan. Year 2000 Results. (draft). Boise, Idaho.
- Engle, J.C. and J.C. Munger. 2000. Population fragmentation of spotted frogs in the Owyhee Mountains. Field Report from a cost share agreement between Boise State University and the Bureau of Land Management (DBP990048). Boise, Idaho.
- Fellers, G.M., D.E. Green, and J.E. Longcore. 2001. Oral chytridiomycosis in the mountain yellow-legged frog (*Rana muscosa*). *Copeia* 2001:945-953.
- Gotelli, N.J. 1995. A primer of ecology, Sinauer and Associates, Sunderland, Massachusetts. 206 pp.
- Green, D.M., T.F. Sharbel, J. Kearsley, and H. Kaiser. 1996. Postglacial range fluctuation, genetic subdivision and speciation in the western North American spotted frog complex, *Rana pretiosa*. *Evolution* 50:(1):374-390.
- Green, D.M., H. Kaiser, T.F. Sharbel, J. Kearsley, and K.R. McAllister. 1997. Cryptic species of spotted frogs, *Rana pretiosa* complex, in Western North America. *Copeia* 1997 (1): 1-8.
- Greenhouse, G. 1976. Effects of Pollutants on Eggs, Embryos and Larvae of Amphibian Species University of California, Irvine, CA, Air Force Tech. Report AMRL-TR-76-31, U.S. NTIS AD-A025 403:24 p.
- Hallock, L.A. and McAllister, K.R. 2002. Columbia Spotted Frog. Washington Herp Atlas. <http://www.dnr.wa.gov/nhp/refdesk/herp/>.
- Hatch, K. 2000. Researcher, University of Nevada, Reno, personal communication.
- Hatch, K. 2001. Researcher, University of Nevada, Reno, personal communication.
- Hayes, M.P. and M.R. Jennings. 1986. Decline of ranid frog species in western North America: are bullfrogs responsible? *Journal of Herpetology* 20:490-509.
- Hodge, R.P. 1976. Amphibians and reptiles in Alaska, the Yukon, and Northwest Territories. Pages 52-53 in Northwest Publishing Company.
- Hollenbeck, R. R. 1974. Growth rates and movements within a population of RANA PRETIOSA PRETIOSA Baird and Girard in south central Montana. M.A. thesis, Montana State University, Bozeman.
- Hovingh, P. 1986. Biogeographic aspects of leeches, mollusks, and amphibians in the Intermountain Region. *Great Basin Naturalist*.
- Hovingh, P. 1990. Investigations of aquatic resources in the Great Basin and adjacent regions with respect to amphibians, mollusks and leeches: a preliminary report for the tri-state region of Idaho, Nevada, and Utah. March 1990. 12 pp. + appendices.
- Idaho Conservation Data Center. 2000. Spotted frog database. Idaho Department of Fish and Game, Boise, Idaho.

- Idaho Department of Fish and Game, Idaho Department of Parks and Recreation, Bureau of Land Management, Regions 1 and 4 of U.S. Forest Service, and U.S. Fish and Wildlife Service. 1995. Habitat Conservation Assessment and Conservation Strategy: Spotted Frog (*Rana pretiosa*). (Draft) Idaho State Conservation Effort.
- Kauffman, J.B., W.C. Krueger, and M. Vavra. 1985. Impacts of cattle on streambanks in northeastern Oregon. *Journal of Range Management* 36(6):683-685.
- Kauffman, J.B. and W.C. Krueger. 1984. Livestock impacts on riparian plant communities and stream-side management implications, a review. *Journal of Range Management* 37(5):430-437.
- Kauffman, J.B., W.L. Krueger, and M. Vavra. 1982. Effects of late season cattle grazing on riparian plant communities. *Journal of Range Management* 36(6):685-691.
- Khangarot, B.S., A. Sehgal and M.K. Bhasin. 1985. Man and biosphere-studies on the Sikkim. Part 5: acute toxicity of selected heavy metals on the tadpoles of *Rana hexadactyla*. *Acta Hydrochim. Hydrobiol.* 13(2):259-263.
- Knapp, R. A. and K. R. Matthews. 2000. Non-native fish introductions and the decline of the mountain yellow-legged frog from within protected areas. *Conservation Biology* 14(2):428-438.
- Koch, E.D., G. Williams, C.R. Peterson, and P.S. Corn. 1997. A summary of the conference on declining and sensitive amphibians in the Rocky Mountains and Pacific Northwest. November 7-8, 1996, Boise Idaho. Meeting sponsored by U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Land Management, Idaho Herpetological Society, Declining Amphibian Population Task Force Rocky Mountain Working Group, U.S. Geological Survey - Biological Resources Division, Idaho Museum of Natural History, Idaho State University.
- Lande, R. and G.F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management, pages 87-124, in *Viable Populations for Conservation*, M. E. Soul (ed.), Cambridge University Press, Cambridge, Great Britain.
- McDonald, M. 1996. Amphibian Inventory of the Jarbidge and Snake River Resource Areas. Idaho Bureau of Land Management Technical Bulletin No. 96-13. 23 pp.
- Leonard, W.P., Brown H.A., Jones, L.L.C., McAllister, Storm R.M. 1993. Amphibians of Washington and Oregon. Seattle, WA: Seattle Audubon Society. 168 p.
- Leonard, W.P., Leonard N.P., Storm R.M., and P.E. Petzel. 1996. *Rana pretiosa* (spotted frog). Behavior and reproduction. *Herpetological Review*, 27(4), 195.
- Licht, L.E. 1975. Comparative life history features of the western spotted frog, *rana pretiosa*, from low- and high-elevation populations. *Canadian Journal of Zoology* 53: 1254-1257.
- Marshall, D. B. 1992. Sensitive vertebrates of Oregon. Oregon Department of Fish and Wildlife. Portland, OR.
- Mellison, C. 2004. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada.
- Morris, R. L. and W. W. Tanner. 1969. The ecology of the western spotted frog, *Rana pretiosa pretiosa* Baird and Girard, a life history study. *Great Basin Naturalist* 2:45-81.
- Munger, J.C., M. Gerber, M. Carroll, K. Madric, and C. Peterson. 1996. Status and habitat associations of the spotted frog (*Rana pretiosa*) in southwestern Idaho. Bureau of Land Management Technical Bulletin No. 96- 1. Boise, Idaho.

- Munger, J.C., A. Ames, and B. Barnett. 1997. 1996 Survey for Columbia spotted frogs in the Owyhee Mountains of southwestern Idaho. Technical Bulletin No. 97-13. Idaho Bureau of Land Management. Boise, Idaho.
- NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: February 2, 2004).
- 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. pp. 183-187.
- Patla, D.A. and C.R. Peterson. 1996. The effects of habitat modification on a spotted frog population in Yellowstone National Park in A summary of the conference on declining and sensitive amphibians in the Rocky Mountains and Pacific Northwest. Idaho Herpetological Society and U. S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho. 96 pp.
- Pearl, C.A. 2000. Amphibian survey and monitoring on the Baker District, Wallowa-Whitman National Forest: Summary of 1999 Findings. Prepared for the Wallowa-Whitman National Forest, Baker Ranger District.
- Pilliod, D., C.R. Peterson, and P. Ritson. 1996. Impacts of introduced fish on spotted frog populations in high mountain lakes of central Idaho. A Summary of the Conference on Declining and Sensitive Amphibians in the Rocky Mountains and Pacific Northwest Idaho Herpetological Society and U.S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho, November 7-8, 1996.
- Reaser, J.K. 1996a. Conservation status of spotted frogs in Nevada: 1996 state-wide surveys. Cooperative Agreement between the U.S. Fish and Wildlife Service and the Center for Conservation Biology, Stanford University. Attachment A. August 9, 1996. 15 pp.
- Reaser, J.K. 1996b. Conservation of the spotted frog (*Rana pretiosa*) in Nevada: Multi-scale population status and trends assessment. A Summary of the Conference on Declining and Sensitive Amphibians in the Rocky Mountains and Pacific Northwest. Idaho Herpetological Society and U.S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, Idaho, November 7-8, 1996.
- Reaser, J.K. 1997. Amphibian declines: Conservation science and adaptive management. Doctoral Dissertation. Stanford University.
- Reaser, J.K. 1998. Jamie K. Reaser, private consultant, Springfield, Virginia, personal communication.
- Reaser, J. K. 2000. Demographic analyses of the Columbia spotted frog (*Rana luteiventris*): case study in spatiotemporal variation. *Canadian Journal of Zoology* 78:1158-1167.
- Schulz, T.T. and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. *Journal of Range Management* 43(4):295-299.
- Schaffer, M. 1987. Minimum viable populations: coping with uncertainty, pages 69-86, *in* *Viable Populations for Conservation*, M. E. Soul (ed.), Cambridge University Press, Cambridge, Great Britain.
- Shay, R. 1973. Oregon's rare or endangered wildlife. *Game Bulletin*. January: 3-8.
- Shipman, M. and S. Anderson. 1997. General survey of the Great Basin population of Columbia spotted frogs (*Rana luteiventris*) in the Jarbidge, Mountain City, and Santa Rosa Ranger Districts of Northern Nevada. Unpublished report prepared for the U.S. Forest Service, Humboldt-Toiyabe National Forest, September 1997.

- Skovlin, J.M. 1984. Impacts of grazing on wetlands and riparian habitat: A review of our knowledge. Pages 1001- 1104, in Developing strategies for rangeland management-a report prepared by the committee on developing strategies for rangeland management. National Research Council/National Academy of Sciences. Westview Press, Boulder, Colorado.
- St. John, A.D. 1994. The spotted frog in the Lakeview District of Oregon. Report to the Bureau of Land Management Lakeview District Office.
- Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston. 336 pp.
- Storer, T. I. 1925. A synopsis of the Amphibia of California. University of California Press, Berkeley, California. 343 pp.
- Tull, J. 1998. U.S. Forest Service, Ely Ranger District, Nevada, personal communication.
- Turner, F.B. 1958. Life history of the western spotted frog in Yellowstone National Park. *Herpetologica* 14: 96-100.
- Turner, F.B. 1960. Population structure and dynamics of the western spotted frog, *Rana pretiosa*. Baird and Girard, in Yellowstone Park, Wyoming. *Ecological Monographs* 30(3): 251-278.
- Turner, F.B. 1962. An analysis of geographic variation and distribution of *Rana pretiosa*. *American Philosophical Society Yearbook* 1962. Pp. 325-328.
- Turner, G.B. and P. C. Dumas. 1972. *Rana pretiosa*. Pages 119.1-119.4 in Catalogue of North American Amphibians and Reptiles. Society for the Study of Amphibians and Reptiles.
- U.S. Fish and Wildlife Service. 1992. Notice: 12-month Petition Finding for the Spotted Frog. United States Department of the Interior, Nevada Fish and Wildlife Office, Reno, Nevada.
- U.S. Fish and Wildlife Service. 2002a. Section 7 Guidelines: Columbia Spotted Frog – Great Basin Population. United States Department of the Interior, Snake River Basin Office, Boise, Idaho.
- U.S. Fish and Wildlife Service. 2002b. Status Review for the Columbia Spotted Frog (*Rana luteiventris*) on the Wasatch Front, Utah. United States Department of the Interior
- U.S. Fish and Wildlife Service Region 6, Denver, Colorado.
- U.S. Fish and Wildlife Service. 2002c. Candidate and Listing Priority Assignment Form: Columbia Spotted Frog. United States Department of the Interior, Nevada Fish and Wildlife Office, Reno, Nevada.
- U.S. Geological Service. Northern Prairie Wildlife Research Center. Website: <http://www.npwrc.usgs.gov/narcam/idguide/rpret.htm>. Accessed 2/2004.
- Utah Department of Natural Resources. 1991. Distribution and status of the western spotted frog in central Utah. DRAFT progress Report to U. S. Fish and Wildlife Service. 29pp.
- Utah Division of Wildlife Resources. 1998. Conservation Strategy for the spotted frog. January 22, 1998.
- Whitaker, J.O., S.P. Cross, J.M. Skovlin, and C. Maser. 1982. Food habits of the spotted frog (*Rana pretiosa*) from managed sites in Grant County, Oregon. *Northwest Science* 57(2): 147-154.
- Wilson, K. 2002. Wildlife Biologist, Utah Division of Wildlife Resources, Salt Lake City, Utah, personal communication.

6.3.4 Great Blue Heron

Great Blue Heron (*Ardea herodias*). Paul Ashley and Stacey Stovall. 2004. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment.

Introduction

The great blue heron (*Ardea herodias*) is the largest, most widely distributed, and best known of the American herons (Henny 1972). Great blue herons occur in a variety of habitats from freshwater lakes and rivers to brackish marshes, lagoons, mangrove areas, and coastal wetlands (Spendelow and Patton in prep.).

Great Blue Heron Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

Fish are preferred food items of the great blue heron in both inland and coastal waters (Kirkpatrick 1940; Palmer 1962; Kelsall and Simpson 1980), although a large variety of dietary items has been recorded. Frogs and toads, tadpoles and newts, snakes, lizards, crocodilians, rodents and other mammals, birds, aquatic and land insects, crabs, crayfish, snails, freshwater and marine fish, and carrion have all been reported as dietary items for the great blue heron (Bent 1926; Roberts 1936; Martin *et al.* 1951; Krebs 1974; Kushlan 1978). Fish up to about 20 cm in length dominated the diet of herons foraging in southwestern Lake Erie (Hoffman 1978). Ninety-five percent of the fish eaten in a Wisconsin study were 25 cm in length (Kirkpatrick 1940).

Great blue herons feed alone or occasionally in flocks. Solitary feeders may actively defend a much larger feeding territory than do feeders in a flock (Meyerrieks 1962; Kushlan 1978). Flock feeding may increase the likelihood of successful foraging (Krebs 1974; Kushlan 1978) and usually occurs in areas of high prey density where food resources cannot effectively be defended.

In southeast Washington, blue herons are often seen hunting along rivers and streams. In the winter months they are often seen hunting rodents in alfalfa fields (P. Fowler, WDFW, pers. comm., 2003).

Reproduction

The great blue heron typically breeds during the months of March - May in its northern range and November through April in the southern hemisphere. The nest usually consists of an egg clutch between 3-7 eggs, with clutch size increasing from south to north. Chicks fledge at about two months.

Nesting

Great blue herons normally nest near the tree tops. Usually, nests are about 1 m in diameter and have a central cavity 10 cm deep with a radius of 15 cm. This internal cavity is sometimes lined with twigs, moss, lichens, or conifer needles. Great blue herons are inclined to renest in the same area year after year. Old nests may be enlarged and reused (Eckert 1981).

The male gathers nest-building materials around the nest site, from live or dead trees, from neighboring nests, or along the ground, and the female works them into the nest. Ordinarily, a pair takes less than a week to build a nest solid enough for eggs to be laid and incubated. Construction continues during almost the entire nesting period. Twigs are added mostly when the eggs are being laid or when they hatch. Incubation, which is shared by both partners, starts with the laying of the first egg and lasts about 28 days. Males incubate during the days and females at night.

Hérons are particularly sensitive to disturbance while nesting. Scientists suggest as a general rule that there should be no development within 300 m of the edge of a heron colony and no disturbance in or near colonies from March to August.

Mortality

The great blue heron lives as long as 17 years. The adult birds have few natural enemies. Birds of prey occasionally attack them, but these predators are not an important limiting factor on the heron population. Draining of marshes and destruction of wetland habitat is the most serious threat. The number of herons breeding in a local area is directly related to the amount of feeding habitat.

Mortality of the young is high: both the eggs and young are preyed upon by crows, ravens, gulls, birds of prey, and raccoons. Heavy rains and cold weather at the time of hatching also take a heavy toll. Pesticides are suspected of causing reproductive failures and deaths, although data obtained up to this time suggest that toxic chemicals have not caused any decline in overall population levels.

Habitat Requirements

Minimum Habitat Area

Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before a species will live and reproduce in an area. Minimum habitat area for the great blue heron includes wooded areas suitable for colonial nesting and wetlands within a specified distance of the heronry where foraging can occur. A heronry frequently consists of a relatively small area of suitable habitat. For example, heronries in the Chippewa National Forest, Minnesota, ranged from 0.4 to 4.8 ha in size and averaged 1.2 ha (Mathisen and Richards 1978). Twelve heronries in western Oregon ranged from 0.12 to 1.2 ha in size and averaged 0.4 ha (Werschkul *et al.* 1977).

Foraging

Short and Cooper (1985) provide criteria for suitable great blue heron foraging habitat. Suitable great blue heron foraging habitats are within 1.0 km of heronries or potential heronries. The suitability of herbaceous wetland, scrub-shrub wetland, forested wetland, riverine, lacustrine or estuarine habitats as foraging areas for the great blue heron is ideal if these potential foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish. A potential foraging area needs to be free from human disturbances several hours a day while the herons are feeding. Suitable great blue heron foraging areas are those in which there is no human disturbance near the foraging zone during the four hours following sunrise or preceding sunset or the foraging zone is generally about 100m from human activities and habitation or about 50m from roads with occasional, slow-moving traffic.

A smaller energy expenditure by adult herons is required to support fledglings if an abundant source of food is close to the nest site than if the source of food is distant. Nest sites frequently are located near suitable foraging habitats. Social feeding is strongly correlated with colonial nesting (Krebs 1978), and a potential feeding site is valuable only if it is within "commuting" distance of an active heronry. For example, 24 of 31 heronries along the Willamette River in Oregon were located within 100m of known feeding areas (English 1978). Most heronries along the North Carolina coast were located near inlets, which have large concentrations of fish (Parnell and Soots 1978). The average distance from heronries to inlets was 7.0 to 8.0 km. The average distance of heronries to possible feeding areas (lakes 140 ha in area) varied from 0 to 4.2 km and averaged 1.8 km on the Chippewa National Forest in Minnesota (Mathisen and Richards 1978). Collazo (1981) reported the distance from the nearest feeding grounds to a heronry site as 0.4 and 0.7 km. The maximum observed flight distance from an active heronry to a foraging area was 29 km in Ohio (Parris and Grau 1979).

Great blue herons feed anywhere they can locate prey (Burleigh 1958). This includes the terrestrial surface but primarily involves catching fish in shallow water, usually 150m deep (Bent 1926; Meyerriecks 1960; Bayer 1978).

Thompson (1979b) reported that great blue herons along the Mississippi River commonly foraged in water containing emergent or submergent vegetation, in scattered marshy ponds, sloughs, and forested wetlands away from the main channel. He noted that river banks, jetties, levees, rip-rapped banks, mudflats, sandbars, and open ponds were used to a lesser extent. Herons near southwestern Lake Erie fed intensively in densely vegetated areas (Hoffman 1978).

Other studies, however, have emphasized foraging activities in open water (Longley 1960; Edison Electric Institute 1980). Exposed mud flats and sandbars are particularly desirable foraging sites at low

tides in coastal areas in Oregon (Bayer 1978), North Carolina (Custer and Osborn 1978), and elsewhere (Kushlan 1978). Cooling ponds (Edison Electric Institute 1980) and dredge spoil settling ponds (Cooper *et al.* in prep.) also are used extensively by foraging great blue herons.

Water

The great blue heron routinely feeds on soft animal tissues from an aquatic environment, which provides ample opportunity for the bird to satisfy its physiological requirements for water.

Cover

Cover for concealment does not seem to be a limiting factor for the great blue heron. Heron nests often are conspicuous, although heronries frequently are isolated. Herons often feed in marshes and areas of open water, where there is no concealing cover.

Reproduction

Short and Cooper (1985) describe suitable great blue heron nesting habitat as a grove of trees at least 0.4 ha in area located over water or within 250m of water. These potential nest sites may be on an island with a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an “open canopy” that allows an easy access to the nest. The suitability of potential heronries diminishes as their distance from current or former heronry sites increases because herons develop new heronries in suitable vegetation close to old heronries.

A wide variety of nesting habitats is used by the great blue heron throughout its range in North America. Trees are preferred heronry sites, with nests commonly placed from 5 to 15 m above ground (Burleigh 1958; Cottrille and Cottrille 1958; Vermeer 1969; McAloney 1973). Smaller trees, shrubs, reeds (*Phragmites communis*), the ground surface, rock ledges along coastal cliffs, and artificial structures may be utilized in the absence of large trees, particularly on islands (Lahrman 1957; Behle 1958; Vermeer 1969; Soots and Landin 1978; Wiese 1978). Most great blue heron colonies along the Atlantic coast are located in riparian swamps (Ogden 1978). Most colonies along the northern Gulf coast are in cypress - tupelo (*Taxodium Nyssa*) swamps (Portnoy 1977). Spendelow and Patton (in prep.) state that many birds in coastal Maine nest on spruce (*Picea spp.*) trees on islands. Spruce trees also are used on the Pacific coast (Bayer 1978), and black cottonwood (*Populus trichocarpa*) trees frequently are used as nest sites along the Willamette River in Oregon (English 1978). Miller (1943) stated that the type of tree was not as important as its height and distance from human activity. Dead trees are commonly used as nest sites (McAloney 1973). Nests usually consist of a platform of sticks, sometimes lined with smaller twigs (Bent 1926; McAloney 1973), reed stems (Roberts 1936), and grasses (Cottrille and Cottrille 1958).

Heron nest colony sites vary, but are usually near water. These areas often are flooded (Sprunt 1954; Burleigh 1958; English 1978). Islands are common nest colony sites in most of the great blue heron's range (Vermeer 1969; English 1978; Markham and Brechtel 1979). Many colony sites are isolated from human habitation and disturbance (Mosely 1936; Burleigh 1958). Mathisen and Richards (1978) recorded all existing heronries in Minnesota as at least 3.3 km from human dwellings, with an average distance of 1.3 km to the nearest surfaced road. Nesting great blue herons may become habituated to noise (Grubb 1979), traffic (Anderson 1978), and other human activity (Kelsall and Simpson 1980). Colony sites usually remain active until the site is disrupted by land use changes.

A few colony sites have been abandoned because the birds depleted the available nest building material and possibly because their excrement altered the chemical composition of the soil and the water. Heron exretia can have an adverse effect on nest trees (Kerns and Howe 19667; Wiese 1978).

Great Blue Heron Population and Distribution

Population

Historic

In the past, herons and egrets were shot for their feathers, which were used as cooking utensils and to adorn hats and garments, and they also provided large, accessible targets. The slaughter of these birds went relatively unchecked until 1900 when the federal government passed the Lacey Act, which prohibits the foreign and interstate commercial trade of feathers. Greater protection was afforded in 1918 with the Migratory Bird Treaty Act, which empowered the federal government to set seasons and bag limits on the hunting of waterfowl and waterbirds. With this protection, herons and other birds have made dramatic comebacks.

In southeast Washington, few historical colonies have been reported. The Foundation Island colony is the oldest, but has been taken over by cormorants. It appears blue herons numbers in the colony have declined significantly.

One colony was observed from a helicopter in 1995 on the Touchet River just upriver from Harsha, but that colony appears to have been destroyed by a wind storm (trees blown down), and no current nesting has been observed in the area (Fowler per. com.)

Current

The great blue heron breeds throughout the U.S. and winters as far north as New England and southern Alaska (Bull and Farrand 1977). The nationwide population is estimated at 83,000 individuals (NACWCP 2001).

In southeast Washington, three new colonies have been discovered over the last few years. One colony on the Walla Walla River contains approximately 24 nests. This colony has been active for approximately 12 years. Two new colonies were discovered in 2003, one on a railroad bridge over the Snake River at Lyons Ferry, and one near Chief Timothy Park on the Snake River. The Lyons Ferry colony contained approximately 11 nests, and the Chief Timothy colony 5 nests (P. Fowler, WDFW, personal communication, 2003).

Distribution

Two known heron rookeries occur within the Walla Walla subbasin, one on the Walla Walla and one on the Touchet River (NPPC 2001). The Walla Walla River rookery contains approximately 13 active nests. The Touchet River rookery contains approximately 8-10 active nests. Blue herons are observed throughout the lowlands of southeast Washington near rivers or streams (P. Fowler, WDFW, personal communication, 2003).

Historic

No data are available.

Current

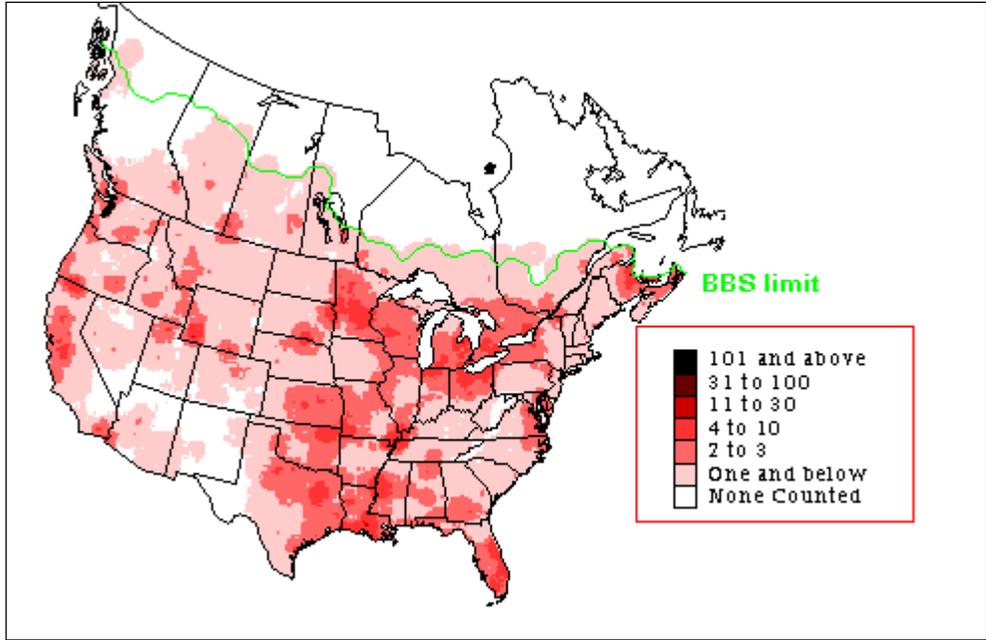


Figure 32. Great blue heron summer distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

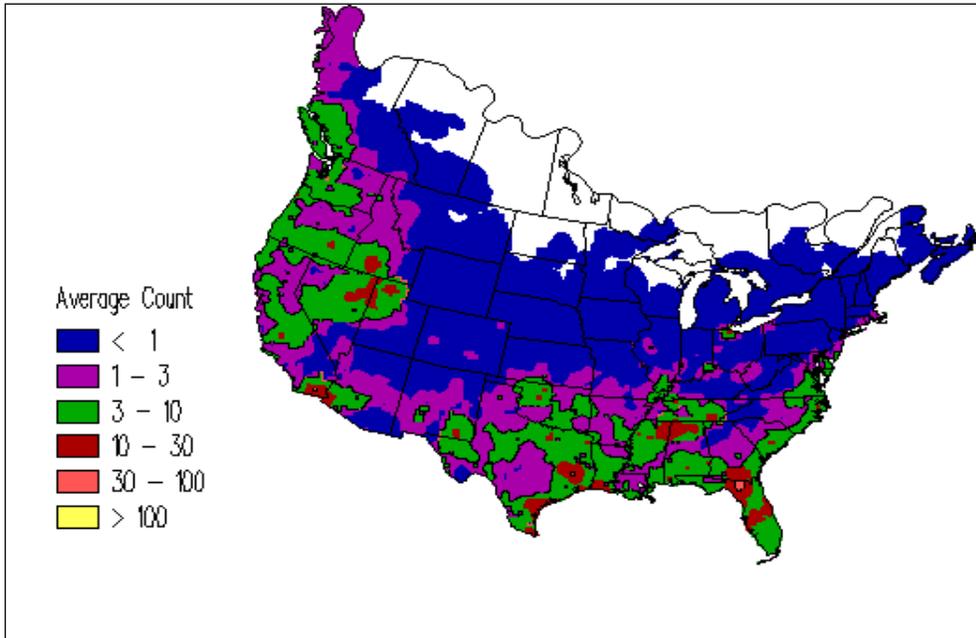


Figure 33 Great blue heron breeding distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

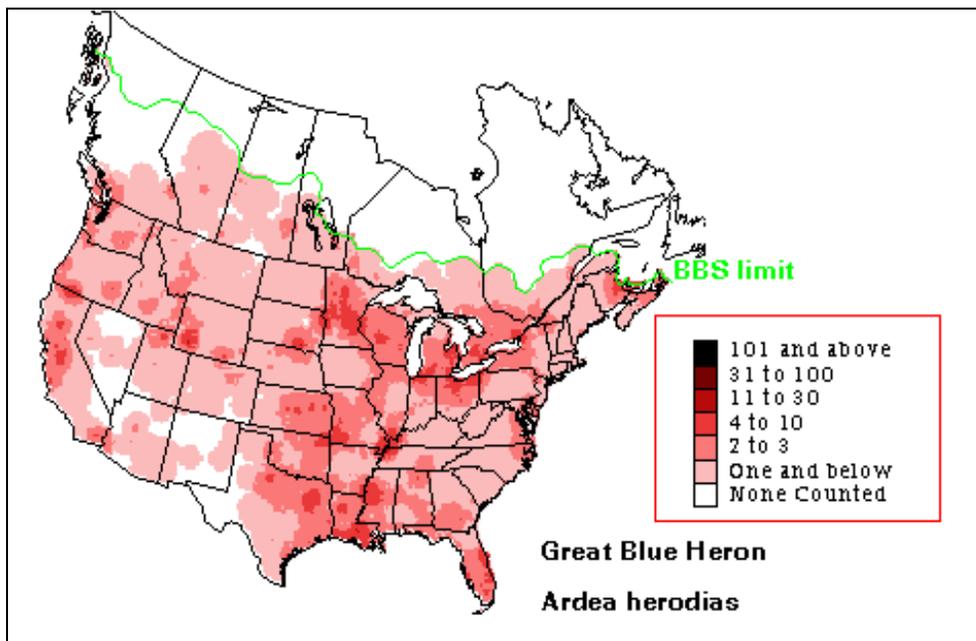


Figure 34. Great blue heron winter distribution from Christmas Bird Count (CBC) data (Sauer *et al.* 2003).

Great Blue Heron Status and Abundance Trends

Status

Surveys of blue heron populations are not conducted. However, populations appear to be stable and possibly expanding in some areas. Two new nesting colonies have been found in on the Lower Snake River (P. Fowler, WDFW, personal communication, 2003).

Trends

Populations in southeast Washington appear to be stable, and may actually be increasing.

