SPECIES OF GREATEST CONSERVATION NEED

Oregon's State Wildlife Action Plan

Contents

SPECIES OF GREATEST CONSERVATION NEED

Oregon's State Wildlife Action Plan (SWAP) identifies 320 Species of Greatest Conservation Need (SGCN). Species of Greatest Conservation Need are defined as having small or declining populations, are at-risk, and/or are of management concern. Oregon's SGCN include 18 amphibians, 63 birds, 35 mammals, 8 reptiles, 45 fish species (80 unique SMU/ESU/DPS/Groups), 71 invertebrates, and 80 plants and algae. Information on the special needs, limiting factors, data gaps, conservation actions, and available resources are listed for each of Oregon's SGCN.

Species of Greatest Conservation Need are designated by **ecoregion** rather than at a statewide level. The ecoregions designated for each species represent the highest priorities for implementing conservation actions for individual species. Some species also occur in ecoregions outside of where they have been designated as an SGCN; conservation actions for these species are targeted towards the ecoregions where actions will most contribute to the overall conservation success for the species.

For information on how the SGCN list was developed, see **Methods for Determining Strategy Species**. For some species, not enough information was known to determine whether a species meets the conservation criteria to qualify as an SGCN. The SWAP identifies these species as **Species of Greatest Information Need (SGIN)**.

Although the focus of this section is on SGCN and the actions needed to conserve them, it also takes a broader view of fish and wildlife conservation and includes information on naturally-occurring **Fish and Wildlife Diseases** and **Animal Concentrations**.

The SGCN and SGIN lists are available for download in Excel table format. The SGCN are listed here by taxa. The downloadable SGCN table also contains information on the special needs, limiting factors, data gaps, conservation actions, and available resources for each SGCN.

AMPHIBIANS

There are 18 amphibians identified as Species of Greatest Conservation Need in the SWAP:

- Cascade Torrent Salamander
- Cascades Frog
- Clouded Salamander
- Coastal Tailed Frog
- Columbia Spotted Frog
- Columbia Torrent Salamander
- Cope's Giant Salamander
- Crater Lake Newt
- Del Norte Salamander
- Foothill Yellow-legged Frog

67 Larch Mountain Salamander
68 Northern Red-legged Frog
69 Oregon Slender Salamander
70 Oregon Spotted Frog
71 Rocky Mountain Tailed Frog
72 Siskiyou Mountains Salamander
73 Southern Torrent Salamander
74 Western Toad

75 BIRDS

76 There are 63 birds identified as Species of Greatest Conservation Need in the SWAP:

77 American Avocet
78 American Goshawk
79 American Three-toed Woodpecker
80 American White Pelican
81 Brant
82 Black Oystercatcher
83 Black Rosy-finch
84 Black Swift
85 Black Tern
86 Black-backed Woodpecker
87 Bobolink
88 Brewer's Sparrow
89 California Brown Pelican
90 California Condor
91 Caspian Tern
92 Cassin's Auklet
93 Chipping Sparrow
94 Columbian Sharp-tailed Grouse
95 Common Nighthawk
96 Dusky Canada Goose
97 Ferruginous Hawk
98 Flammulated Owl
99 Fork-tailed Storm-Petrel
100 Franklin's Gull
101 Franklin's Spruce Grouse
102 Golden Eagle
103 Western Grasshopper Sparrow
104 Great Gray Owl
105 Greater Sage-Grouse
106 Greater Sandhill Crane
107 Harlequin Duck
108 Leach's Storm-Petrel
109 Lewis’s Woodpecker
110 Loggerhead Shrike
111 Long-billed Curlew
112 Marbled Murrelet
113 Northern Spotted Owl
114 Olive-sided Flycatcher
115 Oregon Vesper Sparrow
116 Pinyon Jay
117 Red-necked Grebe (Holboell)
118 Rhinoceros Auklet
119 Rock Sandpiper
120 Sagebrush Sparrow
121 Short-eared Owl
122 White-breasted Nuthatch (Pacific)
123 Snowy Egret
124 Streaked Horned Lark

- Swainson’s Hawk
- Trumpeter Swan
- Tufted Puffin
- Western Bluebird
- Western Burrowing Owl
- Western Grebe
- Western Meadowlark
- Western Purple Martin
- Western Snowy Plover
- White-headed Woodpecker
- Willet
- Willow Flycatcher
- Wilson's Phalarope
- Wrentit
- Yellow Rail

MAMMALS

There are 35 mammals identified as Species of Greatest Conservation Need in the SWAP:

- American Pika
- California Myotis
- Canyon Bat
- Columbian White-tailed Deer
- Fringed Myotis
- Gray whale
- Gray Wolf
- Harbor Porpoise
- Hoary Bat
- Humpback whale (Central-America and Mexico DPS)
- Killer Whale (southern resident DPS)
- Kit Fox
- Little Brown Myotis
- Long-legged Myotis
- North American Porcupine
- Northern elephant seal
- Pacific Fisher
- Pacific Marten
- Pallid Bat
- Pygmy Rabbit
- Red Tree Vole
- Ringtail
- Rocky Mountain Bighorn Sheep
- Sea Otter
- Sierra Nevada Red Fox
- Silver-haired Bat
- Spotted Bat
- Townsend's Big-eared Bat
- Washington Ground Squirrel
- Western Gray Squirrel
- Western Long-eared Myotis
- Western Small-footed Myotis
- White-tailed Jackrabbit
- Wolverine
- Yuma Myotis

REPTILES

There are 8 reptiles identified as Species of Greatest Conservation Need in the SWAP:

- California Mountain Kingsnake
- Desert Horned Lizard
- Great Basin Collared Lizard
- Long-nosed Leopard Lizard
- Northwestern Pond Turtle
- Western Painted Turtle
- Western Rattlesnake
- Leatherback Sea Turtle

FISH

There are 45 fish species (80 unique SMU/ESU/DPS/Groups) identified as Species of Greatest Conservation Need in the SWAP:

- Alvord Chub
- Big skate
- Borax Lake Chub
- Brown rockfish
- Bull Trout
- Cabezon
- Chinook Salmon
- Chinook Salmon
- Chum Salmon
- Coastal Cutthroat Trout
- Coho Salmon
- Eulachon
- Foskett Speckled Dace
- Goose Lake Sucker
- Great Basin Redband Trout
- Green Sturgeon
- Hutton Spring Tui Chub
- Klamath Largescale Sucker
- Klamath River Lamprey
- Lahontan Cutthroat Trout
- Longfin Smelt
- Lost River Sucker
- Miller Lake Lamprey
- Millicoma Dace
- Modoc Sucker
- Northern Anchovy
- Northern Roach
- Oregon Chub
- Pacific Brook Lamprey
- Pacific Lamprey
- Pacific Sand Lance
- Pacific Sardine
- Pit Sculpin
- Shortnose Sucker
- Sockeye Salmon
- Soupfin Shark
- Steelhead / Rainbow / Redband Trout
- Surf Smelt
- Tahoe Sucker
- Umpqua Chub

- Warner Sucker
- Western River Lamprey
- Westslope Cutthroat Trout
- White Sturgeon
- Yelloweye rockfish

INVERTEBRATES

There are 71 invertebrates identified as Species of Greatest Conservation Need in the SWAP:

- Zigzag Darner
- Subarctic Darner
- Beller's Ground Beetle
- Gray-Blue (Butterfly)
- Scott's Apatanian Caddisfly
- California Floater Mussel
- Western Floater Mussel
- Winged Floater Mussel
- Oregon Floater Mussel
- Coronis Fritillary (Butterfly)
- Oregon Silverspot Butterfly
- Silver-Bordered Fritillary (Butterfly)
- Franklin's Bumble Bee
- Morrison Bumble Bee
- Western Bumble Bee
- Suckley's Cuckoo Bumblebee
- Vernal Pool Fairy Shrimp
- Johnson's Hairstreak (Butterfly)
- Seaside Hoary Elfin Butterfly
- A Stonefly
- Sullivan's Sulphur (Butterfly)
- Rock Scallop
- Monarch Butterfly
- Taylor’s Checkerspot Butterfly
- A Caddisfly
- Shortface Lanx
- Columbia Pebblesnail
- Modoc Pebblesnail
- Western Ridged Mussel
- Pinto Abalone
- Red Abalone
- Flat Abalone
- Great Basin Ramshorn
- Oregon Shoulderband
- Oregon Branded Skipper (Butterfly)
- Fender’s Blue Butterfly
- Banded Juga
- Highcap Lanx
- Native Littleneck Clam
- Western Pearlshell Mussel
- Red Sea Urchin
- Dungeness Crab
- California Mussel
- Wahkeena Falls Flightless Stonefly
- Columbia Gorge Caddisfly
- Wonder Caddisfly
- Yuma Skipper (Butterfly)
- Dalles Mountainsnail

- Olympia Oyster
- Misfortunate Crayfish
- Leona's Little Blue Butterfly
- Ochre Sea Star
- Montane Peaclam
- Borax Lake Ramshorn
- Coastal Greenish Blue Butterfly
- Mardon Skipper Butterfly
- Dog Star Skipper (Butterfly)
- Robust Walker
- Pacific Walker
- Sunflower Star
- Archimedes Springsnail
- Owyhee Hot Springsnail
- Owyhee Upland Pyrg
- Mountain Mahogany Hairstreak (Butterfly)
- Razor Clam
- Morning Sun Star
- Striped Sun Star
- Rocky Mountain Fingernail Clam
- Blue Mud Shrimp
- Dalles Hesperian
- Siskiyou Hesperian

PLANTS AND ALGAE

There are 80 plant and algae identified as Species of Greatest Conservation Need in the SWAP:

- Applegate's Milkvetch
- Arrow-Leaf Thelypody
- Barren Valley Collomia
- Bentonite Biscuitroot
- Boggs Lake Hedge Hyssop
- Bradshaw's Desert Parsley
- Bull Kelp
- Cascade Head Catchfly
- Coast Range Fawn Lily
- Columbia Yellowcress
- Cook's Desert Parsley
- Crinite Mariposa Lily
- Cronquist's Stickseed
- Crosby's Buckwheat
- Cusick's Lupine
- Davis' Peppergrass
- Dwarf Meadowfoam
- Gentner's Fritillary
- Golden Buckwheat
- Golden Paintbrush
- Greenman's Desert Parsley
- Grimy Ivesia
- Hitchcock's Blue-Eyed Grass
- Howell's Mariposa Lily
- Howell's Microseris
- Howell's Spectacular Thelypody
- Kincaid's Lupine
- Large-Flowered Goldfields
- Large-Flowered Rush Lily
- Large-Flowered Woolly Meadowfoam

- Lawrence's Milkvetch
- Lemmon's Milkvetch
- Macfarlane's Four O'clock
- Malheur Valley Fiddleneck
- Malheur Wire-Lettuce
- Mcdonald's Rockcress
- Mendocino Coast Paintbrush
- Mulford's Milkvetch
- Narrow-Leaved Monardella
- Native Eelgrass
- Nelson's Checkermallow
- Northern Wormwood
- Ochoco Lomatium
- Oregon Semaphore Grass
- Owyhee Clover
- Packard's Mentzelia
- Peacock Larkspur
- Peck's Milkvetch
- Pink Sandverbena
- Point Reyes Bird's-Beak
- Pumice Grape-Fern
- Red-Fruited Lomatium
- Rough Goldenweed
- Rough Popcornflower
- Sea Palm
- Seaside Gilia
- Sexton Mountain Mariposa Lily
- Shiny-Fruited Allocarya
- Silvery Phacelia
- Smooth Mentzelia
- Snake River Goldenweed
- South Fork John Day Milkvetch
- Spalding's Campion
- Stansell's Daisy
- Sterile Milkvetch
- Surfgrass
- Tall Western Penstemon
- Thin-Leaved Pea
- Tygh Valley Milkvetch
- Umpqua Mariposa Lily
- Water Howellia
- Wayside Aster
- Western Lily
- White Fairy Poppy
- White Rock Larkspur
- Whitebark Pine
- White-Topped Aster
- Willamette Daisy
- Willamette Navarretia
- Wolf's Evening Primrose

SUMMARY OF CHANGES TO THE SGCN LIST

Species Added as SGCN

- A Caddisfly
- American Avocet
- Banded Juga
- Barren Valley Collomia
- Bentonite Biscuitroot

401 Black Rosy-finch
402 Black Tern
403 California Condor
404 Canyon Bat
405 Cassin's Auklet
406 Chinook Salmon
407 Chinook Salmon
408 Columbia Pebblesnail
409 Columbia Yellowcress
410 Coronis Fritillary (Butterfly)
411 Desert Horned Lizard
412 Dog Star Skipper (Butterfly)
413 Franklin's Spruce Grouse
414 Gray-Blue (Butterfly)
415 Great Basin Collared Lizard
416 Hitchcock's Blue-Eyed Grass
417 Humpback Whale (Central-America
418 and Mexico DPS)
419 Johnson's Hairstreak (Butterfly)
420 Klamath Largescale Sucker
421 Klamath River Lamprey
422 Large-Flowered Goldfields
423 Leatherback Sea Turtle
424 Lemmon's Milkvetch
425 Little Brown Myotis
426 Long-Nosed Leopard Lizard
427 Mazama (Crater Lake) Newt
428 Mendocino Coast Paintbrush
429 Misfortunate Crayfish
430 Modoc Pebblesnail
431 Montane Peaclam
432 Morning Sun Star
433 Morrison Bumblebee
434 Mountain Mahogany Hairstreak
435 (Butterfly)
436 Narrow-Leaved Monardella
437 North American Porcupine
438 Northern Roach
439 Ochoco Lomatium
440 Oregon Branded Skipper (Butterfly)
441 Oregon Floater
442 Owyhee Hot Springsnail
443 Owyhee Upland Pyrg
444 Pacific Brook Lamprey
445 Pacific Sardine
446 Pinto Abalone
447 Pinyon Jay
448 Rhinoceros Auklet
449 Rocky Mountain Fingernail Clam
450 Rough Goldenweed
451 Scott's Apatanian Caddisfly
452 Sea Otter
453 Seaside Gilia
454 Silver-Bordered Fritillary (Butterfly)
455 Siuslaw Hairy-Necked Tiger Beetle
456 Sockeye Salmon
457 Soupfin Shark
458 Stansell's Daisy
459 Steelhead / Rainbow / Redband Trout
460 Striped Sun Star
461 Subarctic Darner
462 Suckley's Cuckoo Bumblebee

Sullivan's Sulphur (Butterfly)
Tahoe Sucker
Tall Western Penstemon
Thin-leaved pea
Wahkeena Falls Flightless Stonefly
Western Floater
Western Grebe
Western Pearshell
White Fairy Poppy
White Sturgeon
White Sturgeon
White Sturgeon
Whitebark Pine
Willamette Navarretia
Willet
Wilson's Phalarope
Wonder Caddisfly
Wrentit
Yuma Skipper (Butterfly)
Zigzag Darner

Species Previously Identified as SGCN that were moved to SGIN

American Peregrine Falcon
Black Petaltail
Bulb Juga
Columbia Clubtail
Crater Lake Tightcoil
Dall's Ramshorn
Golden Eagle
Grass Rockfish
Klamath Ramshorn
Lined Ramshorn
Long-Eared Myotis (Western)
Malheur Cave Amphipod
Malheur Cave Flatworm
Malheur Cave Springtail
Malheur Isopod
Malheur Pseudoscorpion
Pacific Giant Octopus
Pile Perch
Redtail Surfperch
Rock Greenling
Scalloped Juga
Shiner Perch
Sinitsin Ramshorn
Sisters Hesperian
Starry Flounder
Striped Perch
Tiger Rockfish
Topsmelt
Turban Pebblesnail
Upland Sandpiper
Western Small-Footed Myotis
Yuma Myotis

