

OCS Chapter 8. Monitoring and Supporting Information

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Strategy Species and Habitat Monitoring

Monitoring Overview

The Oregon Conservation Strategy (Strategy) identifies priority Strategy Species [\[Insert OCS weblink\]](#) and Habitats [\[Insert OCS weblink\]](#). These Strategy Species and Strategy Habitats should be monitored over time to determine their status and effectiveness of applied conservation actions. For some Strategy Species and Strategy Habitats, detailed guidance for monitoring is available and summarized in the Species table or Strategy Habitat chapter. This section of the Strategy:

- Provides an overview of monitoring, defining important terminology
- Provides resources and guidance for monitoring Strategy Species and Habitats
- Lists some ongoing efforts to monitor Strategy Species and Habitats in Oregon

Importance of Monitoring

Investments in conservation should be strategic, effective, and accountable. Success of these investments can be measured by: 1) assessing existing conditions, (2) identifying desired conditions, and 3) measuring change over time.

A well-designed monitoring program takes an adaptive management approach using verifiable and reliable science. Monitoring objectives should be simple, easily communicated, and relevant to people's concerns. Data and information derived from monitoring should be easily understood, well-documented, and accessible in a variety of formats for relevant audiences (e.g., scientists, public and private land managers, and policy makers).

Role of Monitoring in Grants and Project Funding

Specific methodologies for monitoring and reporting monitoring results allow grant administrators and other funders to track specific progress and investment value of projects they have funded. This is especially helpful when tracking investments and projects that occur over wide areas and long periods of time.

Monitoring of conservation or management actions should be funded along with any project implementation. Further, natural resource professionals should seek collaborative ways to make monitoring affordable, relevant, and easily accessible. Monitoring results should be shared with peers, policy makers, and local decision-makers to the extent possible, allowing people to learn about successes and adapt actions and policies more efficiently and strategically.

What to Monitor?

It is not possible to monitor all species of potential conservation concern. Natural resource managers must consider the conservation goals and make reasoned, strategic decisions about monitoring needs. Priority is often placed on species or habitats in decline, or on locations that will potentially have the greatest impact to a number of conservation priorities simultaneously.

Monitoring may occur at different scales: site, stream, watershed, ecoregion, and statewide. While different questions may be addressed, and different variables measured at each scale, a monitoring plan should focus data collection on a clearly defined purpose. Monitoring should be directed at the same scale that the conservation action or limiting factor is occurring. Results from local, site-specific monitoring projects should be incorporated into statewide, regional, national, and even international monitoring projects to allow for examination of larger-scale population or ecological trends. Project goals will determine what should be monitored, the appropriate monitoring approach, and for how long. Monitoring may be directed toward individual species or species groups, habitat conditions, ecological function, or ecological integrity.

Some key considerations when designing programs to monitor the status of Strategy Species and Strategy Habitats include:

- Monitoring efforts for Strategy Species should emphasize either species data collection or limiting factors at appropriate spatial scales. Depending on the existing knowledge base, species monitoring may need to focus on collecting data regarding:
 - Range and distribution
 - Population status and trend (at various scales)
 - Life history traits
 - Response to a particular types of habitat management or human activity
 - Effects of Key Conservation Issues
 - Specific limiting factors (e.g., the degree of contaminants in fish found in the Lower Columbia River).
- For long-term monitoring efforts, emphasize Strategy Species or Habitats and/or support regional, west wide or national programs
- Incorporate Strategy Species monitoring into other monitoring efforts

Strategy monitoring can focus on (1) species, sometimes called the “fine filter for conservation planning”; or (2) habitats or other environmental measurements, sometimes called the “coarse filter for conservation planning”. Specific examples are described below.

Species Monitoring:

What is monitored?	Why?	Example efforts
Strategy Species	Determine presence, distribution or population status/trend of species;	Oregon Biodiversity Information Center maintains records for species

	demographic information	with conservation status Breeding Bird Survey Monitors status and trends of North American bird populations Oregon Department of Fish and Wildlife (ODFW) Turtle Monitoring project
Indicator Species	Monitoring Indicator Species provides information about changes in the characteristics of an environment (habitat, ecoregion, etc.). To be a good indicator, a species needs to be relatively common, occur frequently enough to be monitored and respond to certain actions or represent a desired condition. Strategy Species often are not appropriate as indicator species because they are generally not common and often require specialized habitats. Indicator species are typically “common” species	For example: Partners in Flight. Working with ODFW and other partners, Klamath Bird Observatory developed a Species Monitoring Portfolio to support Strategy monitoring [link to PDF on Strategy website available October 2015]
Surrogate Species	Surrogate Species are intended to represent a suite of species or a particular habitat type. Monitoring a Surrogate Species provides information that can then be used to infer trends or conditions of multiple species. Surrogate Species are not necessarily “common” species	For example: The U.S. Fish and Wildlife Service (USFWS) Surrogate Species Initiative is identifying Surrogate Species for each Strategy Habitat in every ecoregion across Oregon.

Habitat and Ecological Indicator Monitoring:

What is monitored?	Why?	Example efforts:
Strategy Habitats	Assess habitat conditions over time, and provide details on habitat conditions, trends, changes in extent, and many other variables. Questions can include: How much habitat is there? Where is it? What is its ecological condition? What is its conservation status? How much of the habitat exists within a protected area versus private lands?	ODFW Aquatic Inventories Project The Wetlands Conservancy SageCON Refer to Strategy Habitats mapping documentation for updated vegetation monitoring efforts
Aquatic and Watershed	Helps ensure good water quality and healthy watersheds, which are essential for	National Fish Habitat Action Plan provides a national framework for

Monitoring	many species and ecological functions.	assessing aquatic habitat quality Oregon Watershed Restoration Inventory Tracks voluntary efforts to restore watersheds for salmon and wildlife
Ecological Indicators	Represent valued ecological attributes and can help determine if an impact exists	U.S. EPA Ecological Indicators

Strategy Species Monitoring Guidance and Resources

See Strategy Species tables [\[Insert OCS weblink\]](#) for some species – specific efforts and monitoring guidance documents (e.g.. USFWS Surrogate Species, ISSSSP Assessments, Recovery Plans, etc.).

Scientific Taking Permit Requirements:

In Oregon, from the ODFW are required when fish or wildlife will be captured or handled for scientific purposes. ODFW provides information about [Fish Scientific Take Permits](#) or [Wildlife Scientific Take Permits](#). [Federal permits](#) may be required as well.