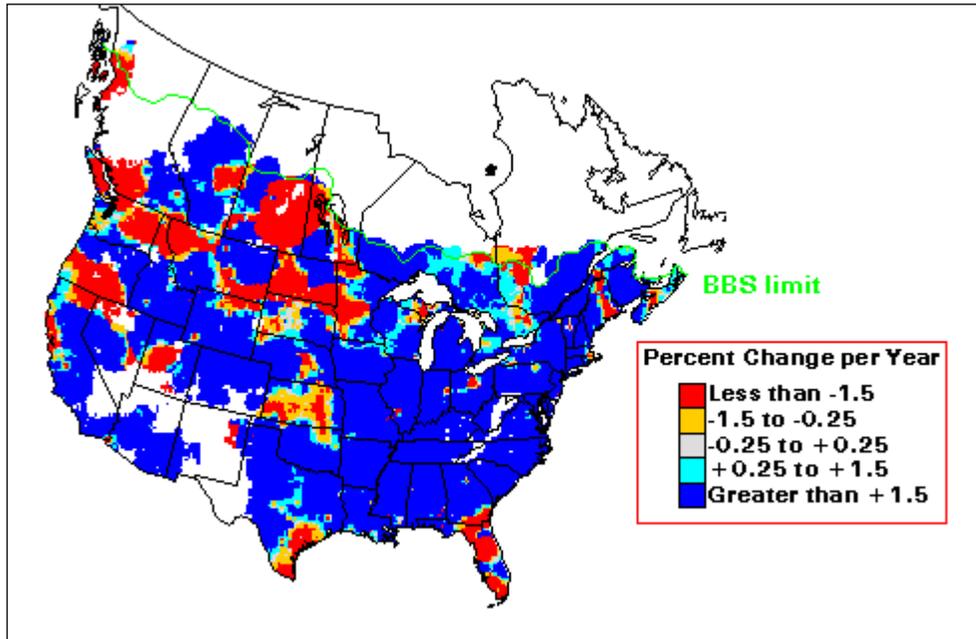
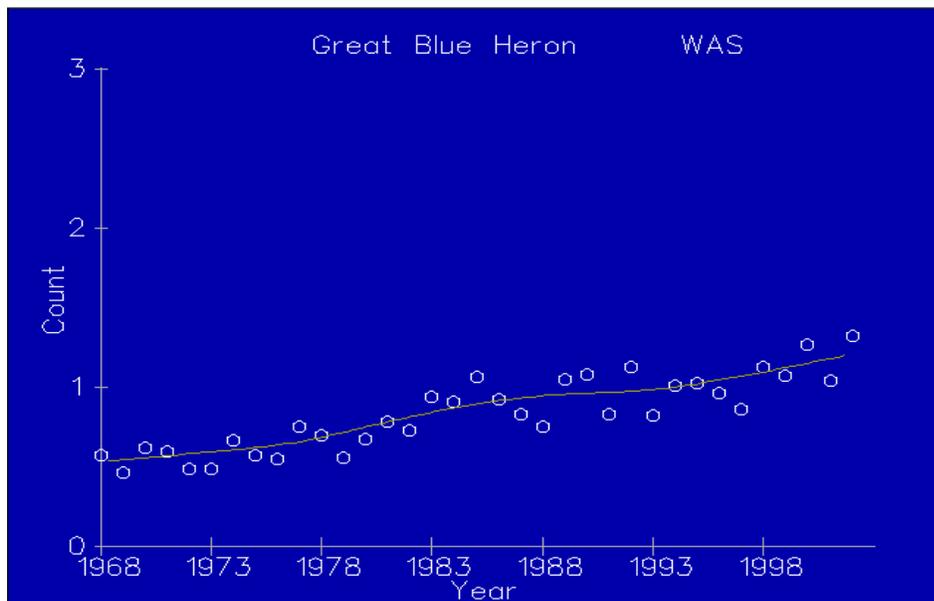


Figure 35. Great blue heron Breeding Bird Survey (BBS) trend results: 1966-1996 (Sauer *et al.* 2003).

Figure 36. Great blue heron Breeding Bird Survey (BBS) Washington trend results: 1966-2002 (Sauer *et al.* 2003).



Factors Affecting Great Blue Heron Population Status Key Factors Inhibiting Populations and Ecological Processes

Habitat destruction and the resulting loss of nesting and foraging sites, and human disturbance probably have been the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979a; Kelsall and Simpson 1980; McCrimmon 1981).

Habitat Loss

Natural generation of new nesting islands, created when old islands and headlands erode, has decreased due to artificial hardening of shorelines with bulkheads. Loss of nesting habitat in certain coastal sites may be partially mitigated by the creation of dredge spoil islands (Soots and Landin 1978). Several species of wading birds, including the great blue heron, use coastal spoil islands (Buckley and McCaffrey 1978; Parnell and Soots 1978; Soots and Landin 1978). The amount of usage may depend on the stage of plant succession (Soots and Parnell 1975; Parnell and Soots 1978), although great blue herons have been observed nesting in shrubs (Wiese 1978), herbaceous vegetation (Soots and Landin 1978), and on the ground on spoil islands.

Water Quality

Poor water quality reduces the amount of large fish and invertebrate species available in wetland areas. Toxic chemicals from runoff and industrial discharges pose yet another threat. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Several authors have observed eggshell thinning in great blue heron eggs, presumably as a result of the ingestion of prey containing high levels of organochlorines (Graber *et al.* 1978; Ohlendorf *et al.* 1980). Konermann *et al.* (1978) blamed high levels of dieldrin and DDE use for reproductive failure, followed by colony abandonment in Iowa. Vermeer and Reynolds (1970) recorded high levels of DDE in great blue herons in the prairie provinces of Canada, but felt that reproductive success was not diminished as a result. Thompson (1979a) believed that it was too early to tell if organochlorine residues were contributing to heron population declines in the Great Lakes region.

Human Disturbance

Heronries often are abandoned as a result of human disturbance (Markham and Brechtel 1979). Werschkul *et al.* (1976) reported more active nests in undisturbed areas than in areas that were being logged. Tree cutting and draining resulted in the abandonment of a mixed-species heronry in Illinois (Bjorkland 1975). Housing and industrial development (Simpson and Kelsall 1979) and water recreation and highway construction (Ryder *et al.* 1980) also have resulted in the abandonment of heronries. Grubb (1979) felt that airport noise levels could potentially disturb a heronry during the breeding season.

References

- American Ornithologists' Union. 1983. Check-list of North American birds. 6th edition. Am. Ornithol. Union. 877 pp.
- Anderson, J. M. 1978. Protection and management of wading birds. Wading birds. Natl. Audubon SOC. Res. Rep. 7:99-103.
- Bayer, R. D. 1978. Aspects of an Oregon estuarine great blue heron population. Wading birds. Natl. Audubon SOC. Res. Rep. 7:213-217.
- Behle, W. H. 1958. The bird life of Great Salt Lake. Univ. Utah Press, Salt Lake City. 203 pp.
- Bent, A. C. 1926. Life histories of North American marsh birds. U. S. Natl. Mus. Bull. 135. 392 pp.
- Bjorkland, R. G. 1975. On the death of a midwestern heronry. Wilson Bull. 87(2):284-287.
- Buckley, F. G., and C. A. McCaffrey. 1978. Use of dredged material islands by colonial sea birds and wading birds in New Jersey. U. S. Army Eng. Waterways Exp. Stn. Tech. Rep. D-78-1. Vicksburg, Miss.
- Bull, J. and J. Farrand, Jr. 1977. The Audubon Society Field Guide to North American Birds. Alfred A. Knopf, New York. 784 pp.
- Burger, J. 1978. The pattern and mechanism of nesting in mixed-species heronries. Wading birds. Natl. Audubon SOC. Res. Rep. 7:45-58.
- Burleigh, T. D. 1958. Georgia birds. Univ. Oklahoma Press, Norman. 746 pp.

- Butler, Robert. 1997. The great blue heron. UBC Press. Vancouver.
- Collazo, J. A. 1981. Some aspects of the breeding ecology of the great blue heron at Heyburn State Park. Northwest Sci. 55(4): 293-297.
- Cottrille, W. P., and B.D. Cottrille. 1958. Great blue heron: Behavior at the nest. Univ. Michigan Mus. Zool., Ann Arbor. Misc. Publ. 102.15 PP
- Custer, T. W., and R. G. Osborn. 1978. Feeding habitat use by colonially breeding herons, egrets, and ibises in North Carolina. Auk 95(4): 733-743.
- _____, R. G. Osborn, and W. F. Stout. 1980. Distribution, species abundance, and nesting site use of Atlantic coast colonies of herons and their allies. Auk 97(3):591-600.
- Dennis, C. J. 1971. Observations on the feeding behavior of the great blue heron. Passenger Pigeon 33(3):166-172.
- DesGranges, J. L. 1979. Adaptive value of social behavior in the great blue heron (*Ardea herodias*). Proc. 1978 Conf. Colonial Waterbird Group 2:192-201.
- Dickinson, J. C. 1947. Unusual feeding habits of certain herons. Auk 64(2):306-307.
- Edison Electric Institute. 1980. Compatibility of fish, wildlife, and floral resources with electric power facilities. Urban Wildl. Res. Cent., Ellicott City, MD. 130 pp.
- Eckert, A.W. 1981. The Wading Birds of North America. Doubleday and Co. Publishers, New York. 252 pp.
- English, S. M. 1978. Distribution and ecology of great blue heron colonies on the Willamette River, Oregon. Wading birds. Natl. Audubon SOC. Res. Rep. 7: 235-244.
- Giles, L. W., and D. B. Marshall. 1954. A large heron and egret colony on the Stillwater Wildlife Management Area, Nevada. Auk 71(3):322-325.
- Godfrey, W.E. 1986. The birds of Canada. Rev. ed. National Museums of Canada. Ottawa.
- Gordin, J. G. 1977. A great blue heron preying on shiner perch in deep water. Can. Field Nat. 91:88-89.
- Graber, J. W., R. R. Graber, and E. L. Kirk. 1978. Illinois birds: Ciconiiformes. III. Nat. Hist. Surv. Biol. Notes. 109. 80 pp.
- Grubb, M. M. 1979. Effects of increased noise levels on nesting herons and egrets. Proc. 1978 Conf. Colonial Waterbird Group 2:49-54.
- Hancock, J., and J.A. Kushlan. 1984. The herons handbook. Harper and Row. New York.
- Hays, R. L., C. Summers, and W. Seitz. 1981. Estimating wildlife habitat variables. U. S. Fish Wildl. Serv. FWS/OBS-81/77. 111 pp.
- Henny, C. J. 1972. An analysis of the population dynamics of selected avian species with special reference to changes during the modern pesticide era. U. S. Fish Wildl. Serv. Wildl. Res. Rep. 1. 99 pp.
- Hoffman, R. D. 1978. The diets of herons and egrets in southwestern Lake Erie. Wading birds. Natl. Audubon SOC. Res. Rep. 7:365-369.
- Kelsall, J. P., and K. Simpson. 1980. A three year study of the great blue heron in southwestern British Columbia. Proc. 1979 Conf. Colonial Waterbird Group 3: 69-74.
- Kerns, J. M., and J. F. Howe. 1967. Factors determining great blue heron rookery movement. J. Minn. Acad. Sci. 34(2): 80-83.
- Kirkpatrick, C. M. 1940. Some foods of young great blue herons. Am. Midl. Nat. 24(3):594-601.
- Konermann, A. D., L. D. Wing, and J. J. Richard. 1978. Great blue heron nesting success in two Iowa reservoir ecosystems. Wading birds. Natl. Audubon SOC. Res. Rep. 7:117-129.
- Krebs, J. R. 1974. Colonial nesting and social feeding as strategies for exploiting food resources in the great blue heron (*Ardea herodias*). Behav. 51(1-2):99-134.
- _____. 1978. Colonial nesting in birds, with special reference to the Ciconiiformes. Wading birds. Natl. Audubon SOC. Res. Rep. 7:299-314.
- Kushlan, J. A. 1976. Wading bird predation in a seasonally fluctuating pond. Auk 93(3):464-476.
- _____. 1978. Feeding ecology of wading birds. Wading birds. Natl. Audubon SOC. Res. Rep. 7:249-297.
- _____, and D. A. White. 1977. Nesting wading bird populations in southern Florida. Fla. Sci. 40(1): 65-72.
- Lahrman, F. W. 1957. Birds of the Isle of Bays, 1957. Blue Jay 15(3):106-109.
- Longley, W. H. 1960. Comment on the flight distance of the great blue heron. Wilson Bull. 72(3): 289.

- Markham, B. J., and S. H. Brechtel. 1979. Status and management of three colonial waterbird species in Alberta. Proc. 1978 Conf. Colonial Waterbird Group 2:55-64.
- Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants; a guide to wildlife food habits. Dover Publications, New York. 500 pp.
- Mathisen, J., and A. Richards. 1978. Status of great blue herons on the Chippewa National Forest. Loon 50(2):104-106.
- McAloney, K. 1973. The breeding biology of the great blue heron on Tobacco Island, Nova Scotia. Can. Field Nat. 87(2):137-140.
- McCrimmon, D. A. 1981. The status and distribution of the great blue heron (*Ardea herodias*) in New York State: Results of a two year census effort. Colonial Waterbirds 4:85-90.
- Meier, T. I. 1981. Artificial nesting structures for the double-crested cormorant. Wis. Dept. Nat. Resour. Tech. Bull. 126. Madison. 13 pp.
- Meyerriecks, A. J. 1960. Comparative breeding behavior of four species of North American herons. Nuttall Ornithol. Club Publ. 2. 158 pp.
- _____. 1962. Diversity typifies heron feeding. Nat. Hist. 71(6):48-59.
- Miller, R. F. 1943. The great blue herons: the breeding birds of the Philadelphia region (Part 11). Cassinia 33:1-23.
- Mosely, E. L. 1936. Blue heron colonies in northern Ohio. Wilson Bull. 48(1):3-11.
- NACWCP. 2001. Review Draft II—North American Waterbird Conservation Plan. Volume One: Seabirds and Colonial Waterbirds, 23 October 2001, Waterbird Conservation Steering Committee, Washington DC (www.nacwcp.org/).
- NPPC. (Northwest Power Planning Council). 2001. Walla Walla Subbasin Summary. Portland, OR.
- Ogden, J. C. 1978. Recent population trends of colonial wading birds on Atlantic and Gulf coastal plains. Wading birds. Natl. Audubon SOC. Res. Rep. 7:137-153.
- Ohlendorf, H. M., D. M. Swineford, and L. N. Locke. 1980. Organochlorine poisoning of herons. Proc. 1979 Conf. Colonial Waterbird Group 3:176-185.
- Palmer, R.S. 1962. Handbook of North American birds. Vol. 1. Yale University Press. New Haven, Connecticut.

- Parnell, J. F., and R. F. Soots. 1978. The use of dredge islands by wading birds. *Wading birds. Nat. Audubon SOC. Res. Rep.* 7:105-111.
- Parris, R. W., and G. A. Grau. 1979. Feeding sites of great blue herons in southwestern Lake Erie. *Proc. 1978 Conf. Colonial Waterbird Group* 2:110-113.
- Portnoy, J. W. 1977. Nesting colonies of seabirds and wading birds – coastal Louisiana, Mississippi, and Alabama. *U. S. Fish Wildl. Serv. FWS/OBS-77/07.* 126 pp.
- Roberts, T. S. 1936. *The birds of Minnesota. Vol. 1. 2nd ed. University Minnesota Press, Minneapolis.* 718 pp.
- Rodgers, J. A., and S. A. Nesbitt. 1980. Feeding energetics of herons and ibises at breeding colonies. *Proc. 1979 Conf. Colonial Waterbird Group* 3:128-132.
- Ryder, R. A., W. D. Graul, and G. C. Miller. 1980. Status, distribution, and movement of Ciconiiforms in Colorado. *Proc. 1979 Conf. Colonial Waterbird Group* 3:49-57.
- Short, H. L., and R. J. Cooper. 1985. Habitat suitability index models: Great blue heron. *U.S. Fish Wildl. Serv. Biol. Rep.* 82(10.99). 23 pp.
- Simpson, K., and J. P. Kelsall. 1979. Capture and banding of adult great blue herons at Pender Harbour, British Columbia. *Proc. 1978 Conf. Colonial Waterbird Group* 2:71-78.
- Soots, R. F., and M. C. Landin. 1978. Development and management of avian habitat on dredged material islands. *U.S. Army Eng. Waterways Exp. Stn. Tech. Rep. DS-78-18. Vicksburg, Miss.* 96 pp.
- Soots, R. F., and J. F. Parnell. 1975. Ecological succession of breeding birds in relation to plant succession on dredge islands in North Carolina estuaries. *Univ. North Carolina Sea Grant Program Publ. UNC-75-27. North Carolina State Univ., Raleigh.* 91 pp.
- Spendelow, J. A., and S. R. Patton. In prep. National atlas of coastal waterbird colonies:1976-1982. *U. S. Fish Wildl. Serv. Biol. Rep.*
- Sprunt, A. 1954. *Florida birdlife. Coward-McCann, New York.* 527 pp.
- Stokes, D.W., and L.Q. Stokes. 1989. *A guide to bird behavior. Vol. III. Little, Brown and Co. Boston, Massachusetts.*
- Thompson, D. H. 1979a. Declines in populations of great blue herons and great egrets in five midwestern States. *Proc. 1978 Conf. Colonial Waterbird Group* 2: 114-127.
- _____. 1979b. Feeding areas of great blue herons and great egrets nesting with in the floodplain of the upper Mississippi River. *Proc. 1978 Conf. Colonial Waterbird Group* 2: 202-213.
- Vermeer, K. 1969. Great blue heron colonies in Alberta. *Can. Field Nat.* 83(3): 237-242.
- _____, and L. M. Reynolds. 1970. Organochlorine residues in aquatic birds in the Canadian prairie provinces. *Can. Field Nat.* 84(2):117-130.
- Vos, D. K. 1984. Response of breeding great blue herons to human disturbance in north central Colorado. *M. S. Thesis, Colorado State University, Fort Collins.* 65 pp.
- Ward, P., and A. Zahavi. 1973. The importance of certain assemblages of birds as "information centers" for food finding. *Ibis* 115(4):517-534.
- Werschkul, D. F., E. McMahon, and M. Leitschuh. 1976. Some effects of human activities on the great blue heron in Oregon. *Wilson Bull.* 88(4):660-662.
- _____, E. McMahon, M. Leitschuh, S. English, C. Skibinski, and G. Williamson. 1977. Observations on the reproductive ecology of the great blue heron (*Ardea herodias*) in western Oregon. *Murrelet* 58:7-12.
- Wiese, J. H. 1978. Heron nest site selection and its ecological effects. *Wading birds. Natl. Audubon SOC. Res. Rep.* 7:27-34.

6.3.5 Bald Eagle

Bald Eagle (*Haliaeetus leucocephalus*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

Bald eagles in the lower 48 states were first protected in 1940 by the Bald Eagle Protection Act and then were federally listed as endangered in 1967. In 1995, the bald eagle was reclassified as threatened in all of the lower 48 States. The bald eagle was proposed for delisting on July 6, 1999; a decision on whether to delist the bald eagle is pending (64 FR 36453). No critical habitat has been designated for the bald eagle (USFWS 2003).

The bald eagle is one of eight species of sea-eagle (genus *Haliaeetus*) worldwide (Brown 1977), and the only sea eagle found throughout North America (Stalmaster 1987). Large size, wingspan of 6.6-8.0 ft (200-243 cm) (Stalmaster 1987), and the contrast of white head and tail, and yellow eyes, beak, and legs, to dark brown body and wings make the adult bald eagle one of our most distinctive raptors (Isaacs and Anthony 2003a).

Bald Eagle Life History, Key Environmental Correlates, and Habitat Requirements

Life History

As our national symbol, the bald eagle is widely recognized. Its distinctive white head and tail do not appear until the bird is four to five years old. These large powerful raptors can live for 30 or more years in the wild and even longer in captivity (USFWS 2003).

Diet

Bald eagles consume a variety of prey that varies by location and season. Prey are taken alive, scavenged, and pirated (Frenzel 1985, Watson et al. 1991). Fish were the most frequent prey among 84 species identified at nest sites in south-central Oregon, and a tendency was observed for some individuals or pairs to specialize in certain species (Frenzel 1985). Wintering and migrant eagles in eastern Oregon fed on large mammal carrion, especially road-killed mule deer, domestic cattle that died of natural causes, and stillborn calves, as well as cow afterbirth, waterfowl, ground squirrels, other medium-sized and small rodents, and fish. Proportions varied by month and location. Food habitats are unknown for nesting eagles over much of the state (Isaacs and Anthony 2003a).

Reproduction

Bald eagles are most abundant in Oregon in late winter and early spring, because resident breeders (engaged in early nesting activities), winter residents, and spring transients are all present. Nest building and repair occur any time of year, but most often observed from February to June (Isaacs and Anthony unpublished data). Bald eagles are territorial when breeding but gregarious when not (Stalmaster 1987). They exhibit strong nest-site fidelity (Jenkins and Jackman 1993), but “divorce” has been documented (Frenzel 1985, Garrett et al 1993). Cooperative nesting by three adults was reported (Garcelon et al. 1995). Both sexes build the nest, incubate eggs, and brood and feed young (Stalmaster 1987). Egg laying occurs mid-February to late April; hatching late March to late May; and fledging late June to mid-Aug (Isaacs and Anthony unpublished data) (Isaacs and Anthony 2003a).

Bald eagles lay one to four eggs in late March or early April and both adults incubate the eggs for about 35 days until hatching. During the nest building, egg laying and incubating periods, eagles are extremely sensitive and will abandon a nesting attempt if there are excessive disturbances in the area during this time. The eaglets are able to fly in about three months and then, after a month, they are on their own. The first year is particularly difficult for young eagles. Only half may survive the first year due to disease, lack of food, bad weather, or human interference (USFWS 2003).

Migration

Bald eagles can be resident year-round where food is available; otherwise they will migrate or wander to find food. When not breeding, may congregate where food is abundant, even away from water (Stalmaster 1987). Migrants passing through Glacier National Park generally followed north-south flyways similar to those of waterfowl (McClelland et al. 1994). In contrast, juveniles and subadults form

California traveled north to Oregon, Washington, and British Columbia in late summer and fall (D. K. Garcelon p.c., R. E. Jackman p.c.) (Isaacs and Anthony 2003a).

Mortality

Reviews of published literature (Harmata et al. 1999., Jenkins et al. 1999) suggested that survival varies by location and age; hatch-year survival was usually >60%, and survivorship increased with age to adulthood. However, recent work by Harmata et al. (1999) showed survival lowest among 3- and 4-year old birds (Isaacs and Anthony 2003a).

The major factor leading to the decline and subsequent listing of the bald eagle was disrupted reproduction resulting from contamination by organochlorine pesticides. Other causes of death in bald eagles have included shooting, electrocution, impact injuries, and lead poisoning (USFWS 2003).

Habitat Requirements

General

Bald eagles are generally associated with large bodies of water, but can occur in any habitat with available prey (Isaacs and Anthony 2003a).

Nesting Habitat

Bald eagles nest in forested areas near the ocean, along rivers, and at estuaries, lakes, and reservoirs (Isaacs and Anthony 2001). Consequently, shoreline is an important component of nesting habitat; 84% of Oregon nests were within 1 mi (1.6 km) of water (Anthony and Isaacs 1989). A nest in the Fort Rock Valley was the most distant from water at 18 mi (29 km) from the nearest shoreline (Isaacs and Anthony unpublished data). All nests observed in Oregon have been in trees, primarily Sitka spruce and Douglas-fir west of the Cascades and ponderosa pine, Douglas-fir, and sugar pine in eastern Oregon (Anthony and Isaacs 1989). Use of black cottonwood for nesting has increased recently as Columbia and Willamette River populations have increased. Bald eagles also nest in white fir, red fir, grand fir, incense-cedar, Oregon white oak, quaking aspen, and willow (Isaacs and Anthony unpublished data). Live trees are usually used for nest trees, although nests will continue to be used if the tree dies. Nest trees are usually large and prominent (Anthony et al. 1982). Large old trees have large limbs and open structure required for eagle access and nest territory. Some use has been made of artificial platforms placed in trees modified for Osprey (Witt 1996, Isaacs and Anthony unpublished data, R. Opp p.c.). Cliff nesting is thus for unknown, but possible, especially in sparsely forested areas of southeast Oregon (Isaacs and Anthony 2003a).

Wintering Habitat

Wintering eagles in the Pacific Northwest perch on a variety of substrates; proximity to a food source is probably the most important factor influencing perch selection by bald eagles (Steenhof et al. 1980). Favored perch trees are invariably located near feeding areas, and eagles consistently use preferred branches (Stalmaster 1976). Most tree perches selected by eagles provide a good view of the surrounding area (Servheen 1975, Stalmaster 1976), and eagles tend to use the highest perch sites available (Stalmaster 1976) (USFWS 1986).

Eagles use a variety of tree species as perch sites, depending on regional forest types and stand structures. Dead trees are used by eagles in some areas because they provide unobstructed view and are often taller than surrounding vegetation (Stalmaster 1976). Artificial perches may be important to wintering bald eagles in situations where natural perches are lacking. Along the Columbia River in Washington, where perch trees are not available, eagles regularly use artificial perches, including both crossarm perches and a tripod perch (Fielder, p.c.) (USFWS 1986).

Habitat requirements for communal night roosting are different from those for diurnal perching. Communal roosts are invariably near a rich food resource and in forest stands that are uneven-aged and have at least a remnant of the old-growth forest component (Anthony et al. 1982). Close proximity to a feeding area is not the only requirement for night roosting sites, as there are minimum requirements for forest stand structure. In open areas, bald eagles also use cottonwoods and willows for night roosting (Isaacs and Anthony 1983). Most communal winter roosts used by bald eagles offer considerably more protection from the weather than diurnal habitat. Roost tree species and stand characteristics vary considerably throughout the Pacific Northwest (Anthony et al 1982) (USFWS 1986).

Isolation is an important feature of bald eagle wintering habitat. In Washington, 98% of wintering bald eagles tolerated human activities at a distance of 300 m (328 yards) (Stalmaster and Newman 1978). However, only 50% of eagles tolerated disturbances of 150 m (164 yards; USFWS 1986).

Bald Eagle Population and Distribution
Distribution

The bald eagle is a resident of North America, and can be found throughout Alaska, Canada, the contiguous U.S. (AOU 1998) as far south as Baja California Sur, Mexico (Henny et al. 1978), and as far west as the Aleutian Is., Alaska (Anthony et al. 1999) (Isaacs and Anthony 2003a).

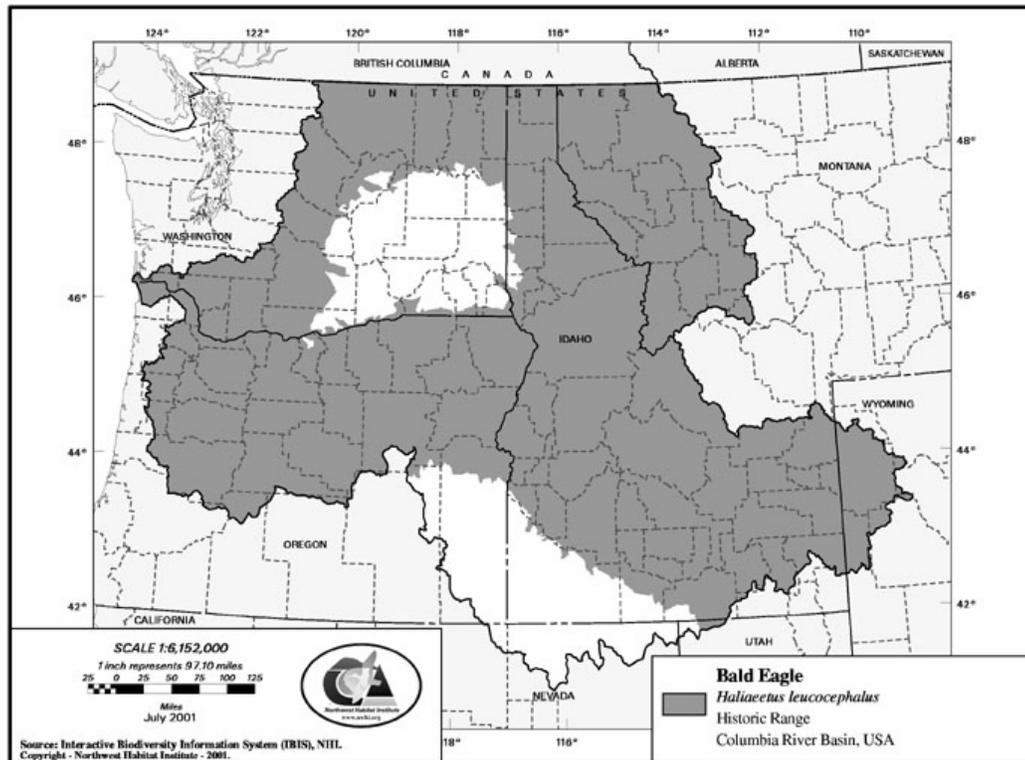


Figure 37. Bald eagle historic range in the Columbia River subbasin (IBIS 2003)

Historic

The status and distribution of bald eagle populations in the decades before World War II are poorly understood. Declines probably begin in some populations in the 19th century; other declines were probably not underway until the 1940's. Between 1947 and 1970, reproduction in most bald eagle populations declined drastically (Broley 1958, Sprunt et al. 1973), and the species disappeared from many parts of its breeding range (USFWS 1986).

Historical records provide evidence for the decline of bald eagles in the Pacific Northwest. Accounts by Baird (1858), Evermann (1886), Merrill (1888, 1897), Belding (1890), Bendire (1892), Woodcock (1902), Hall (1933a, 1933b), and Buechner (1953) document the abundance of bald eagles in the region during the late 19th century. Later records suggest that a population decline may have occurred at the beginning of the twentieth century (Bowles 1906, Dawson and Bowles 1909, Kitchin 1939). These

suspected declines are difficult to quantify, however, because no intensive surveys were conducted until the latter part of the twentieth century. In some cases, historical records have confirmed the disappearance of breeding eagles from parts of their former range. Breeding populations of bald eagles in Oregon and Washington are still widely distributed, but historical information suggests significant declines and changes in distribution (USFWS 1986).