Species Removed from SGCN

Acorn Woodpecker
Black Rockfish

519 Black-necked Stilt
520 Blue Rockfish
521 Canary Rockfish
522 China Rockfish
523 Copper Rockfish
524 Deacon Rockfish
525 Great Spangled Fritillary
526 Juniper Titmouse
527 Kelp Greenling
528 Lingcod
529 Mountain Quail
530 Northern Sagebrush Lizard
531 Pacific Harbor Seal
532 Pacific Herring
533 Pileated Woodpecker
534 Purple Sea Urchin
535 Purple-Lipped Juga
536 Quillback Rockfish
537 Rotund Lanx
538 Scale Lanx
539 Spiny Dogfish
540 Steller Sea Lion
541 Vermilion Rockfish
542 Wolf-Eel
543 Yellow-Breasted Chat
544 Yellowtail Rockfish
545

METHODS FOR DETERMINING SPECIES OF GREATEST CONSERVATION NEED

The U.S. Fish and Wildlife Service (USFWS) requires all State Wildlife Action Plans to designate "Species of Greatest Conservation Need" as well as to provide specific information about problems that may affect those species, information needed to improve conservation, and recommended conservation actions. Oregon's Species of Greatest Conservation Need (SGCN) list and associated species information was developed to meet this requirement. The SWAP identifies wildlife (**amphibians**, **birds**, **mammals**, and **reptiles**), **fish**, **invertebrates**, and **plants and algae** as SGCN, including species occurring within the nearshore.

BACKGROUND

The original list of Species of Greatest Conservation Need was developed by regional biologists and species experts in 2006, referred to as Strategy Species in 2006 and 2016. This was done by first creating a list of all declining species in Oregon, and then using spatial models of Oregon's vegetation types to produce species-habitat associations that estimated the extent of habitat loss experienced by each species. The 2006 SWAP also identified Species of Greatest Information Need (SGIN), referred to as Data Gap Species in 2006 and 2016, defined as species that may be of conservation concern, but insufficient information was available to fully assess whether they met the SGCN conservation criteria.

For the 2016 revision, all 2006 SGCN and SGIN were reviewed and updated. During the 2026 revision, all 2016 SGCN and SGIN species were reviewed for their conservation status and evaluated using the conservation criteria. Additional species were evaluated using the process described below. Information for each SGCN and SGIN was also updated. The Oregon Department of Fish and Wildlife (ODFW) divisions and partner organizations took the lead on reviewing and updating the various taxonomic groups.

WILDLIFE AND FISH CONSERVATION CRITERIA

The ODFW's staff from Wildlife and Fish Divisions and the Marine Resources Program led a comprehensive review process for the Wildlife and Fish Species of Greatest Conservation Need list. The conservation criteria used, described below, were based on the criteria used in 2016 with changes to make them more inclusive of all taxa. Species were reviewed to determine whether to keep, remove, or add species using a two-step process.

1. Species were first assessed for their eligibility for consideration as an SGCN. To be eligible for consideration, species must be both:

   I. Native to Oregon in accordance with OAR 635-056-0010 (13)

II. Regularly occurring in Oregon (Figure 1)

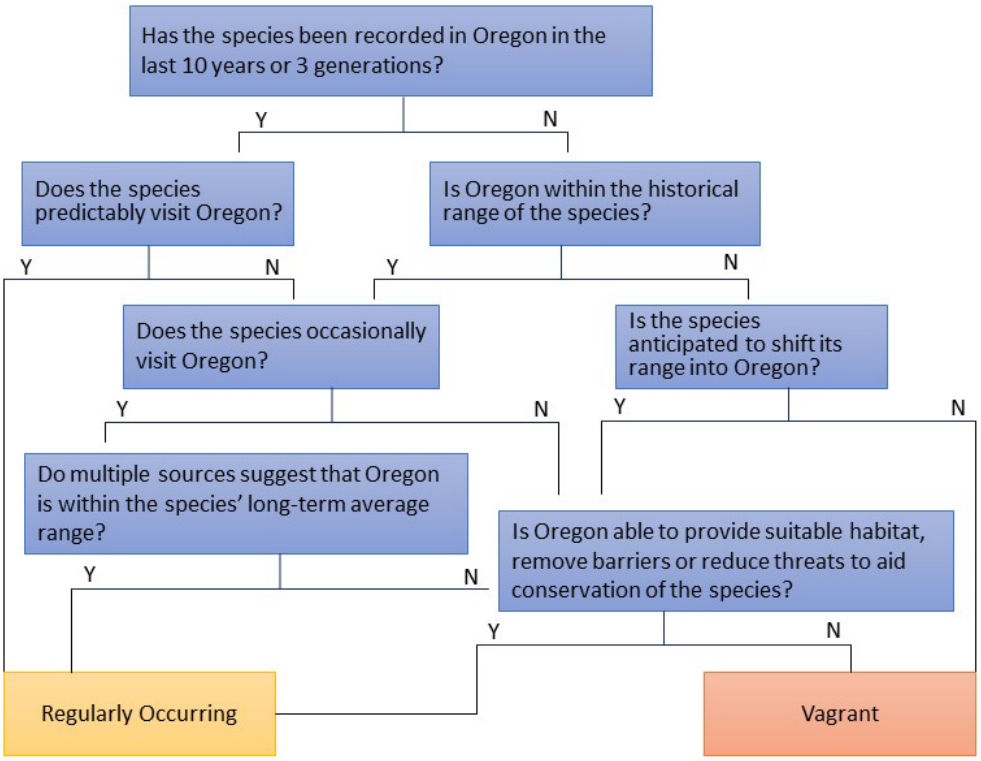

Figure 1. Decision tree used to determine if a species occurs regularly in Oregon. Adapted from the Convention on the Conservation of Migratory Species of Wild Animals, 2021.

Native, regularly occurring species were then put forward to be reviewed for determination that they meet the criteria for being a SGCN under one or more of the three following conditions:

A. Has a conservation status ranking of at least one of the following:
    - Federal listing – Endangered, threatened, or under review in the candidate or petition process
    - State listing – Endangered or threatened
    - IUCN Red List – Critically Endangered or Endangered
    - NatureServe Global Rank – G1 or G2
    - Oregon State Rank – S1 or S2
    - NOAA – Overfished designation
    - Other conservation status ranking that indicates a high risk of extinction or collapse
B. Expert opinion suggests that the species should be reviewed
C. Species has been petitioned for consideration by the public or partners

2. Eligible species that were put forward under the above conditions were then assessed for listing as SGCN. A species must meet two or more of the following four criteria to be listed as an SGCN.

1. The species is vulnerable to potential threats because of (a) life history traits or strategies including but not limited to: low lifetime reproductive success, episodic reproduction, low recruitment, or the species gathers in high concentrations for some part of its life cycle (e.g., nesting, breeding, spawning, and/or feeding sites), or (b) other ecological characteristics of the species including but not limited to: low dispersal ability or dependence on scarce or highly specific environmental conditions.
2. Population size or the number of occurrences of the species is either low or declining, indicating risk of extirpation or loss of population viability, in (a) the ecoregion or (b) statewide.
3. The species is at-risk because it has a restricted distribution. This includes but is not limited to species that: have had a significant retraction from historical geographic range, are at risk of extirpation from a catastrophic event due to narrow range, or represent a disjunct (isolated) population with low or highly restricted landscape or genetic connectivity.
4. Populations of this species are known (or strongly suspected) to be vulnerable to a Key Conservation Issue or major threat, including: 1) climate change, 2) land use changes, 3) water quality and quantity, 4) barriers to animal movement, 5) disruption of disturbance regimes, 6) invasive species, 7) factors described in OAR 635-100-0105 subsection (6), 8) other known threats to populations (e.g., disease, pollutants, trophic interactions, human recreation).