Key Monitoring Guidance Documents for Strategy Species

Bird Monitoring:

- Waterfowl management plans, see the [Pacific Flyway Council Webpage](#)
- For information on population trends from annual monitoring reports, see the:
 - [U.S. Fish and Wildlife Service Annual Reports](#)
 - [Waterbird Monitoring Manual](#)
 - [Shorebird Monitoring Plans](#)
 - [Breeding Bird Survey](#)

Resources for Landbirds:

- [Handbook of Field Methods for Monitoring Landbirds](#)
- USFWS Guide to Statistical Analysis of Data from Avian Monitoring Projects ([USFWS website](#))
- Landbird Monitoring Strategy for Oregon and Washington, Version 1.0, October 2011
- A Directory of Landbird Monitoring and Assessment Projects in Oregon and Washington
- [Inventory Methods for Raptors, Version 2.0 \(Standards for Components of British Columbia’s Biodiversity No. 11\), October 2001](#)
- [Multiple Species Inventory and Monitoring Technical Guide, Version 1. 2006.](#) USDA Gen. Tech. Report WO-73 (Chapters 3 and 4).
- USFWS Raptor Guidelines in the Western US., February 2008

Mammal Monitoring:

- Oregon Explorer [mammal monitoring page](#)
- Multiple Species Inventory and Monitoring Technical Guide, Version 1. (Chapters 5, 6 & 7) USDA Gen. Tech. Report WO-73, August 2006

- Measuring and Monitoring Biological Diversity: Standard Methods for Mammals. F. R. Wilson, J.D. Nichols, R. Rudran, and M.S. Foster, editors. Smithsonian Institution Press, Washington, DC. Pp. 115-155.

Amphibian and Reptile Monitoring:

- USGS Amphibian Research & Monitoring Initiative: armi.usgs.gov/
- [Partners for Amphibian & Reptile Conservation: Inventory and Monitoring: Recommended Techniques for Reptiles and Amphibians](#), with application to the United States and Canada. G. J. Graeter, K. A. Buhlmann, L. R. Wilkinson, and J. W. Gibbons, editors.
- Multiple Species Inventory and Monitoring Technical Guide, Version 1. 2006. USDA Gen. Tech. Report WO-73 (Chapter 8).
- Sampling Methods for Terrestrial Amphibians and Reptiles. 1990. USDA Gen. Tech. Report PNW-GTR-256.
- Sampling Amphibians in Lentic Habitats. 1997. Northwest Fauna No. 4: Society for Northwestern Vertebrate Biology.
- Measuring and Monitoring Biological Diversity; Standard Methods for Amphibians. 1994. W. Ronald Heyer et.al. Smithsonian Institutional Press .
- Western Pond Turtle: Biology, Sampling Techniques, Inventory and Monitoring, conservation and Management. 2012. Northwest Fauna No. 7: Society for Northwestern Vertebrate Biology.

Fish Monitoring:

- ODFW monitors fish species and their habitats across the state. The [ODFW Corvallis Research Laboratory website](#) includes a variety of project-specific information including protocols, guidance (habitat), reports and publications, and data.
- The ODFW [Salmon and Steelhead Recovery Tracker website](#) provides information on the health of Oregon's anadromous salmon and steelhead populations. Website users can explore and download information related to salmon conservation and recovery in Oregon, including metadata explaining how data were collected and analyzed.
- Pacific Northwest Aquatic Monitoring Partnership ([PNAMP](#)) gathers information and resources on monitoring of fish, habitat and water quality. [PNAMP's Resources page](#), provides a network of information and tools to support many facets of ecological and biological monitoring, including orientation and educational materials, a community forum, a place to document and share monitoring methods, the ability to describe monitoring projects and upload sample sites, and tools for creating sample designs.

General Monitoring Resources(including invertebrates and plants):

- [USFS Inter-agency Special Status and Sensitive Species Program](#). Lists references for inventory & monitoring protocols for many sensitive species, including butterflies and moths, snails and slugs, amphibians, birds, bats, plants, and fungi.

Watershed and Effectiveness Monitoring:

- [Oregon Plan for Salmon and Watersheds monitoring program](#). The Oregon Plan's technical assistance manuals produced by the Oregon Watershed Enhancement Board and manuals developed by the Oregon Department of Environmental Quality to guide water quality monitoring are good sources for launching monitoring programs and for guidance on effectiveness monitoring.

Citizen Science

Citizen-based monitoring can greatly expand our ability to collect data. Through citizen science, Oregonians contribute valuable local biological knowledge. For example, bird-watchers and anglers understand the distribution and behavior of their favorite species, and farmers and other landowners have deep familiarity with what occurs on their land. Citizen-based monitoring can tap into this knowledge, increase the amount of data that can be collected, and reduce the overall costs of data collection. Citizen-based monitoring also engages Oregonians to take an active part in conservation, teaching people about their local environment, and providing a forum for feedback and discussions related to conservation actions currently underway on their land or in their neighborhood. By supporting and building on these efforts, scientists and Oregonians can work together to address monitoring priorities identified in the Strategy.

Examples of ongoing Citizen Science Efforts in Oregon:

By supporting and building on these efforts, scientists and Oregonians can work together to address monitoring priorities identified in the Strategy.

Citizen Science Project	Location
North American Breeding Bird Survey	International
eBird	International
North American Bird Phenology Program	National
Christmas Bird Count: Portland metro area Statewide National	Local, regional, and national
Fourth of July Butterfly Count	Oregon
Whale Watching Spoken Here	Oregon Coast
Dragonfly Migration Monitoring	North America
Journey North : Global study of wildlife migration and seasonal change	International
Oregon Master Naturalist Program	Adult education program on Oregon's natural history and natural resources
Alliance of Natural Resource Outreach and Service Programs	Information on Master Naturalist programs throughout the U.S.
iNaturalist : Online space to record natural history observations, interact and learn	International

Citizen Science Resources:

- CitizenScienceAlliance.org: "A collaboration of scientists, software developers and educators who collectively develop, manage and utilize internet-based citizen science projects in order to further science itself, and the public understanding of both science and of the scientific process. These projects use the time, abilities and energies of a distributed community of citizen scientists who are our collaborators."
- [National Wildlife Federation](#): Citizen science hub. Provides resources to NWF programs, including Wildlife Watch, inviting your wildlife observations. "Citizen science is where the public volunteers time to assist scientists in their research. Citizen scientists can support professional

researchers in a lot of ways – by submitting data, sharing experiences or spreading valuable information. Scientists benefit from having a lot more data to analyze and a pool of volunteers willing to help.”