Current

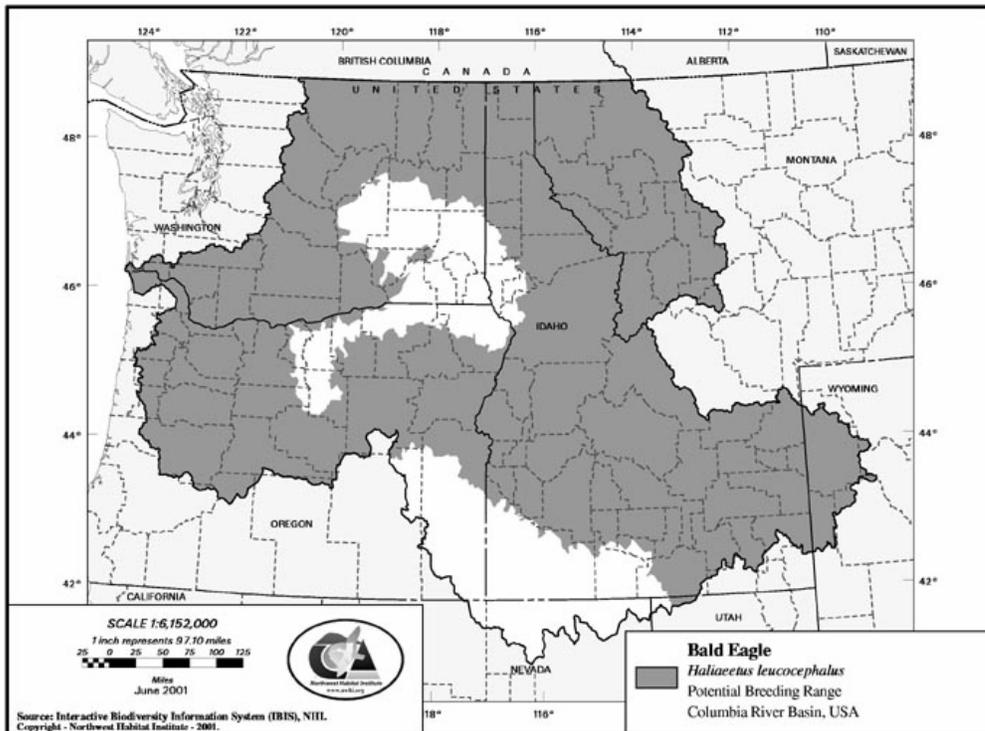


Figure 38. Bald eagle current breeding range in the Columbia River subbasin (IBIS 2003)

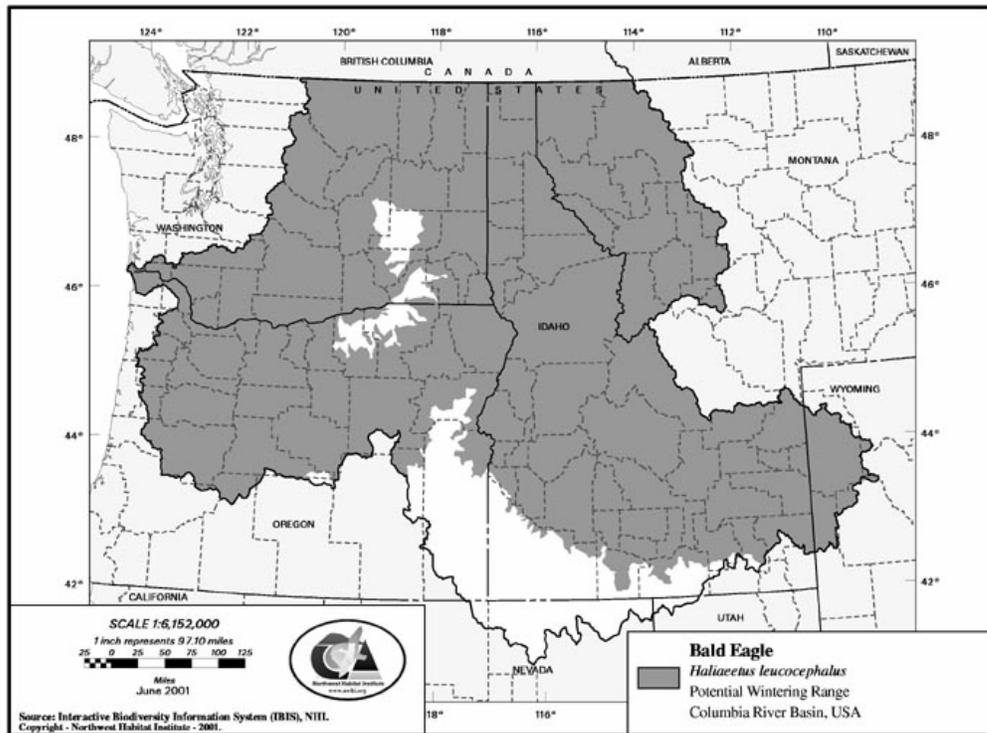


Figure 39. Bald Eagle Current Wintering Range (IBIS 2003)

In Oregon, the bald eagle nested in 32 of 36 counties. Those counties where breeding did not occur include Sherman, Gilliam, Morrow, and Malheur counties (Isaacs and Anthony 2001). Bald eagles can be found throughout the state during non-breeding. Variation locally in number of eagles and timing of peak abundance is due to weather and food supply. Eagles are very common in winter and early spring in the Klamath (Keister et al. 1987) and Harney (Garrett et al. 1988) basins, Columbia River estuary (Garrett et al. 1988), and L. Billy Chinook (Concannon 1998); common in winter and early spring at Hells Canyon, Oxbow, and Brownlee reservoirs, and along the Willowa and Grande Ronde Rivers (Isaacs et al. 1992), the Crooked River Valley above Prineville Reservoir (Isaacs et al. 1993), the south end of the Willamette Valley (Isaacs unpublished data), the John Day River above Service Creek (Isaacs et al. 1996), the Columbia River in Lower Valley (Isaacs unpublished data), the Columbia River in the Umatilla National Wildlife Refuge area (Isaacs unpublished data), Goose Lower Valley (Isaacs unpublished data), Summer Lake and Chewaucan River downstream of Paisley (R.L. Madigan p.c.), and at Sauvie I. (Isaacs unpublished data); common in fall at Wickiup Reservoir (Isaacs unpublished data, G.J. Niehuser p.c.) and Odell Lake (Crescent Ranger District 1998) (Isaacs and Anthony 2003a).

An understanding of population structure, abundance, and distribution is complicated by multiple age classes, breeding status, nesting chronology, origin and movements of individuals, local and regional distribution and abundance of prey, local and regional weather, and season. For example, native and non-native juveniles (<1 yr old), subadults (1-4 yr old), and nonbreeding adults, and breeding adults can all occur in the same area (e.g., Klamath Basin) in winter and early spring (Isaacs and Anthony 2003a).

Bald Eagle Population, Status, and Abundance Trends

Population Status and Conservation

By 1940, the bald eagle had “become rather an uncommon bird” except along the coast and Columbia River, and in Klamath Co. (Gabrielson and Jewett 1940). Habitat loss (cutting of nest trees)

and direct persecution (shooting, trapping, poisoning), probably caused a gradual decline prior to 1940. Between 1945 and 1974 over 4.5 million acres (1.8 million ha) of National Forest in Oregon were sprayed with DDT (Henny and Nelson 1981). Undocumented quantities were also applied on private forests and agricultural crops, and for mosquito control around municipalities. Consequently, the deleterious effects of DDT on reproduction (Stalmaster 1987) joined habitat loss and direct persecution as causes of decline through the early 1970's when the population may have reached its historical low. By then, nesting pairs were extirpated in northeastern Oregon (Isaacs and Anthony 2001), where applications of DDT on National Forest land were common and widespread (Henny and Nelson 1981) (Isaacs and Anthony 2003a).

The bald eagle was declared threatened in Oregon, Washington, Michigan, Minnesota, Wisconsin, and Florida, and endangered in the other 43 contiguous states in 1978 under the federal Endangered Species Act (ESA) because of declining number of nesting pairs and reproductive problems caused by environmental contaminants (USDI 1978). The recovery plan for the Pacific states was completed in 1986 (USFWS 1986b). The bald eagle was listed as threatened under the Oregon ESA in 1987 (Marshall et al. 1996). Listing resulted in protection of eagle habitat and restriction on human activities near nest and roost sites. Site-specific planning was recommended for nest and roost protection (USFWS 1986). Forest management in nesting (Arnett et al. 2001) and roosting (DellaSala et al. 1998) habitat proved useful when declining forest health or fire danger threatened nest and roost trees. Habitat protection and management, the ban on use of DDT (Greier 1982) and reduced direct persecution due to education were followed by a recent population increase. Improved nesting success and a population increase led to a 1999 proposal to delist federally (USDI 1999). Oregon also may propose to delist the species (Isaacs and Anthony 2003a).

The upward population trend could reverse if the species is delisted without maintaining habitat-protection measures implemented under the ESA (e.g., USFS and BLM special habitat management for bald eagles, Oregon Forest Practices Rules protecting bald eagle sites on nonfederal forest land, and local zoning laws that protect wildlife habitat). Habitat degradation and a population decline could go undetected if monitoring of nesting and wintering populations is not continued. Contaminants have been implicated in reduced productivity of nesting pairs on the Columbia River downstream of Portland (Anthony et al. 1993, Buck 1999) and warrant continued monitoring (Isaacs and Anthony 2003a).

Midwinter Bald Eagle Count

Each January, the U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center's Snake River Field Station (SRFS) coordinates the Midwinter Bald Eagle Survey, in which several hundred individuals count eagles along standard, non-overlapping survey routes.

Nationwide counts of eagles were coordinated by the National Wildlife Federation from 1979 until 1992, when the Raptor Research and Technical Assistance Center (now SRFS) assumed responsibility for overseeing the count. Initial objectives of the survey were to establish an index to the total wintering Bald Eagle population in the lower 48 states, to determine eagle distribution during a standardized survey period, and to identify previously unrecognized areas of important winter habitat. In 1986, Millsap (Wildl. Soc. Bull. 14:433-440) reported results of the midwinter survey from 1979 through 1986.

As summarized in Steenhof et al. (2002), mid-winter population trends from 1986-2000 for the Pacific Northwest are: Oregon (+1.4%), Washington (+4.6%), Idaho (+1.9%).

*For more specific data (by route), see: <http://ocid.nacse.org/qml/nbii/eagles/>

Bald Eagle Nest Locations and History of Use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2003

Compiled by Frank B. Isaacs and Robert G. Anthony, 2003b

Highlights

- The 2003 survey year was the 26th year of bald eagle nest site surveys in Oregon (OR) and the Washington (WA) portion of the Columbia River Recovery Zone (CRRZ).

- History of bald eagle use has been compiled for a total of 1,303 nest trees (1,173 in OR, 130 in WA) at 502 nest sites (456 in OR, 46 in WA). Bald eagle nests have been discovered in 33 of 36 (92%) counties in OR, and 6 of 7 counties in the WA portion of the CRRZ. Counties in OR with no reported nests are Sherman, Gilliam, and Morrow. The first nest tree for Malheur County, Oregon was discovered this year. There are no nests known in the Benton County, WA portion of the study area.
- 77 previously unknown nest trees were documented (68 in OR, 9 in WA); 25 were at 23 previously unknown breeding territories (21 at 19 in OR, 4 at 4 in WA), and 52 (47 in OR, 5 in WA) were at previously known territories.
- 458 of 490 (416 of 444 in OR, 42 of 46 in WA) sites surveyed (93%) were occupied by bald eagles. 466 nestlings (430 in OR, 36 in WA) were observed at 445 occupied sites (405 in OR, 40 in WA) where nesting outcome was determined. 5,199 eaglets have been counted at nests in OR since 1971.
- Nesting outcome was 1.06 young per occupied site in OR and 0.90 in WA, resulting in 5-year productivity of 1.03 young per occupied site for OR and 0.94 for WA. This is the second year in a row that the 5-year productivity for OR has been greater than the recovery goal of 1.00.
- Nesting success was 64% in OR and 52% in WA, resulting in 5-year nesting success of 64% in OR and 58% in WA. Young/successful site was 1.65 in OR and 1.71 in WA. Three nestlings were observed at 7 sites in OR and 1 site in WA.
- Nesting success for Recovery Zones with at least 5 occupied sites was highest in Recovery Zone 9 (Blue Mountains) with 1.62 young per occupied site, and was lowest in Recovery Zone 22 (Klamath Basin) with 0.94 young per occupied site. 1.0 young per occupied site in the CRRZ in 2003 was ≥ 1.0 for the second year in a row.
- Net increase in the OR population was 3.7% for 2003. Annual increase averaged 7.4% from 1980-2001; the increase in 2002 was 2.0%. Reasons for the relatively low increase the past 2 years are unknown. Population growth may be slowing, or survey effort has not been sufficient to document eagles nesting in new areas. Data gathered during the next two nesting seasons should help determine the trend.
- Six nest trees at six nest sites burned in wildfires in July and August.

Additional information on nest locations is available.

Factors Affecting Bald Eagle Population Status

Key Factors Inhibiting Populations and Ecological Processes

Currently, loss of habitat and human disturbance are still potential threats. Habitat loss results from the physical alteration of habitat as well as from human disturbance associated with development or recreation (i.e., hiking, camping, boating, and ORV use). Activities that can and have negatively impacted bald eagles include logging, mining, recreation, overgrazing (particularly in riparian habitats), road construction, wetland filling, and industrial development. These activities, as well as suburban and vacation home developments are particularly damaging when they occur in shoreline habitats. Activities that produce increased siltation and industrial pollution can cause dissolved oxygen reductions in aquatic habitats, reductions in bald eagle fish prey populations followed by reductions in the number of eagles. Not all developments in floodplain habitats are detrimental to bald eagles, as some reservoirs and dams have created new habitat with dependable food supplies (USFWS 2003).

Although habitat loss and residual contamination remain a threat to the bald eagle's full recovery, breeding populations in most areas of the country are making encouraging progress. The following continue to be important conservation measures (USFWS 2003):

1. Avoid disturbance to nests during the nesting season: January – August.
2. Avoid disturbance to roosts during the wintering season: November – March.
3. Protect riparian areas from logging, cutting, or tree clearing.
4. Protect fish and waterfowl habitat in bald eagle foraging areas.
5. Development of site-specific management plans to provide for the long-term availability of habitat.

References

- American Ornithologists' Union (AOU). 1998. Check-list of North American birds. 7th edition. American Ornithologists' Union, Baltimore, MD.
- Anthony, R. G., and F. B. Isaacs. 1989. Characteristics of Bald Eagle nest sites in Oregon. *Journal of Wildlife Management* 53: 148-159.
- Anthony, R. G., R. L. Knight, G. T. Allen, B. R. McClelland, and J. I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. *Trans. N. Am. Wildlife Nat. Res. Conference* 47: 332-342.
- Anthony, R. G., M. G. Garrett, and C. A. Schuler. 1993. Environmental contaminants in Bald Eagles in the Columbia River estuary. *Journal of Wildlife Management* 57:10-19.
- Anthony, R. G., A. K. Miles, J. A. Estes, and F. B. Isaacs. 1999. Productivity, diets, and environmental contaminants in nesting Bald Eagles from the Aleutian archipelago. *Environmental Toxicologists and Chemists* 18: 2054-2062.
- Arnett, E. B., R. J. Anderson, C. Sokol, F. B. Isaacs, R. G. Anthony, and W. P. Erickson. 2001. Relationships between nesting Bald Eagles and selective logging in southcentral Oregon. *Wildlife Society Bulletin* 29: 795-803.
- Baird, S. F. 1858. Explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean. War Department Vol. IX. Birds. Washington, D.C.
- Belding, L. 1890. Land birds of the Pacific District. California Academy of Sciences. Occasional paper 2.
- Bendire, C. E. 1892. Life histories of North American birds. U.S. Natl. Mus. Spec. Bulletin 1.
- Bowles, J. H. 1906. A list of the birds of Tacoma, Washington, and vicinity. *Auk* 23:138-148.
- Broley, C. L. 1958. The plight of the American bald eagle. *Audubon* 60:162-163.
- Brown, L. 1977. Eagles of the world. Universe Books, New York.
- Buck, J. 1999. Changes in productivity and environmental contaminants in Bald Eagles nesting along the lower Columbia River. Final Report, U.S. Fish and Wildlife Service, Portland, OR.
- Buechner, M. K. 1953. Some biotic changes in the state of Washington, particularly during the century 1853-1953. *Res. Stud. State Coll. Wash.* 21:154-192.
- Concannon, G. 1998. 1988-1998 wildlife studies summary report, Pelton Round Butte Hydroelectric Project, FERC NO. 2030. Portland General Electric Co., Portland, OR.
- Crescent Ranger District. 1998. Odell Lake Bald Eagle surveys – 1998. Unpublished report, Crescent Ranger District, Deschutes National Forest, Crescent, OR.
- Dawson, W. L. and J. H. Bowles. 1909. The birds of Washington. Volume II. Occidental Publ. Co., Seattle, WA.
- Dellasala, D. A., R. G. Anthony, T. A. Spies, and K. A. Engel. 1998. Management of Bald Eagle communal roosts in fire-adapted mixed-conifer forests. *Journal of Wildlife Management* 62: 322-333.
- Evermann, B. W. 1886. A list of the birds observed in Ventura County, California. *Auk* 5: 344-351.
- Frenzel, R. W. 1985. Environmental contaminants and ecology of Bald Eagles in southcentral Oregon. Ph.D. dissertation, Oregon State University, Corvallis.
- Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis. (Reprinted in 1970 as *Birds of the Pacific Northwest* by Dover Publishing, New York).
- Garcelon, D. K. President, Institute for Wildlife Research, Arcata, CA.

- Garcelon, D. K., G. L. Slater, and C. D. Danilson. 1995. Cooperative nesting by a trio of Bald Eagles. *Journal of Raptor Research* 29:210-213.
- Garrett, M. G., R. G. Anthony, J. W. Watson, and K. McGarigal. 1998. Ecology of Bald Eagles on the lower Columbia River. Final report, U.S. Army Corps of Engineers, Portland, OR. Contract No. DACW57-84-C-0071.
- Grier, J. W. 1982. Ban of DDT and subsequent recovery of reproduction in Bald Eagles. *Science* 218: 1232-1235.
- Hall, F. S. 1933a. Studies in the history of ornithology in the State of Washington (1792-1932) with special reference to the discovery of new species. *Murrelet* 14: 27-36.
- Hall, F.S. 1933b. Studies in the history of ornithology in the State of Washington (1792-1932) with special reference to the discovery of new species. Part II. *Murrelet* 14: 55-77.
- Harmata, A. R., G. J. Montopoli, B. Oakleaf, P. J. Harmata, and M. Restani. 1999. Movements and survival of Bald Eagles banded in the Greater Yellowstone Ecosystem. *Journal of Wildlife Management* 63:781-793.
- Henny, C. J., D. W. Anderson, and C. E. Knoder. 1978. Bald Eagles nesting in Baja California. *Auk* 95: 424.
- Henny, C. J., and M. W. Nelson. 1981. Decline and present status of Peregrine Falcons in Oregon. *Murrelet* 62: 43-53.
- IBIS. 2003. Interactive Biodiversity Information System (<http://ibis.nwhi.org>), Northwest Habitat Institute, Corvallis, OR.
- Isaacs, F. B., and R. G. Anthony. 1983. Ecology of wintering bald eagles in the Harney Basin, Oregon, 1982-1983. Report for U.S. Dept. of Interior, Bureau of Land Management, Burns, OR. Unpublished Manuscript 21 pp.
- Isaacs, F. B., and R. G. Anthony. 2001. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1972 through 2001. Unpublished report, Oregon Cooperative Fish and Wildlife Resources Unit, Oregon State University, Corvallis.
- Isaacs, F. B., and R. G. Anthony. 2003a. Bald Eagle. Pp. 140-144 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Isaacs, F. B., and R. G. Anthony. 2003b. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2003, Oregon Cooperative Fish and Wildlife Resources Unit, Oregon State University, Corvallis.
- Isaacs, F. B., R. G. Anthony, M. Vander Heyden, C. D. Miller, and W. Weatherford. 1996. Habits of Bald Eagles wintering along the upper John Day River, Oregon. *Northwest Science* 70:1-9.
- Isaacs, F. B., R. Goggans, R. G. Anthony, and T. Bryan. 1993. Habits of Bald Eagles wintering along the Crooked River, Oregon. *Northwest Science* 67: 55-62.
- Isaacs, F. B., S. L. Reed, E. R. Reed, and R. G. Anthony. 1992. Habits of Bald Eagles wintering in northeastern Oregon and adjacent areas of Washington and Idaho. Unpublished report, Oregon Coop. Wildl. Res. Unit, Oregon State University, Corvallis.
- Jackman, Ron E. Wildlife Biologist, Predatory Bird Research Group, University of California, Santa Cruz, CA.
- Jenkins, J. M., and R. E. Jackman. 1993. Mate and nest site fidelity in a resident population of Bald Eagles. *Condor* 95: 1053-1056.
- Jenkins, J. M., R. E. Jackman, and W. G. Hunt. 1999. Survival and movements of immature bald eagles fledged in northern California. *Journal of Raptor Research* 33:81-86.
- Keister, G. P., Jr., R. G. Anthony, and E. J. O'Neill. 1987. Use of communal roosts and foraging areas by Bald Eagles wintering in the Klamath Basin. *Journal of Wildlife Management* 51:415-420.
- Kitchin, E. A. 1939. A distributional checklist of the birds of Mount Rainier National Park. *Murrelet* 20: 27-37.
- Madigan, Richard L. Biologist, Oregon Department of Fish and Wildlife, Summer L. WA, Summer L. OR.

- Marshall, D. B., M. W. Chilcote, and H. Weeks. 1996. Species at risk: sensitive, threatened and endangered vertebrates of Oregon, 2nd ed. Oregon Department of Fish and Wildlife, Portland, OR.
- McClelland, B. R., L. S. Young, P. T. McClelland, J. G. Crenshaw, H. L. Allen, and D. S. Shea. 1994. Migration ecology of Bald Eagles from autumn concentrations in Glacier National Park, Montana. Wildlife Monographs 125.
- Merrill, J. C. 1888. Notes on the birds of Fort Klamath, Oregon. Auk 5: 139-146.
- Merrill J. C. 1897. Birds of Fort Sherman, Idaho. Auk 14:347-357.
- Niehuser, Jerry. Volunteer eagle observer, Oregon Eagle Foundation, Bend, OR.
- Opp, Ralph R. Retired, Oregon Dept. Fish and Wildlife, Klamath Falls, OR.
- Servheen, C. W. 1975. Ecology of the wintering bald eagles on the Skagit River, Washington. M.S. Thesis. University of Washington, Seattle. 96 pp.
- Sprunt, A., IV, W. B. Robertson, Jr., S. Postupalsky, R. J. Hensel, C. E. Knoder, and f. J. Ligas. 1973. Comparative productivity of six bald eagle populations. Trnas. N. Am. Wildl. Nat. Res. Conf. 38:96-105.
- Stalmaster, M. V. 1976. Winter ecology and effects of human activity on bald eagles in the Nooksack River Valley, Washington. M.S. Thesis. West Washington State College, Bellingham, WA. 100 pp.
- Stalmaster, M. V. 1987. The Bald Eagle. Universe Books, New York.
- Stalmaster, M. V. and J. R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. Journal of Wildlife Management 43:506-513.
- Steenhof, K., L. Bond, K.K. Bates and L.L. Leppert. 2002. Trends in midwinter counts of Bald eagles in the contiguous United States, 1986-2000. Bird Populations 6:21-32.
- United State Department of the Interior (USDI). 1978. Determinations of certain Bald Eagle populations as endangered or threatened. Federal Register 43: 6230-6233.
- United State Department of the Interior (USDI). 1999. Endangered and threatened wildlife and plants; proposed rule to remove the Bald Eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register 64: 36453-36464.
- United States Fish and Wildlife Service (USFWS). 1986. Recovery Plan for the Pacific Bald Eagle. USFWS, Portland, Oregon.
- United States Fish and Wildlife Service (USFWS). 2003. Oregon Fish and Wildlife Office website, Bald Eagle fact sheet: <http://oregonfwo.fws.gov/EndSpp/FactSheets/Birds/BaldEagle.dwt>.
- Watson, J. W., M. G. Garrett, and R. G. Anthony. 1991. Foraging ecology of Bald Eagles in the Columbia River estuary. Journal of Wildlife Management 55: 492-499.
- Witt, J. W. 1996. Long-term population monitoring of Osprey along the Umpqua River in western Oregon. Journal of Raptor Research 30: 62-69.
- Woodcock, A. R. 1902. An annotated list of the birds of Oregon. Oregon Agric. Exp. Sta. Bull. 68. 119 pp.

6.3.6 White-headed Woodpecker

White-headed Woodpecker (*Picoides albolarvatus*). Paul Ashley and Stacey Stovall. 2004. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment.

Introduction

The white-headed woodpecker (*Picoides albolarvatus*) is a year round resident in the Ponderosa pine (*Pinus ponderosa*) forests found at the lower elevations (generally below 950m). White-headed woodpeckers are particularly vulnerable due to their highly specialized winter diet of ponderosa pine seeds and the lack of alternate, large cone producing, pine species.

Nesting and foraging requirements are the two critical habitat attributes limiting the population growth of this species of woodpecker. Both of these limiting factors are very closely linked to the habitat attributes contained within mature open stands of Ponderosa pine. Past land use practices, including logging and fire suppression, have resulted in significant changes to the forest structure within the Ponderosa pine ecosystem.

White-headed Woodpecker Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

White-headed woodpeckers feed primarily on the seeds of large Ponderosa pines. This makes the white-headed woodpecker quite different from other species of woodpeckers who feed primarily on wood boring insects (Blood 1997; Cannings 1987 and 1995). The existence of only one suitable large pine (ponderosa pine) is likely the key limiting factor to the white-headed woodpecker's distribution and abundance.

Other food sources include insects (on the ground as well as hawking), mullein seeds and suet feeders (Blood 1997; Joe *et al.* 1995). These secondary food sources are used throughout the spring and summer. By late summer, white-headed woodpeckers shift to their exclusive winter diet of ponderosa pine seeds.

Reproduction

White-headed woodpeckers are monogamous and may remain associated with their mate throughout the year. They build their nests in old trees, snags or fallen logs but always in dead wood. Every year the pair bond constructs a new nest. This may take three to four weeks. The nests are, on average 3m off the ground. The old nests are used for overnight roosting by the birds.

The woodpeckers fledge about 3-5 birds every year. During the breeding season (May to July) the male roosts in the cavity with the young until they are fledged. The incubation period usually lasts for 14 days and the young leave the nest after about 26 days. White-headed woodpeckers have one brood per breeding season and there is no replacement brood if the first brood is lost.

The woodpeckers are not very territorial except during the breeding season. They are not especially social birds outside of family groups and pair bonds and generally do not have very dense populations (about 1 pair bond per 8 ha).

Nesting

Generally large ponderosa pine snags consisting of hard outer wood with soft heartwood are preferred by nesting white-headed woodpeckers. In British Columbia 80 percent of reported nests have been in ponderosa pine snags, while the remaining 20 percent have been recorded in Douglas-fir snags. Excavation activities have also been recorded in Trembling Aspen, live Ponderosa pine trees and fence posts (Cannings *et al.* 1987).

In general, nesting locations in the South Okanagan, British Columbia have ranged between 450 - 600m (Blood 1997), with large diameter snags being the preferred nesting tree. Their nesting cavities range from 2.4 to 9 m above ground, with the average being about 5m. New nests are excavated each year and only rarely are previous cavities re-used (Garrett *et al.* 1996).

Migration

The white-headed woodpecker is a non-migratory bird.

Habitat Requirements

Breeding

White-headed woodpeckers live in montane, coniferous forests from British Columbia to California and seem to prefer a forest with a relatively open canopy (50-70 percent cover) and an availability of snags (a partially collapsed, dead tree) and stumps for nesting. The birds prefer to build nests in trees with large diameters with preference increasing with diameter. The understory vegetation is usually very sparse within the preferred habitat and local populations are abundant in burned or cut forest where residual large diameter live and dead trees are present.

Highest abundances of white-headed woodpeckers occur in old-growth stands, particularly ones with a mix of two or more pine species. They are uncommon or absent in monospecific ponderosa pine forests and stands dominated by small-coned or closed-cone conifers (e.g., lodgepole pine or knobcone pine).

Where food availability is at a maximum such as in the Sierra Nevadas, breeding territories may be as low as 10ha (Milne and Hejl 1989). Breeding territories in Oregon are 104 ha in continuous forest and 321 ha in fragmented forests (Dixon 1995b). In general, open Ponderosa pine stands with canopy closures between 30 - 50 percent are preferred. The openness however, is not as important as the presence of mature or veteran cone producing pines within a stand (Milne and Hejl 1989). In the South Okanagan, British Columbia, Ponderosa pine stands in age classes 8 -9 are considered optimal for white-headed woodpeckers (Haney 1997). Milne and Hejl (1989) found 68 percent of nest trees to be on southern aspects, this may be true in the South Okanagan as well, especially, towards the upper elevational limits of Ponderosa pine (800 - 1000m).

White-headed Woodpecker Population and Distribution

Population

Historic

No data are available.

Current

No data are available.

Distribution

Historic

No data are available.

Current

These woodpeckers live in montane, coniferous forests from southern British Columbia in Canada, to eastern Washington, southern California and Nevada and Northern Idaho in the United States. The exact population of the white-headed woodpecker is unknown but there are thought to be less than 100 of the birds in British Columbia. See [Figure 100](#), [Figure 101](#), and [Figure 102](#) for current distribution.

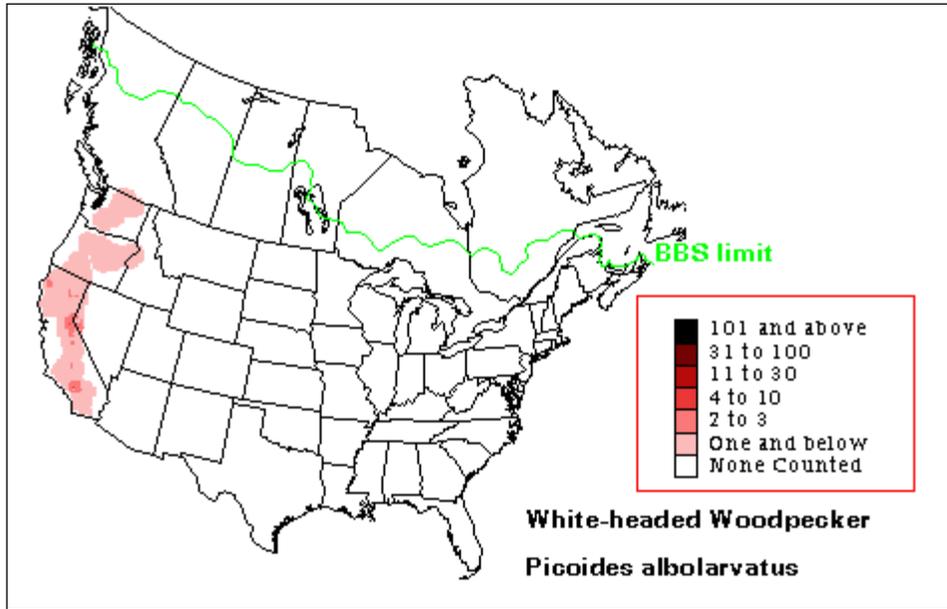


Figure 40. White-headed woodpecker year-round range (Sauer *et al.* 2003).