Information from literature searches, agency and partner databases, and expert review was used to update the content associated with each SGCN, including special needs, limiting factors, data gaps, recommended conservation actions, and key references. The ODFW consulted with species experts throughout Oregon to review and update the SGCN list and information associated with each species.

INVERTEBRATE SGCN LIST

The ODFW consulted with experts from the ODA, the ORBIC, the Xerces Society for Invertebrate Conservation, and other species experts to update the Invertebrate SGCN list and the information associated with each species. To the extent possible, the Wildlife and Fish Conservation Criteria were used to assess invertebrate species.

PLANT SGCN LIST

The list of SGCN Plants was updated to incorporate new species that were added to **Oregon's threatened and endangered plant** species list. The ODFW consulted with

the ODA's Plant Conservation Program and other species experts to update information regarding taxonomy, species descriptions, special needs, limiting factors, data gaps, recommended conservation actions, and key references.

ADDITIONAL MARINE SPECIES OF INTEREST LIST

Marine SGCN were selected using criteria as identified above. Additionally, any species that met at least one of the SGCN criteria were evaluated using the following Nearshore criteria:

1. Ecological importance – i.e. habitat forming, habitat engineer, keystone species, prey species.
2. Economic/social/cultural importance – i.e. commercially important, recreationally important, culturally important to Oregon tribes, flagship or sentinel species.

Those species that met at least one of the SGCN criteria and at least one of these Nearshore criteria are also specifically included in the SWAP as SGCN.

SPECIES OF GREATEST INFORMATION NEED

Oregon's State Wildlife Action Plan (SWAP) identifies 176 Species of Greatest Information Need (SGIN), including 8 amphibians, 23 birds, 11 mammals, 2 reptiles, 34 fish, 7 plants, 3 algae, and 88 invertebrates. The SWAP SGIN list documents species that require more information to determine whether they should be elevated to SGCN status.

SGIN are species potentially vulnerable or of concern, but for which current information and understanding are scarce. For these species, some basic information, such as distribution and range, habitat associations, and general abundance, is not known. It is, therefore, not possible to determine whether they are truly at risk and should be designated as a Species of Greatest Conservation Need. General areas in which SGIN are lacking basic information include taxonomy, distribution and range, population dynamics or trends, threats or stressors, and habitat requirements. For SGIN, conservation actions should be aimed at filling these data gaps.

The SGCN and SGIN lists are available for download in Excel table format.

ANIMAL CONCENTRATIONS

OVERVIEW

Wildlife species may be highly concentrated within relatively small areas seasonally or at various points throughout their life cycles. Fish and wildlife often gather in concentrations for critical activities, such as feeding, breeding/spawning, and migrating. For example, some species breed in colonies, perhaps due to limited, specialized breeding sites or as a strategy to deter predators. Animals also congregate when their food is concentrated, and migrating animals tend to gather at critical feeding sites along migration routes to refuel and rest.

Animals might also 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 tend to gather together for a short burst of spring breeding when they have a limited window of opportunity for egg-laying in seasonal ponds. When Pacific tree frogs gather to breed, a springtime chorus erupts as males sing to attract mates.

People have long appreciated the spectacle of thousands or millions of animals gathered in one area. Oregonians enjoy **wildlife viewing** and there are many opportunities to observe animals firsthand throughout the state. For example, there are several popular bird festivals that celebrate seasonal animal gatherings, including wintering Bald Eagles and migrating songbirds, shorebirds, and waterfowl. Salmon, one of the iconic species of the Pacific Northwest, can be seen **spawning** all across Oregon during the fall months. There are also a number of salmon spawning festivals throughout the state celebrating the return of the fish to their spawning grounds.

Oregon is home to some remarkable concentrations of wildlife. The Klamath Basin in Southern Oregon and Northern California hosts the largest assemblage 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 pastures year-round. At many of Oregon's mountain lakes and ponds, **western toad** tadpoles swarm in large masses in the summer, and can be seen climbing out onto land in large groups in the early fall. In Portland, crowds gather nightly every autumn to watch thousands of migrating Vaux's Swifts swirl and funnel into roosts.

Similarly, large numbers of migrating fish can be seen when spawning. Salmon and trout species can enter small tributaries in large numbers to build redds and deposit eggs. Pacific herring seasonally return to Yaquina Bay and other estuaries along the coast to spawn. Native cyprinids can develop vibrant spawning colors and provide great viewing opportunities. Freshwater mussels can also occur in very dense beds containing thousands of individuals.

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. In south central Oregon, Lake Abert has provided essential habitat and food sources for a myriad of migrating birds, once supporting the largest number of Wilson's Phalaropes in North America. However, this habitat has been threatened by multiple impacts from **Climate Change** and the **Disruption of Disturbance Regimes**. In turn, the numbers of birds visiting each year has dropped, demonstrating how fragile these critical habitats are.

When animals gather in these large groups, they can become particularly vulnerable to threats including climate change, disease, overexploitation, habitat alteration, and human disturbance. Because of the large number of individuals involved, any factors that impact critical sites can affect a large proportion of a population or an entire suite of species. Habitats that support animal concentrations provide important features such as cover and protection, abundant food sources, or nesting and breeding sites. The availability of these habitats may be limited, and impacts to these concentration areas may have a disproportionate effect on wildlife populations by influencing survival and reproduction. The Fish and Wildlife **Habitat Mitigation Policy** is one tool to help avoid, minimize, or mitigate the impact of development on many these limited, irreplaceable, and essential habitats for fish and wildlife species, populations, or species assemblages.

Identifying the most important sites is the first step in conserving animal concentrations. One approach to identifying these areas is The National Audubon Society's **Important Bird Areas** program, which recognizes the importance of migration stopovers and other areas where birds concentrate. Another approach are the **Conservation Opportunity Areas**, which include many, but not all, of the state's animal concentrations. For animal concentrations, appropriate conservation actions depend on the species and site, but should focus on maintaining or restoring important habitat features.

The table below summarizes important habitat types and features for some of Oregon's animal concentrations.

ANIMAL CONCENTRATIONS, HABITAT TYPES, AND FEATURES

Animal Concentration	Important Habitat Types	Important Habitat Features
Bald Eagles: wintering	Large lakes, estuaries, bays, and rivers.	Areas of open water for foraging. Large trees or snags within a forest stand are used for communal roosts and for perching.

Animal Concentration	Important Habitat Types	Important Habitat Features
Bat roost sites (particularly hibernacula, maternal roosts, or diurnal roosts)	Depends on bat species. Includes caves, mines, cliffs, bridges, and tree cavities.	Roost sites must have suitable temperature and humidity. Lack of human disturbance is critical for **Townsend's big-eared bat** and **pallid bat**.
Deer and elk key winter range areas	These vary by ecoregion but generally include warmer sites, such as low valleys and southern slopes, with lower snow depth, further from roads open to motorized vehicles.	Wintering areas include 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), and cover for insulation and hiding are needed. Shrubs are important where snow is deep during winter.
Deer and elk herds: migration routes and transition range	These vary by ecoregion and combine features of summer and winter ranges. Travel corridors unobstructed by fences, roads, and development are important.	Herds need connectivity between winter and summer ranges via corridors with forage and cover to provide safe passage.
Freshwater mussel beds	Permanently inundated habitats, such as perennial rivers, streams, lakes, and ponds.	Native freshwater mussels require clean water with low contamination and sedimentation and natural water flow regimes. They need burrowing substrate, stable habitat features, and the presence of specific host fish species.
Nesting colonies (rookeries): Great	Variable. Usually riparian, estuarine,	Herons require large trees near foraging areas (open grassy and wetland

Animal Concentration	Important Habitat Types	Important Habitat Features
Blue Herons	wetland, marsh, or flood-plain habitats.	habitats) and low levels of human disturbance during the nesting season.
Lamprey (juveniles concentrate in high densities)	Freshwater habitats.	Lamprey may prefer low-gradient floodplain habitats and lower mainstem river channels.
Pond-breeding amphibians (toads, frogs, salamanders)	Ponds and other shallow wetlands. Temporary ponds may dry up each summer but provide essential breeding habitat.	Breeding habitats must retain sufficient water long enough for tadpoles to metamorphose into adults, be relatively free of predators or disturbance, and provide sufficient food.
Raptors: migrating and wintering	Fields and pastures, grasslands and prairies, sagebrush steppe, and wet meadows; ridges during migration.	Habitats with suitable perches where prey are often concentrated, e.g., open grassy areas for rodents, riparian and deciduous shrub communities for songbirds, lakes for waterfowl, and managed agricultural fields. Raptors use thermals over ridges for soaring.
Salmonid (salmon, steelhead, trout) juvenile rearing areas	Estuaries, lakes, rivers, and streams.	These areas must have suitable habitat complexity, low temperatures, and low fine sediment loads.
Salmonid spawning and holding areas	Streams, lakes, and rivers.	These areas must have suitable habitat complexity and low temperatures.
Greater Sage-Grouse leks and breeding areas	Big sagebrush	Open areas are used by males for courtship. Typically nest under sagebrush with large canopies. Areas

Animal Concentration	Important Habitat Types	Important Habitat Features
		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 the species, colonies may include deep soil for burrowing (Tufted Puffin and storm-petrels), rocky ledges (Common Murres), 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 is important.
Shorebirds: migrating and wintering	Wet prairies, flooded fields, mudflats, alkali lakes, shorelines of wetlands and reservoirs, estuaries, and sandy ocean shore.	Shorebirds need undisturbed open, moist, muddy or sandy areas with high invertebrate prey density.
Snake winter hibernaculum	Burrows, caves, rock crevices, and lumber or rock piles	Habitats that maintain above freezing temperature, adequate ventilation, and moisture.
Songbirds: migrating	Deciduous and mixed deciduous-conifer forests, high-elevation deciduous or mixed shrub communities, especially near	Migrating songbirds need deciduous trees and shrubs with high food density and cover for insulation and hiding. Forested buttes are important in urban and agricultural landscapes.

Animal Concentration	Important Habitat Types	Important Habitat Features
	water, and riparian habitat.	
Tadpole aggregations (for example, western toad, Oregon spotted frog)	Shallow areas in mountain lakes and ponds, slow-moving stretches of rivers or side channels.	Maintaining shallow mountain lake habitats, including native aquatic and lakeside vegetation, and slow-moving water is important for young herps.
Waterbird nesting colonies	Lakes and marshes with both deep and shallow water	Colony characteristics vary by species but include isolated and sparsely vegetated islands (American White Pelican), trees (Snowy Egret), and 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	Waterfowl need diverse water features with high food availability (aquatic plant, invertebrate, or fish) and open water for security.
Vaux's Swift roosts	Late successional conifers, urban and suburban areas.	Large hollow trees and snags are important for nesting and roosting. Chimneys (which 'imitate' hollow trees) may also be used.

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FISH AND WILDLIFE DISEASES

OVERVIEW

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 they may show no signs of disease if the pathogen is cleared by the animal's immune system. In some cases, animals may serve as carriers or reservoirs of the pathogen or may die as a result of the infection. In susceptible individuals and species, disease spreads quickly when large numbers of animals are concentrated. This can occur during migration, in species that live in groups or use colonial nesting or rest sites, during breeding, or when animals are forced into small areas of habitat due to habitat loss and fragmentation or attracted to specific sites when they are fed by people. Emerging and novel diseases can have devastating effects on wildlife, human health, and local economies. Climate change may increase the vulnerability of fish and wildlife to disease by altering ecosystem dynamics, increasing opportunities for disease spread, and raising animals' stress, potentially making them more susceptible to disease and illness if they become exposed.

Anyone can help to prevent human-caused disease outbreaks by regularly cleaning and sanitizing bird feeders, vaccinating pets, removing invasive species, and 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. Rehabilitators often also provide valuable educational information and outreach to the public. In addition, accredited Association of Zoos and Aquariums facilities in Oregon (e.g., 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 an inherent part of every ecosystem. However, introduced and emerging diseases not only threaten population or ecosystem health but can be very difficult and costly to eradicate once established. The best action to avoid unwanted disease outbreaks is prevention. Oregon's biologists, veterinarians, and wildlife administrators make every effort to protect the state's fish and wildlife through surveillance, monitoring, training, response plans, active disease response and mitigation, policy, and regulation. Listed below are the diseases that are of the greatest management or conservation concern or that present significant or recurring health risks to Oregon's

765 fish and wildlife. This list includes diseases that occur naturally or are endemic in Oregon,
766 as well as diseases that are introduced or emerging. The list is not inclusive of all diseases
767 identified in Oregon fish and wildlife species.
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769 WILDLIFE DISEASES OF MANAGEMENT CONCERN

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. Remove invasive amphibian and reptile species. Follow disinfection protocols for field equipment.
Chytrid skin fungus (*Batrachochytrium dendrobatidis*)	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 fungus to determine if it is spreading to new areas. Avoid human-caused movement of amphibians to new areas. Remove invasive amphibian species. Follow disinfection protocols for field equipment.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Egg-destroying pathogen (*Saprolegnia ferax*, 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 the role of introduced fish in spread between water bodies.
Amphibian deformities (multiple legs and other deformities caused by a trematode, *Ribeiroia* 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. If possible, control habitat nutrient levels (e.g., reduce agricultural runoff) to control intermediate host densities.
Emydomyces testavorans associated shell disease	Aquatic native turtles of the Pacific Northwest, primarily the Western Pond turtle	Movement of infected animals. Cause presently unknown but there is an association with the fungus *Emydomyces testavorans*. Occurrence also highest with captive-reared animals.	Avoid human-caused movement of turtles to new areas. Remove invasive turtles. Continue research to identify cause in PNW turtles and determine population impacts.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Avian cholera (caused by the bacterium *Pasturella multocida*)	Waterfowl most susceptible. In Oregon, snow geese are most often at risk, but the disease can also impact gulls, terns, coots, and crows.	Observed in northeastern and in southern wetlands of the 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 local point sources and minimize impacts to populations.
Bird feeder diseases (salmonellosis, mycoplasmal conjunctivitis, avian poxvirus, trichomoniasis)	Songbirds. Finch species can be highly impacted.	Concentration of birds at bird feeders. Contaminated feeder surfaces and fecal-contaminated bird food. Bacterial pathogens may be zoonotic.	Conduct outreach regarding prevention methods. Implement frequent sanitation measures at bird feeders or cessation of wild bird feeding.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Newcastle virus	Double-crested Cormorants. Many other bird species are 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, etc.) and peaks in the spring-fall at breeding colonies.	Monitor and conduct surveillance of colonies. Work with wildlife rehabilitators to avoid and manage potential disease risk in facilities.
West Nile virus (Zoonotic disease passed by mosquito vectors)	Birds in the family Corvidae and sage-grouse, other bird species, some mammals (e.g., squirrels)	Conditions conducive to wet habitats and breeding areas, responding density of vectors, and over-winter survival of competent host mosquito species.	Reduce mosquito breeding areas in urban environments. Follow Centers for Disease Control and Prevention recommendations. Place warning guidance at wetland management areas.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Highly pathogenic avian influenza (HPAI)	Naive waterfowl, shorebirds, and raptors are most susceptible to succumbing to disease. Many wild bird species are hosts to low and high path AI strains. Waterfowl and shorebirds are the principal hosts to highly pathogenic (HPAI H5, H7) strains and most responsible for viral spread and distribution. Some strains and genotypes are zoonotic.	Waterfowl, shorebirds, and many wetland wild bird species serve as hosts to most of the 144 strains of the virus. Specific genotypes within highly pathogenic virus strains can have devastating impacts to the poultry industry, dairy cows, other livestock, and human health, in addition to causing death in many wild birds. Poor biosecurity in backyard ponds, falconry birds, rehabilitation facilities, and waterfowl hunt clubs can contribute to outbreaks and spread of avian influenza. Most affected birds are observed during spring and fall migration.	Monitor and conduct surveillance of captured or translocated birds, including waterfowl (duck banding), mountain quail, turkeys, grouse, and farmed game birds. Increase education to landowners, poultry owners, falconers, rehabilitators, and hunt clubs regarding biosecurity. Remove carcasses from the landscape to decrease impacts on scavenging species. Dispose of infected carcasses using appropriate PPE in approved locations (i.e., deep burial, incineration, or lined dump site).

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Botulism (caused by a nerve toxin produced by the bacterium *Clostridium botulinum*)	Waterfowl, shorebirds, and avian scavengers	Associated with shallow wetland habitats during warm weather. Botulism can be made worse by fluctuating water levels. It is often associated with carcasses (waterfowl, fish kills). Fly larvae can bioconcentrate this toxin. Most cases occur during late summer/ fall.	Manage water levels, flow, flushing, and changes at important migration areas to prevent botulism. Manage all known and major die-offs by carcass removal and proper disposal to minimize further impacts to local populations.
Mycoses (diseases caused by fungi, including toxins produced by mold), Aspergillosis (aflatoxins)	Many bird species. Aspergillosis is most common in waterfowl, gulls, corvids, and raptors.	Transmitted from moldy corn or acquired from soil or damp organic materials. Stressed or diseased animals may have increased susceptibility.	Aspergillosis: Monitoring and surveillance. Minimize access to source sites if known, such as moldy silage piles. Manage major die-offs by removing carcasses.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Cryptococcus gattii	*C. gattii* has been identified in harbor porpoises, Dall's porpoises, Roosevelt elk, domestic animals, and humans along the coast and Willamette Valley.	Geographic and local environmental factors are important in development of fungal infection.	Additional research is needed to understand the location of environmental "hot spots".
Harmful Algal Blooms (HAB, Cyanobacteria toxic bloom)	Waterfowl and other wildlife species as well as humans and domestic dogs.	Warmer, stagnant water bodies with high nutrient content can cause anoxic conditions for fish and toxic algal blooms for avian and terrestrial species. Most cases peak in late summer/ fall.	Maintain good water quality, flushing, and flow. Reduce high nitrogen/phosphate/nutrient runoff. Manage major die-offs by removing carcasses and disposing of them appropriately.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Rodent control poisons (anticoagulants, hypercalcemia products, zinc phosphide toxicosis)	Non-target species, particularly waterfowl (zinc phosphide in cackling geese) and raptors, wild canids, mustelids, and felids (anticoagulant rodenticides), and pasture-based migratory songbirds in the Willamette Valley (zinc phosphide).	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 and secondary toxicities (anticoagulants).	Applicators must follow label restrictions for legal application and avoidance of primary and secondary toxicity to non-target species. Involve ODA Pesticides Staff and USFWS in die-offs including migratory species or off- label application of product. Public outreach and education on effects on non-target species.
Canine distemper	Raccoons, foxes, skunks, coyotes, wolves, and seals	Observed in raccoon and fox populations when population densities are high. Spillover from domestic dogs can occur. Infected wildlife also put unvaccinated dogs at risk.	Continue to promote prevention (e.g., by securing garbage, not leaving any pet food outdoors, etc.). Use caution when moving nuisance raccoons. Promote vaccination programs in domestic pets.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Rabies	Bats (primary reservoir in Oregon and the only variant to be detected in the state). Occasional pathogen spill-over into other terrestrial mammals (e.g. raccoons, skunks, foxes, and coyotes). All mammals are susceptible including unvaccinated domestic pets (primarily dogs, cats, and livestock). Human rabies cases are rare in the U.S.	Zoonotic disease. Handling of sick or dead bats, exposure of pets to sick bats or other wild mammals resulting in contact or a biting incident, and unvaccinated domestic pets can result in transmission. Bat strain rabies occurs naturally at very low prevalence levels (<1%) in bat populations in Oregon. Southwestern Oregon has had repeated bat strain rabies outbreaks in non-bat mammalian wildlife.	Continue to promote vaccination programs in domestic pets. Conduct outreach and education to teach people to avoid sick wild mammals or those with unusual behavior. Follow zoonotic disease guidance by the Centers for Disease Control and Prevention.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Canine parvovirus (includes several closely related viruses, such as feline panleucopenia)	Raccoons, foxes, coyotes, and wolves, principally. Canine parvovirus can infect unvaccinated domestic cats.	Wildlife 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	All mammalian wildlife are susceptible. Multiple pathogenic serovars affect rats, mice, squirrels, raccoons, skunks, opossums, foxes, deer, and marine mammals (seals, sea lions, porpoises)	A zoonotic multi-serotype bacterial disease transmitted from contaminated urine of infected animals	Conduct outreach regarding the importance of avoiding contact with seals and sea lions and carcasses along Oregon's coast. Leptospirosis is considered a zoonotic disease.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Tularemia	All mammals are susceptible (except coyotes) but especially rodent and lagomorph species. Several bird and amphibian are also susceptible.	Tularemia can be transmitted through inoculation from parasitic blood feeding arthropod vectors (mosquitos, fleas, tabanid flies, and ticks), ingestion of contaminated food or water, by direct contact with infected blood or tissues through dermal or ocular mucous membranes, or by inhalation of aerosolized pathogen. This bacterial disease can be more prevalent when mammalian hosts occur at higher population densities.	Tularemia is a zoonotic disease with a North American and European distribution but has not been identified in Central or South America, or Africa. Sick or deceased rodents or rabbits should not be handled without gloves, mask, and eye protection.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Plague	Rodent species (particularly mice) can serve as hosts and can suffer high rates of mortality (e.g., prairie dogs). Many mammals are susceptible; canids are refractory.	Fleas act as vectors. Conditions are most conducive to transmission during high rodent population cycles. Birds, lagomorphs, and carnivores may maintain or disseminate the disease by transporting fleas or ticks or infected prey.	Plague is widespread in wild rodent populations west of the 100th meridian (west of the central U.S.). Control can be achieved through an oral vaccination program or burrow dusting with insecticides. Plague is a zoonotic disease.
Notoedric mange	Western grey squirrels, northern and southern flying squirrels	Transmission is primarily through direct contact of affected and unaffected animals and transfer of the mite *Notoedres centrifera*. Increased squirrel densities associated with competition for sparse food resources can be conducive to spread.	Restrict artificial feeding and animal congregations and movement of host or carrier animals.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Exotic biting lice (*Cervicola* (*Damalinia* spp., *Bovicola tibialis*)-Deer hair loss syndrome	Black-tailed, white-tailed, and mule deer	Lice are passed through direct contact between deer and indirectly from common use of bedding sites.	Conduct public education to discourage feeding or baiting deer, which congregates animals and can increase spread of lice. *Cervicola* spp. is widespread in the black-tailed deer population from Washington to central California. *Bovicola tibialis* is found in scattered pockets of mule deer in Oregon, Nevada, Idaho, Washington, and California.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Adenovirus hemorrhagic disease (AHD)- caused by Odocoileus adenovirus (OdADV-1)	Black-tailed, white-tailed, and mule deer. Younger deer are more susceptible.	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. Outbreaks in deer fawns in rehabilitation facilities have resulted in high mortality. Most cases occur during late summer/ fall but can occur at any time of the year.	Avoid movement of adult deer and deer fawns to unaffected populations or areas. Conduct public education to discourage feeding or baiting, which congregates animals and increases disease spread. Restrict rehabilitating deer fawns at facilities with consistent adenoviral hemorrhagic disease outbreaks.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Epizootic hemorrhagic disease (EHD)	White-tailed deer are highly susceptible. Black-tailed and mule deer can also be impacted.	*Culicoides* spp. midges are the insect vectors of this virus. Drought and low water conditions concentrate susceptible animals at limited watering sites and provide conditions for midge-to-deer transmission conducive to amplification of the virus and disease outbreaks in riparian habitats. Spikes of disease typically occur in late summer/ fall.	Continue annual surveillance in previously affected areas. Conduct public education to discourage feeding or baiting, which congregates deer and can increase disease spread.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Treponeme-associated elk hoof disease (TAHD)	Roosevelt and Rocky Mountain elk	Found statewide in elk populations, with a higher incidence in Roosevelt elk. Present distribution includes Washington, Oregon, Idaho, and California. Causal bacterial agent belongs to the genus *Treponema*. Wet pastures and environmental conditions are thought to facilitate spread and infection.	Avoid movement and translocation of elk and soils from infected areas. Consider targeted removals of severely affected animals (via hunting or agency staff). Continue monitoring with the aid of citizen science and hunters.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Bluetongue virus (BTV)	Bighorn sheep and pronghorn appear to be most susceptible, with the occasional occurrence in deer.	Similar to EHD, this virus is spread via *Culicoides* spp. midges. Drought and low water conditions concentrate midges and susceptible animals. Proximity to affected livestock herds also influences disease transmission between livestock and wildlife. Spikes of disease typically occur in late summer/ fall	Continued disease surveillance and testing in suspect cases. Maintain communication with Oregon Department of Agriculture about livestock and wildlife cases. Conduct public education to discourage feeding or baiting, which congregates deer and can increase disease spread.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Bighorn sheep pneumonia	Rocky Mountain bighorn sheep, California bighorn sheep	*M.ovi* is transmitted between domestic sheep and goats and wild sheep. Acting independently, or with other pathogens like lungworms, or *Manheimia* and *Pasteurella* spp. of bacteria, *M. ovi.* suppresses the respiratory system of wild sheep and results in potentially lethal pneumonia. Once contracted, *M. ovi.* spreads quickly throughout the herd and can result in an extreme all age die-off. Surviving individuals with chronic symptoms may serve as a source of disease for newborn lamb which causes low recruitment, and may infect other populations in the area.	Maintain separation between domestic sheep/goats and wild bighorns. Maintain frequent disease monitoring and testing programs throughout restored bighorn herds in Oregon. Support research designed to mitigate effects of respiratory disease on sheep populations. Implement adaptive management strategies in infected herds such as test and remove protocols for chronic carriers. Implement management actions to enhance habitat to improve population health and vigor when faced with risk of disease.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Salmon poisoning disease	The disease occurs in wild canids and ursids and is caused by a rickettsial organism (*Neorickettsia helminthoeca*) present in a trematode parasite (*Nanophyetus salmincola*). Domestic dogs are also susceptible.	This disease is primarily found in the Cascade and Coast Ranges and in associated tributaries. Salmonids and a small number of non-salmonid fish species acquire the rickettsial parasite, which infects a stream snail (*Oxytrema silicula*) commonly eaten by the fish. Canids and bears can then acquire the rickettsial infection upon ingesting infected fish leading to acute illness and death of some affected individuals.	Educate pet owners about the potential risks to themselves from handling parasitized salmon and for dogs ingesting parasitized salmon, clinical signs of the disease in pets, and when to seek veterinary care for required antibiotic treatment. No treatment in wild canids and ursids is conducted as the disease is not population limiting in wildlife.

770 # FISH DISEASES OF MANAGEMENT CONCERN

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Sea-star wasting-densovirus (SSWD; Parvoviradae)	Many species of sea stars, urchins of concern	Causes of SSWD are unknown. SSWD causes rapid degeneration of the animal. Associated with high levels of mortality. Urchins carry disease but have not yet been detected expressing it.	Further research into the cause of the condition, particularly the viral cause, and disease monitoring are needed. Monitor effectiveness of treatments.
Infectious hematopoietic necrosis virus	Most salmonids	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 salmonids	Unknown, but condition depresses immune system and other diseases become patent	Nutrition may affect severity of infection.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Viral hemorrhagic septicemia virus	North American strain can cause high losses in marine species like herring, sardines, and mackerel.	Young immuno-incompetent fish and spawning adults. Fish spread the virus horizontally. Virus may be passed on to progeny.	Avoid by limiting exposure. Monitor for the presence of the European strain which is much more virulent.
Infectious pancreatic necrosis virus	Most salmonids and a few other marine species	Fish to fish transmission. Also vertically transmitted from parent to progeny.	Avoid 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 *Renibacterium salmoninarum*	Salmonids	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.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Columnaris disease caused by the bacterium *Flavobacterium columnare*	Freshwater fish, relatively uncommon in cold water marine fish	Warm water conditions, exposure to other infected individuals	Maintain adequate temperature and water flow. Where possible, augment flows to increase water quantity and decrease temperature.
Furunculosis caused by the bacterium *Aeromonas salmonicida*	Salmonids, some other species	Exposure to infected fish	Use antibiotic treatments 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 (particularly a rapid temperature drop for freshwater fish), and body injuries	Fungal spores are ubiquitous and no possible control of environmental conditions. Educate about condition.
Tapioca disease, caused by the myxosporean parasite *Henneguya salminicola*	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.	Provide education on the parasite and the safety of consuming flesh.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Ceratomyxosis caused by the myxosporean parasite *Ceratomyxa shasta*	Salmonids	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 *Ichthyophthirius multifiliis*	Freshwater fish	Exposure to infected individuals, warm water conditions	Where possible, augment water flows to increase quantity and decrease temperature.
Tapeworms caused by *Proteocephalus* sp., *Diphyllobothrium* sp., *Bothriocephalus* sp.	All fish	Ingestion of intermediate host carrying infectious stage of the parasite	Provide 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 *Salmincola* sp., *Argulus* sp., *Lernaea* sp.	All fish	Exposure to infected individuals, low water conditions, or overpopulation	Where possible, augment water flows to increase quantity and decrease temperature.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
NIX (Nuclear Inclusion X)	Razor clams	Unknown. Affects gill tissue (branchial epithelium). Associated with high levels of mortality in Washington.	Further research and monitoring are needed.
Trematode	Razor clams	Unknown. Found in the gonad.	Further research and monitoring are needed.
Domoic acid (DA) diatom (*Pseudo-nitzschia* sp.)	Primarily affects marine birds and mammals. Can also contaminate shellfish, especially razor clams, posing a risk to humans who consume them.	DA is a naturally occurring toxin produced by the diatom *Pseudo-nitzschia* sp., a microscopic marine alga. Algae "blooms" increase the amount of biotoxin-producing algae. The exact combination of conditions that cause blooms is not yet known. A shellfish biotoxin closure is issued immediately if Domoic Acid levels rise above the alert level of 20ppm.	Oregon Department of Agriculture (ODA) and ODFW jointly issue recreational shellfish closures when biotoxin test results exceed safe levels. Involve Oregon Health Authority, National Oceanic and Atmospheric Administration, Oregon State University, and ODFW in research and monitoring.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Paralytic shellfish toxin (PST) -dinoflagellate	Bivalve shellfish like clams, mussels, oysters, and scallops, as well as some gastropods and crustaceans. People who consume contaminated shellfish are at risk. May affect seabirds and marine mammals.	Unknown environmental conditions. A shellfish biotoxin closure is issued immediately if PST levels rise above the alert level of 80 micrograms per 100 grams of shellfish meat. Shellfish contaminated with PST can cause minor to severe illness, and even death.	ODA monitors PST levels and, with ODFW, jointly issues recreational shellfish closures when biotoxin test results exceed safe levels. Involve Oregon Health Authority, National Oceanic and Atmospheric Administration, Oregon State University, and ODFW in research and monitoring.
Shrimp barnacle (*Sylon* sp.)	Pink shrimp (*Pandalus jordani*), spot prawns (*Pandalus platyceros*)	Unknown. Widely distributed in shrimp and prawns in the Northern Hemisphere but only recently noted by Oregon shrimpers fishing in southern Washington. Parasite generally kills host.	Further research and monitoring are needed.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Needle disease-microsporidian (*Nadelspora canceri*)	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 are needed.
Vibrio pathogen (*Vibrio tubiashii*)	Oysters and clams	Causes premature death in larvae.	Further research and monitoring are needed.
Parasitic isopod (*Orthione griffenis*)	Mud shrimp (*Upogebia pugettensis*)	Probable introduction from Asia. Gill parasite associated with population decline.	Further research and monitoring are needed.
Whirling disease	Salmonids (particularly trout and salmon). Young fish are most vulnerable. Some cyprinids serve as intermediate hosts for the parasite.	The parasite that causes whirling disease thrives in cold water. Poor water quality (low dissolved oxygen and high sediment) can facilitate transmission.	Monitoring and surveillance. Improve or maintain high water quality. Outreach and education on disease prevention and disinfection protocols. Restrict movement of fish from infected areas. Research parasite ecology to inform effective treatments.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Thiamine deficiency	Salmonids. Predatory fish can be indirectly affected from consuming prey fish. Young fish are most vulnerable.	Altered prey availability can result in inadequate intake of thiamine. Environmental contaminants can interfere with thiamine metabolism.	Maintain adequate populations of thiamine-rich prey species. Implement pollution control measures.
Sanguinicola blood fluke	Salmonids and perch species. Other freshwater fish may be at risk. Juvenile fish are esspecially vulnerable.	Warm water temperatures accelerate the life cycle of *Sanguinicola*. High populations of intermediate hosts (often snails) increase transmission rates. Low water quality can stress fish and make them more susceptible to infection.	Control of intermediate host populations. Improve or maintain high water quality. Control environmental factors that promote the life cycle of blood flukes.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Gram-positive septicemias (Lactococcus, Streptococcus)	Various species of fish, as well as shellfish. Rainbow trout and other salmonids are notably susceptible to *Lactococcus* infections.	Poor water quality and elevated water temperatures can stress fish and promote bacterial growth. Infected fish can shed the bacteria into the water and spread disease.	Increase and maintain water quality. Reduce organic load to reduce bacterial proliferation. Manage environmental stressors.
Bacterial Cold Water Disease (BCWD)	Cold-water fish species, particularly salmonids.	Colder water temperatures (4-18°C), which are optimal for bacterium's growth. Poor water quality.	Improve and maintain high water quality. Manage environmental stressors. Improve or maintain water flow.
Spring Viremia of Carp virus (SVCv)	Carp species and other cyprinids.	Outbreaks are more common during spring and early summer. Water temperatures 10-25°C. Poor water quality.	Monitor temperature and water quality. Improve and maintain high water quality. Control environmental stressors. Follow disinfection protocols for fishing and handling equipment.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Koi Herpesvirus (KHV)	Carp species and koi fish	Warm water temperatures promote the replication of the virus, especially during summer months. Poor water quality.	Optimize water conditions. Monitor water temperature and quality. Improve water flow. Restrict movement of fish from infected areas.
Asian Tapeworm (*Bothriocephalus acheilognathi*)	Freshwater fish. Particularly cyprinids, such as carp, but may affect rainbow trout and other salmonids.	High-density fish populations. Poor water quality and warm water temperatures. Movement of infected individuals. Abundance of aquatic invertebrate intermediate hosts (e.g., copepods) facilitate the tapeworm's life cycle.	Avoid human-caused movement of infected fish to new areas. Follow disinfection protocols for field and aquaculture equipment. Reduce populations of intermediate hosts. Monitor water temperature and quality.
Aphanomyces infection	Salmonids, particularly rainbow trout, and cyprinids. Some species of shrimp. Certain amphibians may be susceptible.	High-density fish populations. Poor water quality. Nutrient pollution and organic waste accumulation can favor fungal development. Some species of *Aphanomyces* are more virulent under certain temperature conditions.	Improve water quality. Control organic matter and reduce excess nutrients. Monitor water temperature.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Management Approaches
Channel catfish virus (CCV)	Primarily affects catfish and other species in the Ictaluridae family. Juvenile or fingerling catfish are especially vulnerable.	CCV outbreaks are more common in warmer months, as the virus thrives at higher temperatures. Poor water quality can make fish more vulnerable to infections.	Improve or maintain water quality. Monitor water temperature.
Largemouth Bass Virus (LMBV)	Primarily affects largemouth bass and other species in the Centrarchidae family, which includes bass and sunfish.	Warm water temperatures (68-86°F) promote the replication and spread of the virus. Outbreaks are more common in summer months. Poor water quality can make fish more vulnerable to infections.	Improve or maintain water quality. Monitor water temperature. Monitor for viral presence.

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Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Surveillance and Management Recommendations
Chronic wasting disease of cervids (CWD)	Deer, elk, moose. Captive caribou and reindeer are also at risk.	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 is also possible from long-term environmental contamination.	Conduct surveillance of vehicle-struck and hunter-harvested animals and animals observed with clinical signs. Ban importation and movement of live cervids and hunter-harvested neural tissues imported from wild cervids taken in other states.
Meningeal worm or "brain worm" (*Parelaphostrongylus tenuis*)	White-tailed deer. Moose, elk, mule deer, black-tailed deer, and pronghorn 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. Consider increasing surveillance using molecular tools.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Surveillance and Management Recommendations
Meningoencephalitis associated with *Carnobacterium maltaromaticum*-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 are needed.
Morbillivirus (phocine and cetacean) in marine mammals	Seals, dolphins, whales	Morbilliviruses are highly contagious and cause serious disease with immunosuppression in their hosts. The virus is likely to infect most of the immunologically naive individuals in a population. Herd formation and migration increase the probability of transmission.	Further research and monitoring are needed. Monitor global mass mortality events such as those seen along the eastern U.S. and eastern Pacific in dolphins.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Surveillance and Management Recommendations
Pigeon paramyxovirus (PPMV-1)	Pigeons and doves	Congregation of birds at feeders or watering sites promotes spread of the disease since it is spread via direct contact and feces.	Consider surveillance and monitoring to detect PPMV-1. Maintain biosecurity around poultry operations.
Salamander chytrid fungus (*Batrachochytrium salamandrivorans*)	Salamanders, especially newts	Unknown. Globalization and lack of biosecurity, importation of infected species via the pet trade, and internet shipments of amphibians likely promote spread.	Maintain strict biosecurity and importation protocols. Evaluate novel biosecurity measures. Increase public awareness and education regarding risks to conservation, species impacts, and global health. Further research and monitoring are needed.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Surveillance and Management Recommendations
Snake fungal diseases (*Ophidiomyces ophiodiicola* and *Parananizziopsis sp.*)	Snakes	A disease in snakes caused by the fungus *Ophidiomyces ophiodiicola*. This fungus was first isolated from captive snakes in Europe and the United States in the mid-1980s, and now experts consider it to be an emergent pathogen across North America.	Restrict the interstate movement of wild caught snakes through collectors or the pet trade. Conduct surveillance, research and monitoring.

Disease or Disease-Causing Organism	Vulnerable Species	Conditions that Promote Disease Issues	Surveillance and Management Recommendations
White-nose syndrome (WNS)	Cave-dwelling, hibernating bat species (13 of 15 Oregon species)	Low temperatures and high humidity; bat hibernacula in caves. Potential effects on migratory tree bats are unknown. Primary cause of mortality is skin infection by *Pseudogymnoascus destructans*, particularly on the wing areas essential for flight, and impacts to other vital physiologic processes like heat exchange, circulation, and water balance. Hibernating bats affected by WNS wake up frequently during winter due to the associated infection, which results in bats using up fat reserves and often starving to death before spring arrives.	Conduct active surveillance of susceptible bats, guano and habitats. Follow recommendations in interagency management plan and decontamination protocols.

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