- eBird.org: “Providing global tools for birders, critical data for science. Record the birds you see. Keep track of your bird lists. Explore dynamic maps and graphs. Share your sightings and join the eBird community. Contribute to science and conservation”

[LINK BOX]: State fish and wildlife management agencies working with Klamath Bird Observatory, and other partners, are developing ways to use technology to engage citizens in support of science – based conservation. Many partners recognize eBird as a powerful way to connect the birding community with both the conservation of species of greatest need and concern and efforts to keep common birds common. By participating in citizen science programs, which are designed to meet specific regional information needs, the public’s sense of investment in public lands conservation should grow, resulting in stronger expectations and accountability for government conservation programs. These investments of personal time and resources by engaged citizens may then lead to growing public support for establishing substantial and reliable funding for science-driven conservation. For more information, see this article reprinted on the [eBird Northwest site](#). For more information on eBird, see the citizen science arm of the regional Avian Knowledge Network Node, [Avian Knowledge Northwest](#).

Data Management

A critical component of any monitoring program is effective data management. Quality data are needed to evaluate the effects of conservation actions on species and habitats and make appropriate adjustments, if necessary. Some important first steps for data management include:

- Identifying critical data management needs early in the monitoring project planning phases. Data collection activities should not begin until a proper database design (data dictionary) and data management plan is developed.
- At minimum, a data management plan should include:
 - Database design, including investigating data standards or protocols for data being collected
 - Plans for metadata (data documentation) development
 - Plans for data distribution (incorporate local data in larger scale, regional efforts; provide data access through online functionalities; etc.)

For more information see:

- [ODFW’s Natural Resources Information Management Program](#), including data standards and a data clearinghouse
- Oregon Department of Administrative Services [Geographic Enterprise Office](#)
- USFWS [Geospatial OneStop](#)
- Naturereserve data management tool [Biotics verion 5](#)

Track and Report Results

Monitoring the effectiveness of conservation actions and adapting these actions to respond appropriately to new information or changing conditions requires that results be tracked and reported. The following steps should continue to be considered by agencies, the Oregon Biodiversity Information Center, the Oregon Watershed Enhancement Board, and other partners:

- Identify how progress will be measured (i.e., specific metrics to be used such as number of acres restored, number of stream miles improved, or number of landowners given technical assistance).
- Implement consistent procedures for data entry so that progress reporting can be done through queries to a database. Where possible, develop tools to automate the reporting process.
- Design web-based data tools to ensure consistent data entry by multiple partners, maintain data integrity, and improve data sharing.

Using Monitoring Results

Adaptive Management:

Use monitoring results to determine the conservation outcomes of a project and to identify adaptive management strategies. Natural resource managers must continuously learn from their efforts to restore habitats and implement conservation actions. Management of projects and funds can then be adapted based on new information and/or changing conditions. However, adaptive management is not just trial and error. It is a process that adjusts active management by determining which actions work, and analyzing why they succeed or fail. Steps include: Assess – Plan – Implement – Monitor – Learn – Adapt – Repeat, and more information is available through the [USGS Adaptive Management Guide](#).

Effectiveness Monitoring:

Effectiveness monitoring is designed to determine if the project is effective at meeting its biological and ecological objectives. More information is available through the [Oregon Watershed Enhancement Board's Effectiveness Monitoring page](#).

Species or habitat variables should be monitored over time to determine project effectiveness. Adaptive management approaches should be used if new approaches are needed to meet project goals.

Tracking Conservation Efforts

Providing mapped locations of conservation projects allows land managers to allocate resources more efficiently and reduce duplication of efforts. Over time, tracking projects on-the-ground allows managers to evaluate the cumulative progress towards conservation goals for Strategy Species and Strategy Habitats.

Some example resources that can help track conservation efforts for Strategy priorities include:

Resource	Explanation
Conservation Registry	Landscape-scale conservation project mapping tool. Tracks and maps conservation, restoration and wildlife projects across the U.S. Developed by Defenders of Wildlife, ODFW and other partners to support the Oregon Conservation Strategy and to facilitate informed decision-making, inspire collaboration, and provide context and effectiveness for conservation

	work.
Wildlife Tracking and Reporting Actions for the Conservation of Species (TRACS)	Wildlife TRACS is the tracking and reporting system for conservation and related actions funded by the USFWS Wildlife and Sport Fish Restoration Program. View project reports or view project locations on an interactive map
Results chain model. For information on how other states propose to use in State Wildlife Action Plans, see Teaming with Wildlife	Develop performance measures for wildlife management activities. Define project outcomes and show the connection between management actions and conservation outcomes for Species of Greatest Conservation Need (Strategy Species)

Species Data Gaps: Research and Monitoring Needs

In addition to the “data gaps” identified for individual Strategy Species, the following data gaps apply to multiple species across Oregon.

Species Management and Monitoring:

- Determine baseline conservation status, estimated population size and trends for Strategy Species. Develop and implement survey and monitoring methodology for species lacking protocols.
- Determine population goals for Strategy Species while accounting for current habitat conditions and potential for habitat restoration in Oregon.
- Develop measurable indicators of high quality habitat. For example, develop a framework for using species and habitat indicators to assess habitat status and trends.
- Determine relationships between population dynamics and habitat dynamics.
- Evaluate effectiveness of providing passage around barriers for fish and wildlife (including amphibians, reptiles, mammals) to enhance migration or habitat connectivity.
- Improve data collection efforts and methods for all Plant Strategy Species (all plants of conservation concern).

Determining Status:

For some animals, basic information such as where they occur, basic habitat associations, and general abundance is not known. It isn’t possible to determine whether they are truly at risk or what should be done about it. The Conservation Strategy designates a Data Gap Species List [\[Insert OCS weblink\]](#) for species that need more information to determine whether they should be elevated to Strategy Species status.

For invertebrates, few specific surveys are typically done each year, and basic information is often lacking. Before making a conservation designation for Strategy Species or Data Gap Species status, more taxonomic information is needed to determine whether a group of invertebrates actually represent a population of one species or are a distinct species. If they are determined to be distinct species, then more data on their range and habitat associations may still be needed to determine conservation status.

During the technical review for the 2015 Strategy update, these species were determined to lack sufficient taxonomic information before they can be fully designated as a Data Gap Species or a Strategy Species: Bald Hesperian; Blue Mountains dusky snail; Blue Mountains juga; Columbia dusky snail; Crooked River juga; Columbia springsnail; Deschutes mountain snail; Deschutes sideband; Disc Oregonian; Hells Canyon mountainsnail; Hotspring physa; Basalt, Brown, and three-band Jugas; Keene Creek pebblesnail; Klamath tailedropper; Malheur pebblesnail; Modoc peaclam; Modoc sideband; Oak Springs Hesperian; Opa Springs juga; Purple Hesperian; Pyrgulopsis complex (Lake Abert springsnail, Malheur springsnail, Owyhee hot springsnail); Three band juga; Tuscan pebblesnail; Carinacauda stormi; Oreohelix spp; Thinlip tightcoil; Humped Coin; Vespericola columbianus spp; Salamander slug; and these snail complexes: duskysnails (genus Colligyrus), pebblesnails (genus Fluminicola), jugas (genus Juga), and springsnails (genus Pyrgulopsis); Fluminicola (Diminutive, Fall Creek, Keene Creek, Lake of the Woods, Nerite, Pinhead, and Toothed pebblesnails).