Woodpecker abundance appears to decrease north of California. They are uncommon in Washington and Idaho and rare in British Columbia. However, they are still common in most of their original range in the Sierra Nevada and mountains of southern California. The birds are non-migratory but do wander out of their range sometimes in search of food.

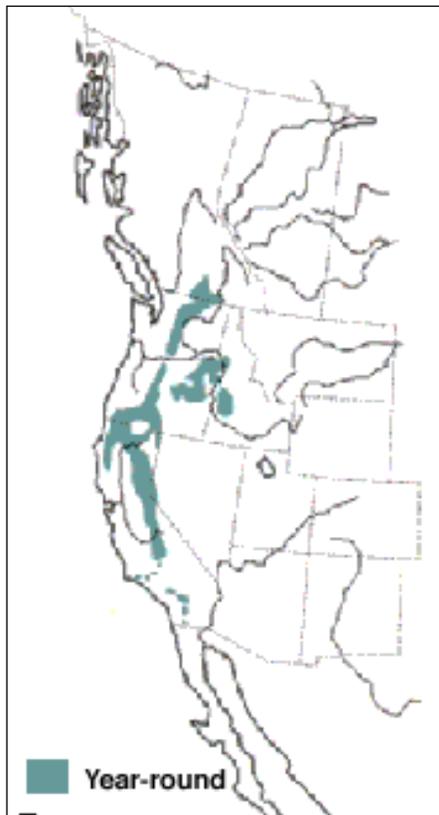


Figure 41 White-headed woodpecker breeding distribution (from BBS data) (Sauer *et al.* 2003).

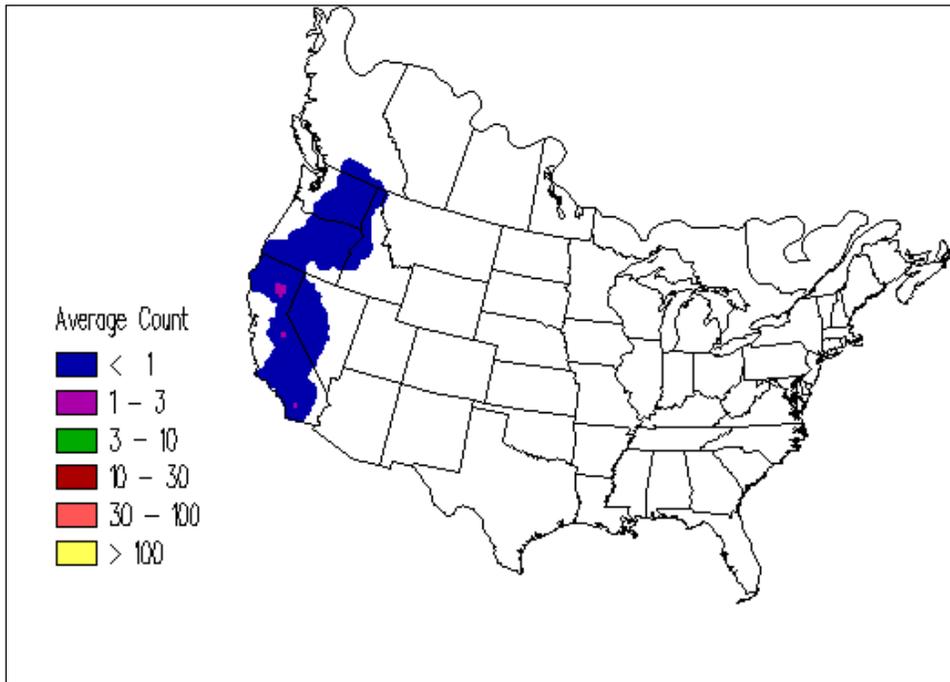


Figure 42. White-headed woodpecker winter distribution (from CBC data) (Sauer *et al.* 2003).

White-headed Woodpecker Status and Abundance Trends

Status

Although populations appear to be stable at present, this species is of moderate conservation importance because of its relatively small and patchy year-round range and its dependence on mature, montane coniferous forests in the West. Knowledge of this woodpecker's tolerance of forest fragmentation and silvicultural practices will be important in conserving future populations.

Trends

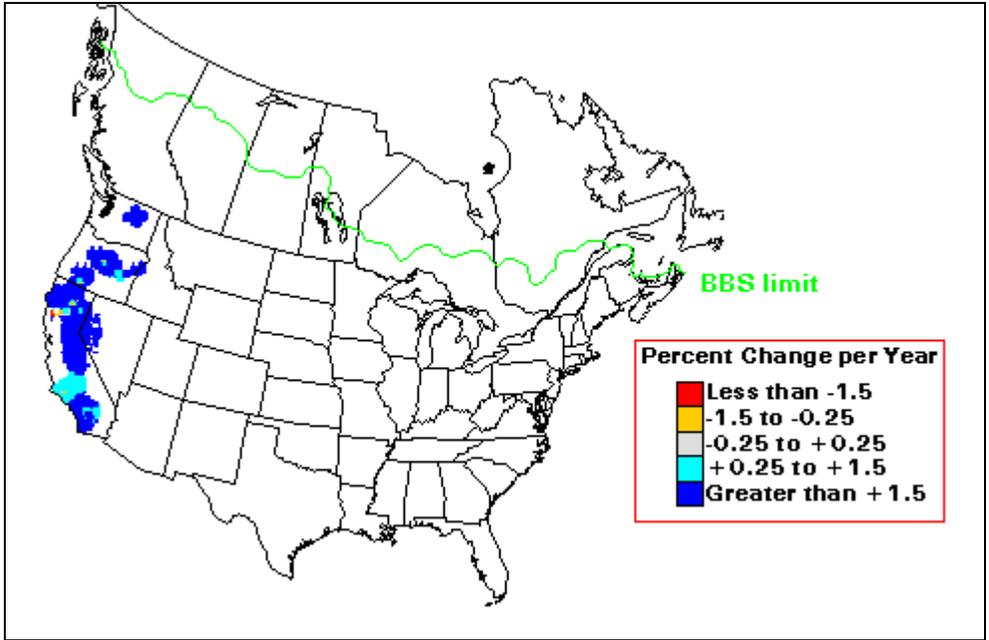


Figure 43. White-headed woodpecker Breeding Bird Survey (BBS) population trend: 1966-1996 (Sauer *et al.* 2003).

Factors Affecting White-headed Woodpecker Population Status

Key Factors Inhibiting Populations and Ecological Processes

Logging

Logging has removed much of the old cone producing pines throughout the South Okanagan. Approximately 27, 500 ha of ponderosa pine forest remain in the South Okanagan and 34.5 percent of this is classed as old growth forest (Ministry of Environment Lands and Parks 1998). This is a significant reduction from the estimated 75 percent in the mid 1800s (Cannings 2000). The 34.5 percent old growth estimate may in fact be even less since some of the forest cover information is incomplete and needs to be ground truthed to verify the age classes present. The impact from the decrease in old cone producing ponderosa pines is even more exaggerated in the South Okanagan because there are no alternate pine species for the white-headed woodpecker to utilize. This is especially true over the winter when other major food sources such as insects are not available. Suitable snags (DBH>60cm) are in short supply in the South Okanagan.

Fire Suppression

Fire suppression has altered the stand structure in many of the forests in the South Okanagan. Lack of fire has allowed dense stands of immature ponderosa pine as well as the more shade tolerant Douglas-fir to establish. This has led to increased fuel loads resulting in more severe stand replacing fires where both the mature cone producing trees and the large suitable snags are destroyed. These dense stands of immature trees has also led to increased competition for nutrients as well as a slow change from a Ponderosa pine climax forest to a Douglas-fir dominated climax forest.

Predation

There are a few threats to white-headed woodpeckers such as predation and the destruction of its habitat. Chipmunks are known to prey on the eggs and nestlings of white-headed woodpeckers. There is also predation by the great horned owl on adult white-headed woodpeckers. However, predation does not appreciably affect the woodpecker population.

References

- Blair G.S., and G. Servheen. 1993. Species Conservation Plan for the White-headed Woodpecker (*Picoides albolarvatus*). US Dept. Agric. For. Serv. (R-1) and Idaho Dept. of Fish and Game.
- Blood D.A. 1997. White-headed Woodpecker. Wildlife at Risk in British Columbia, Brochure. Province of British Columbia, Ministry of Environment, Lands and Parks.
- Campbell R.W., A.K. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, M.C. Mcnall and G.E. John Smith. 1997a. Birds of British Columbia, Volume 2 of 4, Non-passerines, Diurnal Birds of Prey Through Woodpeckers. UBC Press with Environment Canada (Canadian Wildlife Service) and British Columbia Ministry of Environment, Lands and Parks. University of British Columbia, Vancouver, BC. 635pp.
- Cannings, R. J. 1992. Status Report on the White-headed Woodpecker *Picoides Albolarvatus*.
- Cannings, R. J. 1995. Status of the White-headed Woodpecker in British Columbia. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Bulletin No. B-80. 8pp.
- Cannings, R. J. 2000. Update COSEWIC Status Report on White-headed woodpecker (*Picoides albolarvatus*). 18pp.
- Curtis, J. D. 1948. Animals that Eat Ponderosa pine Seed. *Journal of Wildlife Management* (12) 327-328.
- Dixon. R.D. 1995a. Density, Nest-site and Roost-site Characteristics, Home-range, Habitat-use and Behaviour of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl. Nongame Report. 93-3-01.
- Dixon, R. D. 1995b. Ecology of White-headed Woodpeckers in the Central Oregon Cascades. Masters Thesis, Univ. of Idaho, Moscow, ID. In Garrett. K. L., M.G. Raphael and R.D. Dixon. 1996. White-headed Woodpecker (*Picoides albolarvatus*). In *The Birds of North America* No. 252 (A. Poole and F. Gills, eds.) The Birds of North America Inc., Philadelphia, PA.
- Frederick G. P. and T.L. Moore. 1991. Distribution and Habitat of White-headed Woodpecker (*Picoides albolarvatus*) in West Central Idaho. Cons. Data Centre, Idaho Dept. of Fish and Game, Boise, ID. In Ramsay L. 1997. White-headed Woodpecker Survey in the South Okanagan, BC (1996 and 1997). Report to Ministry of Environment Lands and Parks, Wildlife Branch, Penticton, BC. 23pp.
- Garrett. L. K., M. G. Raphael and R.D. Dixon. 1996. White-headed woodpecker (*Picoides albolarvatus*). In *The Birds of North America* No. 252 (A. Poole and F. Gill eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists Union, Washington D.C. 23pp.
- Grinnell, J. 1902. The Southern White-headed Woodpecker. *Condor* (4) 89-90.
- Haney A. 1998. White Headed Woodpecker (*Picoides albolarvatus*) Habitat Capability and Suitability Values, Modeling Guide. Draft Habitat Model for White-headed woodpecker for Ministry of Environment, Lands and Parks.
- Jaeger, E.C. 1947. White-headed Woodpecker Spends Winter at Palm Springs, California. *Condor* (49) 244-245.
- Joy. J., R. Driessche and S. McConnell. 1995. 1995 White-headed Woodpecker Population and Habitat Inventory in the South Okanagan. Report For the BC Ministry of Environment, Lands and Parks. 21pp.
- Ligon J. D. 1973. Foraging Behaviour of the White-headed Woodpecker in Idaho. *Auk* 90: 862 – 869.
- Mannan, R.W. and E.C. Meslow. 1984. Bird Populations and Vegetation Characteristics in Managed and Old-growth Forests, Northeastern Oregon. *Journal of Wildlife Management* (48) 1219-1238.

- Milne, K. A. and S. J. Hejl. 1989. Nest Site Characteristics of White-headed Woodpeckers. *J. Wildl. Manage.* 53 (1) pp 50 - 55.
- Ramsay, L. 1997. White-headed Woodpecker Survey in the South Okanagan, BC (1996 and 1997). Report to Ministry of Environment, Lands and Parks, Wildlife Branch, Penticton, BC. 23pp.
- Raphael, M. G., M.L. Morrison and M.P. Yoder-Williams. 1987. Breeding Bird Populations During 25 Years of Postfire Succession in the Sierra Nevada. *Condor* (89) 614-626.
- Robinson, G. 1957. Observations of Pair Relations of White-headed Woodpeckers in Winter. *Condor* (59) 339-340.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.
- Yom-Tov, Y. and A. Ar. 1993. Incubation and Fledgling Durations of Woodpeckers. *Condor* (95) 282-287.

6.3.7 Yellow-breasted Chat

Yellow-breasted Chat (*Icteria virens*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

The yellow-breasted chat (YBC) is the largest of the wood-warblers. Wood warblers are small and active birds with short, pointed bills. The YBC is superficially tanager-like in appearance, with a somewhat thrasher-like song. They can be found skulking in dense but sunny brush (Sibley 2000).

Western populations of YBC differ slightly in appearance and song than eastern populations. The western birds have slightly longer tails, slightly grayer above with white malar (verses mostly yellow). Western birds also average deeper yellow-orange on the throat and breast (Sibley 2000).

The YBC is frequently overlooked and seldom seen. With its extensive vocal repertoire, the male's presence is easy to document early in the breeding season. Late in the season, during migration, and on the wintering grounds, the non-singing birds are difficult to detect (Eckerle and Thompson 2001).

Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

The YBC has a diet mostly composed of insects, which are gleaned from vegetation (Csuti et al. 1997) in dense shrubs and thickets (Eckerle and Thompson 2001). Insects include ants, bees, and wasps; beetles and weevils; caterpillars, moths, grasshoppers, mayflies, true bugs, and spiders (Bent 1953, Marten et al. 1951, Csuti et al. 1997). Fruit and berries may comprise a small portion of their diet in the summer, and a larger portion in the fall and winter (Csuti et al. 1997, Vroman 2003). Fruits and berries in the Pacific region may consist of Pacific madrone, thimbleberry, sumac, dogwood, nightshade (Martin et al. 1951); berries of many plants and wild grape (Bent 1953, Dunn and Garrett 1997); and introduced Himalayan blackberries (Vroman 2003). Nestlings feed primarily on larval and adult insects (Bent 1953, Schadd 1995), particularly soft-bodied orthopterans (grasshoppers and crickets) and larval lepidopterans (moths and butterflies) (Petrides 1938, Eckerle and Thompson 2001).

Reproduction

YBC arrive in eastern Oregon (east of the Cascades) from early to mid-May (Vroman 1997). They are recorded nesting in Oregon as early as May 6th (Csuti et al. 1997). They tend to

sing as soon as reaching nesting grounds (Vroman 2003). The chats song is long and complex, including a series of cackles, rattles, whistles, mews, and squeals. They perform a bizarre display flight. While singing, the chat flies vertically, or horizontally, with slow wing-beats (exposing yellow underwing coverts), legs dangling, while pumping its tail and holding its head high (Vroman 2003). Females will initiate and complete nest-building shortly after pairing with a male (Eckerle and Thompson 2001). Chats usually have a clutch size of 5 (range 3-6) eggs. The eggs are usually incubated for about two weeks, then after hatching the young will leave the nest in about 8-11 days (Csuti et al. 1997). The young are exclusively brooded by the female, while both parents feed the nestlings (Eckerle and Thompson 2001).

The nest of the YBC is a bulky cup, well-hidden in dense vegetation, usually 2-3 ft (0.6-0.9m), above ground (Ehrlich et al. 1998, Dunn and Garrett 1997, Vroman 2003). It is often constructed of dead leaves, grasses, and weeds, and bark shreds; often lined with finer material (Vroman 2003).

Breeding Territory/Home Range

During the breeding season, male chats maintain and defend individual territories (Dennis 1958, Thompson and Nolan 1973). Pairs of chats tend to congregate, suggesting a degree of loose coloniality that may be independent of differences in availability of suitable habitat (Griscom 1923). During course of settlement on breeding area, territory or home-range size decreases as more males arrive (Thompson and Nolan 1973). Effectiveness of territorial defense appears to decline with increasing population densities (Eckerle and Thompson 2001).

Survivorship

There is no data available on annual survivorship. The oldest YBC banded and recaptured had a minimum age of 8 years and 11 months (Eckerle and Thompson 2001).

Mortality

There is no information on frequency of adult or juvenile depredation, but frequency of nest depredation is high (Eckerle and Thompson 2001). Migrants frequently collide with stationary objects, such as buildings and TV and radio towers (Eckerle and Thompson 2001).

Habitat Requirements

Breeding

YBCs occupy edges of large, dense thickets in valley riparian areas and swales, floodplain areas adjacent to streams and river, and in unmanaged dense leafy vegetation fringing ponds and swamps (Gabrielson and Jewett 1940, Bent 1953, Vroman 2003). Open-canopy overstory trees are generally present, except in desert riparian situations (Vroman 2003). In eastern Oregon, chats have occupied riparian willow and dogwood on the Malheur National Wildlife Refuge (Littlefield 1990). Riparian areas occupied along the Malheur and Owyhee rivers, upper Willow Cr., Succor Cr. and in the Oregon Canyon Mountains consist of brushy mature willow and mountain alder (Contreras and Kindschy 1996, Vroman 2003).

Migration

YBCs are usually found in the same low, dense vegetation used on breeding grounds, although spring migrants have occasionally been found in suburban habitat (Phillips et al. 1964, Parnell 1969, Eckerle and Thompson 2001).

Wintering

Wintering habitat is similar in structure to that used for breeding and migration (Eckerle and Thompson 2001). YBCs are fairly common in undergrowth within tropical ever-green forest, Pacific swamp forest, tropical deciduous forest, arid tropical scrub, and lower reaches of tropical semideciduous forest in Oaxaca, Mexico, where it is most numerous in more humid forest (Binford 1989, Eckerle and Thompson 2001).

Population and Distribution

Distribution

The YBC breeds from southern British Columbia eastward to southern Saskatchewan, western and central New York south to south central Baja California, on Pacific slope to southern Tamaulipas, and to the Gulf coast and northern Florida. The chat winters from southern Baja California, southern Sinaloa, southern Texas, southern Louisiana and southern Florida south through Central America to West Panama (Vroman 2003).

As cited in Vroman (2003), the chat is a locally uncommon summer resident in valley riparian areas of Harney and Malheur counties (Littlefield 1990a, Contreras and Kindschy 1996, OBBA, A. McGie p.c.), the Deschutes and John Day River systems (OBBA); northeast Oregon valleys (Grande Ronde Bird Club 1988, Umatilla NF 1991, ODFW undated checklist); Snake River Canyon, Imnaha River, Little Sheep Creek (OBBA); Grande Ronde, Powder, and Burnt River systems (OBBA); Walla Walla River and tributaries, Umatilla River; Butter, Willow, and Rhea Creek in Morrow County (OBBA). Chats are rare in forested regions of the Blue Mountains (Thomas 1979, OBBA). They are locally common in southeast and northeast Oregon where habitat is excellent.

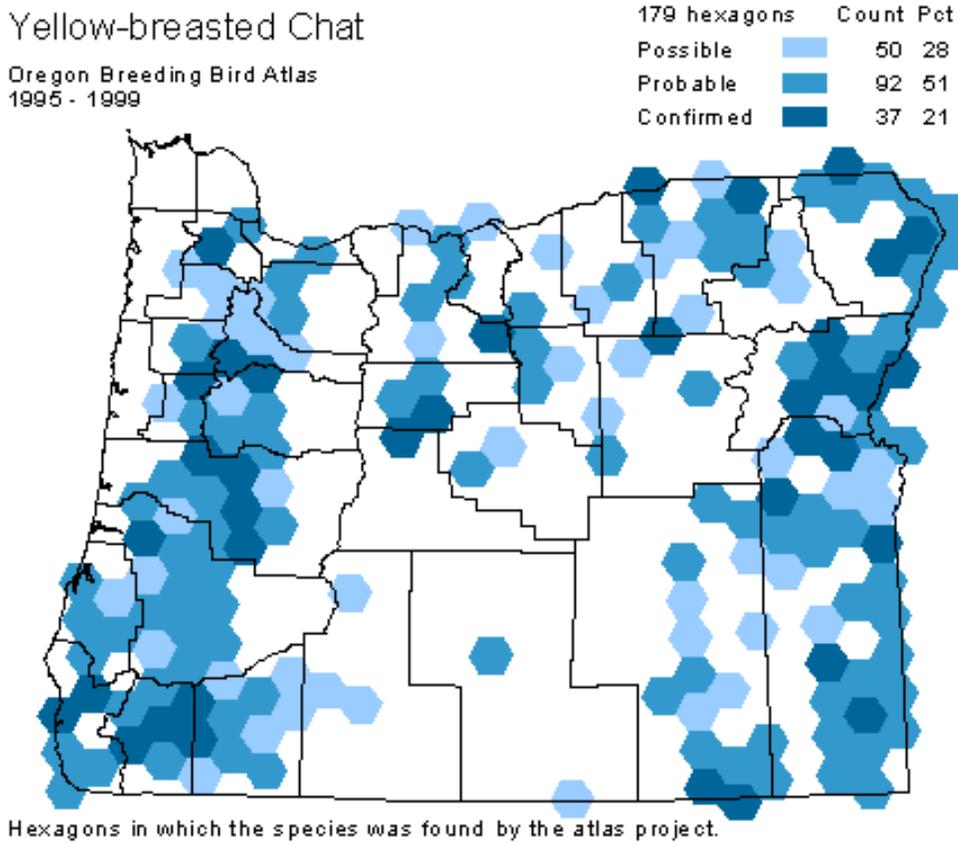


Figure 44. Oregon Breeding Bird Atlas project detections of yellow-breasted chat in Oregon 1995-1999 (Adamus et al. 2001).

Population

Historic

There is no historic population data for YBC.

Current Population and Status

The YBC is threatened, endangered, or extirpated in some areas of its historic range, but overall they are not threatened with extinction (Reed 1992, Eckerle and Thompson 2001).

The chat is not listed by the U.S. Government, but is listed as threatened, endangered, or of special concern in some states and provinces on the periphery of its range (e.g., Connecticut, New Jersey, New York, Ontario, and British Columbia) (Eckerle and Thompson 2001). The YBC is listed as a sensitive species (Critical-Willamette Valley) in Oregon (ODFW 1997). Critical is defined by the State of Oregon as a species for which listing as threatened or endangered is pending, or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken.

In a 1980 breeding season survey, Rogers (1980) detected YBCs at a rate of 8-9 birds/mi (5.5 birds/km) between Joseph and Imnaha (a 20 mi [32.2 km] length of road) (Vroman 2003). Statewide BBS data 1980-98 show an increasing (but statistically non-significant) breeding season trend (2.0%/year) (Vroman 2003).

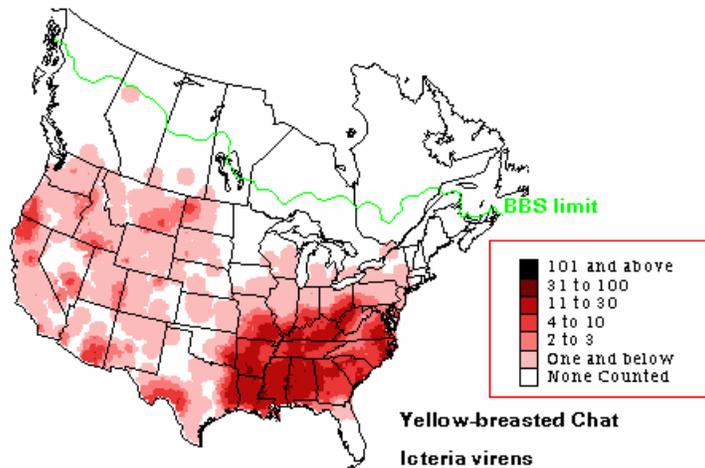


Figure 1. Yellow-breasted Chat breeding distribution from BBS data (1982-1996) (Sauer et al. 2001)

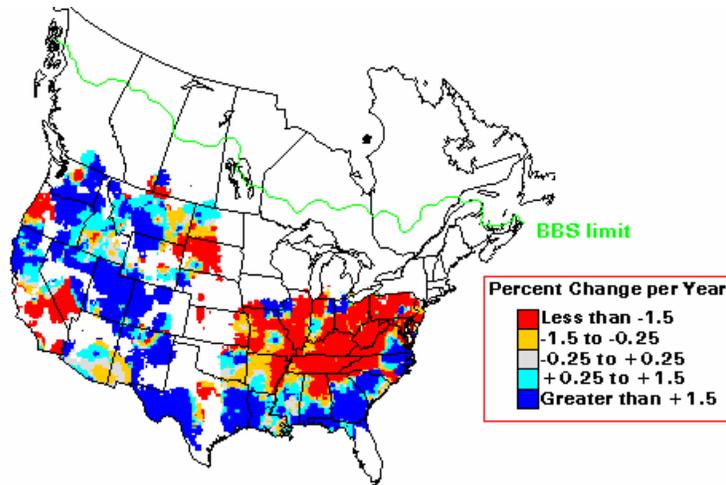


Figure 2. Yellow-breasted Chat population trend from BBS data (1966-1996) (Sauer et al. 1996)

Factors Affecting Population Status

The greatest threat to the YBC population is loss or modification (e.g., undergrowth removal, reduced width) of river riparian and floodplain habitat, particularly, east of the Cascades (Vroman 2003).

Management

The YBC is adapted to exploiting patchy, short-lived habitats (Eckerle and Thompson 2001). The characteristics of high turnover of breeding individuals in natural populations (Thompson and Nolan 1973) and rapid replacement of experimentally removed birds (Thompson 1977) play into the hands of managers who create or maintain suitable habitat (Eckerle and Thompson 2001). In the West, preservation of existing riparian habitats is of the first importance, as well as restoration of lost riparian vegetation. Any process that creates patches of suitable habitat that exceed several hectares will benefit the species (Eckerle and Thompson 2001).

References

- Adamus, P. R., K. Larsen, G. Gillson, and C. R. Miller. 2001. Oregon Breeding Bird Atlas. Oregon Field Ornithologists. [www.oregonbirds.org], Eugene, OR.
- Bent, A. C. 1953. Life histories of North American wood warblers. U.S. Natl. Mus. Bull. 203.
- Binford, L. C. 1989. A distributional survey of the birds of the Mexican state of Oaxaca. Ornithological Monographs No. 43.
- Contreras, A., and R. Kindschy. 1996. Birds of Malheur County, Oregon, and the adjacent Snake River islands of Idaho. Oregon Field Ornithologists Special Publication 8, Eugene.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History. Oregon State University Press. Corvallis, OR.
- Dennis, J. V. 1958. Some aspects of the breeding ecology of the Yellow-breasted Chat (*Icteria virens*). Bird-Banding 29:169-183.
- Dunn, J. L. and K. L. Garrett. 1997. A field guide to warblers of North America. Houghton Mifflin Co., Boston, MA.

- Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted chat (*Icteria virens*). In *The Birds of North America*, No. 575 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. *The birders guide to the natural history of North American birds*. Simon & Schuster, New York, NY.
- Gabrielson, I. N., and S. G. Jewett. 1940. *Birds of Oregon*. Oregon State College, Corvallis. (Reprinted in 1970 as *Birds of the Pacific Northwest* by Dover Publishing, New York).
- Grande Ronde Bird Club. 1988. *Birds of northeastern Oregon: Union, Baker and Wallowa counties (checklist)*. La Grande, OR.
- Griscom, L. 1923. *Birds of the New York city region*. American Museum of Natural History Handbook Series Number 9.
- Littlefield, C. D. 1990. *Birds of Malheur National Wildlife Refuge, Oregon*. Oregon State University Press, Corvallis.
- Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. *American wildlife and plants*. McGraw-Hill Book Co. (Reprinted in 1961 by Dover Publishing, New York).
- McGie, Alan. Retired: Oregon Department of Fish and Wildlife. Oregon Bird Records Committee.
- Oregon Breeding Bird Atlas (OBBA). Oregon Breeding Bird Atlas data 1995-1999, prior to finalizing and publishing the CD (see Adamus et al. 2001).
- Oregon Department of Fish and Wildlife (ODFW). 1997. *Oregon Department of Fish and Wildlife sensitive species*. ODFW, Portland.
- Oregon Department of Fish and Wildlife (ODFW). Undated checklist. *Birds of Ladd Marsh Wildlife Area, La Grande, OR*.
- Parnell, J. F. 1969. Habitat relations of the Parulidae during spring migration. *Auk* 86: 505-521.
- Petrides, G. A. 1938. A life history study of the Yellow-breasted Chat. *Wilson Bulletin* 50:184-189.
- Phillips, A., J. Marshall, and G. Monson. 1964. *The birds of Arizona*. University of Arizona Press, Tucson.
- Reed, J. M. 1992. A system for ranking conservation priorities for Neotropical migrant birds based on relative susceptibility to extinction. Pp. 524-536 in *Ecology and conservation of Neotropical migrant landbirds* (J. M. Hagan, III, and D. W. Johnson, eds.). Smithsonian Institution Press, Washington, D. C.
- Rogers, T. H. 1980. Northern Rocky Mountain-intermountain region. *American Birds* 34: 291-293.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1*, USGS Patuxent Wildlife Research Center, Laurel, MD. <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>
- Schadd, C. A. 1995. *Adult provisioning behavior and nestling begging behavior in the Yellow-breasted Chat (Icteria virens)*. M.S. Thesis, Eastern Kentucky University, Richmond.
- Sibley, D. A. 2000. *National Audubon Society: The Sibley Guide to Birds*. Chanticleer Press, Inc., New York.
- Thomas, J. W., Technical editor. 1979. *Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington*. U.S. Department of Agriculture, Forest Service, Agric. Handbook 553.
- Thompson, C. F. and V. Nolan, Jr. 1973. Population biology of the Yellow-breasted Chat (*Icteria virens L.*) in southern Indiana. *Ecological Monographs* 43: 145-171.
- Thompson, C. F. 1977. Experimental removal and replacement of territorial male Yellow-breasted Chats. *Auk* 94: 107-113.
- Umatilla National Forest. 1991. *Birds of the Umatilla National Forest (checklist)*. U.S. Department of Agriculture, Forest Service, Umatilla National Forest, Pendleton, OR.

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

Vroman, D. P. 2003. Yellow-breasted Chat. Pp. 529-530 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

6.3.8 Mule Deer

Mule Deer (*Odocoileus hemionus hemionus*) George Keister, ODFW

Introduction

Mule deer have been an important member of eastern Oregon's landscape, serving as a food and clothing source for Native Americans prior to settlement by Euro-Americans. Today mule deer remain an important component of the landscape, providing recreational opportunities for hunters and wildlife watchers, and tremendous economic benefits to local communities and the state of Oregon. Mule deer range throughout eastern Oregon, occupying various habitats from coniferous forest at 9,000 feet elevation to the farmlands and shrub steppe habitats along the breaks of the Snake River.

Mule Deer Life History, Habitat Requirements, and Populations

Life History

The Lower-Middle Snake SubBasin is both summer and winter range for mule deer. The Snake River, from McGraw Creek to Fairwell Bend in Oregon is an important winter range for ~6,000 mule deer that come from five Big Game Management Units to winter in the lower elevation habitats. A similar number of deer winter on the Idaho side of the Snake River. Mule deer fawns are born from late May through mid June following a gestation of approximately 203 days, with does commonly having twins. Does require nutritious forage and water while nursing fawns. Fawns need good hiding cover to protect them from predators. The breeding season occurs in the late fall and early winter (November – early December), with mule deer becoming sexually mature as yearlings. During the fall season, high quality forage should be available to allow does to recover from the rigors of nursing fawns and prepare for the leaner winter months. Late summer/fall rains that create a greenup are very important for mule deer. The fall greenup provides the nutrition necessary to improve body condition for the coming winter, and maintain the fertility of does that breed in late fall. A late summer/fall drought can result in increased winter mortality of adults and fawns and may lower fertility rates for does. Good spring range conditions are important because they provide the first opportunity for mule deer to reverse the energy deficits created by low quality forage and winter weather. Winter is a difficult time for mule deer; forage quality and availability are limited, and does that are carrying developing fetuses are under significant stress. Ideally, mule deer winter range should be free of disturbance and contain abundant, high quality forage. Poor winter range conditions and severe winter weather in the form of deep snow and cold temperatures have resulted in high mortality, especially among the old and young.

Diet

Mule deer diets are as varied as the landscapes they inhabit. Grass is preferred only when green and succulent, during spring and fall greenup. Forbs are very desirable as long as available, usually during spring and early summer. Shrubs are extremely important during the winter when snow covers other low-growing vegetation.

Habitat Use

Mule deer occupy a variety of summer habitats in the Lower-Middle Snake SubBasin. Consequently, habitat use varies with vegetative and landscape components contained within each herd range. Forested habitats provide mule deer with forage as well as thermal and escape cover. Mule deer occupying mountain-foothill habitats live within a broad range of elevations,

climates, and topography which includes a wide range of vegetation. Some mule deer summer in the deep canyon complexes along the Snake River and its tributaries; these areas are dominated by shrub-steppe, mountain shrub, native bunch grass, and annual grass vegetation.

Migration

Most mule deer that summer at higher elevation in the Wallowa Mountains migrate to lower elevations to winter along the Snake River. Some mule deer have been observed to migrate considerable distances (up to 40 mi.) between summer and winter ranges. A recent study (1999 – 2001) of mule deer along the Snake River by Idaho Power Corporation documented deer migrating from five different Big Game Management Units to winter along the Snake River in the Lower-Middle Snake SubBasin.

Population

Mule deer were utilized for food by Native Americans, but deer populations and level of harvest is unknown. Large numbers of European settlers came to the area when gold was discovered in 1861. Deer were heavily hunted by settlers for food and numbers became quite depleted by 1900. Harvest was regulated after that time. By the early 1900s, predators were significantly reduced or eliminated due to competition with livestock and settlers. The result of regulated harvest and depleted predator populations was an explosion in deer numbers, which peaked in the 1950's – 1970's. Deer numbers during that period were twice the current levels and hunter numbers and harvest were six times present levels. Deer populations and fawn:doe ratios have fluctuated annually but have been in general decline since the early 1980s due to several hard winters, periodic drought, and increasing predation rates. As populations have declined so did buck:doe ratios. Limited entry (limited number of hunters determined by a draw) rifle hunting began in the late 1980s to limit buck harvest and maintain post season buck ratios. Antlerless hunting has been insignificant in the Lower-Middle Snake SubBasin since 1988. Archery hunting has increased in popularity over the last 20 years. Archery season continues to be a “general season” (unlimited number of hunters) and hunter numbers continue to increase.

Mortality

A recent study done by Idaho Power found a high mortality rate for mule deer wintering in the Lower-Middle Snake area. There was a 24% annual mortality rate for adult does, whereas 7 – 15% is expected. The major cause of mortality for adult does was predation by cougars. For fawns, the major cause of mortality was coyote predation. The high adult mortality rate is believed to be a recent development and is too high for the population to sustain itself over the long term.

Factors Affecting Mule Deer Population Status

Mule deer in the Lower-Middle Snake SubBasin have been negatively impacted by habitat conversion, dam construction, road and highway construction, drought, fire, extreme winters, and increasing predator populations.

Weather

Weather conditions can play a major role in the survival, productivity, and abundance of mule deer. Drought conditions can have a severe impact on mule deer. Drought conditions during the summer and fall result in poor physical condition going into winter months. Severe winter weather often resulted in high mortality, particularly after a drought. Severe weather can result in mortality of all age classes, but the young, old, and mature bucks usually sustain the highest mortality. If mule deer are subjected to drought conditions in the summer and fall, followed by a severe winter, the result can be high mortality rates and low productivity the following year.

Habitat

The Lower-middle Snake SubBasin has historically been a very important winter range for mule deer due to its lower elevation, which allows them to escape deep snow cover most years. However, much of the habitat along Brownlee Reservoir has been converted to annual grasslands (i.e. cheat grass, medusa head rye) and shrubs (i.e. bitterbrush, sagebrush) have been lost. Fire suppression, historic overgrazing by livestock, and introduction of exotic plants have all been factors in habitat conversion.

During milder winter periods, annual grasses and forbs become green and succulent and are extensively utilized by mule deer. However, during periods of snow cover and cold temperatures, these plants are not available and shrubs are lacking. In addition up to 100 feet of lower elevation habitat has been lost to inundation due to the Hells Canyon Dams. During extended cold periods, the reservoirs sometimes freeze and mule deer have died in large numbers on the ice. Idaho Power estimated ~10% annual mortality of mule deer wintering along the Hells Canyon Complex as a result of the operation of these reservoirs.

Predation

Coyote populations increased significantly after the cessation of the use of 1080 poison in 1972. In addition, cougar populations have increased over the last 30 years. During this period, mule deer numbers have declined to about half of historic levels.

Hydroelectric Dams

Three dams known as the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee Dams) were constructed on the lower-middle Snake River during the 1960s. The reservoirs created by these dams inundated thousands of acres of riparian habitat that supported many species of wildlife, including mule deer. This riparian zone provided important habitat, especially during the winter months. Up to 100 feet of lower elevation habitat was lost to inundation. Idaho Power estimated ~ 10% annual mortality of mule deer as a result of these reservoirs.

6.3.9 Canyon Wren

Canyon Wren (*Catherpes mexicanus*)



© Shaw Creek Bird Supply

Introduction

The canyon wren is one of the least-studied birds in part to its frequently inaccessible habitat (Miller 2003). The canyon wren can be found in arid, rocky habitats including rocky cliffs, rimrock, outcrops, boulder piles, and deep canyon walls (Jones and Dieni 1995, Miller 2003, Harris 1999). The canyon wren is described as visually inconspicuous but easily detected during the breeding season by its loud, distinctive, and melodious song, often heard echoing throughout canyonlands of western North America (Jones and Dieni 1995).

Description, Life History, and Habitat Requirements

Description

The canyon wren is a small wren; total length 5.12 inches (13 cm). The canyon wren is distinguished from other wrens by its gleaming white throat set off by gray head, rusty brown underparts and back, and bright rufous tail (Miller 2003). The underparts are speckled with black and white, while the tail has black barring (Harris 1999). The head has a flattened appearance and the bill is long and slender (Harris 1999).

Life History

Diet

The canyon wren feeds entirely on spiders and insects. They catch their prey by gleaning from rocky surfaces, often in concealed situations (Grinnell and Miller 1944, Bent 1948, Jones and Dieni 1995). The canyon wren's long, slender bill, flattened skull, and short tarsi are adapted to foraging and locomotion in narrow and confined spaces (Miller 2003). Their distinctive foraging posture includes spread legs, extended neck, and breast and bill close to the surface (Miller 2003). Large feet, long claws, and short tarsi allow upward and downward climbing along vertical rock (Mirsky 1976). Occasionally, the canyon wren attempts flycatching (Tramontano 1964, Jones and Dieni 1995).

Reproduction

Canyon wrens are monogamous, possibly mating for life (Tramontano 1964, Mirsky 1976, Jones and Dieni 1995). Nest building peaks in early May to early June (Jones and Dieni 1995). Females lay 3-7 (average 5) white eggs with a few faint reddish brown dots (Bent 1948, Jones and Dieni, Miller 2003). Female incubates eggs 12-18 days (Miller 2003). The male feeds

the female during incubation (Tramontano 1964, Verner and Willson 1969, Jones and Dieni 1995). Hatched young fledge in 12-17 days (Miller 2003). Both parents feed nestlings and fledglings (Tramontano 1964, Verner and Willson 1969) for 5-10 days after fledging (Mirsky 1976, Jones and Dieni 1995).

Canyon wrens typically nest in rock caverns, crevices, cliffs, or banks; some nests attached by a stick and twig base to rock faces in caves or crevices (Bent 1948, Tramontano 1964, Jones and Dieni 1995). Nests are built by both the male and female (Verner and Willson 1969, Jones and Dieni 1995). The nest is a cup with a base of twigs and coarser material, e.g., moss, twigs, grasses, dead leaves, lined with lichens, plant down, wool, cobwebs, feathers, or other soft material (Jones and Dieni 1995). Nests are occasionally reused, both for second broods and in subsequent years (Bailey and Niedrach 1965, Jones and Dieni 1995).

Breeding Territory/Home Range

The canyon wren holds breeding and foraging territories (Mirsky 1976). In Colorado, average breeding territory size was 2.25 acres (0.91 ha), while winter territory averaged 3.56 acres (1.44 ha) (Jones and Dieni 1995). In some canyons of the Front Range Mountains of Colorado, canyon wren territories were evenly spaced approximately 0.37 miles (0.6 km) apart throughout suitable habitat (Jones and Dieni 1995). In southern California, foraging territories were reported as 39.5-49.4 acres (16-20 ha); foraging appears to be restricted to within territorial boundaries (Mirsky 1976, Jones and Dieni 1995).

Migration/Overwintering

The canyon wren is noted as a sedentary species, non-migratory throughout most of its range except possibly for short altitudinal movements (Jones and Dieni 1995). Some individuals may withdraw in winter from high elevations and from eastern and northern portions of the range, and may wander during winter (McCaskie et al. 1988, Jones and Dieni 1995).

Survivorship

No reported information.

Mortality

No records of predation on nests, juveniles, or adults. Potential predators may include snakes, corvids, hawks, and falcons (Jones and Dieni 1995).

Habitat Requirements

Breeding

The canyon wren occupies cracks, crevices, and interstices found in steep rocky canyon walls, cliff faces, rimrock, and boulder piles in open arid country (Gilligan et al. 1994, Jones and Dieni 1995, Miller 2003). Cool, shaded, stream-carrying canyons with exposed, steep-walled rock outcrops and a vertical component are a typical setting (Verner and Boss 1980, Jones and Dieni 1995). These microhabitats provide protective shade and cool temperatures during seasons of intense heat and exposure (Miller and Stebbins 1964). They have been known to marginally adapt to human dwellings, and have even been known to inhabit occupied homes (Bent 1948, Kornfield p.c., cited in Miller 2003, Miller 2003). The canyon wren has been found to have no association with any vegetative community (Jones and Dieni 1995).

Non-breeding

Non-breeding habitats are similar to breeding habitats (Jones and Dieni 1995). Resident canyon wrens typically use the same area for breeding and non-breeding (Jones and Dieni 1995, Miller 2003).

Population and Distribution

Distribution

Historic Distribution

See current distribution. There is no documentation of changes from the historic to the current distribution.

Current Distribution



Canyon Wren distribution. Shaw Creek Bird Supply ©

The canyon wren is a resident from southcentral British Columbia, western and southern Idaho, and southern Montana south to westcentral Texas, Baja California, and Mexico to Oaxaca (Miller 2003). Disjunct populations occur in southwest South Dakota, northeast Wyoming, and southeast Montana (Jones and Dieni 1995). The Canyon wren winters in generally the same range, but is sometimes found in desert areas where breeding rarely, if ever, occurs (Miller 2003).

In Oregon, the canyon wren is fairly common but a local breeder east of the Cascade summit; restricted to rocky cliffs or outcrops (Miller 2003). They are often found more dispersed after the breeding season (Miller 2003).

Population

Historic Population

No rangewide or regional estimates exist.

Current Population and Status

There are no current population estimates available. Breeding Bird Survey (BBS) data are of limited value because the habitat of this species is inadequately surveyed throughout its range (Jones and Dieni 1995). BBS trend data 1996-1994 (B. Peterjohn and J. Sauer, unpublished data) indicates declines throughout the coverage area, but few trends have statistical significance (Jones and Dieni 1995). Only Arizona, Texas, and California have a sample size of >10 BBS routes. Both Texas and California show population declines, whereas data for Arizona indicate stable trends (Jones and Dieni 1995). There is no information available regarding population trends in Oregon.

Threats

The only potential threat to canyon wrens is recreational rock climbing which may disturb nesting locally (Jones and Dieni 1995).

References

Bailey, A. M., and R. J. Niedrach. 1965. Birds of Colorado. Volume 2. Denver Museum of Natural History, Denver, CO.

- Bent, A. C. 1948. Life histories of North American nuthatches, wrens, thrashers, and their allies. U.S. National Museum Bulletin 195.
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publishing, McMinnville, OR.
- Grinnell, J., and A. H. Miller. 1944. Distribution of the birds of California. Pacific Coast Avifauna 27.
- Harris, M. 1999. "*Catherpes mexicanus*" (On-line), Animal Diversity Web. Accessed April 14, 2004 at:
http://animaldiversity.ummz.umich.edu/site/accounts/information/Catherpes_mexicanus.html.
- Jones, Stephanie L. and Joseph Scott Dieni. 1995. Canyon Wren (*Catherpes mexicanus*). In The birds of North America, No. 197 (A. Poole and F. Gill, eds.). Academy of Natural Sciences, Philadelphia, and American Ornithological Union, Washington, D.C.
- Kornfield, Steve. Field Ornithologist, Bend, OR.
- McCaskie, G. P., R. DeBenedictis, R. Erickson, and J. Morlan. 1988. Birds of northern California, an annotated field list. 2nd edition. Golden Gate Audubon Society, Berkeley, CA.
- Miller, A. H. and R. C. Stebbins. 1964. The lives of desert animals in Joshua Tree National Monument. University of California Press, Berkeley.
- Miller, Craig R. 2003. Canyon Wren. Pp. 457-459 in Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Mirsky, E. N. 1976. Ecology of co-existence in a wren-wrentit-warbler guild. Ph.D. dissertation, University of California, Los Angeles.
- Shaw Creek Bird Supply. Canyon Wren photo/distribution map. Used with permission 4/23/04. <http://www.shawcreekbirdsupply.com>
- Tramontano, J. P. 1964. Comparative studies of the Rock Wren and Canyon Wren. Master's thesis, University of Arizona, Tucson.
- Verner, J., and A. S. Boss. 1980. California wildlife and their habitats: western Sierra Nevada. U.S. Forest Service General Technical Report PSW-37.
- Verner, J., and M. F. Willson. 1969. Mating systems, sexual dimorphism, and the role of male North American passerine birds in the nesting cycle. Ornithological Monographs 9.

6.3.10 Sage Grouse

Sage Grouse (*Centrocercus urophasianus*) Keith Paul, USFWS



Sage Grouse, BLM et al. 2000.

Introduction

The sage grouse is North America's largest grouse, a characteristic feature of habitats dominated by big sagebrush (*Artemisia tridentate*) in Western North America (Schroeder et al. 1999). The first written accounts of this species were based on observations by the Lewis and Clark expedition in 1805, when the species was widespread in the West (Schroeder et al. 1999). Sage grouse were an important game species for Native Americans and European settlers and continue to be valued for hunting and food (Storch 2000). Because of the stunning display of sage grouse on their strutting grounds, they have become popular with naturalists and bird watchers.

Due to loss, fragmentation, and degradation of greater sage grouse habitat and large reductions of their population, seven petitions have been submitted to the U.S. Fish and Wildlife Service (Service) requesting listing of distinct populations and the entire species, collectively. The Service determined that there was not significant information available to classify the greater sage grouse into two distinct population segments (the western and eastern subspecies of sage grouse). In a recent news release dated April 15, 2004, the Service announced its completion of evaluating three petitions to list the greater sage grouse rangewide as either threatened or endangered. The Service has determined that the petitions and other available information provide substantial biological information indicating that further review of the status of the species is warranted. This status review will determine whether the greater sage grouse warrants listing as a threatened or endangered species.

Concern about long-term declines in sage grouse populations has prompted western State wildlife agencies and Federal agencies such as the Bureau of Land Management (BLM), U.S. Forest Service, and the Service to engage in a variety of cooperative efforts aimed at conserving and managing sagebrush habitat for the benefit of sage grouse and other sagebrush-dependent species.

Description, Life History, and Habitat Requirements

Description

Adult male sage grouse has fuscous upperparts, profusely marked with drab gray and white; tail long and pointed; primaries plain brown; chin and throat sepia (blackish); sides of neck, breast, and upper belly whitish and slightly distended, forming a ruff; belly and undertail-coverts sepia, with large white spots on tips of undertail-coverts; thighs buff (Schroeder et al. 1999). Head has yellow fleshy comb above eye, and long filoplumes that arise from back of the neck (Schroeder et al. 1999). During courtship displays, tail fanned and breast distended, exposing two yellow ocher patches of bare skin (cervical apteria) on lower throat and breast (Schroeder et al. 1999). These apteria briefly exposed during the display, appearing as round balloons. The adult female is similar to the male but smaller and has fuscous feathers, marked with drab gray and white on head and breast, creating a more cryptic appearance overall than in male (Schroeder et al. 1999). Female also lacks cervical apteria and has smaller comb over eye than male (Schroeder et al. 1999).

Life History

Diet

Sagebrush dominates diet during late autumn, winter, and early spring (Girard 1937, Rasmussen and Griner 1938, Bean 1941, Batterson and Morse 1948, Patterson 1952, Leach and Hensley 1954, Barber 1968, Wallestad et al. 1975, Schroeder et al. 1999). Sage grouse eat numerous species of sagebrush, including big, low (*Artemisia arbuscula*), silver (*Artemisia cana*), and fringed (*Artemisia fridida*) (Remington and Braun 1985, Welch et al. 1988, 1991, Myers 1992, Schroeder et al. 1999). Insects are an important component of the juvenile diet, especially during the first three weeks of life; after which forbs increase in importance as juveniles age (Patterson 1952, Trueblood 1954, Klebenow and Gray 1968, Savage 1968, Peterson 1970, Johnson and Boyce 1990, Drut et al. 1994, Pyle and Crawford 1996, Schroeder et al. 1999). Although insects are also eaten by adults during spring and summer, forbs and sagebrush dominate their diet (Rasmussen and Griner 1938, Moos 1941, Knowlton and Thornley 1942, Patterson 1952, Leach and Hensley 1954, Schroeder et al. 1999).

Reproduction

The breeding of sage grouse begins in mid-March when the males start to congregate on the leks (BLM et al. 2000). Females come to the leks to mate and generally nest in the vicinity (BLM et al. 2000). Nesting rates vary from year to year and from area to area (Bergerud 1988, Coggins 1998, Connelly et al. 1993, Gregg 1991, and Schroeder 1997). This variation is most likely a result of the quality of available nutrition and the general health of pre-laying females (Barnett and Crawford 1994). At least 70% of the females in a population will initiate a nest each year, with higher nest initiation rate recorded during years of higher precipitation in comparison to periods of drought (Coggins 1998). Renesting rates by females who have lost their first clutch are 10 to 40 % (Bergerud 1988, Connelly et al. 1993, Eng 1963, Patterson 1952, and Petersen 1980). Clutch size per nest normally ranges from seven to ten eggs (Connelly unpub., Schroeder 1997, Wakkinen 1990, BLM et al. 2000).

Breeding Territory/Home Range

Adult males are highly territorial on leks, actively defending areas of 53.8-1076 ft² (5-100 m²) (Simon 1940, Patterson 1952, Dalke et al. 1960, Hartzler 1972, Wiley 1973, Gibson and Bradbury 1987, Schroeder et al. 1999). Yearling males rarely defend territories or breed, although they are physiologically capable of breeding (Eng 1963). Leks vary from 1 to 16 ha in size because of number of males attending lek and topography of lek site (Scott 1942, Patterson 1952, Wiley 1973, Schroeder et al. 1999). Male sage grouse are not territorial off leks (Schroeder et al. 1999). Home range for sage grouse may exceed 579 mi² (1,500 km²) (Connelly, unpub. data, cited in BLM et al. 2000). Sage grouse may have two or more seasonal ranges including a breeding range, a brood-rearing range, and a winter range (BLM et al. 2000).

Migration/Overwintering

Sage grouse populations can be migratory or non-migratory (Beck 1975, Berry and Eng 1985, Connelly et al 1988, Fischer 1994, Wakkinen 1990, and Wallestad 1975, BLM et al. 2000), depending on location and associated land form. Where topographic relief allows, sage grouse generally move to higher elevations from spring through fall as snow melts and plant growth advances (BLM et al. 2000). Non-migratory populations may spend the entire year within an area of 38.61 mi² (100 km²) or less in size (BLM et al. 2000). In migratory populations, seasonal movements may exceed 46.5 mi (75 km) (Connelly et al. 1998, Dalke et al. 1963, BLM et al. 2000).

Survivorship

Annual survival rates for yearling and adult sage grouse vary from 35 to 85 percent for females, and from 38 to 54 percent for males (Connelly et al. 1994, Wallestad 1975, and Zablan 1993, BLM et al. 2000). Lower survival rates for males may be related to the higher predation rates on males during the lekking season (Swensen 1986). Sage grouse tend to live longer than other upland gamebird species; individual birds four to five years old are common (BLM et al. 2000).

Mortality

Predation on eggs and birds is the primary cause of mortality (Schroeder et al. 1999). Other causes of mortality include human disturbance, livestock, farm machinery, moving vehicles, electric or telephone wires, fences, pesticides, fire flood, drought, sun exposure, heavy rain, and cold (Borell 1939, Bean 1941, Batterson and Morse 1948, Patterson 1952, Dalke et al. 1963, Rogers 1964, Wallestad 1975, Barber 1991, Schroeder et al. 1999).

Habitat Requirements

Breeding

Breeding grounds are centered on and within the vicinity of leks. The same lek sites are used from year to year. They are established in open areas surrounded by sagebrush, which is used for escape and protection from predators (Gill 1965, Patterson 1952, BLM et al. 2000). Examples of lek sites include landing strips, old lake beds or playas, low sagebrush flats, openings on ridges, roads, crop land, and burned areas (Connelly et al. 1981, Gates 1985, BLM et al. 2000). The lek is considered the center of year-round activity for resident grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974). On the average, most nests are located within 4 miles (6.2 km) of the lek; however some females or hens may nest more than 12 miles (20 km) away from the lek (Autenrieth 1981, Fischer 1994, Hanf et al. 1994, Wakkinen et al. 1992, BLM et al. 2000). Most sage grouse nests are located under sagebrush plants (Gill 1965, Gray 1967, Patterson 1952, Schroeder et al. 1999, Wallestad and Pyrah 1974, BLM et al. 2000). Optimum sage grouse nesting habitat consists of the following: sagebrush stands containing plants 16 to 32 inches (40 to 80 cm) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 7 inches (18 cm) tall (BLM et al. 2000). Ideally, these vegetative conditions should be on 80 percent of the breeding habitat for any given population of sage grouse (BLM 2000).

Non-breeding

Sage grouse winter habitats are relatively similar throughout most of their ranges. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate amounts of sagebrush (BLM et al. 2000). Sagebrush canopy can be highly variable (Beck 1977, Eng and Schladweiler 1972, Patterson 1952, Robertson 1991, Wallestad et al. 1975, BLM et al. 2000). Sage grouse tend to select areas with both high canopy and taller Wyoming big sagebrush (*A. t. wyomingensis*) and feed on plants highest in protein content (Remington and Braun 1985, Robertson 1991, BLM et al 2000). It is critical that sagebrush be exposed at least 10 to 12 inches (25 to 30 cm) above snow level to provide food and cover for wintering sage grouse (Hupp and Braun 1989, BLM et al. 2000). If snow covers the sagebrush, the birds move to areas

where sagebrush is exposed. Therefore, good wintering habitat consists of sagebrush with 10 to 30 percent canopy cover on 80 percent of the wintering area (BLM et al. 2000).

Population and Distribution

Distribution

Historic Distribution

Historically, sage grouse occurred in at least 16 states and three Canadian provinces. Since then, sage grouse have been extirpated from British Columbia, Arizona, Utah, Montana, New Mexico, Colorado, Wyoming, Alberta, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, and Nebraska (Connelly and Braun 1997, Braun 1998, Schroeder et al. 1999). It is unclear whether birds in Oklahoma and Kansas represented a distinct population (Schroeder et al. 1999). Historically, it is estimated that 220 million acres (81 million ha) of sagebrush-steppe vegetation types existed in North America (McArthur and Ott 1996), making it one of the most widespread habitats in the country (BLM et al. 2000). However, much of this habitat has been lost or degraded over the last 100 years (BLM et al. 2000).

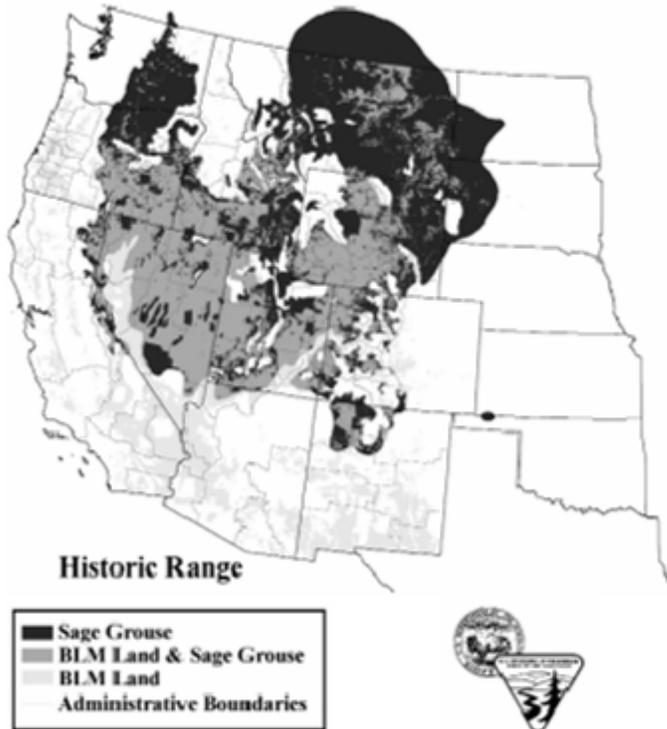


Figure 1. Sage Grouse historic range map (BLM et al. 2000)

Current Distribution

Currently, in states and provinces that still have sage grouse, their range has been reduced. Declines in distribution have been noted throughout the twentieth century (Hornaday 1916, Locke 1932, McClanahan 1940, Aldrich and Duvall 1955, Connelly and Braun 1997, Schroeder et al. 1999). Within the Interior Columbia River Basin, sagebrush habitat has been reduced from about 40 million acres (16 million ha) to 26 million acres (11 million ha), representing a loss of about 35% since the early 1900's (Hann et al. 1997, BLM et al. 2000). Most remaining sagebrush-steppe ecosystems in Oregon are on public lands managed by the Bureau of Land Management (BLM) (BLM et al. 2000).

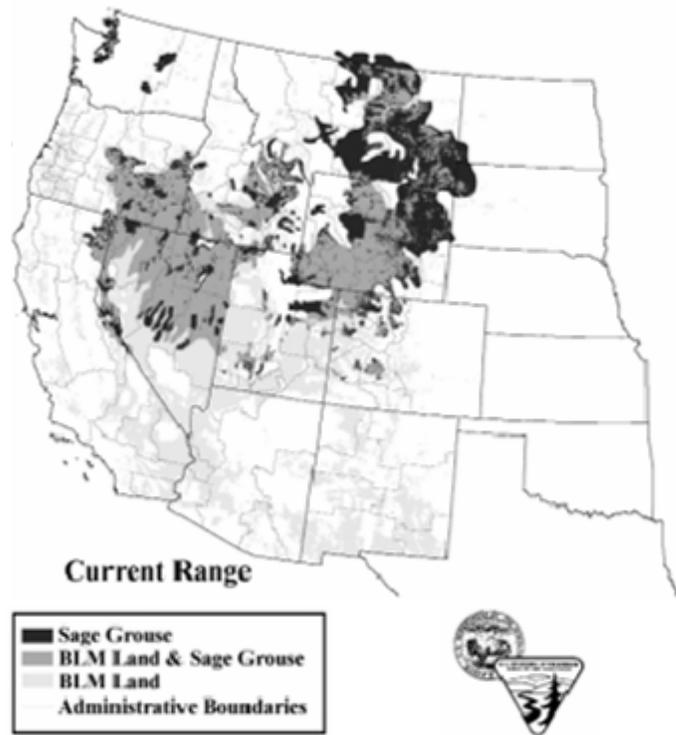


Figure 2. Sage Grouse current range map (BLM et al. 2000)

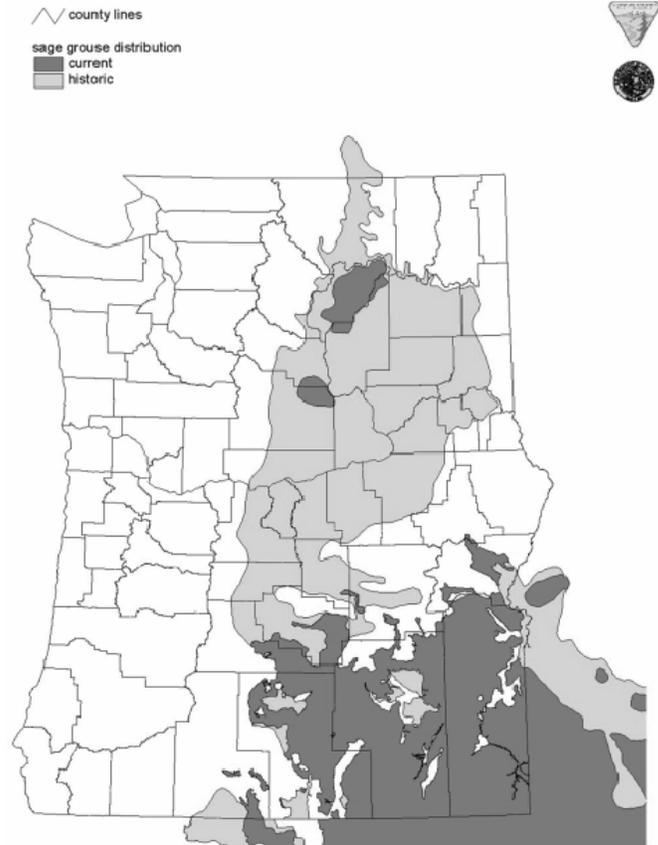


Figure 3. Current versus historic sage grouse rangemap in Oregon and Washington (BLM et al. 2000).