For more information about invertebrates see the [Oregon Biodiversity Information Center](#) or consult with the [Oregon Department of Agriculture](#).

Species Observation Data Management:

An initial step to filling Strategy Species Data Gaps is taking advantage of available species observation datasets.

Species observation information collected throughout the Oregon Department of Fish and Wildlife (ODFW) should be compiled and managed within centralized databases, and the process to incorporate data should be streamlined and automated as much as possible. This would not only allow surveys and research results to be better incorporated into statewide analyses and programs, but also provide a structure for recording incidental observations of Strategy Species by ODFW field staff.

Incorporating species observation datasets developed and maintained by partner agencies and organizations into ODFW databases and programs is a critical component of understanding species distributions, populations, and ranges. Species observations are a common dataset, frequently collected by government agencies, private contractors, conservation organizations, and public citizens. A concerted effort is involved to communicate with these organizations to understand what is available, and then how best to incorporate the information. ODFW works closely with the Institute for Natural Resources, Oregon Biodiversity Information Center (<http://orbic.pdx.edu/>), to access and incorporate their biodiversity database of species occurrences throughout Oregon. This database includes contributions from various state and federal agencies, as well as specific monitoring projects such as the North American Breeding Bird Survey. This database provides an ideal way to incorporate information from multiple agencies, but additional effort would result in finding additional datasets. Carefully planned citizen science projects can provide more information on species observations with members that are trained in technique and identification protocols, while also providing a way for the public and landowners to contribute species information for use within the Conservation Strategy and other ODFW projects.

Animal Concentrations

Many animals gather together in large groups for migration, breeding or sheltering, and these concentrations can be vulnerable to disturbance. Identifying the most important sites is the first step in conserving animal concentrations. Approaches include The Audubon Society's [Important Bird Area](#)

program, which recognizes the importance of migration stopovers and other areas where birds concentrate. The Oregon Conservation Strategy Conservation Opportunity Areas include many, but not all of the state’s animal concentrations. For animal concentrations, appropriate conservation actions depend on the species and site but will focus on maintaining or restoring important habitat features. Klamath Lake hosts the largest concentration of wintering bald eagles in the continental United States, with up to a thousand individuals. At Dean Creek Wildlife Viewing area, numerous elk congregate in marshy fields during the winter. At many of Oregon’s mountain lakes and ponds, Western toad tadpoles and swarm in large masses in the summer, and begin to change into frogs and climb out onto land in large groups in the early Fall. In Portland, crowds gather nightly every autumn to watch 35,000 migrating Vaux’s swifts swirl and funnel into an old chimney at Chapman School; the largest known Vaux’s swift roost in the world.

Estuaries and bays along the Oregon coast and the lakes of southeastern Oregon provide vital stop-over refuges for shorebirds migrating to and from southern wintering areas and nesting locations in Canada and Alaska. Lake Abert, Oregon may support the largest number of Wilson’s phalaropes in North America: up to 70,000 birds congregate here in late July.

People have long appreciated the spectacle of thousands or millions of animals gathered in one area. Oregonians enjoy wildlife viewing at several popular festivals that celebrate seasonal animal gatherings, including wintering bald eagles and migrating songbirds, shorebirds, or waterfowl.

Fish and wildlife often gather in concentrations for critical activities such as feeding, breeding, or migrating. Some species breed in colonies, perhaps due to limited, specialized breeding sites or as a strategy to deter predators. Animals congregate when their food is concentrated, and migrating animals flock to a feeding site to refuel and rest.

Animals also might gather when an important resource is naturally limited in the landscape, such as fresh water in the desert or mineral springs in mineral-poor areas. Frogs and toads that breed in seasonal ponds tend to gather together for a short burst of spring breeding because they have a limited window of opportunity for egg-laying. When Pacific tree frogs gather to breed, a springtime chorus erupts as males sing to attract mates.

When animals gather in these large groups, they can become particularly vulnerable to habitat alteration and human disturbance. Because of the large number of individuals involved, any factors that impact highly critical sites can affect a large proportion of a species or an entire suite of species. The table below summarizes important habitat types and features for some of Oregon’s animal concentrations.

Animal Concentration Habitat Types and Features.

Animal Concentration	Important Habitat Types	Important Habitat Features
Bald Eagles: wintering	Large lakes and rivers	Large trees or snags within a forest stand used for communal roosts.
Bat roost sites (particularly hibernacula, maternal roosts, or diurnal roosts)	Depending on bat species, includes caves, mines, cliffs, bridges, and buildings	Suitable temperature and humidity. Lack of human disturbance is critical for Townsend’s big-eared bat and

Animal Concentration	Important Habitat Types	Important Habitat Features
		pallid bat.
Deer and elk key winter range areas	Winter range characteristics vary by ecoregion, but usually include warmer sites such as lower valleys and southern slopes	Diverse forested landscapes with openings and a variety of age classes, perennial grasslands, and sagebrush steppe habitats. Woody vegetation for foraging (e.g., bitterbrush, aspen, alder, willow, oak). Cover for insulation and hiding. Shrubs are important where snow is deep during winter.
Deer and elk herds (migration routes and transition range)	Varies by ecoregion and combines features of summer and winter range; travel corridors that are unobstructed by roads and urban areas	Varies, but includes both forage and cover to provide safe passage between winter and summer ranges.
Freshwater mussel beds	Aquatic habitats	Clean water with low contamination and sedimentation; natural water flow regimes. Freshwater mussels are important to tribal culture; filter water; are good indicators of high water quality; and are an important food source for fish, mink, otters, and raccoons
Great Blue Herons: nesting colonies (rookeries)	Riparian habitats	Large trees near foraging areas (open grassy and wetland habitats); low levels of human disturbance during the nesting season. Great blue heron nesting colonies are declining and at risk in some areas, particularly in the Willamette Valley.
Lamprey (juveniles concentrate in high densities)	Freshwater habitats. Potential preference for low-gradient floodplain habitats and lower mainstem river channels.	Unknown.
Pond-breeding amphibians (toads, frogs, salamanders)	Ponds and other shallow wetlands. In many areas, these ponds are created by winter and spring rains, then dry up each summer. These	Critical breeding habitat, particularly during spring and early summer. Must remain wet long enough for tadpoles to metamorphose, be

Animal Concentration	Important Habitat Types	Important Habitat Features
	temporary ponds provide essential breeding habitat for amphibians.	relatively free of predators or disturbance, and provide sufficient food.
Raptors: migrating and wintering	Fields and pastures, grasslands and prairies, sagebrush steppe, wet meadows; ridges are important during migration	Habitats where prey are concentrated (e.g., open grassy areas for rodents; riparian and deciduous shrub communities for songbirds; lakes for waterfowl); managed agricultural fields; thermals over ridges for soaring.
Salmonid (salmon, steelhead, trout) juvenile rearing areas	Estuaries, lakes, rivers, and streams	Suitable habitat complexity, low temperature, and low fine sediment loads.
Salmonid spawning and holding areas	Streams, lakes and rivers	Areas with low temperature and suitable habitat complexity.
Greater Sage-Grouse leks	Big sagebrush	15-50% cover for nesting. Open areas used by males for courtship. Areas rich in forbs such as playas, meadows, and higher elevation sagebrush steppe habitats are important for brood rearing.
Seabird nesting colonies	Coastal bluffs; offshore islands and rocks; and sandy islands	Depending on species may include deep soil for burrowing (tufted puffin and storm-petrels), rocky ledges (common murre), or unvegetated sandy areas (Caspian terns). Isolation from mammalian predators and human disturbance is critical.
Seal and sea lion haul-outs and pupping areas	Flat offshore rocks and isolated beaches	Isolation from human disturbance can be important.
Shorebirds: migrating and wintering	Wet prairies, flooded fields, mudflats, alkali lakes, shorelines of wetlands and reservoirs, estuaries, sandy ocean shore	Open, moist muddy or sandy areas with high invertebrate prey density.
Songbirds: migrating	Deciduous and mixed deciduous-conifer forests; high- elevation deciduous or mixed shrub communities, especially near water; riparian habitat	Deciduous trees and shrubs with high invertebrate prey density and cover for insulation and hiding. Forested buttes are important in urban and agricultural

Animal Concentration	Important Habitat Types	Important Habitat Features
Tadpole aggregations (for example, Western toads, Oregon spotted frog)	Shallow areas in mountain lakes and ponds, slow stretches of rivers or side channels	landscapes. Maintain shallow mountain lake habitats, including native aquatic and lakeside vegetation.
Waterbird nesting colonies	Lakes and marshes with both deep and shallow water	Varies by species, but includes isolated and sparsely vegetated islands (American white pelican); trees (snowy egret); emergent vegetation (eared grebes). Isolation from mammalian predators and human disturbance is important.
Waterfowl and other waterbirds: migrating and wintering	Wetlands, lakes, reservoirs, and estuarine bays	Diverse water features with high food availability (aquatic plant, invertebrate, or fish) and open water for security.
Vaux's swift roosts	Late successional conifer; urban and suburban	Large hollow trees and snags for nesting and roosting; chimneys (which 'imitate' hollow trees).

Naturally Occurring Wildlife and Fish Diseases

Fish and wildlife are susceptible to naturally-occurring and introduced diseases caused by a variety of pathogens including viruses, bacteria, fungi, prions, and protozoans. Animals exposed to pathogens may exhibit illness or death or show no signs of disease if the pathogen is cleared by the animal's immune system or they may serve as carriers or reservoirs of the pathogen. In susceptible individuals and species, disease spreads quickly when large numbers of animals are concentrated naturally during migration, when they are artificially fed, or when they congregate during breeding or due to limited habitat. Emerging and novel diseases can have devastating effects on wildlife, human health and local economies. Climate change may increase susceptibility of fish and wildlife to disease by altering ecosystem dynamics; increasing opportunities to spread disease; and raising animals' stress response, potentially making them more susceptible to disease and illness if they become exposed. Although not a disease, ocean hypoxia and acidification may have similar effects on populations of some marine species.

People can help prevent unnatural disease outbreaks by remembering not to feed wildlife, vaccinating pets, providing and managing natural habitat. Licensed Oregon wildlife rehabilitators care for sick or injured wild animals with the goal of returning them to their natural habitat, and provide valuable educational information and outreach to the public (for additional information see [ODFW](#)). In addition, accredited Association of Zoos and Aquarium facilities in Oregon (for example, Oregon Zoo, Wildlife Safari, Oregon Coast Aquarium) provide valuable public education, outreach, and conservation projects related to the health of Oregon's fish and wildlife and their native habitats.

Endemic disease is a natural part of every ecosystem. However, introduced and emerging diseases not only threaten the balance of ecosystem health, but can be very difficult and costly to eradicate once established. The best action to avoid unwanted disease outbreaks is prevention. ODFW's biologists, veterinarians and wildlife administrators make every effort to protect the state's fish and wildlife through surveillance, monitoring, training, response plans, policy, and regulation. Listed below are the diseases that present the greatest management concern or that present significant or recurring health risk to Oregon's fish and wildlife. This list includes diseases that occur naturally or are endemic in Oregon, as well as diseases that are introduced or emerging. The list is not inclusive of all diseases identified in Oregon fish and wildlife.

Diseases of Management Concern in Oregon

Wildlife Diseases:

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Ranavirus	All amphibians and reptiles	Conditions that weaken immune response (e.g., UV-B light, pesticides); Movement of infected animals	Maintain high water quality, investigate the natural distribution of Ranavirus to determine if it is spreading to new areas; avoid human caused movement of amphibians and reptiles to new areas and

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
			habitats
Chytrid skin fungus (<i>Batrachochytrium dendrobatidis</i>)	All amphibians, although some species may be more vulnerable	Conditions that weaken immune response (e.g., UV-B light, pesticides); Movement of infected animals	Maintain high water quality, investigate the natural distribution of Chytrid to determine if it is spreading to new areas; avoid human caused movement of amphibians to new areas and habitats
Egg-destroying pathogen (<i>Saprolegnia ferax</i> , a watermold)	All amphibians, although some species may be more vulnerable	Conditions that weaken immune response (e.g., UV-B light, pesticides)	Maintain high water quality; investigate role of introduced fish in spread between water bodies
Amphibian deformities (multiple legs and other deformities caused by a trematode, <i>Ribeiroia</i> sp,	All amphibians, but seen most often in some frog species	High nutrient levels that increase densities of intermediate hosts (snails)	Maintain high water quality; monitor incidence of amphibian deformities; avoid human caused movement of amphibians to new areas and habitats
Septicemic Cutaneous Ulcerative Disease	Aquatic native turtles	Movement of infected animals; cause presently unknown but occurs highest in “Headstart” turtles	Avoid human caused movement of turtles to new areas and habitats. Continue research to identify cause and determine population impacts
Avian cholera (caused by a bacterium, <i>Pasturella multocida</i>)	Waterfowl especially, but can also impact gulls, terns, coots, and crows	Seen primarily in southern wetlands of state in winter from concentration of waterfowl during migration. Waterfowl concentrations increase when the amount of open water is reduced (e.g., during drought, freezing temperatures, or due to habitat loss). Freezing temperatures also increase vulnerability by weakening immune systems	Maintain and restore wetland habitats important for migratory waterfowl; manage major die-offs through carcass removal and appropriate disposal to reduce point sources in local habitat to minimize impacts to populations
Bird feeder Diseases (Salmonellosis, and Mycoplasma)	Songbirds, primarily finch species	Concentration of birds at bird feeders; contaminated feeder surfaces and fecal	Outreach regarding prevention methods; sanitation measures at