Population

Historic Population

Historically, there may have been roughly 1.6 million and 16 million sage grouse rangewide prior to European expansion across western North America (65 Federal Register 51578).

Current Population and Status

Rangewide, with the extirpation of sage grouse from several states, and the reduction and degradation of sagebrush-steppe habitat, the numbers of sage grouse have been reduced significantly. Between 1985 and 1994, populations declined by an average of 33% (Storch 2000). Braun (1998) estimated a rangewide sage grouse population of 142,000 in 1998, clearly lower than historic levels.

In Oregon, Oregon Department of Fish and Wildlife (ODFW) made a minimum estimate of sage grouse in 1992 of between 27,505 and 68,012 adults (see Table 1).

County	Known Leks	Mean Number of Males/Lek	Total Number of Males	Total Adult Estimate*
Malheur	112	24.3	2,722	6,805
Harney	119	31.0	3,689	9,223
Lake	108	24.3	2,624	6,560
Hart Refuge	22	28.8	634	1,585

Klamath	8	14.2	114	285
Deschutes	22	14.1	310	775
Crook	28	14.7	412	1,030
Baker	33	14.2	469	1,172
Union	2	14.2	28	70
Total	461		11,002	27,505

*Assumes a 60:40 female:male sex ratio to calculate totals.

Table 1. Minimum Population Estimate of Adult Sage Grouse in Oregon, 1992 (ODFW 1993).

Oregon upland game bird harvest data (1993-2002) is shown below (Table 2).

Table 2. Source - ODFW Upland Game Bird Harvest 1993-2002.

Year	Sage Grouse	Year	Sage Grouse
1993	973	1998	839
1994	1,015	1999	808
1995 ¹	857	2000	716
1996	1,015	2001	976
1997 ¹	681	2002	549

¹ Concern for integrity of data collected in 1997. 1995 survey conducted by OSU.

Continuing Threats

Numerous activities have adversely impacted, and continue to have potential to adversely impact, the distribution and quality of sage grouse and their habitat. In addition, natural events and the human response to them could directly impact sage grouse, as well as their habitats (BLM et al. 2000).

Permanent conversion of sagebrush to agricultural lands is the single greatest cause of decline in sagebrush-steppe habitat in the interior Columbia Basin (Quigley and Arbelbide 1997, BLM et al. 2000). In the northern half of eastern Oregon, large areas of sagebrush-steppe habitat have been converted to agricultural lands (Wisdom et al. 2000).

Prior to the 1980's, herbicide treatment of large tracts of rangeland (primarily 2, 4-D) was a common method of reducing sagebrush (Braun 1987, BLM et al. 2000). In many cases, broad herbicide treatment may have contributed to declines in sage grouse breeding populations (Enyeart 1956, Higby 1969, Peterson 1970, Wallestad 1975, BLM et al. 2000).

Various livestock management practices have altered sage grouse habitat over the last century. In many areas, grazing has contributed to long-term changes in plant communities and reduced certain habitat components, such as biological crusts that contribute to the health of sagebrush-steppe habitat (Mack and Thompson 1982, Quigley and Arbelbide 1997, Wisdom et al. 2000, BLM et al. 2000).

Fire has altered sage grouse habitat on the landscape in Oregon. Existing BLM fire management plans have not, for the most part, identified sage grouse habitat as a high priority for protection (BLM et al. 2000). Repeated wildfires have favored invasion by cheatgrass (*Bromus tectorum*) and other exotic species (Pellant 1990, Valentine 1990, BLM et al. 2000). Conversion to cheatgrass alters the fire frequency from the historic 32-70 years in sagebrush-steppe habitat ecosystems to five years or less (Wright and others 1979). Additionally, prescribed fire has also contributed to the decrease in Wyoming big sagebrush habitat and sage grouse brood-rearing habitat (Connelly et al. 1994, Fischer et al. 1996, BLM et al. 2000).

The lack of prompt and appropriate fire rehabilitation following a wildfire can present additional threats to sage grouse habitat (BLM et al. 2000). If cheatgrass or any of a number of other exotic plant species are present before a fire occurs, they are likely to become more dominant afterwards if the area is not properly rehabilitated (BLM et al. 2000).

Power lines, fences, roads and urban development have all had an adverse impact on sage grouse habitat and their populations (Braun 1998).

Juniper expansion may also be contributing to declining sage grouse populations by reducing suitable sagebrush-steppe habitat (BLM et al. 2000).

Management Goals and Objectives

For detailed BLM management goals, objectives, and strategies see:
Greater Sage-Grouse and Sagebrush-Steppe Ecosystems Management Guidelines, August 21, 2000 (BLM et al. 2000).

References

- Aldrich, J. W. and A. J. Duvall. 1955. Distribution of American gallinaceous game birds. U.S. Department of the Interior, Fish and Wildlife Service Circular 34.
- Autenrieth, R. E. 1981. Sage grouse management in Idaho Wildlife Bulletin Number 9. Idaho Department of Fish and Game. Boise. 239 p.
- Barber, H. A. 1991. Strutting behavior, distribution and habitat selection of Sage Grouse in Utah. M.S. thesis, Brigham Young University, Provo, UT.
- Barber, T. A. 1968. Function of the cecal microflora in Sage Grouse nutrition. M.S. thesis, Colorado State University, Fort Collins.
- Barnett, J. F., and J. A. Crawford. 1994. Pre-laying nutrition of sage grouse hens in Oregon. *Journal of Range Management* 47:114-118.
- Batterson, W. M. and W. B. Morse. 1948. Oregon Sage Grouse. Oregon Game Commission, Portland, Oregon Fauna Service 1.
- Bean, R. W. 1941. Life history studies of the Sage Grouse (*Centrocercus urophasianus*) in Clark County, Idaho. B.S. thesis, Utah State Agricultural College, Logan.
- Beck, T. D. I. 1977. Sage grouse flock characteristics and habitat selection during winter. *Journal of Wildlife Management* 41:18-26.
- Beck, T. D. I. 1975. Attributes of a wintering population of sage grouse, North Park, Colorado. M.S. thesis. Colorado State University, Fort Collins. 49 p.
- Bergerud, A. T. 1988. "Population ecology of North American grouse." Pages 578-648 in A.T. Bergerud and M. W. Gratson, eds. Adaptive strategies and population ecology of northern grouse. University of Minnesota Press, Minneapolis. 809 p.
- Berry, J. D., and R. L. Eng. 1985. Interseasonal movements and fidelity to seasonal use areas by female sage grouse. *Journal of Wildlife Management* 49:237-240.
- Borell, A. E. 1939. Telephone wires fatal to Sage Grouse. *Condor* 41: 85-86.
- Braun, C. E. 1987. Current issues in sage grouse management. *Proceedings of the Western Association of Fish and Wildlife Agencies* 67:134-144.
- Braun, C. E. 1998. Sage grouse declines in western North America: what are the problems? *Proceedings of the Western Association of State Fish and Wildlife Agencies* 78:139-156.
- Coggins, K. A. 1998. Sage grouse habitat use during the breeding season on Hart Mountain National Antelope Refuge. M.S. thesis, Oregon State University, Corvallis 61 p.
- Connelly, J. W., and C. E. Braun. 1997. Long-term changes in sage grouse *Centrocercus urophasianus* populations in western North America. *Wildlife Biology* 3:123-128.
- Connelly, J. W., W. J. Arthur, and O. D. Markham. 1981. Sage grouse leks on recently disturbed sites. *Journal of Range Management* 52:153-154.
- Connelly, J. W., R. A. Fischer, A. D. Apa, K. P. Reese, and W. L. Wakkinen. 1993. Renesting of sage grouse in southeastern Idaho. *Condor* 95:1041-1043.

- Connelly, J. W., K. P. Reese, W. L. Wakkinen, M. D. Robertson, and R. A. Fischer. 1994. Sage grouse ecology report. Idaho Department of Fish and Game Job Completion Report. W-160-R-19. Subproject 9. 91 p.
- Dalke, P. D., D. B. Pyrah, D. C. Stanton, J. E. Crawford, and E. F. Schlatterer. 1960. Seasonal movements and breeding behavior of Sage Grouse in Idaho. *Trans. North American Wildlife Conference* 25: 396-407.
- Dalke, P. D., D. B. Pyrah, D. C. Stanton, J. E. Crawford, and E.F. Schlatterer. 1963. Ecology, productivity, and management of sage grouse in Idaho. *Journal of Wildlife Management* 27:810-841.
- Drut, M. S., W. H. Pyle, and J. A. Crawford. 1994. Diets and food selection of sage grouse chicks in Oregon. *Journal of Range Management* 47:90-93.
- Eng, R. L. 1963. Observations on the breeding biology of male sage grouse. *Journal of Wildlife Management* 27:841-846.
- Eng, R. L., and P. Schladweiler. 1972. Sage grouse winter movements and habitat use in central Montana. *Journal of Wildlife Management* 36:141-146.
- Enyeart, G. 1956. Responses of sage grouse to grass reseeding in the Pines area, Garfield County, Utah. M.S. thesis, Utah State Agricultural College, Logan. 55 p.
- Fischer, R. A. 1994. The effects of prescribed fire on the ecology of migratory sage grouse in southeastern Idaho.
- Fischer, R. A., K. P. Reese, and J. W. Connelly. 1996. An investigation on fire effects within xeric sage grouse brood habitat. *Journal of Range Management* 49:194-198.
- Gates, R. J. 1985. Observations of the formation of a sage grouse lek. *Wilson Bulletin* 97:219-221.
- Gibson, R. M., and J. W. Bradbury. 1987. Lek organization in Sage Grouse: variations on a territorial theme. *Auk* 104: 77-84.
- Gill, R. B. 1965. Distribution and abundance of a population of sage grouse in North Park, Colorado. M. S. thesis, Colorado State University, Fort Collins. 187 p.
- Girard, G. L. 1937. Life history, habits and food of the Sage Grouse, *Centrocercus urophasianus* Bonaparte. University of Wyoming, Laramie. Publication 3.
- Gray, G. M. 1967. An ecological study of sage grouse broods with reference to nesting movements, food habits and sage brush strip spraying in the Medicine Lodge drainage, Clark County, Idaho. M.S. thesis, University of Idaho, Moscow. 200 p.
- Gregg, M. A. 1991. Use and selection of nesting habitat by sage grouse in Oregon. M.S. thesis, Oregon State University Corvallis. 46 p.
- Hanf, J. M., P. A. Schmidt, and E. B. Groshens. 1994. Sage grouse in the high desert of central Oregon: results of a study, 1988-1993. U. S. Department of Interior, Bureau of Land Management Series P-SG-01, Prineville, OR. 56 p.
- Hann, W. J., J. L. Jones, M. G. Karl, P. F. Hessburg, R. E. Kean, D. G. Long, J. P. Menakis, C. H. McNicoll, S. G. Leonard, R. A. Gravenmier, and B. G. Smith. 1997. An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great Basins, Vol. II. Landscape dynamics of the basin. U.S. Dept. Agric., Pacific Northwest Res. Stat., For. Serv. Gen. Tech. Rep. PNW-GTR-405, Portland, OR.
- Hartzler, J. E. 1972. An analysis of Sage Grouse lek behavior. Ph.D. dissertation, University of Montana, Missoula.
- Higby, L. W. 1969. A summary of the Longs Creek sagebrush control project. *Proceedings Biennial Western States Sage Grouse Workshop* 6:164-168.
- Hornaday, W. T. 1916. Save the Sage Grouse from extinction, a demand from civilization to the western states. *N.Y. Zool. Park Bulletin* 5: 179-219.
- Hupp, J. W. and C. E. Braun. 1989. Topographic distribution of sage grouse foraging in winter. *Journal of Wildlife Management* 53:823-829.

- Johnson, G. D., and M. S. Boyce. 1991. Survival, growth, and reproduction of captive-reared Sage Grouse. *Wildlife Society Bulletin* 19: 88-93.
- Klebenow, D. A., and G. M. Gray. 1968. Food habits of juvenile Sage Grouse. *Journal of Range Management* 21: 80-83.
- Knowlton, G. F., and H. F. Thornley. 1942. Insect food of the Sage Grouse. *Journal of Econ. Entomol.* 35: 107-108.
- Leach, H. R., and A. L. Hensley. 1954. The Sage Grouse in California, with special reference to food habits. *California Dept. of Fish and Game* 40: 385-394.
- Locke, S. B. 1932. The sage hen situation and its needs. *Trans. American Game Conference* 19: 408-410.
- Mack, R. N. and J. N. Thompson. 1982. Evolution in steppe with few large, hoofed mammals. *American Naturalist* 119:757-773.
- McArthur, E. D. and J. E. Ott. 1996. Potential natural vegetation in the 17 conterminous western United States. pp. 16-28 in *Proceedings: Shrub land ecosystem dynamics in a changing environment*, J. R. Barrow, E. D. McArthur, R. E. Sosebee and R. J. Tausch, compilers. USDA Forest Service Gen. Tech. Rep. INT-GTR-338. Ogden, UT.
- McClanahan, R. C. 1940. Original and present breeding ranges of certain game birds in the United States. U. S. Department of the Interior, Bur. Biology Survey Wildlife Leaflet BS-158.
- Moos, L. M. 1941. Sage hen eats grasshoppers. *Auk* 58: 255.
- Myers, O. B. 1992. Sage Grouse habitat enhancement: effects of sagebrush fertilization. Ph.D. dissertation, Colorado State University, Fort Collins.
- Oregon Department of Fish and Wildlife. 2002. Oregon Upland Game Bird Harvest 1993-2002. Website: http://www.dfw.state.or.us/ODFWhtml/InfoCntrWild/upland_harvest_summary_1993_2002.pdf. Accessed 4/23/04.
- Oregon Department of Fish and Wildlife. 1993. Sage Grouse in Oregon. Wildlife Research Report Number 15. Wildlife Research Section, Portland, Oregon.
- Patterson, R. L. 1952. The sage grouse in Wyoming. Sage Books, Inc. Denver, CO. 341 p.
- Pellant, Mike. 1990. The cheatgrass-wildfire cycle—are there any solutions? In: McArthur, E. Durant; Romney, Evan M.; Smith, Stanley D; Tueller, Paul T. , comps. *Proceedings — symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management: 1989 April 5-7; Las Vegas, NV.* Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 11-17.
- Petersen, B. E. 1980. Breeding and nesting ecology of female sage grouse in North Park, Colorado. M.S. thesis, Colorado State University, Fort Collins, CO. 86 p.
- Peterson, J. G. 1970. The food habits and summer distribution of juvenile sage grouse in central Montana. *Journal of Wildlife Management* 34:147-155.
- Pyle, W. H., and J. A. Crawford. 1996. Availability of foods of Sage Grouse chicks following prescribed burning in sagebrush-bitterbrush. *Journal of Range Management* 49: 320-324.
- Quigley, T.M., and S.J. Arbelbide, technical editors. 1997. Volume II of: An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins. General Technical Report PNW-GTR-405. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.
- Rasmussen, D. I., and L. A. Griner. 1938. Life history and management studies of the Sage Grouse in Utah, with special reference to nesting and feeding habits. *Trans. North American Wildlife Conference* 3: 852-864.
- Remington, T. E., and C. E. Braun. 1985. Sage grouse food selection in winter, North Park, Colorado. *Journal of Wildlife Management* 49:1055-1061.
- Robertson, M. D. 1991. Winter ecology of migratory sage grouse and associated effects of prescribed fire in southeastern Idaho. M.S. thesis, University of Idaho, Moscow, ID.

- Rogers, G. E. 1964. Sage Grouse investigations in Colorado. Colorado Game, Fish and Parks Department, Denver Technical Publication no. 16.
- Savage, D. E. 1968. The relationship of Sage Grouse to upland meadows in Nevada. M.S. thesis, University of Nevada, Reno.
- Schroeder, M. A. 1997. Unusually high reproductive effort by sage grouse in a fragmented habitat in north-central Washington. *Condor* 99:933-941.
- Schroeder, M. A., J. R. Young and C. E. Braun. 1999. Sage Grouse (*Centrocercus urophasianus*). In *The Birds of North America*, No. 425 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Scott, J. W. 1942. Mating behavior of the Sage Grouse. *Auk* 59: 477-498.
- Simon, J. R. 1940. Mating performance of the Sage Grouse. *Auk* 57: 467-471.
- Storch, I. (compiler). 2000. Grouse Status Survey and Conservation Action Plan 2000-2004. WPA/BirdLife/SSC Grouse Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK and the World Pheasant Association, Reading, UK. X + 112pp.
- Swenson, J. E. 1986. Differential survival by sex in juvenile sage grouse and gray partridge. *Ornis Scandinavica* 17:14-17.
- Trueblood, R. W. 1954. The effect of grass reseeding in sagebrush lands on sage grouse populations. M.S. thesis, Utah State Agricultural College, Logan, UT.
- U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, U.S. Department of Agriculture, Forest Service, Oregon Department of Fish and Wildlife and Department of State Lands. 2000. Greater Sage-Grouse and Sagebrush-Steppe Ecosystems, Management Guidelines. 27 p.
- Valentine, J. F. 1990. Grazing management. Academic Press, Incorporated. San Diego, CA. 553pp.
- Wakkinen, W. L. 1990. Nest site characteristics and spring-summer movements of migratory sage grouse in southeastern Idaho. M. S. thesis, University of Idaho, Moscow. 57 p.
- Wakkinen, W. L., K. P. Reese, and J. W. Connelly. 1992. Sage grouse nest locations in relation to leks. *Journal of Wildlife Management* 56:381-383.
- Wallestad, R. O. 1975. Life history and habitat requirements of sage grouse in central Montana. Montana Fish and Game Department Technical Bulletin. 66 p.
- Wallestad, R. O., and D. B. Pyrah. 1974. Movement and nesting of sage grouse hens in central Montana. *Journal of Wildlife Management* 38:630-633.
- Wallestad, R. O., and P. Schladweiler. 1974. Breeding season movements and habitat selection of male sage grouse. *Journal of Wildlife Management* 38:634-637.
- Wallestad, R. O., J. G. Peterson, and R. L. Eng. 1975. Foods of adult sage grouse in central Montana. *Journal of Wildlife Management* 39:628-630.
- Welch, B. L., J. C. Pederson, and R. L. Rodriguez. 1988. Selection of big sagebrush by Sage Grouse. *Great Basin Nat.* 48: 274-279.
- Welch, B. L., F. J. Wagstaff, and J. A. Roberson. 1991. Preference of wintering Sage Grouse for big sagebrush. *Journal of Range Management* 44: 462-465.
- Wiley, R. H., Jr. 1973. Territoriality and nonrandom mating in Sage Grouse, *Centrocercus urophasianus*. *Animal Behavior Monographs* 6: 85-169.
- Wisdom, M.J., R.S. Holthausen, B.C. Wales, D.C. Lee, C.D. Hargis, V.A. Saab, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia Basin: Broad-scale trends and management implications. General Technical Report PNW-GTR-XXX. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.
- Wright, H.A., L.F. Neuenschwander, and C.M. Britton. 1979. The role and use of fire in sagebrush-grass and pinyon-juniper plant communities: A state-of-the-art review. General Technical Report INT-GTR-58. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT.

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

Zablan, M. A. 1993. Evaluation of sage grouse banding program in North Park, Colorado. M.S. thesis, Colorado State University, Fort Collins, CO. 59 p.

6.3.11 American Marten

American marten (*Martes americana*)

Distribution

In eastern Oregon, martens can be found in the Blue and Wallowa mountains (Verts and Carraway 1998).

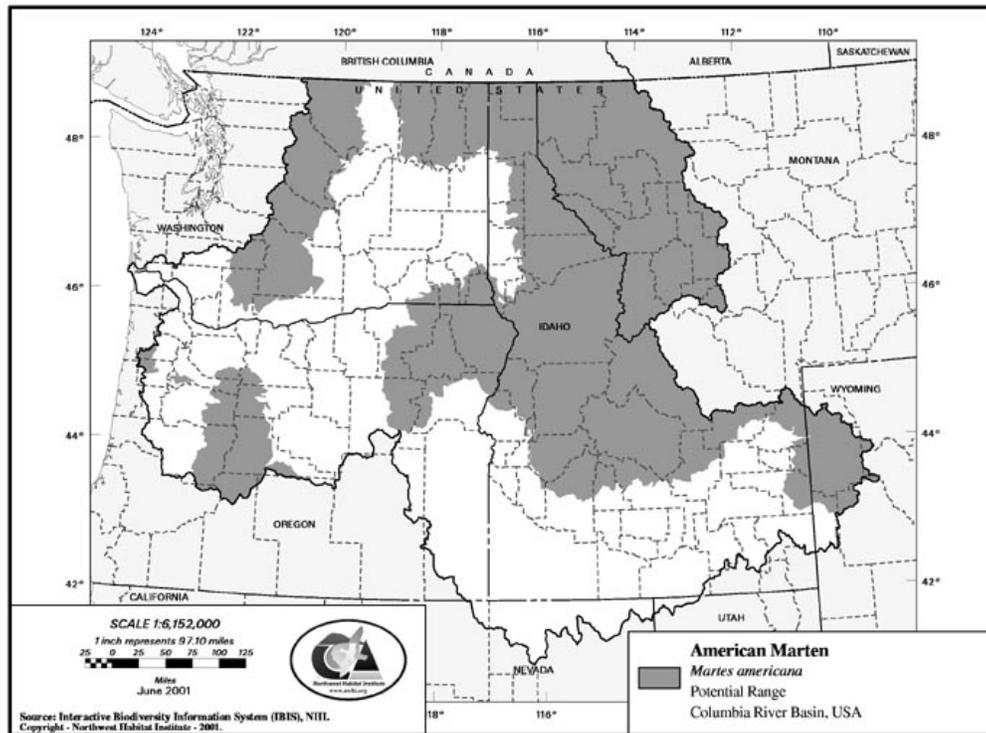


Figure 1. Current Distribution of American marten (*Martes americana*) in the Columbia River Basin (IBIS 2004).

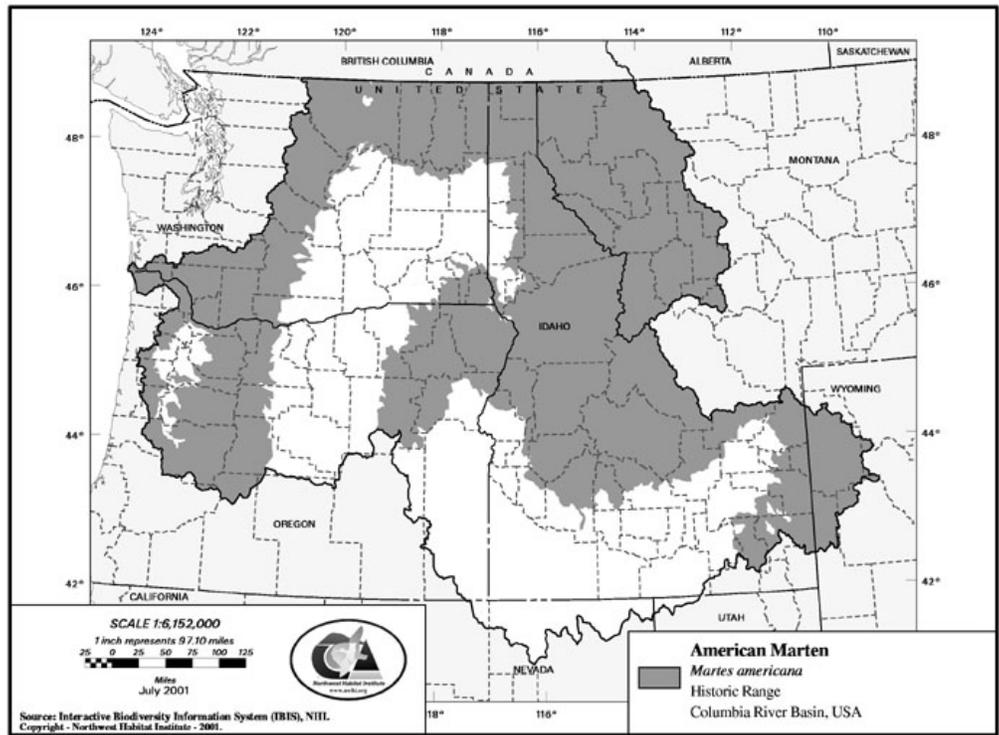


Figure 2. Historic distribution of American marten (*Martes americana*) in the Columbia River Basin (IBIS 2004).

Habitat and Density

The marten is a forest species capable of tolerating a variety of habitat types if food and cover are adequate (Strickland and Douglas 1987, cited in Verts and Carraway 1998).

Extensive logging and forest fires reduce the value of areas to martens, sometimes for many years (Strickland and Douglas 1987, cited in Verts and Carraway 1998). In addition to these areas supporting fewer individuals, martens in these areas have shorter life spans, are less productive, and suffer higher natural and trapping mortality than those in undisturbed forest (Thompson 1994, cited in Verts and Carraway 1998). In addition, martens captured significantly less mass of food per kilometer of foraging travel in logged forests (Thompson and Colgan, 1994, cited in Verts and Carraway 1998).

There is no known published quantitative information regarding habitats used by martens in Oregon (Verts and Carraway 1998).

*Evelyn Bull – working on marten studies

There are no estimates of density of martens for Oregon (Verts and Carraway 1998). Oregon Department of Fish and Wildlife has harvest data on marten.

Reported annual harvest of martens in Union and Wallowa Counties, OR (ODFW)

	Union	Wallowa		Union	Wallowa		Union	Wallowa
1969-1970	2		1978-1979	3		1987-1988		6
1970-1971	3		1979-1980		4	1988-1989	1	10

1971-1972	1		1980-1981		1	1989-1990		1
1972-1973		2	1981-1982		1	1990-1991	9	
1973-1974			1982-1983	2	1	1991-1992	2	
1974-1975		2	1983-1984			1992-1993		
1975-1976			1984-1985		10	1993-1994	9	2
1976-1977		18	1985-1986	8	10	1994-1995		1
1977-1978		4	1986-1987	1	29			

Diet

In Montana, remains of mammals occurred in 93.3% of 1,758 fecal droppings of martens; birds occurred in 12.0%, insects in 19.0%, and fruits in 29.2%. In California (Zielinski et al. 1983) and in Wyoming (Murie, 1961) the diet of martens is much the same as that in Montana (cited in Verts and Carraway 1998).

Remarks

We know little firsthand of the marten in Oregon, but we suspect that populations here likely will not increase greatly if short-rotation timber harvest and single-species replanting continue as recommended forest-management practices. Other practices, more of the past than of the present—such as burning or otherwise removing slash, snags, and downed logs, and large clear-cuttings—likely are detrimental to marten populations (Verts and Carraway 1998).

References

- Murie, A. 1961. Some food habits of the marten. *Journal of Mammalogy*, 42: 516-521.
- Strickland, M. A., and C. W. Douglas. 1987. Marten. Pp. 531-546, in *Wild furbearer management and conservation in North America* (M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds.). Ontario Ministry of Natural Resources, Toronto, 1150 pp.
- Thompson, I. D. 1994. Marten populations in uncut and logged boreal forests in Ontario. *The Journal of Wildlife Management*, 58: 272-280.
- Thompson, I. D., and P. W. Colgan. 1994. Marten activity in uncut and logged boreal forests in Ontario. *The Journal of Wildlife Management*, 58: 280-288.
- Verts, B. J., and L. N. Carraway. 1998. *Land Mammals of Oregon*. University of California Press, 668 pp.
- Zielinski, W. J., W. D. Spencer, and R. H. Barrett. 1983. Relationship between food habits and activity patterns of pine martens. *Journal of Mammalogy*, 64: 387-396.

6.3.12 Olive-sided Flycatcher

Olive-sided flycatcher (*Contopus cooperi*) Keith Paul, USFWS



© Shaw Creek Bird Supply

Introduction

The olive-sided flycatcher is one of the most recognizable breeding birds of Oregon's coniferous forests with its resounding, three-syllable, whistled song *quick, three beers* (Altman 2003) and its position of prominence perched atop a large tree or snag (Altman and Sallabanks 2000). This flycatcher undergoes one of the longest and most protracted migrations of all Nearctic migrants, wintering primarily in Panama and the Andes Mountains of South America (Altman and Sallabanks 2000).

Description, Life History, and Habitat Requirements

Description

The olive-sided flycatcher is a relatively large, somewhat bulky, large-headed, short-necked flycatcher that perches erect and motionless at the top of a tall tree or snag except when singing or darting out to capture flying insects (Altman 2003). The overall olive-gray plumage is generally nondescript except for a whitish stripe down the breast and belly which gives the impression of an unbuttoned vest, and white patches between the wings and lower back (Altman 2003).

Life History

Diet

Olive-sided flycatchers prey almost exclusively on flying insects including flying ants, beetles, moths, and dragonflies, but with a particular preference for bees and wasps (Bent 1942, Altman 2003).

Olive-sided flycatchers forage mostly from high, prominent perches at the top of snags or the dead tip or uppermost branch of a live tree (Altman 2003). They forage by "sallying" or "hawking" out to snatch a flying insect, and then often returning to the same perch ("yo-yo" flight) or another prominent perch (Altman 2003). Foraging behavior as an air-sallying insectivore requires exposed perches and unobstructed air space, thus tall trees or snags and broken canopy provide a better foraging environment than closed-canopy forest (Altman 2003, Altman and Sallabanks 2000). During the early reproductive period, the males usually forage

from the tops of the tallest trees and snags, and females forage at lower heights and near the nest (Altman 2000, 2003).

Reproduction

Olive-sided flycatcher territory establishment and pairing begins upon arrival to breeding grounds (Altman 2003). Nest building is most evident during the first and second week of June, but completed nests have been reported as early as May 27 (Altman 2000). The nest area is aggressively defended by both members of the pair (Altman and Sallabanks 2000). Olive-sided flycatchers are monogamous. They produce 3-4 eggs per clutch and one clutch per pair. Incubation period lasts 14-15 days, nestling period lasts approximately 19-22. The hatching of nestlings from a successful first nest occurs mostly in second week of July. Olive-sided flycatchers will renest after a failed clutch until about July 1. The latest fledging of nestlings is August 30 (Altman 2000). Adults remain with fledglings for up to two weeks (Altman 2003).

Females appear to choose the nest site; nests are most often found in coniferous trees (Altman and Sallabanks 2003). The nest is constructed primarily, if not totally, by the female (Altman and Sallabanks 2003). The foundation of the nest is built with larger twigs, while smaller twigs and larger rootlets are used to frame the nest. They will often use arboreal lichens to cover edges of nest rim and to line the cup of the nest (Altman and Sallabanks 2000); grasses, fine rootlets, or pine needles may also be used to line the nest (Bent 1942)

Breeding Territory/Home Range

Nesting pairs are generally well spaced and require relatively large territory. While estimates of territory size vary, most are 24.7-49.2 acres (10-20 ha) per pair (Altman 1997) and some as large as 100 ac (40-45 ha) per pair (Altman 2003).

Migration/Overwintering

The olive-sided flycatcher is a long distance, complete migrant between its breeding grounds in North America and its wintering grounds in Central and South America (Murphy 1989). They have the longest migration route of any flycatcher breeding in North America (Murphy 1989).

In Oregon, the spring migration of olive-sided flycatchers is well documented because of the loud, distinctive song. Spring migration peaks in late May, earlier in southwest and coastal Oregon, and later in eastern Oregon. Timing of fall migration is less known, but peaks in late August and into the first week of September (Altman 2003).

Survivorship

There is limited knowledge of the life-span of olive-sided flycatchers. From Bird Banding Laboratory data, two individuals that were banded and recaptured were at least seven years old.

Mortality

Very limited data exists. In one instance, sibling competition caused mortality (Altman and Sallabanks 2000). Other data shows that olive-sided flycatcher remains were discovered in a peregrine nest (Cade et al. 1968).

Habitat Requirements

General

The olive-sided flycatcher breeds only in coniferous forests of North America and is associated with forest openings and forest edge. During migration olive-sided flycatchers have been observed in a great diversity of habitats compared to that of the breeding season, including lowland riparian, mixed or deciduous riparian at higher elevations and urban woodlots and forest

patches (Altman 2003). Olive-sided flycatchers have been observed moving north through sagebrush flats in Malheur and Harney Counties, OR (M. Denny p.c., cited in Altman 2003).

Breeding/Foraging

Olive-sided flycatchers breed in coniferous forest, particularly in the following circumstances: within forest burns where snags and scattered tall, live trees remain; near water along the wooded shores of streams, lakes, rivers, beaver ponds, marshes, and bogs, often where standing dead trees are present; at the juxtaposition of late- and early-successional forest such as meadows, harvest units, or canyon edges; and in open or semi-open forest stands with a low percentage of canopy cover (Altman and Sallabanks 2000). In the Blue Mountains, territorial birds are found mostly along stream courses and around wet openings (M. Denny p.c. cited in Altman 2003). Tall, prominent trees and snags, which serve as foraging and singing perches, are common features of all nesting habitat.

Wintering/Foraging

Wintering habitat is similar to that on breeding grounds; forest edges and forest openings, especially where scattered tall trees or snags are present (AOU 1983, Stotz et al. 1992, 1996, Ridgely and Tudor 1994, Altman and Sallabanks 2000). They are most commonly found in mature evergreen forest (Petit et al. 1995, particularly montane forest (Willis et al. 1993, Ridgely and Tudor 1994, Stotz et al. 1996).

Population and Distribution
Distribution

Historic Distribution

The historic distribution of olive-side flycatchers is similar to the distribution today. Several Breeding Bird Atlases, including Michigan (Evers 1991), New York (Peterson 1988), Ontario (Cheskey 1987), and Monterey Co., CA (Roberson and Tenney 1993), report few significant changes in distribution during the twentieth century (Altman and Sallabanks 2000).

Current Distribution



Figure 1. Birds of North America – Breeding distribution of the olive-sided flycatcher in North and Middle America.

The olive-sided flycatcher breeds only in coniferous forests of North America; from Alaska's boreal forest south to Baja California, in central North America south to northern Wisconsin, and in eastern North America south to northeast Ohio and southwest Pennsylvania, including all of New England, and locally in the Appalachians south to western North Carolina (Altman 2003).

Principal migratory route is throughout the forest of western North America, Mexico, and Central America (Bent 1942, Gabrielson and Lincoln 1959, Altman 2003).

Olive-sided flycatchers winter primarily in Panama and the Andes of northern and western South America, from northwestern Venezuela south through Ecuador to southeast Peru and northern Bolivia (Fitzpatrick 1980, DeGraaf and Rappole 1995, Altman 2003).

In Oregon, the olive-sided flycatcher breeds in low densities throughout conifer forests from near sea level along the coast to timberline in the Cascades and Blue Mountains (Altman 2003). The olive-sided flycatcher is most abundant throughout the Cascades (Sauer et al. 1997). In migration, they may occur in any forested habitat including forest patches, desert oases of southeast Oregon, urban forest, and deciduous or mixed deciduous/coniferous riparian forest (Altman 2003).

Population

Historic Population

Historic population numbers of olive-sided flycatchers are unknown.

Current Population and Status

Population trends for OSF based on Breeding Bird Surveys (BBS) data show highly significant declines for all continental (N. America), national (U.S. and Canada), and regional (e. and w. N. America) analysis, and for most state and physiographic region analyses (Sauer et al. 1997, Altman 2003). In Oregon, there has been a highly significant ($p < 0.01$) statewide decline of 5.1% per year from 1966-96 (Sauer et al. 1997, Altman 2003).

Causes of population decline have focused on habitat alteration and loss on the wintering grounds, because declines are relatively consistent throughout the breeding range of the species (Altman and Sallabanks 2000). Other factors potentially contributing to declines on the breeding grounds include habitat loss through logging, alteration of habitat from forest management practices (e.g., clearcutting, fire suppression), lack of food resources, and reproductive impacts from nest predation or parasitism (Altman 2003).

It has also been speculated by Hutto (1995a), that the olive-sided flycatcher may depend on early post-fire habitat, and has likely been negatively affected by fire-control policies of the past 50-100 years (Altman, 2003). The ability of forest management practices (e.g., selective cutting, clearcutting) to mimic natural disturbance regimes caused by forest fires has been questioned. Habitat created by these forest management scenarios may provide only the appearance of early post-fire habitat, but be lacking in some attributes or resources required by olive-sided flycatchers (Altman, 2003).

During the past 50 years, forest management resulted in an increase in forest openings and edge habitat, which has seemingly increased habitat for the olive-sided flycatcher. However, this dichotomy of increased habitat availability and declining populations may indicate that harvested forest represents an "ecological trap" (Hutto 1995b), where habitat may appear suitable, but reproductive success and/or survival is poor due to factors such as limited food resources, predation, or parasitism (Altman, 2003).

Continuing Threats

One of the largest continuing threats to the olive-sided flycatcher is deforestation in Central and South America. Diamond (1991), calculated that olive-sided flycatchers would lose

39% of their wintering habitat in the Andean montane forests between 1980 and 2000. This loss is in addition to habitat loss prior to 1980.

Continuing threats within the breeding range of olive-sided flycatcher include habitat loss to conversion to non-forest, alteration/degradation of habitat, reduced availability and acquisition of food resources, pesticides, and nest predation (Altman and Sallabanks 2003).

References

- American Ornithologists' Union. 1983. Check-list of North American birds. 6th ed. American Ornithologists' Union, Washington, D.C.
- Altman, B. 2000. Olive-sided flycatcher nest success and habitat relationships in post-fire and harvested forests of western Oregon, 1997-1999. Unpublished report submitted to U.S. Fish and Wildlife Service, Regional Office, Portland.
- Altman, B. 2003. Olive-sided Flycatcher. Pp. 374-376 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Altman, B. and R. Sallabanks. 2000. Olive-sided Flycatcher (*Contopus cooperi*). *In* The birds of North America, No. 502. (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Bent, A. C. 1942. Life Histories of North American flycatchers, lark, swallows and their allies. U.S. Natl. Mus. Bull. 179. (Reprinted in 1963 by Dover Publ., New York).
- Cade, T. J., C. M., White, and J. R. Hough. 1968. Peregrines and pesticides in Alaska. *Condor* 70: 170-178.
- Cheskey, T. 1987. Olive-sided Flycatcher. Pp. 250-251 *in* Atlas of the breeding birds of Ontario (M. D. Cadman, P. F. J. Eagles, and F. M. Helleiner, eds.). Fed. Ontario Nat., University of Waterloo Press, Waterloo, ON.
- DeGraff, R. M. and J. H. Rappole. 1995. Neotropical migratory birds: natural history, distribution, and population change. Comstock Publishing Association, Ithaca, NY.
- Denny, M. Field biological technician, U.S. Forest Service, Walla Walla, Washington.
- Diamond, A. W. 1991. Assessment of the risks from tropical deforestation to Canadian songbirds. *Trans. 56th N. A. Wildlife and Natural Resources Conference* 177-194.
- Evers, D. C. 1991. Olive-sided Flycatcher. Pp. 276-277 *in* The atlas of breeding birds of Michigan (R. Brewer, G. A. McPeck and R. J. Adams, Jr., eds.). Michigan State University Press, East Lansing.
- Fitzpatrick, J. W. 1980. Wintering of North American tyrant flycatchers in the neotropics. Pp. 67-78 *in* Migrant birds in the neotropics: ecology, behavior, distribution, and conservation (A. Keast and E. S. Morton, eds.) Smithsonian Inst. Press, Washington, D.C.
- Gabrielson, I. N. and F. C. Lincoln. 1959. Birds of Alaska. Stackpole Co. and Wildlife Management Institute, Harrisburg, PA.
- Hutto, R. L. 1995a. Composition of bird communities following stand-replacement fires in northern Rocky Mountain U.S.A. conifer forests. *Conservation Biology*. 9:1041-1058.
- Hutto, R. L. 1995b. U.S. Forest Service Northern Region songbird monitoring program: distribution and habitat relationships. Contract report to U.S. Forest Service Region 1.
- Peterson, J. M. C. 1988. Olive-sided Flycatcher, *Contopus borealis*. Pp. 244-245 *in* The atlas of breeding birds in New York state (R. F. Andrie and J. R. Carroll, eds.). Cornell University Press, Ithaca, NY.
- Petit, D. R., J. F. Lynch, R. L. Hutto, J. G. Blake, and R. B. Waide. 1995. Habitat use and conservation in the Neotropics. Pp. 145-197 *in* Ecology and management of Neotropical migratory birds: a synthesis and review of critical issues (T. E. Martin and D. M. Finch, eds.). Oxford University Press, New York.

- Ridgely, R. S. and G. Tudor. 1994. The birds of South America. Volume 2: the suboscine passerines. University of Texas Press, Austin.
- Roberson, D., and C. Tenney, eds. 1993. Atlas of the breeding birds of Monterey County, California. Monterey Peninsula Audubon Society, Carmel, CA.
- Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American breeding bird survey results and analysis. Version 96.4. Patuxent Wildlife Res. Center, Laurel, MD. URL = <http://www.mbr.nbs.gov/bbs/bbs.html> Accessed 20 Sep 2002.
- Shaw Creek Bird Supply. Olive-sided flycatcher photo. Used with permission 4/23/04. <http://www.shawcreekbirdsupply.com>
- Stotz, D. F., R. O. Bierregaard, M. Cohn-Haft, P. Petermann, J. Smith, et al. 1992. The status of North American migrants in central Amazonian Brazil. *Condor* 94: 608-621.
- Stotz, D. F., J. W. Fitzpatrick, T. A. Parker, and D. K. Moskovits. 1996. Neotropical birds: ecology and conservation. University of Chicago Press, Chicago, IL.
- USGS Patuxent Wildlife Research Center. 2004. North American Breeding Bird Survey Internet data set, 5 January 2004 (<http://www.mp2-pwrc.usgs.gov/bbs/retrieval/>).
- Willis, E. O., D. W. Snow, D. F. Stotz, and T. A. Parker III. 1993. Olive-sided Flycatchers in southeastern Brazil. *Wilson Bulletin* 105: 193-194.

6.3.13 Western Meadowlark

Western Meadowlark (*Sturnella neglecta*) K. Paul, USFWS



Introduction

The western meadowlark is one of the most familiar and endearing avian images of grass- or sagebrush-dominated habitats throughout Oregon. They have a yellow breast and belly with a distinct black V across the chest. Meadowlarks are commonly found perched on fences along roadsides. Chosen as Oregon's state bird in 1927, it is one of the most widely distributed open-country species in the state, and one of the most abundant species in the arid desert country of eastern Oregon. It can be found in the state year-round, although most birds in eastern Oregon migrate out of the state in winter (Bob Altman 2003).

Description, Life History, and Habitat Requirements

Description

The western meadowlark is a medium-sized songbird with long, slender bill, short tail with rather rigid rectrices, and long legs and toes (Lanyon 1994). They have a dark crown with a light median stripe; a light line over the eye becomes bright yellow from eye to bill; upperparts with intricate concealing pattern of buffs, browns, and black streaks and bars; underparts bright yellow; the sides, flanks, and undertail-coverts dull white, broadly streaked and spotted with dusky black; the outer wing and tail feathers barred with black and brown; outer rectrices partly white (Lanyon 1994). Adult meadowlarks have a black shield-shaped or crescent-shaped patch on their chest (Lanyon 1994).

Life History

Diet

Western meadowlarks take mostly insects in late spring and summer, seeds in the fall, and where available, grain in winter and early spring (Altman 2003). Meadowlarks obtain food from the top of the ground, by probing beneath soil, and by searching under clods, manure, etc (Lanyon 1994). They show a preference for habitats with good grass and litter cover (Wiens and Rotenberry 1981). Favorite insects include beetles, crickets, grasshoppers, weevils, wireworms, cutworms, caterpillars, craneflies, sow bugs, and spiders (Csuti et al. 1997, Lanyon 1994). They occasionally eat snails, bird eggs, and carrion (Csuti et al. 1997).

Reproduction

Most nesting begins in late April, with the peak of nesting activity throughout May, although there is an early egg date of April 3 (Gabrielson and Jewett 1940, Altman 2003). In eastern Oregon, migrants first arrive in late February and most are on territories by April (Gilligan et al. 1994, Altman 2003). At Malheur National Wildlife Refuge (NWR), the earliest spring arrival has been February 6, with the average arrival February 27, peak of passage March 10-25, and earliest nesting April 23 (Littlefield 1990, Altman 2003).

Singing begins upon arrival on the breeding grounds, as early as March. The male often sings from an exposed perch (e.g., a powerline, fence post), but will also sing from the ground. A male's song is often immediately followed by a "rattle" call, which is a female vocalizing (Altman 2003). The meadowlark's mating system is polygynous; males often have two mates concurrently, occasionally three (Lanyon 1994). Meadowlarks may reneest after a failed nesting attempt, and can produce two broods in one season (Altman 2003). The normal clutch of 5 (range 3-7) eggs is incubated by the female for about two weeks. The young are fed by both parents for about a month (Csuti et al. 1997).

Nests are usually located in a pasture, prairie, or other grassland habitat; rarely in cultivated fields (Lanyon 1994). The nest is usually well concealed, on the ground, and often in fairly dense vegetation (Lanyon 1994). Nests are constructed of coarse dried grasses, stems of forbs, or fine bark, more or less interwoven with and attached to surrounding vegetation; lined with finer grasses (Lanyon 1994). The nests are typically domed shaped (Sibley 2000).

Breeding Territory/Home Range

Male meadowlarks have multipurpose territories within which they gather food, mate, and rear young, and which they defend against intruding meadowlarks (Lanyon 1994). Males alone establish and defend territories, for up to four weeks prior to arrival of females and until fledging of final brood (Lanyon 1994). Males unsuccessful in acquiring mates fail to maintain territories (Lanyon 1994). Territories ranged in size from 6.9-7.9 acres (2.8-3.2 ha) in Wisconsin (Lanyon 1994), 9.9-32 acres (4-13 ha) in Iowa (Kendeigh 1941), and 17.3 acres (7 ha) in Manitoba (Schaeff and Picman 1988). Csuti et al. (1997) reports territory size to range from a few to over ten acres.

Migration/Overwintering

Western meadowlarks are resident throughout much of their range, but migrate from colder northern and central regions and higher elevations as snow restricts foraging (Lanyon 1994). They tend to seek sheltered valleys during severe winter weather (Bent 1958). Fall migrants along the coast begin to appear in dunes and farm fields in late August and early September (M. Patterson p.c., cited in Altman 2003). In western valleys, flocks increase in size from August through October, probably due to arrival of northern migrants (Altman 2003). At Malheur NWR, autumn migrants arrive in early August and the peak of migration is August 20 through September 20 (Littlefield 1990, Altman 2003). A few linger into October and November there, with occasional wintering birds. During the nonbreeding season in western valleys, meadowlarks form foraging flocks that may vary from a few to over 100 birds. Wintering flocks on the north coast are usually <10 birds (M. Patterson p.c., cited in Altman 2003). In western Oregon valleys and along the coast, wintering flocks increase in size and number in late February and throughout March during early northward migration. Flocks break up by late March, and there is a pulse of migratory movement in early April (Altman 2003).

Survivorship

Captive birds maintained for breeding and studies of ontogeny of vocalizations normally lived 3-5 years; one female lived 9 years and one male 10 years in captivity (Lanyon 1979). There is no information for wild populations.

Mortality

Deaths of meadowlarks have been reported from eating grain poisoned for rodent or insect control (Griffen 1959), drowning in stock tanks (Chilgren 1979), exposure to deep snow and ice storms, and mowing in hay fields (Lanyon 1994). Eggs and nestlings are often deserted because of human activity (irrigation, mowing) (Lanyon 1994). Eggs or chicks are often trampled by livestock, eaten by foxes, domestic cats and dogs, coyotes, snakes, skunks, raccoons, and other small mammals (Lanyon 1957, Bent 1958, Lanyon 1994). Adults are often taken by various species of hawks (Lanyon 1994).

Habitat Requirements

Breeding/Foraging

Most common breeding habitat is native grasslands and pastures, but also in hay and alfalfa fields, weedy borders of croplands, roadsides, orchards, or other open areas and occasionally desert grassland (Lanyon 1994). Optimal breeding habitat in the Willamette Valley is lightly grazed pastures or fallow fields with grass height 1-2 ft (0.3-0.6 m), and shrub or tree cover <10% (Altman 2003). Marginal habitat is hayfields and cultivated grass fields (annual or perennial) with grass height 1-3 ft (0.3-1 m) and shrub or tree cover <25% (Altman 1999, Altman 2003). Cultivated grass fields are used as escape cover and to a lesser extent nesting cover, but have only limited use as foraging habitat (Altman 2003). Thus, quality foraging habitat for meadowlarks (e.g., lightly grazed pastures, fallow fields) needs to be adjacent to or within territories dominated by cultivated grass fields or hayfields in order for the latter habitats to be used for nesting (Altman 2003). Singing perches (fencelines, telephone pole, shrubs, trees, boulders) are essential components of all territories (Altman 2003).

Breeding habitat in eastern Oregon includes all types and conditions of shrub-steppe or rangeland habitat outside of forested areas (Altman 2003). Abundance of meadowlarks is greater in bunchgrass and sagebrush habitats that are free from grazing (Altman 2003). Holmes and Geupel (1998, cited in Altman 2003) noted that the three variables most highly associated with meadowlark abundance were percent open ground (negative association), and shrub height and bitterbrush density (positive associations).

General/Non-breeding/Foraging

Western meadowlarks use a variety of habitats including grasslands, savanna, cultivated fields, and pastures (Subtropical and Temperate zones) (AOU 1998). They prefer high forb and grass cover, low to moderate litter cover, and little or no woody cover (Sample 1989, Kimmel et al. 1992, Anstey et al. 1995, Hull et al. 1996, Madden 1996, NatureServe 2003). In shrubsteppe and desert grasslands, meadowlarks prefer mesic areas; low shrub cover and density; patchiness in vegetative structure and in heights of forbs and shrubs; and high coverage of grass, forb, and litter (Lanyon 1962, Rotenberry and Wiens 1980, Wiens and Rotenberry 1981, Wiens et al. 1987, McAdoo et al. 1989, Knick and Rotenberry 1995, NatureServe 2003). In general, meadowlarks prefer open, treeless areas (Salt and Salt 1976, Sample 1989, Johnson 1997), although a few shrubs may be used as song perches (Knick and Rotenberry 1995, NatureServe 2003).

Population and Distribution

Distribution

Historic Distribution

The historic distribution was smaller than the current distribution. The western meadowlark formerly bred only to the forest edge in Missouri, Illinois, and Wisconsin (Lanyon 1994). During the twentieth century, with forest clearing and expanding agriculture, the meadowlark population has undergone dramatic expansion of breeding range northeast; now breeding in colonies in Michigan, northern Indiana, northern Ohio, southern Ontario, and extreme western New York (Lanyon 1994). This expansion is remarkable in view of lack of significant eastward expansion in Missouri, Kansas, Oklahoma, and Texas (Robbins and Easterla 1992,

Lanyon 1994). Lanyon (1956) notes, that the northeastward expansion is correlated with average spring precipitation, which may be a proximate factor governing expansion.

Current Distribution

The western meadowlark breeds in grassland and shrub-grassland habitats south from c. British Columbia, east to w. Ontario and n. Minnesota, Michigan, and Wisconsin, south through the eastern edge of the Great Plains to westcentral Texas, and west through northwest Sonora, Mexico to northwest Baja California (Lanyon 1994). Winters in much of its breeding range south of Canada and the northern tier of the U.S., including Washington and Oregon (Altman 2003).

In Oregon, the meadowlark breeds in scattered locations along the coast, in western Oregon valleys, and throughout desert shrub-steppe, grassland, and agricultural areas of eastern Oregon (Altman, 2003). In eastern Oregon, meadowlarks enjoy a ubiquitous breeding distribution throughout unforested habitat up to 6,000 ft (1,830 m) (Gilligan et al. 1994), and they are one of the most common breeding species in all habitat types in shrub-steppe country (Altman 2003).

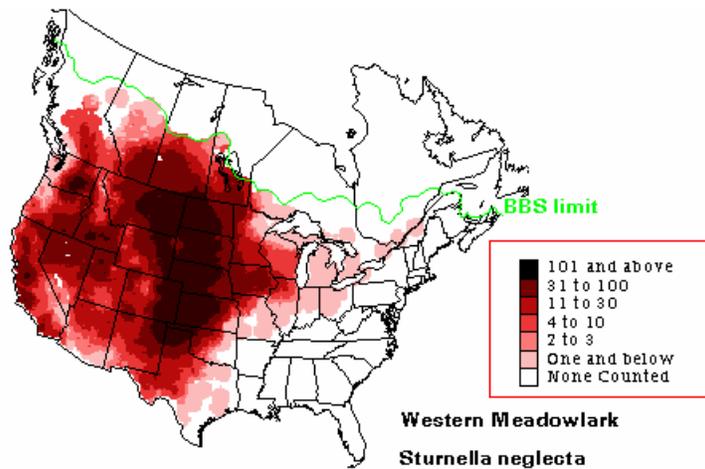


Figure 1. Western meadowlark breeding distribution from BBS data (1982-1996) (Sauer et al. 2001)

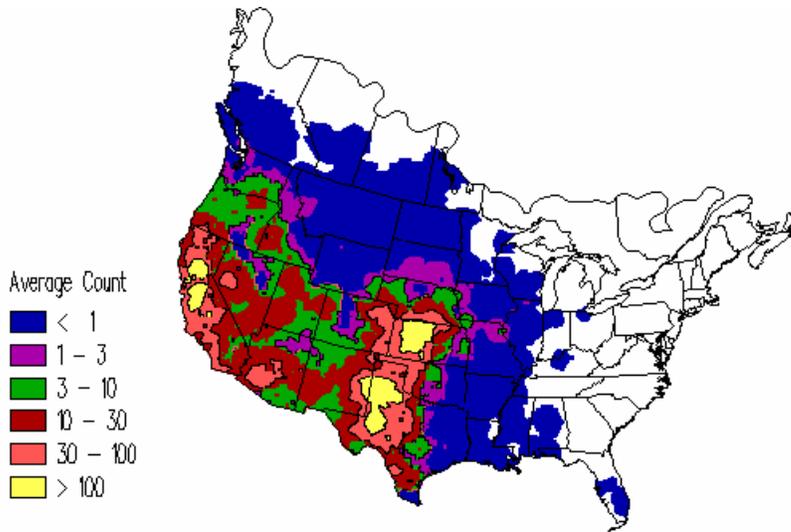


Figure 2. Western meadowlark winter distribution from CBC data (1982-1996) (Sauer et al. 2001)

Population

Historic Population

Historic population numbers are unknown.

Current Population and Status

Throughout the range of the western meadowlark in the U.S. and Canada, breeding populations have been declining slightly (annual rate of 0.6%), with the highest rates of decline in the northeast portion including Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, and Ontario, at annual rates of 4-9% (BBS 1968-1991) (Lanyon 1994).

Wintering populations in western Oregon are generally higher than breeding populations (Altman 2003). The highest wintering concentration in the state of Oregon is in the Rogue Valley (CBC, Altman 2003). Meadowlarks also winter in small flocks along the entire coast. Populations of meadowlarks are reduced in eastern Oregon, suggesting some birds migrate, but small wintering flocks at low elevations are not uncommon (Altman 2003). The highest concentrations in eastern Oregon are in Umatilla County (CBC, Altman 2003).

Population trends in Oregon based on BBS data indicate relatively stable long-term (1966-96) trends (1%/year decline, but non-significant ($p < 0.01$) short-term (1980-96) declining trends (2.9%/year) (Sauer et al. 1997, Altman 2003). Populations in the Columbia Plateau BBS Region (includes all non-forest in e. Oregon, e. Washington, and s. Idaho) mirror the Oregon state trend; relatively stable long-term trends (non-significant decline of 0.6%/year), and highly significant declining short-term trends (2.6%/year) (Sauer et al. 1997, Altman 2003). Population trends based on Christmas Bird Count (CBC) data also indicate declining populations (Altman 2003).

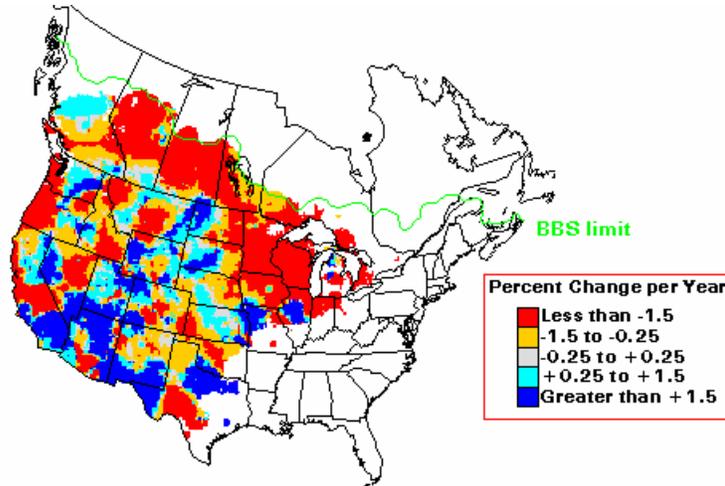


Figure 3. Western meadowlark population trend from BBS data (1966-1996) (Sauer et al. 1996)

Grande Ronde Subbasin

BBS Survey Route	Years	Number Detected
Howard Meadows 69206	1992-94, 96, 98-2003	1, 1, 0, 1, 3, 1, 0, 3, 5, 2
Flora 69007	1986-2003	17, 22, 11, 12, 8, 5, 22, 12, 11, 9, 12, 23, 18, 29, 29, 25, 38, 27
Troy 69207	1992-98, 2000-02	0, 0, 0, 0, 0, 0, 1, 1, 0, 0

Continuing Threats

Factors suspected to contribute to declines include conversion of native grasslands and shrub-steppe to non-suitable agriculture (e.g., rowcrops); habitat degradation from grazing; mortality at nest from trampling by livestock and agricultural practices such as mowing; a high degree of sensitivity to human disturbance near nest sites; and potential reproductive failures from use of pesticides or other contaminants (Lanyon 1994, Altman 2003). The meadowlark has been identified as a species of high concern under all proposed management options for the Interior Columbia Basin (also includes e. Oregon, Idaho, and parts of Montana and Nevada) (Saab and Rich 1997) (Altman 2003).

References

Altman, B. 1999. Status and conservation of grassland birds in the Willamette Valley. Unpublished report, Oregon Department of Fish and Wildlife, Corvallis.

Altman, B. 2003. Western Meadowlark. Pp. 580-582 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

American Ornithologists' Union (AOU). 1998. Check-list of North American birds. Seventh edition. American Ornithologists' Union, Washington, DC. 829 pp.

Anstey, D.A., S.K. Davis, D.C. Duncan, and M. Skeel. 1995. Distribution and habitat requirements of eight grassland songbird species in southern Saskatchewan. Saskatchewan Wetland Conservation Corporation, Regina, Saskatchewan. 11 pp.

Bent, A. C. 1958. Life histories of North American blackbirds, orioles, tanagers, and allies. Dover, New York.

Chilgren, J. D. 1979. Drowning of grassland birds in stock tanks. *Wilson Bulletin* 91: 345-346.