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
conjunctivitis, Avian Poxvirus, trichomoniasis)		contaminated bird food	bird feeders; cessation of wild bird feeding
Newcastle virus	Double-Crested cormorants; many bird species at risk	Occurs in breeding colonies along the Columbia River and northwest coast, appears to occur on an every other year cycle; typically in odd numbered years (2013, 2015...)	Monitor and surveillance of colonies, work with wildlife rehabilitators to avoid and manage potential disease risk in facilities
West Nile Virus	Birds in the family Corvidae and sage grouse; many bird species, some mammals (squirrels)	Conditions conducive for mosquito production and over-winter survival	Zoonotic disease passed by mosquito vectors; reduce mosquito breeding areas in urban environments; follow CDC recommendations; Warning guidance placed at wetland management areas
Avian Influenza (Highly Pathogenic)	Many wild bird species are hosts, Waterfowl and shorebirds are principal host to highly pathogenic (HPAI H5, H7) strains; Harbor seals may serve as hosts in marine habitats.	Waterfowl shorebirds and other wild bird species serve as hosts to most of the 144 strains of the virus; Mutated or highly pathogenic strains can have devastating impacts to poultry industry and human health and may cause wild bird deaths; poor bio-security in backyard ponds, with falconry birds, rehabilitation facilities, hunt clubs.	Monitor and conduct surveillance of captured or translocated birds including, waterfowl (duck banding), mountain quail, turkeys, grouse, and farmed game birds; increase biosecurity education, to landowners, poultry owners, falconers, rehabilitators, hunt clubs. Consider HPAI surveillance in harbor seals during capture events and unusual mortality events.
Botulism (caused by a nerve toxin produced by bacterium, <i>Clostridium botulinum</i>)	Waterfowl and shorebirds	Associated with shallow wetland habitats during warm weather; can be made worse by fluctuating water levels; often associated with carcasses (waterfowl, fish kills), fly larvae bioconcentrate toxin	Manage water levels, flow, flushing, and changes at important migration areas to prevent botulism; manage major die-offs by carcass removal and proper disposal to minimize further impacts to local populations

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
<p>Mycoses (diseases caused by fungi, including toxins produced by mold): Aspergillosis (aflatoxins); <i>Cryptococcus gattii</i></p>	<p>Many bird species; waterfowl and shore birds (especially waterbirds and raptors) are very susceptible to aspergillosis; <i>C. gattii</i> has been identified in harbor porpoises, Dall’s porpoises, Roosevelt elk, domestic animals ,and humans along the coast and Willamette valley</p>	<p>Transmitted from moldy corn or acquired from soil or damp organic materials; stressed or diseased animals may have increased susceptibility: <i>C. gattii</i> – Geographic and local environmental factors important in development of infection.</p> <ul style="list-style-type: none"> - Found in soil and Douglass fir bark - 	<p><u>Aspergillosis</u>: Monitoring and surveillance; minimize access to source sites (such as moldy silage piles), manage major die-offs by carcass removal to minimize impacts to local populations <u>Cryptococcosis</u>: Additional research needed to understand location of environmental “hot spots”</p>
<p>Algal Blooms; Toxic</p>	<p>Water fowl and other wildlife species associated with contaminated water sources. Algal bloom toxins in marine habitat can affect shellfish safety for human consumption and cause disease in shore birds and marine mammals.</p>	<p>Warmer, stagnant, water bodies with high nutrient content particularly can cause anoxic habitat for fish and toxic algal blooms for avian and terrestrial species. Factors that influence harmful algal blooms in marine waters are not well understood.</p>	<p>Maintain good water quality, flushing and flow maintained, reduction of high nitrogen/phosphate/nutrient runoff; manage major die-offs by carcass removal and appropriate disposal. Sample marine waters for levels of harmful algae present and shellfish for safe human consumption.</p>
<p>Rodent control poisons (Anticoagulants, Metal phosphides, Hypercalcemia products; Zinc Phosphide toxicosis)</p>	<p>Non-target species; Raptors and wild canids and felids; Geese and pasture-based migratory songbirds in the Willamette valley</p>	<p>Application during high rodent population seasons and cycles, and when applied off-label by inappropriate methods of delivery and during periods identified as high-risk for non-target species.</p>	<p>Applicators must follow label restrictions for legal application and avoidance of primary and secondary toxicity to non-target species.</p>
<p>Canine distemper</p>	<p>Raccoons, foxes, skunks, coyotes, wolves, seals.</p>	<p>Observed in raccoon and fox populations when population densities are high; spillover from domestic dogs; infected wildlife also put unvaccinated dogs at risk</p>	<p>Continue to promote prevention (e.g., by not feeding raccoons); use caution when moving nuisance raccoons; promote vaccination programs in domestic pets</p>

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Rabies	Bats; Raccoons, skunks, bats, foxes; wolves; any mammal; unvaccinated dogs and domestic cats at highest risk; public health issue; Bat strain rabies is only documented variant identified in Oregon	Handling of sick or dead bats, exposure of pets to sick bats or other wild mammals resulting in contact or biting incident; unvaccinated domestic pets; bat strain rabies occurs naturally at very low prevalence levels (<1%) in bat populations in Oregon; 2010 spillover event occurred in fox population in SW Oregon	Continue to promote vaccination programs in domestic pets; outreach and education to avoid sick wild mammals or those with unusual behavior; follow zoonotic disease guidance by CDC
Canine Parvovirus (includes several closely-related viruses such as feline panleucopenia)	Raccoons, fox, coyotes, wolves principally; note: can infect unvaccinated domestic cats	Exposure to unvaccinated dogs and domestic cats (e.g., outdoor cats, abandoned cats and feral cat colonies)	Promote pet vaccination programs. Promote benefits to cats, wildlife and people when cats are kept indoors. Discourage community feral cat colonies.
Leptospirosis	Marine mammals (seals, sea lions, porpoises); all mammalian wildlife	A multi-serotype bacterial disease transmitted from contaminated urine of infected animals	Outreach regarding the importance of avoiding contact with sea lions and sea lion carcasses along Oregon's coast; considered a zoonotic disease
Tularemia	Rodent and lagomorph species; all mammals	Tularemia is generally transmitted through the bite of a flea or tick. This bacterial disease can be more prevalent when mammalian hosts occur at higher population densities	Zoonotic Disease with a worldwide distribution. Sick or deceased rodents or rabbits should not be handled without gloves and additional protective equipment.
Plague	Rodent species can serve as hosts (several mice species) and can suffer high rates of mortality i.e. prairie dogs); many mammals susceptible; canids refractory	Fleas act as vectors; Conditions conducive during high rodent population cycles; Birds, lagomorphs, carnivores may maintain or disseminate disease by transporting fleas or ticks or infected prey	Widespread in wild rodent populations west of the 100 th meridian, control can be achieved through oral vaccination program or burrow dusting with insecticide. Zoonotic Disease
Notoedric mange	Western grey squirrels, northern	Transmission is primarily through direct contact of	Minimize artificial feeding and movement

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
	and southern flying squirrels	affected and unaffected animals and transfer of the mite <i>Notoedres centrifera</i> . Increased squirrel densities associated with competition for sparse food resources	of animals
Exotic Biting Lice (<i>Cervicola Damaliniaspp.</i> ; <i>Bovicola tibialis</i>)	Black-tailed, white-tailed, and mule deer	Lice is passed through direct contact between deer and probably from common use of bedding sites	Public education to not congregate deer by feeding or baiting; <i>Cervicola</i> is widespread in black-tailed deer population from Washington to central California; <i>Bovicola</i> found in scattered pockets of mule deer in OR, NV, ID, WA, CA
Cervid adenoviral hemorrhagic disease	Black-tailed, white-tailed, and mule deer	Transmission is through direct nose to nose contact between infected and uninfected deer. Exposed animals may become diseased in acute or chronic state or mount an antibody response in the absence of disease; outbreaks in deer fawns in rehabilitation facilities has resulted in high mortality	Avoid movement of adult deer and deer fawns to unaffected populations or areas; Public education to not congregate deer by feeding or baiting; restrict rehabilitating deer fawns at facilities with consistent AHD outbreaks
Epizootic Hemorrhagic disease	White-tailed deer are highly susceptible; Black-tailed and mule deer may also exhibit disease	<i>Culicoides</i> spp. gnats are the insect vectors of this virus; Drought and low water conditions with concentrations of susceptible animals at limited watering sites provides conditions conducive to amplification of the virus and disease outbreaks in riparian habitats.	Continued annual surveillance in previously affected areas (SW Oregon). Public education to not congregate deer by feeding or baiting.
Elk Hoof Rot Disease –(<i>Treponema</i> bacterial associated)	Roosevelt elk	Found in NW Oregon elk populations; causal bacterial agent belongs to the genus <i>Treponema</i> ; Wet pastures and environmental conditions thought to facilitate <i>Treponema</i> associated elk hoof	Avoid movement and translocation of elk from infected areas; removal of affected, limping elk. Consider research in novel habitat treatments. Continue monitoring

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
		disease.	with the aid of citizen science
Respiratory Disease in wild sheep	Rocky mountain bighorn sheep; California Bighorn sheep	NW Rocky Mountain populations primarily affected; Mycoplasma ovipneumonia, Mannheimia and Pasteurella spp. respiratory pathogens transmitted to wild sheep from domestic sheep and goats; occurs primarily in NE Hells Canyon populations of bighorn sheep shared with Washington and Idaho	Maintain separation of wild and domestic sheep and goats; implement management actions to enhance habitat and maintain or improve population densities; support research designed to mitigate effects of respiratory disease on wildlife sheep population health; Consider population management manipulations of infected herds using adaptive management strategies
Salmon Poisoning Disease. The disease in canids is caused by a rickettsial organism (<i>Neorickettsia helminthoeca</i>) present in a trematode parasite (<i>Nanophyetus salmincola</i>)	Salmonid fish and a restricted number of non-salmonid species acquire the rickettsial parasite which infects a stream snail (<i>Oxytrema silicula</i>) commonly eaten by the fish. Canids and bears can then acquire the rickettsial infection upon eating infected fish.	Primarily found in the Cascade Range and associated tributaries; Exposure of fish to the infective stage of the worm life cycle; Increased snail populations	Education to pet owners about the potential risks for dogs eating parasitized salmon, familiarity with clinical signs; seek veterinary care for required antibiotic treatment.

Fish Diseases:

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Sea-Star Wasting-Densovirus (Parvoviridae) associated with mortality	Many species of sea stars. Urchins of concern.	Unknown. Causes "rapid degeneration" of animal. Associated with high levels of mortality. Urchins carry disease but have not yet been detected expressing it.	Further research and monitoring needed
Infectious Hematopoietic Necrosis virus	Most salmonid stocks	Stress situations such as spawning or adverse environmental conditions	Reduce movements of infected fish and track different isolates of the virus
Erythrocytic Inclusion Body Syndrome	Several salmonid stocks	Unknown, but condition depresses immune system and other diseases become patent	Nutrition may affect severity of infection
Viral Hemorrhagic Septicemia virus	North American strain causes little mortality in salmonids but can cause high losses in marine species like herring, sardines, and mackerel	Young immuno-incompetent fish and spawning adults. Fish spread the virus horizontally. May be passed on to progeny	Avoidance by limiting exposure. Monitor for the presence of the European strain which is much more virulent
Infectious Pancreatic Necrosis virus	Most salmonid stocks and few other marine species	Fish to fish transmission and vertically transmitted from parent to progeny	Avoidance by limiting exposure. Screen spawning adults for virus and cull eggs from positive parental groups
White Sturgeon Iridovirus White Sturgeon Herpesvirus	White sturgeon and possibly other related species	Likely vertically transmitted from parents to progeny. High stress environmental conditions may lead to outbreaks	Limit transfer of known carriers. Examine fish and stock history
Bacterial Kidney Disease caused by <i>Renibacterium salmoninarum</i>	Salmonid stocks	Exposure to infected fish and transferred within the egg from infected females	In hatcheries reduce the pathogen by culling eggs from infected females and using antibiotic injections and feedings
Columnaris Disease caused by the bacterium <i>Flavobacterium columnare</i>	Freshwater fish, relatively uncommon in coldwater marine fish	Warm water conditions, exposure to other infected individuals	Where possible, augment water flows to increase quantity and decrease temperature
Furunculosis caused	Salmonid stocks,	Exposure to infected fish.	Antibiotic treatments

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
by the bacterium <i>Aeromonas salmonicida</i>	Some other species		where possible.
External fungal infections (water molds) caused by multiple species of fungi	Most common in freshwater fish	Stress situations such as spawning, low water, low temperature (freshwater fish particularly a rapid temperature drop), body injuries	Fungal spores ubiquitous and no possible control of environmental conditions. Educate about condition
Tapioca disease, caused by myxosporean <i>Henneguya salmincola</i>	Several species but most noted in Chinook and Coho salmon	Unknown, rarely detrimental to fish but a concern for anglers due to cysts in flesh	Educate about the parasite and the safety of consuming flesh
Ceratomyxosis caused by the myxosporean <i>Ceratomyxa shasta</i>	Salmonid stocks	Exposure to infectious stage of parasite that originates in a worm. Warm, slow water and low flows can increase contact with agent	Where possible, augment water flows to increase quantity and decrease temperature
White Spot caused by the protozoan <i>Ichthyophthirius multifiliis</i>	Freshwater fish	Exposure to infected individuals, warm water conditions	Where possible, augment water flows to increase quantity and decrease temperature
Black Spot caused by Strigeid trematodes (<i>Neascus</i>)	All fish – more common in warmwater species.	Exposure to infected snails. Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.
Yellow Grub caused by <i>Clinostomum marginatum</i>	All fish fish – more common in warmwater species.	Exposure to infected snails Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.
White Grub caused by <i>Posthodiplostomum minimum</i>	All fish fish – more common in warmwater species.	Exposure to infected snails Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.
Tapeworms caused by <i>Proteocephalus</i> sp., <i>Diphyllbothrium</i> sp. <i>Bothriocephalus</i> sp.	All fish	Ingestion of intermediate host carrying infectious stage of the parasite.	Education on the source of the parasites and the proper handling of fish for consumption. Zoonotic potential
Copepods, Fish Lice and Anchor Worms caused by <i>Salmincola</i> sp., <i>Argulus</i> sp., <i>Lerne</i> sp.	All fish	Exposure to infected individuals, low water conditions or overpopulation.	Where possible, augment water flows to increase quantity and decrease temperature
NIX (nuclear inclusion)	Razor clams	Unknown. Effects gill tissue	Further research and

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
X)		(branchial epithelium). Associated with high levels of mortality in WA.	monitoring needed
Trematode	Razor clams	Unknown. Found in the gonad.	Further research and monitoring needed
Domoic Acid diatom (<i>Pseudo-nitzschia sp</i>)	birds and mammals	Unknown environmental conditions.	ODA, NOAA, OSU, ODFW involvement in research and monitoring
Paralytic Shellfish Toxin -dinoflagellate	birds and mammals	Unknown environmental conditions.	ODA, NOAA, OSU, ODFW involvement in research and monitoring
Shrimp barnacle- (<i>Sylon sp</i>)	Pink shrimp (<i>Pandalus jordani</i>), spot prawns (<i>Pandalus platyceros</i>)	Unknown. Widely distributed in shrimp and prawns in Northern Hemisphere, but only recently noted by Oregon shrimpers fishing in So. Washington. Parasite generally kills host.	Further research and monitoring needed
Needle disease-microsporidian (<i>Nadalspora canceri</i>).	Dungeness crab	Unknown. More prevalent in Dungeness crab living in bays and estuaries. Needle-shaped spores are found in the muscle. Can greatly increase crab mortality.	Further research and monitoring needed
Vibrio -Virus (<i>Vibrio tubiashii</i>)	Oysters and clams	Causes premature death in larvae.	Further research and monitoring needed
Parasitic Isopod- (<i>Orthione griffenis</i>)	Mud shrimp (<i>Upogebia pugettensis</i>)	Probable introduction from Asia. Gill parasite associated with population decline.	Further research and monitoring needed

Emerging Diseases Known to be of Potential Concern to Fish and Wildlife in Oregon.

Disease or Disease-Causing Organism	Vulnerable species	Conditions that promote disease issues	Surveillance and management recommendations
White nose syndrome	Cave dwelling, hibernating bat species (13 of 15 Oregon species)	Low temperatures and high humidity; bat hibernacula in caves are affected. Potential effects on migratory tree bats are unknown. Primary cause of mortality is skin infection by <i>Pseudogymnoascus destructans</i> , but the process is	Active monitoring of susceptible bats and habitats; interagency plan developed; decontamination protocols developed

Disease or Disease-Causing Organism	Vulnerable species	Conditions that promote disease issues	Surveillance and management recommendations
		unknown and exact conditions for infection and mortality are unknown.	
Chronic Wasting Disease of Cervids	Deer, elk, moose	A fatal neurological prion-associated disease transmitted via direct contact between infected and non-infected susceptible cervids through saliva, urine and feces; indirect contact infection possible from long-term environmental contamination of susceptible animals.	Not presently identified in Oregon. Conduct surveillance of hunter-harvested animals and animals observed with clinical signs; Ban on importation of live cervids and hunter harvested neural tissues from wild cervids harvested in affected states.
Meningeal worm (<i>Parelaphostrongylus tenuis</i>)	White-tailed deer; moose, elk, caribou, mule deer, black-tailed deer, antelope are aberrant hosts	Non-pathogenic to white-tailed deer but causes severe neurologic signs and death in aberrant hosts.	Prevent movement of wild cervids from meningeal worm endemic areas.
Salamander chytrid fungus (<i>Batrachochytrium salamandrivorans</i>)	Salamanders, especially newts	Unknown; globalization and lack of biosecurity; importation of infected species via the pet trade; internet shipments of amphibians	Maintain strict biosecurity and importation protocols, evaluate novel biosecurity measures; increase public awareness and education of risks to conservation, species impacts, global health Further research and monitoring needed
Snake Fungal Disease (<i>Ophidiomyces ophiodiicola</i>)	Fungal dermatitis in snake species currently in nine states, including Illinois, Florida, Massachusetts, Minnesota, New Jersey, New York, Ohio, Tennessee, and Wisconsin	Unknown	Further research and monitoring needed
Pigeon paramyxovirus	Pigeons and doves	Congregation of birds at feeders or watering sites	Currently not identified in Oregon, but has

Disease or Disease-Causing Organism	Vulnerable species	Conditions that promote disease issues	Surveillance and management recommendations
(PPMV-1)		promotes spread of the disease since it is spread via direct contact and feces.	caused massive die-offs of Eurasian collared doves in Western states such as Colorado, Arizona, and Montana. Surveillance and monitoring is needed.
Morbillivirus (phocine and cetacean) in marine mammals	Seals, dolphins, whales	Unknown	A number of unusual mortality events (UME's) documented along the eastern US in dolphins. Further research and monitoring needed.
Meningoencephalitis associated with <i>Carbacterium maltaromaticum</i> -like bacteria	Juvenile salmon sharks	Unknown. Documented in juvenile salmon sharks breeding along the California coast during late summer and early fall	Further research and monitoring needed