- Christmas Bird Count Data. Available from The National Audubon Society at
URL=<http://www.audubon.org/bird/cbc/index.html> Accessed 20 Sept. 2002.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History. Oregon State University Press. Corvallis, OR.
- Fix, David. Observer, Arcata, CA.
- Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis. (Reprinted in 1970 as Birds of the Pacific Northwest by Dover Publishing, New York).
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publishing, McMinnville, OR.
- Griffen, D. N. 1959. The poisoning of meadowlarks with insecticides. Wilson Bulletin 71: 193.
- Holmes, A. L., and G. R. Geupel. 1998. Avian population studies at naval weapons systems training facility Boardman, Oregon. Final report to Department of Navy, and Oregon Department of Fish and Wildlife. Point Reyes Bird Observatory Contract 844.
- Hull, S.D., R.J. Robel, and K.E. Kemp. 1996. Summer avian abundance, invertebrate biomass, and forbs in Kansas CRP. Prairie Naturalist 28:1-12.
- Johnson, D.H. 1997. Effects of fire on bird populations in mixed-grass prairie. Pages 181-206 in F.L. Knopf and F.B. Samson, editors. Ecology and conservation of Great Plains vertebrates. Springer-Verlag, New York.
- Kendeigh, S. C. 1941. Birds of a prairie community. Condor 43: 165-174.
- Kimmel, R.O., A.H. Berner, R.J. Welsh, B.S. Haroldson, and S.B. Malchow. 1992. Population responses of Grey Partridge (*PERDIX PERDIX*), Ring-necked Pheasant (*PHASIANUS COLCHICUS*), and meadowlarks (*STURNELLA* spp.) to farm programs in Minnesota. Gibier Faune Sauvage 9:797-806.
- Knick, S. T., and J. T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology 9:1059-1071.
- Lanyon, W. E. 1956. Ecological aspects of the sympatric distribution of meadowlarks in the northcentral states. Ecology 37: 98-108.
- Lanyon, W. E. 1957. The comparative biology of the meadowlarks (*Sturnella*) in Wisconsin. Publ. Nuttall Ornithological Club, no. 1. Cambridge, MA.
- Lanyon, W. E. 1962. Species limits and distribution of meadowlarks of the desert grassland. Auk 79:183-207.
- Lanyon, W. E. 1979. Hybrid sterility in meadowlarks. Nature 279: 557-558.
- Lanyon, W. E. 1994. Western Meadowlark (*Sturnella neglecta*). In The birds of North America, No. 104 (A. Poole and F. Gill, eds.). Academy of Natural Sciences, Philadelphia, and American Ornithological Union, Washington, D.C.
- Littlefield, C. D. 1990. Birds of Malheur National Wildlife Refuge, Oregon. Oregon State University Press, Corvallis.
- Madden, E.M. 1996. Passerine communities and bird-habitat relationships on prescribe-burned, mixed grass prairie in North Dakota. M.S. thesis. Montana State University, Bozeman, MT. 153 pp.
- McAdoo, J.K., W.S. Longland, and R.A. Evans. 1989. Nongame bird community responses to sagebrush invasion of crested wheatgrass seedings. Journal of Wildlife Management 53:494-502.
- NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: February 13, 2004).
- Patterson, Mike. Consultant, North Coast Land Conservancy and Nature Conservancy, Clatsop County, OR.
- Robbins, M. B. and D. A. Easterla. 1992. Birds of Missouri: their distribution and abundance. University of Missouri Press, Columbia.

- Rotenberry, J.T., and J.A. Wiens. 1980. Habitat structure, patchiness, and avian communities in North American steppe vegetation: a multivariate analysis. *Ecology* 61:1228-1250.
- Saab, V. A., and T. D. Rich. 1997. Large-scale conservation assessment for Neotropical migratory land birds in the interior Columbia River basin. In Interior Columbia Basin ecosystem management project: scientific assessment (T.M. Quigley, ed.). U.S. Department of Agriculture, Forest Service General Technical Report. PNW-GTR-399. Portland, OR.
- Salt, W.R., and J.R. Salt. 1976. *The Birds of Alberta*. Hurtig Publishers, Edmonton, Alberta. 498 pp.
- Sample, D.W. 1989. Grassland birds in southern Wisconsin: habitat preference, population trends, and response to land use changes. M.S. thesis. University of Wisconsin, Madison, WI. 588 pp.
- Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American breeding bird survey results and analysis. Version 96.4. Patuxent Wildlife Res. Center, Laurel, MD. URL = <http://www.mbr.nbs.gov/bbs/bbs.html> Accessed 20 Sep 2002.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1*, [USGS Patuxent Wildlife Research Center, Laurel, MD. http://www.mbr-pwrc.usgs.gov/bbs/bbs.html](http://www.mbr-pwrc.usgs.gov/bbs/bbs.html)
- Schaeff, C. and J. Picman. 1988. Destruction of eggs by Western Meadowlarks. *Condor* 90: 935-937.
- USGS Patuxent Wildlife Research Center. 2004. North American Breeding Bird Survey Internet data set, 5 January 2004 (<http://www.mp2-pwrc.usgs.gov/bbs/retrieval/>).
- Wiens, J.A., J.T. Rotenberry, and B. Van Horne. 1987. Habitat occupancy patterns of North American shrubsteppe birds: the effect of spatial scale. *Oikos* 48:132-147.
- Wiens, J.A., and J.T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. *Ecological Monographs* 51:21-41.

6.3.14 American Beaver

American Beaver (*Castor Canadensis*) K. Paul, USFWS.

Distribution

In Oregon, the American beaver can be found in suitable habitats throughout the state (Verts and Carraway 1998).

Habitat

The beaver almost always is associated with riparian or lacustrine habitats bordered by a zone of trees, especially cottonwood and aspen (*Populus*), willow (*Salix*), alder (*Alnus*), and maple (*Acer*) (Verts and Carraway 1998). Small streams with a constant flow of water that meander through relatively flat terrain in fertile valleys and are subject to being dammed seem especially productive of beavers (Hill 1982, cited in Verts and Carraway 1998). Streams with rocky bottoms through steep terrain and more subject to wide fluctuations in water levels are less suitable to beavers. In large lakes with broad expanses subject to extensive wave action, beavers usually are restricted to protected inlets (Verts and Carraway 1998).

Harvest

Harvest of beavers in Oregon between 1969 and 1992 per 1,000 hectares in Union and Wallowa Counties were <1 and 1-10 respectively (ODFW, annual reports, cited in Verts and Carraway 1998).

Diet

Beavers are herbivorous. In summer, a variety of green herbaceous vegetation, especially aquatic species, is eaten (Jenkins and Busher 1979; Svendsen 1980, cited in Verts and Carraway 1998). In autumn and winter as green herbaceous vegetation disappears, beavers shift their diet to stems, leaves, twigs, and bark of many of the woody species that grow near the water (Verts and Carraway 1998). Bulbous roots of aquatic species also may be eaten in winter (Beer 1942, cited in Verts and Carraway 1998). Beavers cut mostly deciduous trees such as cottonwood, willow, alder, maple, and birch, but in some regions, coniferous species may be used (Jenkins 1979, cited in Verts and Carraway 1998).

In southeastern Oregon, riparian-zone trees have been reduced or eliminated in many areas by browsing herbivores. However, comparison of growth of red willow (*Salix lasiandra*) in an area inaccessible to cattle but occupied by beavers with that in an area inaccessible to both cattle and beavers, indicated that beavers were not responsible for the deterioration. Although beavers harvested 82% of available stems annually, they cut them at a season after growth was completed and reserves were translocated to roots. Subsequent growth of cut willows increase exponentially in relation to the proportion of the stems cut by beavers (Kindschy 1985, cited in Verts and Carraway 1998).

Habits

Beavers, because of their ability to fell trees, dam streams (and irrigation ditches), dig canals, and tunnel into banks, and because of their taste for certain crops, doubtlessly have the greatest potential of any wild mammal in the state to affect the environment. Their economic value, both positive and negative, can be enormous, depending largely upon the point of view of those affected. However, the more subtle contributions such as to flood control, to maintenance of water flows, to fisheries management, and to soil conservation resulting from their activities, in the long term, may have the greatest economic value (Verts and Carraway 1998).

References

- Beer, J. R. 1942. Notes on the winter food of beavers in the Palouse Prairies, Washington. *Journal of Mammalogy*, 23:444-445.
- Hill, E. P. 1982. Beaver: *Castor Canadensis*. Pp. 256-281, in *Wild mammals of North America: biology, management, and economics* (J. A. Chapman and G. A. Feldhamer, eds.). The Johns Hopkins University Press, Baltimore, 1147 pp.
- Jenkins, S. H. 1979. Seasonal and year-to-year differences in food selection by beavers. *Oecologia*, 44:112-116.
- Jenkins, S. H., and P. E. Busher. 1979. *Castor Canadensis*. *Mammalian Species*, 120:1-8.
- Kindschy, R. R. 1985. Response of red willow to beaver use in southeastern Oregon. *The Journal of Wildlife Management*, 49:26-28.
- Svendsen, G. E. 1980. Seasonal change in feeding patterns of beaver in southeastern Ohio. *The Journal of Wildlife Management*, 44:285-290.
- Verts, B. J., and L. N. Carraway. 1998. *Land Mammals of Oregon*. University of California Press, 668 pp.

6.3.15 Ruffed Grouse



Ruffed Grouse (*Bonasa umbellus*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

The ruffed grouse (RG) is distributed throughout deciduous and coniferous forest of North America but is most abundant in early-successional forests dominated by aspens and poplars (*Populus spp.*) (Rusch et al 2000). The distinctive RG is found singly in woods (Sibley 2000).

The RG is named for a series of black iridescent feathers on the sides of the neck called the ruff, which is erected by males to form an umbel-shaped ring around the neck during courtship displays (Pelren 2003). Both sexes are mottled in rich brown, black, and white (Pelren 2003). Two color morphs occur, with some intermediates (Pelren 2003, Rusch et al. 2000). Gray birds have tails barred with alternating bands of black and gray, whereas red birds have tails banded with black and rust (Pelren 2003, Rusch et al. 2000). Most RG in western Oregon are red, while most in eastern Oregon are gray although both morphs can exist in mixed broods on both sides of the state (Pelren 2003).

The male RG's display consists of a series of accelerating, muffed thumps, produced by beating wings rapidly while standing, that sound like a distant motor starting. This low-pitched "drumming" is often felt rather than heard. Both sexes give clucking notes and higher squeal when alarmed (Sibley 2000).

Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

RG are omnivorous. Their diet in spring consists primarily of leaves, buds, and flowers of grasses and forbs (Pelren 2003, Csuti et al. 1997, Rusch et al. 2000). Microarthropods increase in the diet during summer, and berries and other fruits such as salal, hawthorn, and blackberry become common in the diet as they ripen (Durbin 1979, Pelren 2003). During the winter RG mainly consume buds, seeds, twigs and catkins of deciduous trees (Pelren 2003, Csuti et al. 1997, Rusch et al. 2000). Aspen are a major winter food in Oregon, but where aspen is limited RG may also feed on alder, willow, birch, dogwood, hawthorn, and others (Pelren 2003). Ferns and other ground-level evergreen plants are also utilized during winter (Durbin 1979). Newly hatched young are feed primarily insects and spiders (Csuti et al. 1997).

Reproduction

In Oregon, breeding at lower elevations can begin in April, and young are fledged by late August (Csuti et al. 1997). Males exhibit territorial behavior throughout the year, but typically in early March territoriality increases and peaks in late March or April, then declines in May (Johnsgard 1983). During this period, male RG select a log, which is used for visual strutting displays and drumming (Pelren 2003). A single drumming log is often used throughout the life of a RG, and many have been used by numerous successive generations (Pelren 2003). Visual displays may include upright strutting, a “bowing” movement, and a rush sequence (Hjorth 1970). Sullivan (1992) described an observation of a display in the Wallowa Mountains as “rattlesnake” behavior due to the rattle-like sound of the tail following the rush sequence (Pelren 2003).

RG are polygamous. After copulation, the female seeks a nest site (Pelren 2003), typically at the base of a tree, stump, or boulder (Rusch et al. 2000). Nests can also be found in deadfalls and brushpiles, in the base of hollowed, partially opened stump, or at the base of multiple-stem shrubs; sometimes nest may be by itself without any object nearby (Johnsgard and Maxson 1989, Rusch et al. 2000). RG prefer nest sites in hardwood stands and stands that are fairly open at ground level (Johnsgard and Maxson 1989). Nests are rarely found in dense vegetation. Some nests are found in wet and brushy habitat (Maxson 1977, Rusch et al. 2000). Nests are shallow depressions lined with feathers (Pelren 2003).

Eggs are laid at a rate of two per three days with an average clutch size of 11. Incubation begins after the last egg is laid and usually lasts 23-24 days. Chicks usually hatch in early to mid-June, and gain flight in approximately two weeks. During the summer RG, and particularly broods, frequent habitat with dense invertebrate populations, such as logging roads or other disturbed locations with herbaceous growth (Pelren 2003).

Breeding Territory/Home Range

On average, male RG defend a territory of 10-30 acres in the breeding season (Csuti et al. 1997). Available literature shows that home range of both female and male RG vary significantly by region and by habitat type. Females tend to have a smaller home range when they have eggs or chicks.

Survivorship

Average annual survival rates of adult males rangewide is about 34% but varies by age class, region, habitat, and phase of population cycle (Rusch et al. 2000). A study conducted in the Appalachians by Haulton (1999), showed that survival was lowest in the first week after hatching with a high incidence of total brood loss (38%). Survival was 13.5% five weeks after hatching and 7% ten weeks after hatching.

Mortality

RG are rarely found dead from exposure, disease, or starvation (Rusch et al. 2000). Predation, including hunting by humans, is the largest source of mortality (Rusch et al. 2000). In Wisconsin, out of 563 radio-tagged grouse, 29.8% were killed by hunters, 46.2% were killed by hawks and owls, and 20.4% were killed by small mammals (Rusch et al. 2000).

Habitat Requirements

RG are closely associated with dense deciduous or deciduous/evergreen forest, represented primarily by alder-dominated stands in western Oregon and stands containing alders, quaking aspens, hawthorns, and other small trees and shrubs in eastern Oregon (Durbin 1979, Pelren 2003). In the relatively dry habitat of the Blue and Wallowa Mountains, RG frequently congregate along stream corridors and drainages that afford dense vegetation and a diversity of berries, catkins and other food sources (Pelren 2003).

Spring habitat for males include their “drumming” log or elevated surface, frequently located in mid-successional deciduous stands, often with conifer and dense understory components (Johnsgard 1983, Pelren 2003).

Nesting habitat is often found in mid-aged deciduous or mixed deciduous-conifer habitat (Johnsgard 1983).

Population and Distribution

Distribution

In the western United States, the RG is a resident of the coastal and Cascade mountains of western Washington, Oregon, and northwest California, and the Rocky Mountains of eastern Washington and Oregon, northern Idaho, western Montana, and Wyoming, and northeast Utah (Pelren 2003). There are small populations in northeast Nevada and western North Dakota and South Dakota (Pelren 2003).

In Oregon, RG are a common resident throughout most forested regions of the state (Durbin 1979). *Bonasa umbellus affinis* occupies most forests at low to moderate elevations east of the Cascade crest (Browning 2002, Pelren 2003), primarily the east slope of the Cascades and the Blue Mountains, but also forested extensions into the lowlands (Pelren 2003). The RG is not known to inhabit the riparian or aspen stands of southeast Oregon desert regions (Pelren 2003).

Population

Historic

There is no historic population data for RG.

Current Population and Status

The population status in Oregon appears favorable (Pelren 2003) and the range remains consistent with that noted by Gabrielson and Jewett (1940). Population density data is unavailable for Oregon. Oregon Department of Fish and Wildlife (ODFW) hunter surveys indicated harvest from 1979-1996 range from an estimated 23,983 in 1985 to 74,290 in 1992 (Pelren 2003). Intensive hunter harvest data in Wallowa County suggest relatively stable populations (Pelren 2003). Populations in some states exhibit 10-year cycles of alternating abundance and relative scarcity (Johnsgard 1983); insufficient data exist on cyclic fluctuations in Oregon (Pelren 2003).

Factors Affecting Population Status

Timber harvest can actually help improve RG habitat by creating a mosaic of young timber stands favorable for the species (Pelren 2003). In the relatively dry Blue and Wallowa Mountains, streamside buffer zones facilitate dense stands of hawthorn and other food-producing shrubs ideals for the species (Pelren 2003). Currently, the outlook for RG in Oregon is positive (Pelren 2003).

References

- Browning, M. R. 2002. Taxonomic comments on selected species of birds from the Pacific Northwest. *Oregon Birds* 28: 69-82.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. p. Gaines, and M. M. P. Huso. 1997. *Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History*. Oregon State University Press. Corvallis, OR.
- Durbin, K. 1979. The forest drummer: a look at the Ruffed Grouse in Oregon. *Oregon Wildlife* 3-7.
- Gabrielson, I. N., and S. G. Jewett. 1940. *Birds of Oregon*. Oregon State College, Corvallis. (Reprinted in 1970 as *Birds of the Pacific Northwest* by Dover Publishing, New York).
- Haulton, G. S. 1999. Ruffed Grouse natality, chick survival, and brood micro-habitat selection in the southern Appalachians. M. S. thesis, Virginia Tech., Blacksburg.
- Hjorth, I. 1970. Reproductive behavior in the Tetraonidae with special reference to males. *Viltrevy* 7: 183-596.
- Johnsgard, P. A. 1983. *The grouse of the world*. University of Nebraska Press, Lincoln.
- Johnsgard, P. A., and S. J. Maxson. 1989. Nesting. Pp. 130-137 *in* Ruffed Grouse (S. Atwater and J. Schnell, eds.). Stackpole Books, Harrisburg, PA.
- Maxson, S. J. 1977. Activity patterns of female Ruffed Grouse during the breeding season. *Wilson Bulletin* 89: 439-455.
- Pelren, E. C. 2003. Ruffed Grouse. Pp. 176-177 *in* *Birds of Oregon: A General Reference*. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.
- Rusch, D. H., S. Destefano, M. C. Reynolds, and D. Lauten. 2000. Ruffed Grouse (*Bonasa umbellus*). *In* *The Birds of North America*, No. 515 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Sibley, D. A. 2000. *National Audubon Society: The Sibley Guide to Birds*. Chanticleer Press, Inc., New York.
- Sullivan, P. T. 1992. "Rattlesnake" behavior. *Oregon Birds* 18: 56.

6.4 Appendix 4: QHA Tables

Table 37. Current Habitat Attribute Ratings for the Oregon Side LMS subbasin QHA Analysis.

		Attribute Confidence											2.0	
		Attribute Toggle											1	
Reach Name	Description	Not Rated	Riparian Condition	Channel Stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Confidence
Pine Cr-1	From mouth at Columbia R to NF Pine including tribs of Pine Cr		2.5	2.5	3.0	2.0	2.5	3.0	4.0	4.0	2.5	4.0	4.0	1
Pine Cr NF-1	From mouth to Lake Fork including tribs of NF Pine Cr		2.0	2.0	2.5	2.5	2.0	3.0	4.0	4.0	3.0	4.0	4.0	1
Lake Fork Cr	Lake Fork Cr watershed		3.5	3.0	3.5	3.0	3.0	2.5	4.0	4.0	3.5	4.0	2.5	1
Pine Cr NF-2	NF Pine Cr and tribs above Lake Fork		3.0	3.0	3.5	1.5	2.0	3.0	4.0	4.0	3.0	4.0	4.0	1
Pine Cr-2	From NF Pine to EF Pine including tribs of Pine Cr		3.0	3.0	2.5	2.0	3.0	3.0	4.0	4.0	1.5	4.0	4.0	1
Fish Creek	Split off of Pine Cr-2		3.0	3.0	3.0	2.0	3.0	2.5	4.0	4.0	2.5	4.0	3.5	1
Long Branch/Four Mile	Split off of Pine Cr-2		3.0	3.0	3.0	2.0	3.0	2.5	4.0	4.0	2.5	4.0	3.0	1
Pine Cr E-1	East Pine watershed below irrigation diversion/NF boundary		2.5	2.5	2.5	1.5	3.0	2.0	3.0	4.0	2.0	3.0	2.5	1
Pine Cr E-2	East Pine Creek upstream of irrigation diversion at NF boundary		3.0	3.0	3.0	2.5	3.5	3.0	4.0	4.0	3.5	4.0	3.0	1
Pine Cr-3	to 2560 ft level close to town of Pine including tribs of Pine Cr		2.5	2.5	2.5	1.5	3.0	2.0	3.0	4.0	2.0	3.0	2.5	1
Clear Cr-1	Clear Creek and Tribs between National Forest Boundary and mouth		2.5	2.5	2.5	1.5	3.0	2.0	3.0	4.0	2.0	3.0	2.5	1
Clear Cr-2	Clear Creek from Reservoir to National Forest Boundary		3.5	3.0	2.5	2.5	4.0	3.0	4.0	4.0	3.5	4.0	3.0	1
Pine Cr-4	Pine Cr watershed above 2560 ft level to Carson		3.0	2.0	2.0	2.5	4.0	2.0	4.0	4.0	3.0	4.0	3.0	1
Pine Cr-5	Pine Cr-4 upstream of Carson		3.5	3.0	3.5	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1
Sag Cr-1	Sag Cr watershed and all tribs downstream of Laird Dam		3.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	3.0	3.0	1.0	0.5
Sag Cr-2	Sag Cr upstream of Laird Dam and all tribs of Sag Cr	NR												0.5

Table 38. Reference Habitat Attribute Ratings for the Oregon Side LMS subbasin QHA Analysis.

		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
		1	1	1	1	1	1	0	1	1	0	1	1	0	1
Reach Name	Description	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Confidence		
Pine Cr-1	re including tribs of Pine Cr	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	
Pine Cr NF-1	cluding tribs of NF Pine Cr	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	
Lake Fork Cr	Lake Fork Cr watershed	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	
Pine Cr NF-2	and tribs above Lake Fork	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	
Pine Cr-2	re including tribs of Pine Cr	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	1.0	
Fish Creek	Split off of Pine Cr-2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	4.0	1.0	
Long Branch/Four Mile	Split off of Pine Cr-2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	4.0	1.0	
Pine Cr E-1	tion diversion/NF boundary	4.0	4.0	4.0	3.0	4.0	3.5	3.5	4.0	3.0	4.0	4.0	4.0	1.0	
Pine Cr E-2	n diversion at NF boundary	4.0	4.0	4.0	3.5	4.0	4.0	4.0	4.0	3.5	4.0	4.0	4.0	1.0	
Pine Cr-3	re including tribs of Pine Cr	4.0	4.0	4.0	3.0	4.0	3.5	3.5	4.0	3.0	4.0	4.0	4.0	1.0	
Clear Cr-1	Forest Boundary and mouth	4.0	4.0	4.0	3.0	4.0	3.5	3.5	4.0	3.0	4.0	4.0	4.0	1.0	
Clear Cr-2	o National Forest Boundary	4.0	3.5	3.0	3.0	4.0	3.5	4.0	4.0	3.5	4.0	3.0	4.0	1.0	
Pine Cr-4	ove 2560 ft level to Carson	4.0	3.5	4.0	3.5	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	1.0	
Pine Cr-5	re Cr-4 upstream of Carson	4.0	3.5	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0	
Sag Cr-1	s downstream of Laird Dam	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.5	
Sag Cr-2	Dam and all tribs of Sag Cr														

Table 39. Protection and Restoration habitat ranking for redband trout in the Oregon Side LMS subbasin.

NPC= Not present currently

NPR = Not present in reference condition

Reach Name	Protection Habitat Ranking											Restoration Habitat Ranking												
	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
Pine Cr-1	13	6	3	2	7	1	5	9	7	9	9	4	12	4	2	5	3	1	6	7	7	7	7	7
Pine Cr NF-1	8	7	4	2	4	8	1	10	3	6	10	9	4	1	3	3	5	2	6	8	8	7	8	8
Lake Fork Cr	2	2	3	1	4	6	8	10	7	5	10	9	9	6	2	5	3	4	1	9	9	7	9	8
Pine Cr NF-2	4	3	2	1	8	7	4	10	6	5	10	9	7	4	3	7	1	2	5	8	8	6	8	8
Pine Cr-2	12	4	2	3	7	1	6	10	5	9	10	8	6	4	3	2	1	5	7	8	8	6	8	8
Fish Creek	6	5	2	2	7	4	6	10	1	8	10	9	8	5	3	3	1	6	2	9	9	7	9	8
Long Branch/Four Mile	14	5	3	3	6	2	7	10	1	8	10	9	15	6	4	4	1	3	2	9	9	7	9	8
Pine Cr E-1	9	5	3	3	7	1	6	10	2	8	10	9	1	3	1	1	4	6	5	9	9	7	9	8
Pine Cr E-2	5	4	1	1	8	3	5	10	7	6	10	9	10	3	1	1	5	6	4	8	8	8	8	7
Pine Cr-3	11	5	3	3	6	1	7	10	2	9	10	8	2	3	1	1	4	6	5	9	9	7	9	8
Clear Cr-1	10	5	3	3	7	1	6	10	2	8	10	9	3	3	1	1	5	6	4	9	9	7	9	8
Clear Cr-2	3	1	3	5	8	2	4	10	7	6	10	9	13	3	1	1	5	6	4	6	6	6	6	6
Pine Cr-4	7	2	5	5	4	1	7	10	3	8	10	9	5	5	2	1	4	7	3	7	7	7	7	6
Pine Cr-5	1	3	5	1	7	4	2	10	8	6	10	9	14	3	1	1	4	5	5	5	5	5	5	5
Sag Cr-1	NPC												11	6	2	2	7	4	5	9	9	8	9	1
Sag Cr-2	NR												NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	NPC												NPR											

Table 40. Protection and Restoration habitat ranking for bull trout in the Oregon Side LMS subbasin.

NPC= Not present currently

Protection Habitat Ranking

NPR = Not present in reference condition

Restoration Habitat Ranking

Reach Name	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
Pine Cr-1	12	8	6	5	9	4	3	9	9	6	1	1	11	3	2	6	4	1	5	8	8	7	8	8
Pine Cr NF-1	7	8	6	3	9	5	2	10	10	7	1	4	5	2	3	4	5	1	6	8	8	7	8	8
Lake Fork Cr	3	2	4	3	8	5	7	10	10	6	1	9	6	5	2	6	4	3	1	9	9	7	9	8
Pine Cr NF-2	4	4	3	2	9	7	5	10	10	6	1	8	9	4	3	7	2	1	5	8	8	6	8	8
Pine Cr-2	11	4	3	5	7	2	6	10	10	9	1	8	4	5	4	2	1	3	7	8	8	6	8	8
Fish Creek	6	5	3	4	8	2	6	10	10	7	1	9	8	5	4	6	1	3	2	9	9	7	9	8
Long Branch/Four Mile	8	5	3	4	8	2	6	10	10	7	1	9	7	5	4	6	1	3	2	9	9	7	9	8
Pine Cr E-1	9	5	3	4	8	2	6	10	10	7	1	9	3	2	1	3	6	7	5	10	10	8	4	9
Pine Cr E-2	2	3	4	5	8	2	6	10	10	7	1	9	10	1	2	3	4	6	5	8	8	8	8	7
Pine Cr-3	9	5	3	4	8	2	6	10	10	7	1	9	1	1	2	3	6	7	4	10	10	8	5	9
Clear Cr-1	NPC												13	6	1	1	8	3	5	10	10	9	3	7
Clear Cr-2	NPC												NPR											
Pine Cr-4	1	3	5	7	6	2	8	10	10	4	1	9	2	4	3	1	5	7	2	7	7	7	7	6
Pine Cr-5	5	4	6	5	8	2	3	10	10	7	1	9	12	1	2	3	4	5	5	5	5	5	5	5
Sag Cr-1	NPC												NPR											
Sag Cr-2	NR												NR											
	NPC												NPR											

Table 41. Protection and Restoration habitat ranking for steelhead in the Oregon Side LMS subbasin.

NPC= Not present currently

Protection Habitat Ranking

NPR = Not present in reference condition

Restoration Habitat Ranking

Reach Name	Protection Habitat Ranking											Restoration Habitat Ranking													
	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	
Pine Cr-1	NPC												11	5	2	3	6	1	4	7	7	7	7	7	
Pine Cr NF-1	NPC												4	2	3	3	5	1	6	8	8	8	7	8	8
Lake Fork Cr	NPC												7	7	2	6	4	3	1	9	9	8	9	5	
Pine Cr NF-2	NPC												8	5	3	7	1	2	4	8	8	6	8	8	
Pine Cr-2	NPC												6	6	4	1	2	3	5	8	8	7	8	8	
Fish Creek	NPC												9	6	3	3	1	5	2	9	9	7	9	8	
Long Branch/Four Mile	NPC												14	6	4	4	1	3	2	9	9	7	9	8	
Pine Cr E-1	NPC												1	5	1	1	6	7	3	9	11	10	4	8	
Pine Cr E-2	NPC												10	3	1	1	5	6	4	8	8	8	8	7	
Pine Cr-3	NPC												2	5	1	1	6	7	3	9	11	10	4	8	
Clear Cr-1	NPC												3	5	1	1	6	7	3	9	11	10	4	8	
Clear Cr-2	NPC												12	4	1	1	5	6	3	6	6	6	6	6	
Pine Cr-4	NPC												5	4	3	1	5	7	2	7	7	7	7	6	
Pine Cr-5	NPC												13	3	1	1	4	5	5	5	5	5	5	5	
Sag Cr-1	NPC												NPR												
Sag Cr-2	NR												NR												
	NPC												NPR												

Table 42. Protection and Restoration habitat ranking for Chinook salmon in the Oregon Side LMS subbasin.

NPC= Not present currently

Protection Habitat Ranking

NPR = Not present in reference condition

Restoration Habitat Ranking

Reach Name	Protection Habitat Ranking											Restoration Habitat Ranking												
	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
Pine Cr-1	NPC												10	4	2	5	5	1	3	7	7	7	7	7
Pine Cr NF-1	NPC												5	2	3	5	6	1	4	8	8	7	8	8
Lake Fork Cr	NPC												7	6	2	7	4	3	1	9	9	8	9	5
Pine Cr NF-2	NPC												9	5	4	7	2	1	3	8	8	6	8	8
Pine Cr-2	NPC												6	6	5	2	3	4	1	8	8	7	8	8
Fish Creek	NPC												13	5	1	1	1	1	6	7	7	7	7	7
Long Branch/Four Mile	NPC												NPR											
Pine Cr E-1	NPC												2	3	2	5	6	6	1	9	11	10	4	8
Pine Cr E-2	NPC												8	3	2	4	5	6	1	8	8	8	8	7
Pine Cr-3	NPC												1	3	2	5	6	7	1	8	11	10	4	9
Clear Cr-1	NPC												3	3	2	5	6	7	1	9	11	10	4	8
Clear Cr-2	NPC												11	3	2	4	5	6	1	6	6	6	6	6
Pine Cr-4	NPC												4	4	2	3	5	7	1	7	7	7	7	6
Pine Cr-5	NPC												12	2	1	3	4	5	5	5	5	5	5	5
Sag Cr-1	NPC												NPR											
Sag Cr-2	NR												NR											
	NPC												NPR											

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT