Chapter 4. Refuge Biology and Habitat

This chapter addresses the biological environment of the Oregon Islands, Three Arch Rocks, and Cape Meares NWRs; however, it is not an exhaustive overview of all species and habitats. The chapter begins with a discussion of biological integrity; we then focus on the presentation of pertinent background information for the conservation targets designated under the CCP. Background information includes a description, location, condition, and the trends associated with wildlife or habitats, key ecological attributes, and stresses and sources of stress (collectively, "threats") to the target. The information presented was used when the CCP team developed goals and objectives for each of the conservation targets. The biological integrity (601 FW3) analysis section introduces the biological environment by describing the native wildlife and vegetation that occur on the three Refuges in comparison to the surrounding landscape. The conservation target identification and analysis section identifies species, species groups, and features the Refuge Complex personnel will actively manage to accomplish biological conservation and restoration. The biological research and monitoring programs section describes techniques and studies and their relationship to conservation targets.

4.1 Biological Integrity Analysis

The National Wildlife Refuge System Improvement Act of 1997 directs the FWS to ensure that the biological integrity, diversity, and environmental health (BIDEH) of the Refuge System are maintained for the benefit of present and future generations of Americans. In simplistic terms, elements of BIDEH are represented by native fish, wildlife, plants, and their habitats as well as those ecological processes that support them. The Service's policy on BIDEH (601 FW 3) also provides guidance on consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges, and associated ecosystems that represent BIDEH on each refuge.

The Oregon Islands and Three Arch Rocks NWRs include rocks, reefs and islands in an isolated and protected marine environment. In addition, Oregon Islands NWR includes two coastal headlands with native grasslands, second-growth forests, rocky cliffs, and human-impacted dunes and bluffs. Cape Meares NWR encompasses one of the few remaining stands of old-growth forest on the Oregon coast. The marine waters adjacent to or surrounding these three NWRs are not under the jurisdiction or management of the Service.

Human impacts on refuge lands have been limited since refuges are protected from exploitation and development. However, the ecosystem surrounding the Refuges has undergone dramatic alteration since pre-settlement times. The most discernible change is the conversion of large portions of coastal areas into residential and commercial lands. Also, the marine ecosystem experiences impacts due to human presence, resource exploitation, and climate change. This summary is not a complete analysis of all factors related to changes in native vegetation, fish, and wildlife. Much of the information presented here is based upon the CCP team's knowledge and existing scientific understanding of the area.

Aerial view of development along the coast. (Roy W. Lowe/USFWS)

4.1.1 Coastal lands conversion and development

4.1.1.1 Human population growth

The effects of human-induced stresses on habitat and species of the coastal lands and estuarine systems of the Pacific Northwest have increased due to population growth. As of 2005, Oregon has an estimated population of 3,641,056, which is an increase of 49,693 (1.4%) from the prior year and an increase of 219,620 (6.4%) since the year 2000. The cities of the central Oregon coast have experienced moderate (24–49% increase) to rapid (greater than 50% increase) human population growth rate over a 20-year period from 1980 to 2000 (Achterman et al. 2005). As a result of the population growth, activities such as boating, personal aircraft, surfing, and other recreational activities have increased along the coast. These activities often cause stress, reduced productivity, and increased predation rate to seabirds and pinnipeds associated with the Refuge (LCDC 1994; Rodgers and Smith 1997; Rojek et al. 2007). Please refer to section 4.2 for further discussion and detailed descriptions of habitat, associated wildlife, and disturbance factors.

4.1.1.2 Land development

The beautiful Oregon coast offers breathtaking scenery, mild temperatures and climate, wide open spaces, recreational activities, and many other desirable features that attract people from all over the world. Oregon coast real estate has become a popular commodity and many coastal lands are being or have already been developed into vacation resorts, commercial property, and residential communities. New residential subdivisions and other developments have emerged along the coast at an increasing rate in the last 20 years. Many new residential communities are in

close proximity to the ocean and structures are being built near water's edge. Building structures and development continually encroach upon wildlife habitat and in some cases cause increased stress on biological resources (SCBC 2003).

4.1.1.3 Logging

The logging industry began in the Pacific Northwest at the beginning of the twentieth century and has been one of the dominant natural resource extraction industries in Oregon's economy. Many old-growth forests have been logged and the wildlife resources associated with the habitat altered (Maas-Hebner and Schrader 2001). The public now realizes the importance of the old-growth ecosystem and actions have been initiated to preserve these fragile wildlife areas. The establishment of Cape Meares NWR in 1938 ensured that these refuge lands are protected; however, forested areas surrounding Cape Meares NWR have undergone extensive clearcut logging and replanting during the past century.

4.1.2 Marine ecosystem changes

4.1.2.1 Contaminant load

Shipping lanes for cargo ships and large oil transport vessels that carry crude oil to refineries are located along the Oregon coast. These shipping lanes are designated marine highway channels or routes that vessels use near the coastline to avoid marine hazards and are part of the Great Circle Route that ships transit between the west coast and Asia. More than 7,000 ships per year travel the route, almost 20 per day, and the number is growing. With increased vessel presence, the risk of oil spills that can cause devastation to the marine ecosystem increases as well. Large-scale marine oil spills that have occurred in Oregon or influenced Oregon resources include the New Carissa in 1999, the Tenyo Maru in 1991, the Nestucca in 1988, and the Blue Magpie in 1983. The fuel or oil is persistent and remains in the environment for years and causes long-term environmental damage as well as acute and chronic effects to wildlife. In addition, ballast water and other waste dumping from ocean vessels increase contaminant load in the Pacific Ocean (Flagella et al. 2007). Pollution, caused by the transfer and introduction of exotic or foreign aquatic species through the ballast water of ships, threatens the conservation and sustainable use of biological diversity (Bax et al. 2003).

4.1.2.2 Changes to colonial nesting birds

Approximately 1.3 million seabirds, representing 13 species, breed at 393 colonies along the Oregon coast. Current seabird breeding populations for the entire coast of Oregon can be found in Naughton et al. (2007) or are available by contacting the refuge headquarters in Newport, Oregon. The most common seabird species that breeds in Oregon is the common murre with 685,000 individuals or 53% of total breeding population (Naughton et al. 2007). Murres are difficult to census, as numbers on the colony at any one time depend on a host of variables including ocean productivity, nesting chronology, time of day, weather conditions, disturbance events, and tidal conditions (Birkhead 1978; Rodway 1990; Slater 1980). However, the overall health and status of the marine ecosystem can be determined by observing population trends of the common murre since populations are indicative of prey availability, suitable nesting habitat, and overall ocean productivity (Carter et al. 2001). Murres have been termed marine condition "indicator species", a biological species that defines a trait or characteristic of the environment. Indicator species can be among the most sensitive species in the region, acting as an early warning of changing environmental conditions. Population surveys have been conducted at the Yaquina

Head common murre colony at Newport, Oregon, from 1988 to 2007 and indicate an upward population trend (Figure 4-1). The population increase at this colony is probably a result of bird immigration from other colony sites that are impacted by bald eagle disturbance (USFWS unpublished data). The murre population at Yaquina Head is increasing; however, the total population in Oregon remains stable and fluctuates annually in correlation with marine ecosystem changes and other factors.

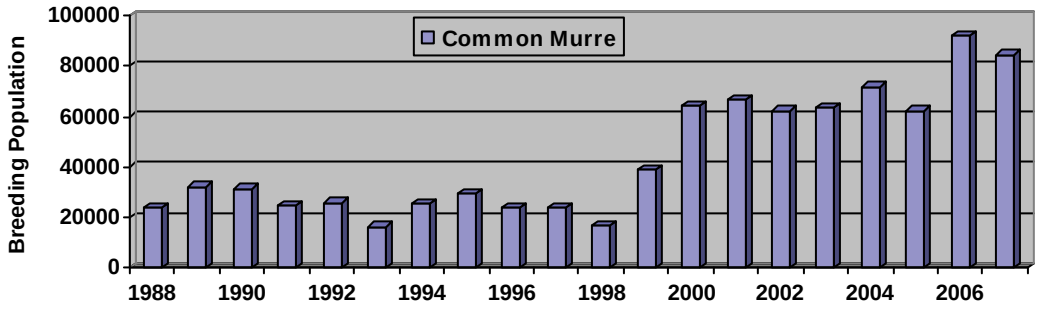

Figure 4-1. Breeding population of common murre at Yaquina Head (1988–2007; USFWS unpublished data).

4.1.2.3 Coastal biodiversity changes

Currently, we are in a state of climate change and global warming that will increase the earth's surface temperature, cause ocean levels to rise due to polar ice melt, change precipitation patterns, cause glacial retreat, and influence ocean productivity and food availability (Defenders of Wildlife 2006; Irons et al. 2008; Kuletz et al. 2003). The climate change effects for Oregon's coastal ecosystem likely include a projected increase in ambient temperature, more frequent and intense wildlife fires, changes in stream flow and freshwater systems, and rising sea levels that will inundate coastal areas (Defenders of Wildlife 2006). Climate-induced changes in the California Current, driven by wind and climate effects off the Oregon coast, may delay upwelling of nutrient rich waters that will result in a reduction of prey for seabirds and pinnipeds (Irons et al. 2008; Lawler et al. 2008). In extreme events of change in upwelling, there is the potential of increased dead zones where low oxygen levels in ocean waters inhibit most forms of marine life (Barth et al. 2007).

4.1.3 Influx of exotic and invasive species

One of the largest threats to wildlife and habitat of the Refuges is invasive plants and pest animals. Invasive plant species displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes (Olson 1999). Introduced native and non-native animal species are usually in direct competition with native wildlife species for food, shelter, and breeding areas and often cause existing native species populations to decline or become extirpated. Ultimately, both plant and animal invasive species can result in considerable impact to native wildlife and the habitat they are dependant upon. For example, introductions of Arctic (*Alopex lagopus*) and red (*Vulpes vulpes*) foxes for fur farming purposes resulted in widespread extirpation of breeding Aleutian cackling geese in the Aleutian Islands, Alaska, due to predation (Bailey and Trapp 1984; USFWS 1993). The fox decimated goose populations by preying upon vulnerable nesting adults, chicks, and eggs. The Aleutian

cackling geese inhabit refuge lands in Alaska during the summer and Oregon during the winter. Because of cooperative recovery efforts, the Service officially delisted this species from threatened status in 2001 (USFWS 2001). Another example is ice plant. Native to South Africa, it was brought into the country for bank stabilization and landscaping. This species excludes native dunemat vegetation, stabilizes sand, and displaces native dune plant species such as beach layia (*Layia camosa*), Wolf's evening primrose (*Oenothera wolfii*), and pink sand verbena (NPS 2001).

4.1.3.1 Invasive plants

Non-native invasive plants on the Refuges include gorse, European beachgrass, tansy ragwort, Canada thistle, and ice plant (Kagan 2002; USFWS unpublished data). This list is not all inclusive and includes only the most problematic species; many other exotic plants have also been introduced.

The most aggressive and prolific species on the Coquille Point Unit is gorse. Gorse is native to western and central Europe where it was cultivated as hedgerows and reserves for livestock forage. In southern coastal Oregon, gorse was introduced by early European emigrants and planted as an ornamental shrub. This invasive non-native plant grew in monotypic stands and became an established exotic shrub in most coastal habitats. This species is extremely competitive, displaces native plants, and impoverishes the soil. In addition, it creates an extreme fire hazard due to oily, highly flammable foliage and seeds, and abundant woody material in the plant's center. The city of Bandon in southwestern Oregon was almost completely destroyed by a fire fueled in part by gorse in 1936. All but 16 buildings out of 500 were completely burned to the ground.

Widespread infestations of ice plant occur throughout the southern portion of Oregon Islands NWR and along public mainland beach areas. This species stabilizes sand and prevents its natural movement, which most native dune species need to survive. Ice plant is usually associated with disturbed areas and is capable of growing over entire beaches (NPS 2001).

Tansy ragwort, a common wildflower introduced by early pioneers, is native to the Eurasian continent. This species contains many different alkaloids, making it poisonous to animals, and can have a cumulative effect (Sharrow et al. 1988). A substantial infestation of tansy ragwort exists on the north side of the riparian area at Cape Meares NWR, predominantly on adjacent county lands. This species also occurs at Crook Point and many islands along the coast.

4.1.3.2 Pest animals

Native and non-native mammals that have the potential to negatively affect seabird populations and their habitat on the Refuges include raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), short and long-tailed weasels (*Mustela* spp.), mink (*Mustela vison*), striped and spotted skunks (*Spilogale putorius, Mephitis mephitis*), feral cats, dogs (*Canis familiaris*), rats and small rodents (*Rattus* spp.), gray and red fox (*Urocyon cinereoargenteus*, *Vulpes vulpes*), and feral livestock (e.g., sheep, goats). Based on observations at the Coquille Point Unit, knowledge of local wildlife and feral animal populations, and a review of scientific literature, the Service and cooperating agencies have identified red foxes, feral cats, rats, and raccoons as having the greatest potential to negatively impact Oregon's seabird colonies (USFWS 2005a). Predation, particularly by non-native predatory mammal species, has been documented to have devastating effects on nesting seabird populations throughout the world (Ashmole et al. 1994; Atkinson 1985; Gaston 1994; Jehl 1984; Kadlec 1971; USFWS 1993). Predator impacts on seabirds may include

direct predation on eggs, young and adults; reproductive failure due to disturbance during nesting season; and detrimental alteration of habitat including destruction of nesting burrows. These impacts can result in complete abandonment of nesting colonies.

Raccoons are opportunistic omnivorous predators that have adapted well to human-altered urban and rural landscapes. An increasing population of coastal raccoons can be attributed to easily accessible human supplied or available food sources (garbage cans, compost bins, gardens, outdoor pet food bowls). When available, raccoons naturally feed upon avian and mammalian food resources including seabirds (eggs, young, and adults). In 2006 and 2007, signs of mammalian predation were documented on Saddle Rock of Oregon Islands NWR. Through direct observations and the use of infra-red photographic techniques, refuge biologists were able to determine that western gulls, great horned owls (*Bubo virginianus*), and barn owls (*Tyto alba*), with river otter and raccoon, impact the seabird colony. Biologists concluded raccoons were the primary predator preying upon nesting Leach's storm-petrels, and eradication efforts were initiated (USFWS 2005a).

A feral cat is a domestic cat that is free-roaming, untamed, and un-owned. These cats live and breed entirely in the wild and depend on native wildlife as prey items. Feral cats are often apex predators in local ecosystems feeding on local birds and small mammals. Feral cat predation has been documented to be particularly devastating to colonies of island-breeding seabirds. Keitt et al. (2002) documented annual growth rates of black-vented shearwaters (*Puffinus opisthomelas*) and manx shearwater (*Puffinus puffinus*) to decline approximately 5% for every 20 cats in a population of 150,000 birds on Natividad Island, Baja California Sur, Mexico. Jehl (1984) summarized conservation problems associated with seabirds in Baja California, Mexico, and the Pacific Coast of North America and concluded that feral cats are an important predator of island seabirds, specifically storm-petrels and alcids, including Craveri's murrelet (*Synthlibocamphus craveri*). Feral cats were documented by Moors and Atkinson (1984) to be responsible for killing 1.2 million birds each year on Kerguelen Island in the southern Indian Ocean (USFWS 1993). Ashmole et al. (1994) attribute the decline of shearwaters on Ascension Island in the South Atlantic to the introduction of feral cats and rats. Seabirds nesting on the mainland at Yaquina Head, Oregon, have experienced feral cat predation in the past (USFWS unpublished data).

Feral and trespass cats and dogs can also be a source of disturbance of native wildlife on the Refuges. The Coquille Point Unit and Cape Meares receive heavy visitor use annually and it continues to grow. Current wildlife-dependent public uses on these refuges include wildlife observation, photography, interpretation, and environmental education. Dog walking, with animals on leash, is a non-wildlife dependent use that currently occurs on the refuge trail at Coquille Point. An Appropriateness Finding and a Compatibility Determination (CD) have been completed for this use on the Coquille Point Unit, and these documents are appended to this CCP (Appendices D and E).

Rats and small rodents of different species are found along the Oregon mainland and likely occur on some rocks and offshore islands. Rats are considered to be a threat to seabirds during all life stages, but especially to eggs and chicks prior to fledging. The potential introduction of rats to the islands and rocks from shipwrecks is of particular concern. The sailing ships of European explorers provided a mechanism for roof rats (*Rattus rattus*), also known as black rats, to spread rapidly to six continents and thousands of islands (Clark 1981). Roof rats can occupy available vegetated habitats from desert scrub to lush montane forests (Clark 1981). They commonly live in trees and can potentially prey upon almost any bird nest (Atkinson 1985). Roof rats are

omnivorous with plant foods comprising an average of 80% of sampled stomach contents. However, animal food also occurred in at least 81% of the rats examined on the Galapagos Islands (Clark 1981).

The Norway rat, also called the house rat, sewer rat, wharf rat, brown rat and gray rat, was also introduced into North America by sailing ships from Europe (Timm 1994). The predominantly nocturnal habits of these rats make both their identification and observation of their predatory behavior difficult. Consequently, the incidence of rat predation is probably higher than realized (Atkinson 1985). Even a low frequency of rat predation can have a severe effect if, for other reasons, there are few birds (Bourne 1981; Moors and Atkinson 1984). According to Gaston (1994), introduced raccoons and rats are believed to be responsible for the decline of the formerly very large colony of ancient murrelets (*Synthliboramphus antiquus*) at Langara Island, British Columbia. This population has decreased by about 90% over recent decades. Additionally, raccoons and rats are believed to be responsible for population declines of ancient murrelets occupying colonies on Lyell Island, the Limestone islands, and islands of Englefield Bay in British Columbia. In all cases, these declines seem to be related to the presence of introduced rats or raccoons. Unless rats and raccoons can be eliminated, or the spread of raccoons can be halted, a high proportion of the population of ancient murrelets may be extirpated within a few decades (Gaston 1994). Atkinson (1985) documented that within a few years of the introduction of rats on Lord Howe Island, Australia; more than 40% of the indigenous bird species became extinct.

Historically, feral sheep and goats have been observed on the mainland adjacent to refuge lands and on islands on the Oregon south coast. Goat Island, on the Oregon south coast, received its name because goats were placed on the island to graze by a Scottish pioneer named George Harris in the late 1880s. In 2006, feral goats were observed at Boardman State Park during a seabird survey and again in 2008 (USFWS unpublished data). Prior to acquisition in 2000, feral goats were observed grazing at Crook Point (USFWS unpublished data). Feral goats and sheep could cause damage to wildlife and associated habitat if they were immigrated to or were released on refuge lands. During the colonization period, many islands off the East Coast were cleared of predators and set aside for sheep: Nantucket, Long Island, and Martha's Vineyard were notable examples. Placing semi-feral sheep and goats on islands was common practice in colonization during this period (Anderson 2006).

Red foxes are notorious seabird predators and have caused many population declines, and in some cases total eradication, of a prey species from an area. The Service (1993) conducted a comparative study of bird populations on islands in Alaska with and without foxes, and documented that fork-tailed storm-petrels, Leach's storm-petrels, Aleutian terns (*Sterna aleutica*), arctic terns (*Sterna paradisaea*), ancient murrelets, Cassin's auklets, and tufted puffins were not present in substantial numbers on islands with foxes. During 2001 and 2002, red foxes caused the failure of seabird nesting on Middle Coquille and Elephant Rocks within Oregon Islands NWR (USFWS unpublished data). Red foxes were observed loafing near the entrances to the nesting burrows of tufted puffins and pigeon guillemots and in the area of ground nesting western gulls, Brandt's cormorants and double-crested cormorants (USFWS unpublished data). Red foxes were also observed eating and burying western gull eggs. During the 2003 through 2008 nesting seasons, no red foxes were observed in the area and nesting western gulls, pigeon guillemots, and black oystercatchers successfully bred on the rocks. A number of seabird species, including tufted puffin and Brandt's cormorant, which historically bred on Middle Coquille and Elephant Rocks, were observed in the area, but continued to restrict their breeding efforts to islands not accessible to red foxes (USFWS unpublished data). In addition to the loss of valuable

seabird breeding habitat, opportunities to observe seabirds like tufted puffins have been greatly reduced due to the presence of red fox.

4.1.3.3 Integrated Pest Management (IPM)

Mechanical, physical, biological, and chemical means have been utilized to combat invasive plants throughout the Refuges in accordance with 7 RM 14 (Pest Control policy). Plans to remove, control, and prevent establishment of non-native plant species and treat infestations with IPM techniques are implemented on an as-needed basis. Control efforts are planned annually, as staff and funding are available. An insect introduced for biological control for non-native gorse includes the gorse spider mite (*Tetranychus lintearius*) that was only marginally effective because of predation by other arthropods at Coquille Point Unit. Considerable progress has been made in some areas with infestations of invasive plants being reduced or eliminated by volunteers and refuge staff (USFWS unpublished data).

Control of pest mammals negatively effecting seabird colonies have been implemented at the Crook Point Unit where raccoons have impacted nesting Leach's storm-petrels (A. Pollard unpublished data). Efforts for the predation management program are guided by the tools and techniques detailed in the Environmental Assessment for Mammalian Predator Damage Management to Protect Seabird Colonies on Oregon Islands National Wildlife Refuge, Three Arch Rocks National Wildlife Refuge, and Adjacent Mainland Areas (USFWS 2005a).

4.2 Conservation Target Selection and Analysis

4.2.1 Conservation target selection

In preparing this plan, the Service reviewed other local, regional, and national plans that pertain to the wildlife and habitats of the Oregon Coast. The Service also sought input from Oregon State conservation agencies, non-governmental organizations, and the general public. The refuge purposes, as stated in the enabling legislation for each refuge (see Chapter 1) were carefully reviewed as was the Refuges contribution to maintenance of BIDEH (Appendix J) on the Oregon Coast. As a result of this information gathering and review process, certain species and habitats were identified as resources of concern. From this list of resources of concern, those species and habitats that are most representative of refuge purposes and habitats, BIDEH (Appendix J), as well as other Service and ecosystem priorities, were chosen as priority resources of concern. Examples include the common murre (refuge purposes) for Oregon Islands Refuge, the Vaux's swift (represents species that utilize old-growth Sitka spruce) for Cape Meares, and the Brandt's cormorant (species that nests on the rocks) for Three Arch Rocks. The complete list of priority resources of concern, i.e., focal species and habitat types, for each refuge is also contained within Appendix J. These priority resources of concern are the species and habitats whose conservation and enhancement will guide refuge management into the future. Potential management actions will be evaluated on their effectiveness in achieving refuge goals and objectives for the priority resources of concern.

Management of refuge focal species and habitats that support them will benefit many of the other native species that are present on the Refuges and the Oregon Coast. Many of the species that will benefit from management of the refuge focal species are identified in the "Other Benefiting Species" column in Appendix J. Through the consideration of BIDEH, the Refuges will provide for or maintain all appropriate native habitats and species. Refuge management priorities may

change over time and since the CCP is designed to be a living flexible document, changes will be made as needed and at appropriate times as identified by refuge personnel.

Note that although migratory birds comprise a major focus of the purpose on the Refuges, migratory birds were not designated as a conservation target separately, mainly because migratory birds occupy such a variety of habitat niches. Also, Complex staff members do not attempt to monitor and document the status of many migratory bird species, such as passerines, due to time constraints and work load. Instead, most migratory bird species were grouped or categorized into groups as seabirds and endangered, threatened, or sensitive species (Table 4-1).

Table 4-1. Key habitats or species groups identified during the conservation target identification analysis

System Targets	Nested or Benefiting Resources
Old-growth and late-successional Sitka spruce/ salal forest habitats	All vegetation and wildlife species associated with old-growth forest and late-successional Sitka spruce/salal forest habitats as detailed in Appendix J.
Steep rock cliff and coastal erosion bluff habitats	All vegetation and wildlife species associated with steep rock cliff and steep coastal erosion bluff habitats as detailed in Appendix B but not including seabirds and endangered, threatened, or sensitive species.
Stream and riparian habitat	All stream and riparian habitat associated species as detailed in Appendix B but not including seabirds and endangered, threatened, or sensitive species.
Headland riparian shrublands	All vegetation and wildlife species associated with headland riparian shrubland habitat associated species as detailed in Appendix B but not including seabirds and endangered, threatened, or sensitive species.
South coast headland erosion forblands and dunes	All vegetation and wildlife species associated with south coast headland erosion forbland and dune habitat associated species as detailed in Appendix B but not including seabirds and endangered, threatened, or sensitive species.
Rare early successional south coast headland prairie-grassland habitats	All early successional south coast headland prairie-grassland habitat associated species and habitat.
Rocks, reefs, and islands	All vegetation and wildlife species associated with coastal rocks, reefs, and islands that extend above the surface of the ocean and are surrounded by water at mean high tide, including nesting and roosting seabirds, wintering waterfowl, and other migratory birds as detailed in Appendix B.
Seabirds	All birds that frequent coastal waters and nest and/or loaf on refuge rocks, reefs, islands, and cliffs.
Endangered, threatened, or sensitive species	Species currently present or suspected historically to have inhabited the Refuges that are listed as endangered, threatened, candidate, or proposed under the Federal Endangered Species Act, as well as Federal Species of Concern. Target also includes Oregon State-listed threatened, endangered, or candidate species but does not include State-listed sensitive species; these are included as nested species under the appropriate habitat targets.
Pinnipeds	All pinnipeds that frequent coastal waters, haul-out, and or breed on refuge rocks, reefs, and islands.

4.2.2 Conservation target analysis

4.2.2.1 Old-growth and late-successional Sitka spruce/salal forest

4.2.2.1.1 Description and location

Cape Meares NWR provides permanent protection to one of the few remaining old-growth Sitka spruce and late-successional forest habitats on the Oregon coast. The Refuge is located along the Three Capes Scenic Route, approximately 10 miles west of Tillamook, Oregon. The 138-acre forested headland consists of Sitka spruce and western hemlock with intermittent open areas of forest wind-throw and an understory dominated by salal. The overstory Sitka spruce and western hemlock are very large and some individual trees approach 800 and 195 years in age respectively (USFWS 2004). Oregon's state champion Sitka spruce, the largest known representative of its species in Oregon, is located on Cape Meares NWR. This individual tree stands 144 feet tall, measures 576 inches in circumference and 15.5 feet in diameter. The crown averages 93 feet across (crown spread 90 by 88 feet), and it is estimated at 750 to 800 years old (French 2008).

Forested communities present at Cape Meares NWR include both Sitka spruce/salal and Sitka spruce-western hemlock/swordfern (*Polystichum munitum*). Neither community is represented in a pure stand, which is typical for coastal Sitka spruce forests. There is a tendency for the salal understory to predominate toward the windward or coastal edge of the site and for the swordfern understory to dominate on steep northerly slopes and to the interior of the site. The understory in the community is dominated by swordfern with salal, salmonberry, leatherleaf licorice fern (*Polypodium scouleri*), wood sorrel (*Oxalis oregana*), evergreen huckleberry, and vine maple (*Acer circinatum*) also occurring in lesser amounts (USFWS 2004).

The Sitka spruce-western hemlock/swordfern vegetation type, once common to the central and northern Oregon coast, remains uncut in only a few isolated areas, including Cape Meares NWR. This community is found on the upper reaches of the cape, usually on more gentle topography on all aspects. The canopy has a more closed appearance than that of the Sitka spruce/salal community. The western hemlock dominates the overstory in actual numbers of trees, but Sitka spruce trees are much larger in diameter. Pockets of extensive blowdown are found in this community, especially on the north slope of the cape. The Sitka spruce/salal community is found primarily as a narrow band atop the ocean cliffs. The key natural process that influences the unique habitat characteristics for this community appears to be intense exposure to salt spray and high winds coming from the ocean. The spruce trees are widely spaced in this community and the understory is dominated by salal (30–80% cover), and salmonberry (15–30% cover; USFWS 2004).

4.2.2.1.2 Condition and trends

The forest community within the Cape Meares NWR represents old-growth or late-successional forest conditions with representative large downed wood, standing snags, and a variety of age class trees present. The forest on surrounding refuge lands has been harvested by clearcutting, the majority of which took place 25 to 30 years ago. Because of adjacent clearcut logging practices, Cape Meares is more exposed to high southerly winds and forest blowdown has increased.

In 1987, the entire refuge, with the exception of the Oregon Coast Trail, was designated an RNA by the Oregon Natural Heritage Program (2003). Within designated RNAs, natural processes are allowed to predominate without human intervention and drive successional vegetative changes. An example of this management at Cape Meares NWR is the 20-acre unit east of the Three Capes

Scenic Route that is an early seral stage forest resulting from an almost complete wind-throw of the old-growth forest during a 1981 high-wind storm event. This stand appears to have been largely a Sitka spruce-western hemlock/swordfern stand. This site is one of the very few coastal locations in the Pacific Northwest where timber salvaging of downed old-growth was not conducted following a blowdown event and natural forest regeneration was allowed to occur. However, under certain circumstances such as invasion by non-native plant species (e.g., tansy ragwort), deliberate manipulation may be used to maintain the unique features for which the RNA was established. Because of the Refuge's purpose and the RNA restrictions, management of Cape Meares NWR and RNA will focus on protection, preservation, inventory, monitoring, and research.

In order to assist settlement after the Civil War, the U.S. Congress began offering land grants from federally owned land to assist rail and wagon road construction. In 1866, the state of Oregon received a grant that included every other square mile (section) in a 40-mile swath of land stretching from Portland to the California border. Oregon then awarded a private railroad company the land, to sell to settlers, and clearcutting practices began. The BLM acquired almost 2.4 million acres and the U.S. Forest Service administered several hundred thousand acres. The federal timber sale program began with the post–World War II housing boom and within 50 years over 80% of old-growth forest was lost. Logging reached its peak in the 1980s and only several hundred thousand acres remain protected in old-growth preserves. Because land was granted as every other section, it formed a checkerboard ownership pattern. Several areas have been consolidated over the years as a result of land exchanges, and some large blocks of old-growth forest still persist in Oregon, on BLM land.

Old-growth forests in California, Washington, and Oregon cover about 10.3 million acres. Oregon has almost half of the old-growth acres with about five million acres in seven different ownerships. More than 80% of the old-growth is on federal land, primarily National Forests. Old-growth occupied about half of the forest area when the first comprehensive forest surveys were made in the 1930s and 1940s. Less than 20% of the forest is now old-growth (Bolsinger and Waddell 1993). Future trends of old-growth in the state may change, by proposals developed by federal land management agencies to alter protection for the remaining old-growth forests.

4.2.2.1.3 Associated wildlife

4.2.2.1.3.1 Migratory birds

Species known to generally occur in old-growth forests within coastal Oregon that have been observed at Cape Meares NWR include marbled murrelet and Vaux's swift. In addition, northern spotted owl may occur; however, there have been no observations or reports in the past two decades. The late-successional Sitka spruce species include brown creeper, red crossbill, pileated woodpecker, and varied thrush. Other species common to the area are bald eagle, peregrine falcon, and numerous migratory songbirds (Cornell and AOU 2008; USFWS unpublished data). Inventories and monitoring of avian species within this habitat community of the Refuge have not been initiated and are needed.

4.2.2.1.3.2 Terrestrial mammals

Observations of mammals on the Refuge have revealed the presence of a diversity of large vertebrate species including Roosevelt elk, black-tailed deer (*Odocoileus hemionus*), and black bear (USFWS unpublished data; USFWS 2004). Carnivores such as coyote (*Canis latrans*), raccoon, and striped skunk are frequently observed and an occasional mountain lion (*Felis*

concolor) may also forage or range through the Refuge (USFWS unpublished data). Seven species of rodents were documented in the old-growth forest habitat during a 1996 study, where Townsend's chipmunk (*Tamias townsendi*) and deer mouse (*Peromyscus maniculatus*) accounted for over 70% of the captured animals, along with Oregon meadow mouse (*Microtus oregoni*), California red-backed vole (*Clethrionomys californicus*), red tree mouse (*Phenacomys longicaudus*), northern flying squirrel (*Glyucomys sabrinus*), and bushy-tailed wood rat (*Neotoma cinerea*; Gomez et al. 1997). Surveys to determine current population estimates for all mammal species within this refuge habitat community have not been attempted, and estimates do not exist and are needed.

4.2.2.1.3.3 Herptiles (reptiles and amphibians)

During the 1996 study of small mammal and amphibian abundance at Cape Meares NWR conducted under contract by the Oregon Cooperative Wildlife Research Unit at OSU, five amphibian species were captured in old-growth forest habitat. These species include roughskin newt (*Taricha granulose*), western red-backed salamander (*Plethodon vehiculum*), ensatina salamander, torrent salamander (*Rhyacotriton* spp.), and long-toed salamander (*Ambystoma macrodactylum*; Gomez et al. 1997). Further inventory is needed in this habitat community to develop baseline population estimates and trends.

4.2.2.1.4 Key ecological attributes

Table 4-2 describes key ecological attributes of a functioning old-growth forest and associated indicators. For each indicator, the conditions that would represent "good" or better are shown. Desired conditions stated in the tables are descriptions and information of the listed ecosystem type as outlined by Oregon Natural Heritage Program and Information Center, OSU Institute for Natural Resources (ONHIC 2008).

Table 4-2. Old-growth and late-successional Sitka spruce/salal forest ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Late seral-stage Sitka spruce	• Various stages of decay • Large hollow snags • Some trees 300 years old or older • Multiple tree layers	• Decomposing woody material • Snags 25 meters tall • Tree/snag densities >18/hectares • 60% canopy cover
Salal dominated understory	• High stem density • Multiple floor vegetation layers • Soft loose floor debris	• Relatively low open understory and forest floor • 2 feet • Decomposing woody and plant material
Salmonberry forest	• Berry-producing shrubs	• 3–5 feet tall
Native plant species	• Total native plant cover • Understory native plant richness	• >70% • Natural succession
Stream and riparian zone habitat	• Streams with medium to steep gradient • Basalt parent geology • Canopy dominated by early successional red alder	• Step-pool morphology • High percent basalt base • Non-native invasive plants absent

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators played a role in determining the ultimate

parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process, but the ultimate objective design was subject to further discussion and consideration.

4.2.2.1.5 Threats

A threat or stress is something that destroys, degrades, or impairs a conservation target by impacting a key ecological attribute of that target. In addition, different stresses place varying degrees of pressure on the environmental system, and sources (the proximate cause of a stress) can contribute to more than one stress. Sources contributing to multiple stresses and having high contribution and irreversibility are of major concern and must be addressed.

4.2.2.1.5.1 Human activities

Human-induced wildfire is a potential catastrophic threat to old-growth forest habitat. The Fire Management Plan (USFWS 2004) needs to be reviewed annually or as needed to ensure that contact information is up-to-date and the responding agencies are familiar with allowable suppression techniques and sensitive areas within the Refuge/RNA.

At Cape Meares NWR, illegal activities such as rock climbing, mushroom collection, and general trespass have the potential to cause tremendous disturbance to wildlife and also have the potential for introduction of invasive plant species into closed areas of the Refuge. Boundary survey and posting are necessary to delineate where certain public use activities are permitted and to reduce or eliminate illegal logging or other trespass on refuge lands, and are most critical along the boundary of the Refuge/RNA tract on the east side of Three Capes Scenic Route and on the northeastern portion of the Refuge adjacent to private and county forest lands.

There are potentially direct impacts from nonfederal forest management practices on species that move between federal and nonfederal forest habitats during the year or during their life cycle. A review of the cumulative effects analysis of spotted owl habitat management alternatives, highlighting the role of nonfederal lands in maintenance of old-growth-dependent amphibian and bird species and their habitats, emphasizes the desirability of partnering with adjacent landowners to maintain and enhance habitat quality on adjacent privately owned forest lands (USFS and BLM 1994). Maintenance and improvement of habitat on adjacent forest land would also provide a protective buffer from high winds and secondary effects of logging.

4.2.2.1.5.2 Edge effects

A specialized range of plant and wildlife species exists and is dependent upon old-growth forest habitat. Some of these species depend on the more stable climatic environment of the forested interior, whereas others require snags and decaying woody debris often found there. Many species require large unbroken tracts to survive; however, the amount and quality of this habitat has gradually decreased due to logging. As forests are harvested, edges are created. The environmental conditions produced along these edges may modify habitat values that are important to interior old-growth forest dwellers. Habitat disruption and potential loss of landscape-level biodiversity may ensue if interior habitat ecosystems and processes are not sustained. Therefore, preserving sufficient interior habitat is important to protect these species and maintain biodiversity (BCMF and BCMELP 1995).

Plants and animals adapted to the moderate climatic conditions of interior habitat often cannot survive the effects of drying winds and temperature changes that penetrate from edge environments. The depth of influence for air temperature and humidity extended 120 to 140

meters from a clear-cut edge into an old-growth Douglas-fir (*Pseudotsuga menziesii*) forest in southern Washington State. For soil temperature and moisture the range of edge influence was 60 to 120 meters (Chen et al. 1990).

Edge effects can be positive or negative because some species thrive in the edge habitat while others perish. For example, species such as elk and deer tend to flourish in edge environments because the habitat contains a wide variety of cover and food resources (Nyberg and Janz 1990). Many amphibians require the cool moist conditions of forest floor microhabitats, and they may be vulnerable to the drier, warmer, exposed edges between forests and clearcuts (Davis 1996). Breeding populations of marbled murrelets decline as areas of old-growth forest decrease since this species largely relies on heavily forested areas with large trees having high epiphyte cover (Piatt et al. 2007).

4.2.2.1.5.3 Pest species

Urbanization often causes changes in hydrology, increased disturbance, pollution, and the introduction of plants and animals (USFS 2006). All of these changes can lead to an increase in biological invasions and unwanted infestations of introduced plants (Reichard 2004). A substantial infestation of non-native invasive tansy ragwort is spreading and threatening native plants and wildlife habitat on the north side of the riparian area predominantly on adjacent county lands near Cape Meares NWR. In addition, urbanization causes introductions of non-native animal species. Populations of raccoon, feral cat, feral livestock, and rats may increase and cause predation and competition of native wildlife species. See section 4.1, Biological Integrity Analysis, for detailed description of invasive plants and animal species associated with the Refuge.

4.2.2.2 Steep rock cliffs and coastal erosion bluffs

4.2.2.2.1 Description and location

Areas of steep basalt cliffs and coastal bluffs can be found throughout the Cape Meares NWR and the two headland units of Oregon Islands NWR, Coquille Point and Crook Point. The forested headland of Cape Meares NWR consists of a mosaic of habitats including old-growth forest, headland riparian shrublands, stream mouth coastal riparian, steep rock cliffs and steep coastal erosion bluffs and cliffs. The area occupied by these habitats at Cape Meares has not been surveyed and is hard to quantify, but it is estimated that cliffs and bluffs occupy approximately 28.5 acres (USFWS 2004).

The Coquille Point Unit, located within the city limits of Bandon, Oregon, also has sections of steep coastal erosion bluffs. One of the primary purposes for establishing the Coquille Point Unit was to protect and restore the steep coastal erosion bluff habitat for wildlife species dependent upon it (USFWS 1991). Total acreage of bluff areas for the Coquille Point Unit has not been surveyed and is needed.

The Crook Point Unit is located approximately 12 miles south of the town of Gold Beach and is an example of southern Oregon's diverse habitat types including steep rock cliffs and coastal erosion bluffs. The steep rock cliffs and coastal erosion bluffs at this unit have not been surveyed; surveys are needed before pursuing specific management actions.

The rock cliff and coastal erosion bluff vegetative characteristics are similar for the Coquille Point and Crook Point Units. The steep rock cliff face areas are generally devoid of vegetation with occasional wind sweep shrubs, succulents and grasses growing from rock fissures. Plant species

present on the cliff sides and nearby surrounding headlands and bluffs at Coquille Point include gorse, kinnikinnick (*Arctostaphylos uva-ursi*), shore pine, plantain (*Plantago lanceolata*), dock (*Rumex* spp.), and rushes (*Juncus* spp.; USFWS 2004). Vegetation inventories and surveys have not been completed at refuge rock cliffs and coastal erosion bluffs and are needed.

4.2.2.2.2 Condition and trends

Cape Meares NWR and RNA is managed to maintain and protect the existing steep rock cliff habitat and the old-growth Sitka spruce/salal forest in an "unaltered, natural condition" to support migratory bird and other wildlife populations. In addition to the requirements of management as an RNA, the inaccessibility of the steep cliff habitat at Cape Meares and at Crook Point together with the susceptibility of nesting seabirds to disturbance, make it necessary to implement a hands-off management approach to this habitat type. The condition trend of the steep cliff habitat habitats is generally stable and not impacted by human disturbance.

Other than the limited habitat and wildlife data or observations used to nominate and approve the RNA designation of Cape Meares NWR, existing baseline data and inventory of plants and wildlife species found within Cape Meares NWR and the two mainland units' steep cliff and coastal erosional bluff habitats are currently nonexistent or inadequate for monitoring trends in these communities.

At Coquille Point Unit, prior to the acquisition of lands by the Refuge from 1991 to 1994, invasive gorse and European beachgrass dominated Coquille Point Unit's erosional bluffs and headland habitats. Refuge management efforts in 1994 and 1995 involved mechanical re-grading of the headland to create a natural vegetated open space buffer and to establish an interpretive trail. Efforts also included importation of topsoil and restoring vegetation with native plant species. Habitat management efforts from 1996 to present have involved mowing, fertilizing, and controlling invasive plants. In addition to establishment of headland native plant and soil restoration, Complex staff members initiated invasive gorse control measures along the erosional bluffs and headland habitats using an IPM program of mechanical, biological, and chemical treatments. From 2004 to 2007, extensive infestations (approximately 5–10 acres) of gorse have been removed mechanically and treated with herbicides through a Wildland Urban Interface Grant to reduce the threat of wildland fire and to re-establish displaced coastal erosional bluff and headland native plant diversity (USFWS unpublished data). Continued efforts will be required to reduce the potential of wildland fire associated with highly flammable gorse and to re-establish low-fuel-load native vegetation in the bluff habitat for the benefit of wildlife species.

4.2.2.2.3 Associated wildlife

These steep rock cliffs and coastal erosional bluffs provide nesting habitat for cliff-dwelling seabirds and raptors, as well as foraging and shelter habitat for various small mammals and herptiles. Inventory and baseline surveys of many species including mammals, reptiles, amphibians, and invertebrates are lacking due to insufficient staffing and funding. The only wildlife inventory that has been conducted is in the rock cliffs of Cape Meares NWR, that provide nesting habitat for peregrine falcon, pelagic cormorant, Brandt's cormorant, common murre, tufted puffin, rhinoceros auklet, pigeon guillemot, and western gull. Current seabird breeding populations for the entire coast of Oregon can be found in Naughton et al. (2007).

4.2.2.2.4 Key ecological attributes

The CCP team members identified the following as key ecological attributes for a healthy and functioning cliff and bluff system.

Table 4-3. Steep rock cliff and coastal erosion bluff ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Very steep or vertical basalt rock faces	• Elevation, mean high tide to higher than 200 feet above sea level • Basalt rock	• Stable cliff material • Nesting birds • Invasive plants not present
Vegetated and unvegetated ledges	• Pockets of vegetated soil • Native vegetation present	• Ledges for nesting birds • Invasive plants not present
Steep rock cliffs	• Very steep, largely unvegetated cliffs of mostly serpentine rock or sandstone with patches of seaside daisy, Pacific sedum, and coast eriogonum	• Nesting birds • Invasive plants not present
Steep coastal erosion bluffs	• Steep, largely vegetated cliffs/bluffs above the ocean with a mixture of grasses and forbs	• Large concentrations of native coastal grasses and forbs • >75% native plant species
High levels of disturbance by past human activities	• Grading, top soil removal, building construction	• No or minimal human disturbance
Non-native invasive plants actively managed	• Reduced gorse, European beachgrass	• Non-native or introduced plant species absent

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.2.5 Threats

Introduced invasive plants (e.g., gorse, European beachgrass, tansy ragwort, ice plant) are a constant issue along the Oregon coast and within the habitats of steep rock cliffs and erosional bluffs. Refuge management will prevent the establishment of invasive plant species and treat existing or new infestations with IPM techniques using mechanical, physical, biological, and chemical means.

Human-induced wildfire is a potential catastrophic threat at Coquille Point Unit due in large part from invasive nonnative gorse. The Fire Management Plan (USFWS 2004) needs to be reviewed annually or as needed to ensure that contact information is up-to-date and the responding agencies are familiar with allowable suppression techniques and sensitive areas within the Refuge/RNA.

At the Coquille Point and Crook Point Units, where steep rocky cliffs and erosional bluffs occur, illegal activities such as rock climbing and general trespass have the potential to cause tremendous disturbance to wildlife and introduce invasive plant species into closed areas of the Refuge units. Boundary survey and posting are necessary to delineate where certain public use activities are permitted and to reduce or eliminate trespass on refuge lands.

4.2.2.3 Stream and riparian habitat

4.2.2.3.1 Description and location

Cape Meares' forested headland consists of a mosaic of habitats including headland riparian shrublands, stream mouth coastal riparian, steep rock cliffs, and steep coastal erosion bluffs and cliffs. The stream and riparian habitat within Cape Meares NWR and RNA is located in the northeast corner of the northern unit, in an active glacial slide area. Several spring-fed and surface runoff streams flow across this area from the top of the adjacent privately owned headland, crossing under an early successional red alder canopy and ending in a 12-foot drop to the beach on a continually eroding bank.

4.2.2.3.2 Condition and trends

The condition and trend of the Cape Meares NWR's stream and riparian area remains stable. Because Cape Meares NWR is classified as an RNA, and the riparian habitat is closed to the general public, the human influences are minimal and land management practices are not implemented. Natural processes are allowed to predominate without human intervention and successional vegetative changes occur naturally. However, at Cape Meares, a substantial infestation of tansy ragwort exists on the north side of the riparian area predominantly on adjacent county lands.

4.2.2.3.3 Associated wildlife

The large mammal and bird species listed for the old-growth habitat also frequent riparian areas. The 1996 small mammal and amphibian survey at Cape Meares NWR indicated the total capture rate of rodents was highest in the riparian area (Gomez et al. 1997). Townsend's chipmunk, deer mouse, Oregon vole (*Microtis oregoni*), Pacific jumping mouse (*Zapus trinotatus*), and long-tailed vole (*Microtis longicaudus*) were captured in the riparian habitat. Insectivore captures included Trowbridge's shrew (*Sorex trowbridgii*), Pacific shrew (*Sorex pacificus*), marsh shrew (*Sorex bendirii*), and shrew-mole (*Neurotrichus gibbsii*).

Amphibian species richness was greatest in the old-growth and riparian habitat with five species, but total capture rate was highest in the riparian zone at Cape Meares. The species documented include roughskin newt, western red-backed salamander, torrent salamander, Pacific giant salamander (*Dicamptodon tenebrosus*), and Pacific tree frog (*Pseudacris regilla*; Gomez et al. 1997).

4.2.2.3.4 Key ecological attributes

The CCP team members identified the following as key ecological attributes for a healthy and functioning riparian system.

Table 4-4. Riparian ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Streams with medium to steep gradient	• Good drainage • Seasonal runoff	• Step-pool morphology • Natural flood regime
Native species representation	• Native plant species cover • Early successional red alder	• Greater than 75% native plant species cover • Non-native or introduced plant species absent

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors,

such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.3.5 Threats

The area of riparian habitat at Cape Meares NWR is in the remote portion of the Refuge and is closed to public access. More than 20 million visitors travel the Oregon coast immediately adjacent to and through Cape Meares NWR on an annual basis. Visitation of Cape Meares NWR will probably increase due to the new state champion Sitka spruce tree and upgrades at the lighthouse and State Scenic Viewpoint. The increase in visitation to the champion tree may bring issues of trespass into closed areas and an increase in the potential of non-native plant invasion.

4.2.2.4 Headland riparian shrublands

4.2.2.4.1 Description and location

The Crook Point Unit is an example of southern Oregon's diverse habitat types that are associated with a windswept marine terrace headland bordered by relatively undisturbed beaches, small coastal streams, and Sitka spruce forests. The headland riparian shrublands located at the Crook Point Unit are in the northeastern portion of the unit. Plant species associated with the riparian habitat include a mixture of native rushes, Sitka spruce, red alder, willow, and a variety of grasses and forbs.

4.2.2.4.2 Condition and trends

The Crook Point Unit is designated as a Natural Heritage Conservation Area (ORS 273-586) by the Oregon Department of State Lands, Oregon Natural Heritage Program. To be designated as a Natural Heritage Conservation Area it was determined that the Refuge unit has substantially retained its natural character, or, if altered in character, shall in addition to its natural heritage resource values, be valuable as habitat for plant and animal species or for the study and appreciation of the natural features. Since Crook Point Unit is classified as a Natural Heritage Conservation Area and the riparian habitat is closed to the general public, human influences have been and are expected to be minimal. Natural processes are allowed to predominate without human intervention and successional vegetative changes occur naturally.

4.2.2.4.3 Associated wildlife

Wildlife inventories and monitoring surveys have not occurred at the Crook Point Unit and are needed to understand the significance of the headland shrubland riparian habitat. Due to the undeveloped nature of Crook Point Unit, wildlife is abundant and uses the unit's habitats. Migrant songbird species that may breed or roost in this riparian habitat include red crossbills, hermit warblers, and Swainson's thrush (*Catharus ustulatus*; USFWS unpublished data).

Common mammalian species such as black bear, black-tailed deer, mink, river otter, and bobcat (*Lynx rufus*) have been observed using the headland and undisturbed portions of the headland shrubland riparian habitat. Found in the Refuge's waters of Sand Creek, coastal cutthroat trout, which have been considered a sensitive species by the Service and the State of Oregon, are associated with the unit's lush riparian corridor that is a mixture of native rushes, Sitka spruce, red alder, willow, and a variety of grasses and forbs (USFWS unpublished data).

4.2.2.4.4 Key ecological attributes

Table 4-5. Headland riparian shrubland ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Headland riparian shrublands	• Stream channel associated riparian corridor with patches of Sitka spruce, red alder, and hooker willow	• 60–70% native plant cover in riparian area
Native species representation	• Native plant species cover • Early successional red alder	• >75% native plant species cover • Non-native or introduced plant species absent
Minimal human disturbance	• Human presence	• No human impacts

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.4.5 Threats

The Crook Point Unit of Oregon Islands NWR offers spectacular coastal views and if opened to the public would be difficult to control due to its remote and rugged location, limited access road, and lack of public use facilities and staff to ensure the safety of visitors. Many of the habitats found on the headland are occupied by rare and fragile plants, making them susceptible to erosion and impacts from public-use foot traffic (Kagan 2002). Current management tools necessary for the long-term survival of these fragile plants and habitats, exposed cultural resources, and adjacent sensitive seabird breeding sites include management of the area as a closed biological reserve with no general public use, limited staff guided tours, and well-posted access points to control unauthorized entry. The Refuge promotes an undisturbed natural environment by excluding public access. Lack of funding and maintenance staff is curtailing habitat management efforts, additional boundary posting, and maintenance of access roads and facilities.

Adjacent to the Crook Point Unit, private lands are currently managed as large forested parcels and grazed grasslands with residential homes interspersed along the scenic bluffs overlooking the majestic Mack Reef archipelago. Cooperative working relationships with adjacent landowners and managers is essential to curbing the threats of wildland fire, non-native invasive plants, feral and domestic animals (e.g., sheep, goats, cows, horses, dogs, and cats) and trespass on refuge lands and resources. Cooperative efforts through programs such as the Service's Partners for Wildlife Program and forest management initiatives would assist adjacent private and public landowners in the management of threats to the unit's biodiversity and rare habitat types.

The presence and extent of invasive plant infestations in this habitat are unknown due to lack of plant inventories and surveys, which are needed. Invasive plant and animal species cause competition and degradation of native species. Efforts to remove, control, and prevent establishment of invasive woody and non-native plant species will be accomplished with IPM techniques using mechanical, physical, biological, and/or chemical means.

4.2.2.5 South coast headland erosion forblands and dunes

4.2.2.5.1 Description and location

Coquille Point Unit consists of a headland jutting toward the ocean and overlooking rocks and islands within Oregon Islands NWR. From the point, a beach stretches to the north and another to the south. At the time of acquisition, the bluff portion of the headland was covered with large areas of eroded hardpan soil interspersed with gorse, Scotch broom, and other invasive plants. The northern portion of the property is low-lying stabilized dunes with invasive European beachgrass (USFWS 2004). A small one-acre emergent wetland, formed from ground water seepage from the bluff's base, exists between the bluff and dunes at the unit's north end.

The Crook Point Unit is an example of southern Oregon's diverse habitat types that are associated with a windswept marine terrace headland bordered by relatively undisturbed beaches, small coastal streams, and Sitka spruce forests. Uplifted serpentine and sedimentary layers dominate the soils and geology of the headland with plant communities that have developed on partially stabilized sand dunes or on marine terraces. Within the Refuge unit, examples of rare and exceptional habitat types of great conservation concern occur, including coastal headland forblands and dunes. Many of the more common habitats found at Crook Point are not late-successional or unusual, but they are one of the largest remnants of undeveloped areas in southern Oregon (Kagan 2002).

4.2.2.5.2 Condition and trends

The Crook Point Unit is designated a Natural Heritage Conservation Area (ORS 273-586) by the Oregon Department of State Land's Oregon Natural Heritage Program. To be designated as a Natural Heritage Conservation Area it was determined that the Refuge unit has substantially retained its natural character, or, if altered in character, is in addition to its natural heritage resource values, valuable as habitat for plant and animal species or for the study and appreciation of the natural features. The coastal headland forblands and dunes at Crook Point are managed to retain their current state by controlling non-native invasive plants.

The coastal dune habitat at Coquille Point Unit is dominated by non-native European beachgrass. This species displaces native dune species significantly altering the morphology of dune systems (Barbour and Johnson 1977). In 2006, the Refuge started a test beachgrass control effort on the northern boundary of the unit to investigate the potential of native plant re-establishment. This habitat is of importance to a suite of dune community plants including pink sand verbena. This extirpated species is listed as endangered by the Oregon Department of Agriculture and is considered a Species of Concern by the Service. Restoration of this habitat and re-establishment of native species at Coquille Point will provide habitat for wildlife and will provide an opportunity for the public to understand the ecology of coastal dunes and restoration techniques.

4.2.2.5.3 Associated wildlife

No wildlife inventories or monitoring surveys have occurred at the Crook Point Unit, and they are needed to understand the wildlife significance of the headland forblands and dune habitat. Due to the undeveloped nature of Crook Point Unit, wildlife is abundant and using habitats lost in other areas due to encroaching human presence. Common mammalian species such as black bear, black-tailed deer, mink, river otter, and bobcat have been observed using the headland forblands and dune habitat for foraging and as travel corridors.

Wildlife inventories and monitoring surveys have not occurred at Coquille Point Unit and are needed to understand the wildlife significance of the headland forblands and dune habitat. In contrast to undeveloped Crook Point Unit, there is minimal wildlife use of Coquille Point's habitats due to limited natural habitat onsite, its small size, and encroaching human presence. Common mammalian species such as black-tailed deer, long-tailed weasel (*Mustela frenata*), and brush rabbit (*Sylvilagus bachmani*) are rarely observed in headland forblands and dune habitat. These habitats are extremely important as open space for migrant birds and travel corridors for breeding seabirds (USFWS unpublished data).

4.2.2.5.4 Key ecological attributes

Table 4-6. South coast headland erosion forblands and dunes ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
South coast headland erosion forblands and dunes	• Exposed, windswept marine terrace and partially stabilized sandstone, forbs, and low isolated dunes	• Stable or increasing
Minimal non-native invasive plants	• Tansy ragwort, Canada thistle, ice plant, European beachgrass	• Less than 10% invasive species
Native forbs	• Beach strawberry, field horsetail, common yarrow, selfheal, western brackenfern, broadleaf lupine, seaside daisy, coastal sagewort	• 60–70% native plant cover
Minimal human disturbance	• Human presence	• No human impacts at Crook Point Unit • Minimal human impacts at Coquille Point Unit

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus, the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.5.5 Threats

The lands at Crook Point Unit are in a remote location and closed to public access, while lands at Coquille Point Unit are within an urban environment and are designed to manage high levels of human-caused disturbance and trespass. The Coquille Point Unit is bordered to the east, north and south by residential development within the City of Bandon. The west boundary of the unit is ocean shoreline managed by ORPD, which abuts the unit's coastal forblands and dunes. The shoreline has heavy public use for recreation and wildlife viewing. Immediately adjacent to the Refuge, illegal driftwood fires occur year-round and the use of illegal fireworks occurs during the Fourth of July holiday, both of which have a high potential for igniting vegetation on the Refuge and spreading rapidly into adjacent residential and commercial properties. To reduce the threat of wildland fire, cooperative efforts by the Bandon Rural Fire Protection District and OPRD result in seasonally posting "No Driftwood Fires" and "Fireworks Prohibited on all Beaches" signs in the area, in addition the Refuge's "Fireworks and Campfires Prohibited" signage at all beach access points.

Invasive plants dominate the coastal forblands and dunes at Coquille Point and are minimally present at the Crook Point Unit. Invasive plants cause competition and degradation of native species, and in the high levels at Coquille Point Unit they constitute a wildland fire threat. Efforts to remove, control, and prevent re-establishment of invasive non-native plant species could be accomplished with IPM techniques using mechanical, physical, biological, and/or chemical means.

Many of the habitats found on the Crook Point Unit headland are occupied by rare and fragile plants, making them susceptible to erosion and impacts from public-use foot traffic (Kagan 2002). The unit is closed to public access; however, lack of funding and maintenance staff is limiting habitat management efforts, additional boundary posting, and maintenance of access roads and facilities.

4.2.2.6 Rare early successional south coast headland prairie-grasslands

4.2.2.6.1 Description and location

The 134-acre Crook Point Unit, the second mainland addition within Oregon Islands NWR, was acquired in 2000 and is located along Oregon's south coast approximately 12 miles south of Gold Beach. It is bordered on the west by a coastal beach administered by the State of Oregon, on the south and east by private property, and on the north by Pistol River State Park. Crook Point contains numerous rare plant species, undisturbed cultural resource sites, unique geological formations, and 1 mile of pristine beach with interspersed rocky intertidal habitat, and serves to protect major seabird colonies.

The Crook Point Unit consists of grassland, meadows, Sitka spruce forest, unvegetated headland, and coastal beach. The top of the headland slopes off to the north into a small watershed and to the west down to the beach. These vegetated grassland slopes are dominated by native red fescue as well as other unique plant species including San Francisco bluegrass and Roemer's fescue. The red fescue grassland on Crook Point is among the largest and best in Oregon. This area is managed as a biological reserve under the State of Oregon Natural Heritage Conservation Area designation. The Oregon Natural Heritage Program has identified 19 "special-status" plant species that may occur on Crook Point. Two rare plants, large-flowered goldfield and beach wormwood (*Artemisia pycnocephala*), have been observed on Crook Point.

An objective of the Refuge is to preserve and maintain the native coastal habitats within the Crook Point Unit, for the benefit of rare plants, migratory birds, and other native wildlife. The Crook Point Unit has some small but exceptional examples of coastal grasslands, representing rare and endemic vegetation types that have almost entirely vanished from the Oregon coast. South coast headland prairie-grassland is unnamed in the National Vegetation Classification System (Grossman et al. 1998) and the Oregon Classification of Native Vegetation (Kagan et al. 2000). The closest existing alliance is *Festuca rubra* coastal headland vegetation that is classified by the State of Oregon as critically imperiled because of extreme rarity, with five or fewer occurrences or very few remaining acres in the state, and is globally imperiled because of rarity, with six to 20 occurrences or few remaining acres worldwide. Roemer's fescue is found in the south coast headland prairie-grassland habitat in Crook Point. In addition, this rare early successional south coast headland prairie-grassland at Crook Point is one of four large populations of large-flowered goldfields, endemic to Curry County, which is known to occur at only 16 locations along the coast from Brookings to Cape Blanco. This member of the Asteraceae family is listed as a Candidate Species by the State of Oregon and is imperiled because of its rarity, with 6 to 20 occurrences or few remaining acres.

4.2.2.6.2 Condition and trends

Crook Point is the narrow headland between the dunes created by the mouth of the Pistol River to the north and the sedimentary terraces to the south. The point itself is of serpentine origin. The Crook Point headland consists of a mosaic of habitats including grassland, meadows, coniferous forest, rock formations, and barren ground. The western portion of Crook Point is dominated by a barren, windblown, highly eroded landscape of flat to gentle slopes approximately 100 feet above sea level. The history and reason for the barrenness of the area is unclear, but human activities (e.g., human-induced fires, forest management practices, grazing), weather and local geomorphology have likely played a major role. Crook Point is located in one of the windiest locations on the Pacific Coast. During the spring and summer, strong persistent northwest winds sweep the area with gusts sometimes exceeding 50 miles per hour. During the fall and winter, powerful Pacific storms pound the area with wind gusts commonly exceeding 100 miles per hour in the bigger storms. Annual precipitation ranges from 60 to 100 inches. If this barren area was once vegetated it would have taken little disturbance or vegetation removal to initiate serious top soil erosion. Geologic formations and the presence of numerous landslides and slips indicate that the area is highly unstable, and much of the area may be naturally unvegetated. The extreme western tip of Crook Point consists of a rock outcrop that forms a large pinnacle. Numerous seeps and springs can be found throughout Crook Point (USFWS 2004).

At Crook Point the south coast headland prairie-grasslands are found in areas where harsh coastal weather conditions slow forest invasion, but they will not persist over time, as secondary succession will eventually lead to forest dominating the entire site unless management action is taken to prevent this succession (Kagan 2002). During the period of 2005 through 2008, limited habitat management efforts using volunteer labor have been initiated to control woody vegetation encroachment on grasslands. These efforts have included mechanical and manual removal of encroaching Sitka spruce, shore pine, evergreen huckleberry, coyote bush, and wax myrtle.

4.2.2.6.3 Associated wildlife

No wildlife inventories or monitoring surveys have occurred at the Crook Point Unit, and they are needed to understand the wildlife significance of the South Coast Headland Prairie-Grassland habitat. Due to the undeveloped nature of Crook Point Unit, wildlife is abundant and using habitats lost in other areas due to encroaching human presence. Common mammalian species such as black bear, black-tailed deer, mink, river otter, and bobcat have been observed using the south coast headland prairie-grassland habitat for foraging and as travel corridors.

There has been one survey to document the presence of the Oregon silverspot butterfly's (*Speyeria zerene hyppolyta*) obligate host plant, the western blue violet (*Viola adunca*), at Crook Point. The Oregon silverspot butterfly is federally listed as a threatened species. In the spring of 2008, it was determined that there are a minimum of 12 discrete violet locations within the south coast headland prairie-grassland at Crook Point. Three of these plant locations are in areas managed for woody vegetation control. No larvae of Oregon silverspot were observed in this initial survey, but six of the larger concentrations of *Viola adunca* could possibly support the species or would potentially be suitable habitat for reintroduction of this butterfly (D. and D. Bilderback unpublished data). It remains to be determined if the Crook Point Unit has sufficient plant resources to support this threatened invertebrate species. "Hundreds" of silverspots were observed during a field visit in August 2008 at Cape Blanco, north of Crook Point (USFWS unpublished data).

4.2.2.6.4 Key ecological attributes

Table 4-7. Rare early successional south coast headland prairie-grassland ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Early successional south coast headland grassland	• Windswept, gently to moderately sloping with 60–70% cover of native grasses and forbs (e.g., native grasses, beach strawberry, western blue violet, field horsetail, common yarrow, selfheal, western brackenfern, broadleaf lupine, seaside daisy)	• Stable or increasing • 60–70% native plant cover
Minimal non-native invasive plants	• Tansy ragwort, Canada thistle, ice plant, European beachgrass	• Less than 10% invasive species
Minimal intrusion of woody species	• Sitka spruce, shore pine, evergreen huckleberry, coyote bush	• Less than 30% woody species cover
Minimal human disturbance	• Human presence	• No human impacts

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.6.5 Threats

The Crook Point Unit offers spectacular coastal views and would likely be a popular location for wildlife-dependent activities if opened to the public. However, due to its remote and rugged location, limited access, and lack of public-use facilities and staff to ensure the safety of visitors, allowing public use at Crook Point Unit could result in adverse effects to wildlife and habitat. This is because many of the habitats found on the unit, including south coast headland prairie grassland, are occupied by rare and fragile plants, making them particularly susceptible to erosion and impacts from foot traffic (Kagan 2002). Thus, the current management approach used for the long-term survival of these fragile plants and habitats is to manage the area as a closed biological reserve with no general public use, allow limited staff guided tours, and post access points to control unauthorized entry.

A minimal amount of invasive non-native plants (e.g., tansy ragwort, Canada thistle, ice plant, European beachgrass) and a suite of encroaching native woody species (e.g., Sitka spruce, shore pine, evergreen huckleberry, coyote bush) are present at Crook Point Unit, which cause competition and degradation of rare native species found in early successional south coast headland prairie-grassland. Efforts to remove, control, and prevent establishment of invasive woody and non-native plant species could be accomplished with IPM techniques using mechanical, physical, biological, and/or chemical means.

4.2.2.7 Rocks, reefs, and islands

4.2.2.7.1 Description and location

Oregon Islands and Three Arch Rocks NWRs include all land masses that extend above the ocean surface and are surrounded by water at mean high tide with the exception of Chief's Island at Gregory Point. Oregon Islands NWR is also a designated Wilderness (Oregon Islands Wilderness) that spans six counties and 320 miles of the Oregon coastline from Tillamook Head

south to the California border and includes 1,854 rocks, reefs, and islands. Three Arch Rocks NWR comprises three large and six smaller rocks totaling 15 acres and lies one-half mile offshore from the community of Oceanside, and is also a designated Wilderness (Three Arch Rocks Wilderness). The total area of all rocks, reefs, and islands of Oregon Islands and Three Arch Rocks NWRs is estimated at 373 acres. These two Refuges have highly vulnerable wildlife habitats including major seabird nesting colonies, pinniped rookeries, and threatened and endangered species use areas.

4.2.2.7.2 Condition and trends

Seabirds and pinnipeds spend the majority of their life at sea foraging on marine fishes and invertebrates, and return to land for breeding, loafing, and roosting. The rocks, reefs, and islands associated with Oregon Islands and Three Arch Rocks NWRs provide wildlife habitat that is important for vulnerable adults, young, and, in the case of seabirds, eggs and young. Nearly 1.3 million seabirds, representing 13 different species (Naughton et al. 2007), and four species of pinnipeds, including threatened Steller sea lions, depend on these habitats. Protective measures for pinnipeds include the designation of critical habitat under the Endangered Species Act for threatened Steller sea lions at the two major rookeries in Oregon (i.e., Rogue and Orford Reefs). All rocks, reefs, and islands within Oregon Islands and Three Arch Rocks Refuges are closed to public entry to reduce disturbance to wildlife. Management of seabird resources is facilitated by implementation of the Service's Regional Seabird Conservation Plan (2005b). Pinniped resources are managed and protected by the Marine Mammal Protection Act of 1972 by providing undisturbed breeding and haul-out habitat for pinnipeds.

The Steller sea lion was listed as a threatened species in Oregon, and in 1990 critical habitat was designated around the major breeding rookeries including Pyramid Rock on the Rogue Reef Unit and Large Brown Rock on the Orford Reef Unit of Oregon Islands NWR. Critical habitat includes an aquatic zone that extends 3,000 feet out from the shoreline of these rocks into the State Territorial Sea and a 3,000-foot air zone that extends over these rocks (CFR 50, Part 226.202b). Listing as a threatened species and classification of critical habitat extended additional legal protection to Steller sea lions and provided awareness of the status and management concern for these species to ocean users and the general public.

The goal of protecting an undisturbed natural environment on all refuge rocks, reefs, and islands is being accomplished by prohibiting public access. Refuge personnel enforce and document trespass violations according to federal regulations (CFR 50, Part 26.21). Cooperative law enforcement efforts with state and federal agencies, with limited Service law enforcement efforts for the protection of seabirds, pinnipeds, and refuge habitats, have been initiated. In addition, signs and other deterrents to keep the public off rocks, reefs, and islands that are accessible at low tide have been developed (see Chapter 5).

The Coquille Point Unit of Oregon Islands NWR has limited wildlife use, and its primary value is providing a buffer zone between residential development within the City of Bandon and the nearshore rocks and islands that provide habitat to sensitive breeding and loafing wildlife (USFWS 1991). These rocks and islands provide habitat to hundreds of loafing harbor seals (Brown et al. 2005) and breeding habitat for thousands of migrating and nesting birds (Naughton et al. 2007). The adjacent islands of Elephant, Middle Coquille Point, North Coquille Point, and Haystack Rocks are close to shore and accessible to the public at low tides. These easily climbed islands provide cliff and island top habitat for black oystercatchers, Aleutian cackling geese, peregrine falcons, and a suite of seabirds including tufted puffin and brown pelican. As the human

population in Bandon and on the Oregon south coast increases, the pressure on refuge resources grows with additional recreational beach use, trespass on refuge islands, illegal driftwood beach fires and fireworks, and development of adjacent lands for residential homes and hotels with exterior lighting, non-native landscaping, domestic and feral animals, and human-related refuse.

4.2.2.7.3 Associated wildlife

4.2.2.7.3.1 Colonial seabirds

Nesting seabird colonies are the most distinctive biological feature of the rocks, reefs, and islands. Oregon Islands and Three Arch Rocks provide nesting habitat for 1.3 million seabirds of 13 species including fork-tailed storm-petrel, Leach's storm-petrel, Brandt's cormorant, double-crested cormorant, pelagic cormorant, black oystercatcher, western gull, glaucous-winged gull (*Larus glaucescens*), common murre, pigeon guillemot, Cassin's auklet, rhinoceros auklet, and tufted puffin. The seabird nesting season on the islands generally extends from March through August. Another seabird bird that frequents the Refuges is the endangered brown pelican.

4.2.2.7.3.2 Pinnipeds

The Steller sea lion, California sea lion, northern elephant seal, and harbor seal use the rocks, reefs, and islands as haul-outs throughout the year.

4.2.2.7.3.3 Reptiles and amphibians

No reptile and amphibian inventories or monitoring surveys have occurred on the rocks, reefs and islands associated with Oregon Islands and Three Arch Rocks NWRs. Anecdotal observations of clouded and ensatina salamanders have been documented on larger islands (Goat and Hunter islands and Saddle Rock) in the southern portion of the Oregon Islands NWR (USFWS unpublished data).

4.2.2.7.4 Key ecological attributes

Table 4-8. Rocks, reefs, and islands ecological attributes, indicators, and condition parameters*

Key Ecological Attributes	Indicators	Desired Conditions
Steep, rocky, and precipitous edges	• Basalt, metasedimentary, and sandstone	• Stable rock fissures and ledges with a variety of aspects
Non-vegetated without soil or vegetated with soil	• Native coastal plants	• Non-native invasive plants not present
Native species representation	• Native species percent cover	• 100% native plants
Coastal rocks and islands	• Water depth around islands	• Land mass exposed at mean high tide
Sanctuary	• Secure roosting and nesting habitats for seabirds • Secure haul-out and pupping habitat for pinnipeds • Predation • Impacts from diseases	• Wildlife areas protected from disturbance • Rocks and islands with soil covered by native plant communities • No invasive mammals present and avian predation limited to natural events • Limited or no disease

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate

parameters and condition levels chosen for each conservation target. Thus, key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.7.5 Threats

Some of the onsite threats to the wildlife associated with rocks, reefs, and islands include human-induced disturbance events, invasive species competition with native plants and animals, and predation that causes direct mortality of native wildlife species. A single aircraft or watercraft disturbance event at a common murre colony can cause reduced reproductive output, breeding failure, and abandonment of the colony (Rojek et al. 2007). The presence of an individual mammalian (e.g., climbing human, red fox) or avian (e.g., bald eagle) predator can have serious negative effects on seabird nesting success (Rojek et al. 2007; USFWS 1993). Human disturbance to pinnipeds using the Refuge can cause direct mortality of pups, loss of energy resources to resting animals, and disruption of normal loafing activities (Riemer and Brown 1997). The invasion of seabird breeding habitat by non-native plants, such as ice plant and tansy ragwort, may restrict or eliminate burrow-nesting species (e.g., Leach's storm-petrels) from the capability to access or dig nesting burrows (A. Pollard unpublished data). Oil spills in the California Current System have caused significant seabird and shorebird mortality and are the greatest threat to refuge resources (USFWS 2005b, 2007a).

Many of Oregon's seabird colonies are physically isolated from the shoreline, providing a measure of protection from humans and mammalian predators. However, many other colonies are close enough to shore to be accessible to human intrusion during periods of low tides. Predation of seabirds, particularly by non-native red fox and raccoon, has been documented to have negative effects on nesting seabirds on Oregon's south coast (A. Pollard unpublished report; USFWS 2005a). The Oregon coast is experiencing rapid growth in residential, resort and recreational development. As the human population increases and lands are developed there will likely be accompanying increased range expansion and population sizes of predators such as red foxes, raccoons, feral cats, and rats. To reduce predation at seabird colonies where mammalian predators have been determined to be a threat, the Refuge Complex would manage the predation problem using procedures approved in the Mammalian Predator Damage Management Environmental Assessment (USFWS 2005a). In addition, it is expected that with increased illegal activities (e.g., trespass) caused by rapid human population growth on the coast there would be an increased risk of invasive non-native plant species introduction on coastal rocks and islands, thereby altering seabird nesting habitats.

Watercraft approaching too close to the rocks, reefs, and islands within Oregon Islands and Three Arch Rocks NWRs can cause serious disturbance to seabirds and pinnipeds and can result in the loss of reproduction, and in some cases, colony or rookery abandonment (USFWS unpublished data). Legal watercraft activities occurring in the marine environment near these islands, such as scuba diving, sport and commercial fishing, bait and shellfish collection, kayaking, and canoeing have a high potential for disturbing wildlife. The need to establish buffer zones to minimize disturbance around waterbird colonies and pinniped rookeries is well documented (LCDC 1994; Rodgers and Smith 1997). The NOAA guidelines request the public and watercraft to remain a minimum of 100 yards from pinnipeds when they are hauled out on shore. All NWRs that support seabird colonies or pinniped haul-out areas strictly regulate or close the area to human entry (CFR 50, Part 26.21). Three Arch Rocks NWR has an enforceable 500-foot watercraft buffer (closure) zone annually from May 1 to September 15 to minimize wildlife disturbance by boaters (OSMB 1994; OAR 250-20-309). The Refuge Complex continues to deploy buoys annually to

delineate the Three Arch Rocks closure. This is currently the only watercraft closure zone in Oregon marine waters.

Aircraft overflights lower than 2,000 feet AGL or closer than a quarter- or half-mile have a high potential for disrupting seabirds and pinnipeds. The FAA's aeronautical charts currently request a 2,000-foot AGL vertical clearance over all NWRs; however, this is only a request, not a regulation and is regularly ignored by many pilots. The Service does not have jurisdiction over air space above the rocks, reefs, and islands of Oregon Islands and Three Arch Rocks NWRs.

Populations of colonial nesting seabirds and pinniped rookeries are extremely vulnerable to the effects of oil or hazardous material spills. To minimize the potential effects of a catastrophic spill in Oregon, the main transportation corridor for crude-laden tankers in the Trans-Alaskan Pipeline Petroleum Trade occurs 30 to 60 nautical miles offshore. In contrast, numerous small oil tankers, cargo vessels, bulk carriers and barges use the waters near the coast as a transportation route. Any spill from these routes could potentially be devastating to populations of marine wildlife and habitat. In addition, nonpoint source oil tarballs, or slicks, periodically wash up on Oregon's beaches and impact wildlife. Nonpoint chronic sources may be products of vessels illegally pumping bilges, recreational outboard motors, and improper use of petroleum products in marinas (USFWS 2005b).

4.2.2.8 Seabirds

4.2.2.8.1 Description and location

There are an estimated 1.3 million breeding seabirds of 13 species nesting on the Refuge's 1,854 rocks, reefs, and islands. The Oregon Islands and Three Arch Rocks NWRs primary purposes are the protection and conservation of sea lions and colonial nesting seabirds (E.O. No. 4364 and 699). Seabird conservation and management at the Refuge Complex has been extensive over the past three decades despite limited staff and funding. Future efforts will be based upon statistically viable scientific research, combined with long-term monitoring of key species, provided funding is available for these important tasks. Seabirds using Oregon Islands and Three Arch Rocks NWRs represent a group of species that use different foraging guilds in the marine food web (R. Suryan unpublished data). Long-term small-scale or localized research using this suite of species as indicators of ocean conditions can be used to document change in the larger marine environment. The need to change or regulate human induced threats to refuge resources will be driven by an understanding of marine ecological parameters that is directly influenced by anthropogenic actions. The Refuges' role in increasing this knowledge is key to making informed management decisions with the best scientific information possible. Emphasis of research should focus on understanding the cause of reduced or declining seabird populations and development of tools and techniques to aid recovery of threatened or endangered species (USFWS 2005b).

4.2.2.8.2 Condition and trends

The Service has conducted seabird surveys along the coast of Oregon from 1966 to present (Naughton et al. 2007). Aerial and boat surveys have been standardized, both in technique and timing (Carter et al. 2001; Takekawa et al. 1990) since 1988 to more accurately census and monitor breeding seabirds. Pelagic and Brandt's cormorants have been monitored to determine population trends, and since 1988, have shown interannual variation in numbers, but overall remain stable over the study period (USFWS unpublished data). Common murre population

levels have shown during this time period to be influenced by natural (e.g., levels of upwelling, prey availability, bald eagle predation and presence) and human-induced (e.g., oil spills, aircraft

Pigeon guillemot. (Roy W. Lowe/USFWS)

and boating disturbance) factors and maybe on the verge of population decline (Naughton et al. 2007; R. Lowe pers. com.) Limited data and qualitative observations indicate that tufted puffin have been in decline in Oregon for more than a decade (Piatt and Kitaysky 2002) and may now represent less that 50% of the population present in 1988 (R. Lowe pers. com.) Common murres, Brandt's cormorants, and pelagic cormorants have been and will continue to be focal species for these surveys due to the ability of staff to conduct distant aerial or boat observations and/or photography of surface nesters with little or no disturbance. The knowledge is limited concerning the majority of seabirds that nest on the Refuges and is needed to determine the status of population levels and trends.

The black oystercatcher is a Service Focal Species for priority conservation efforts due to its restricted population size and range, susceptibility to human-caused disturbances, and lack of baseline natural history and ecological data to assess management actions and conservation status (Tessler et al. 2007). The black oystercatcher is also listed as a species of high concern within national, state, and regional shorebird conservation plans. As an obligate rocky shore species and good keystone species, it has been monitored along the central Oregon coast since 1997 by the Service. Reproductive output during this period has shown a stable population with interannual variability and no significant trend over the study period (USFWS unpublished data). Population

declines from increased disturbance and associated nest abandonment may lead to local extirpation on the Oregon coast. To assess the importance of demographic parameters, USGS with the Service's Ecological Services Division and a suite of other public agencies have developed a research assessment study to understand the ecology of the species in the southern portion of its range and to determine if increased management (e.g., public education, regulations, predator control) is needed for its conservation (Tessler et al. 2007). Because of this species' status as a species of concern, refuge staff will continue to assist the Service's Ecological Services Division and USGS with monitoring population trends.

The ODFW's management responsibilities along the coast including lands and waters, fish and wildlife, threatened and endangered species, and other programs that frequently overlap with Service resources and responsibilities. Increased cooperation between ODFW and the Refuge Complex will assist both agencies in meeting their missions and mandates and provide a more systematic and accessible process for sharing information and expertise, and funding as contained in the Oregon Conservation Strategy (ODFW 2006). Since refuge boundaries stop at the mean high tide line, ODFW and other state agencies are in a unique position to greatly assist the Refuge Complex in protecting sensitive seabirds and pinnipeds from human disturbance in close proximity to the Refuges though management actions as described in the Rocky Shores Management Strategy of the Territorial Sea Plan (LCDC 1994). The ODFW and the Refuge Complex share mutual interests in wildlife surveys, documenting and responding to seabird mortality events, developing joint research projects, education and outreach programs, species management, and dissemination of data, results, and information to a wider audience. Working in concert with ODFW is consistent with the policies of Oregon Statewide Planning Goal 19 - Ocean Resources and the Territorial Sea Plan. The Territorial Sea Plan specifies that Oregon should seek co-management arrangements with federal agencies when appropriate to ensure that ocean resources are managed and protected and to cooperate with other states and governmental entities directly and through regional mechanisms to manage and protect ocean resources and uses (LCDC 1994). The potential establishment of Marine Reserves in waters surrounding refuge rocks, reefs, and islands by the State of Oregon could add additional protection to refuge wildlife and habitats.

The Refuge Complex and the BLM have been working cooperatively since the early 1980s to protect the wildlife resources of YHONA and the adjacent rocks within Oregon Islands NWR. Working in close cooperation with BLM over the past two decades has resulted in the protection of existing seabird colonies and the pinniped haul-out site and provided for dramatic population increases in nesting seabirds and the colonization of new sites on the mainland and refuge rocks (R. Lowe pers. com.) Public use of YHONA is extremely high, exceeding 350,000 visitors annually. This site is now one of the premier seabird viewing locations in the country; it provides tremendous opportunities for wildlife resource interpretation and environmental education. There is a need for continued close coordination between the Refuge Complex and BLM to share data and ensure that adaptive management of public use and wildlife protection continues to prevent impacts to wildlife using refuge rocks directly adjacent to YHONA.

4.2.2.8.3 Key ecological attributes

Table 4-9. Key ecological attributes for seabirds*

Key Ecological Attributes	Indicators	Desired Conditions
Species abundance and diversity	• Population levels • Population available for viewing	• Stable or increasing • Large concentrations
Sanctuary	• Secure roosting and nesting habitats • Native plants • Predation • Impact from diseases	• Roosting and nesting areas protected from disturbance • Rocks and islands with soil covered by native plant communities • No invasive mammals present and avian predation limited to natural events • Minimal avian and mammalian predators • Limited or no disease

*Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence certain indicators, played a role in determining the ultimate parameters and condition levels chosen for each conservation target. Thus the key ecological attributes should be viewed as a step in the planning process but the ultimate objective design was subject to further discussion and consideration.

4.2.2.8.4 Threats

One of the greatest challenges currently facing the National Wildlife Refuge System and fish and wildlife populations in the twenty-first century is rapid climate change brought about by global warming (Defenders of Wildlife 2006). Oregon's climate is warmer than it was 20 years ago and this trend is likely to continue into the next century. Climate change is a large-scale issue that has and will continue to affect refuge resources in the future. The potential large-scale impacts of global warming on the Pacific Ocean and nearshore environment include increase in sea-level and sea-surface temperatures, changes in salinity, alkalinity, wave and ocean circulation patterns and upwelling, and loss of coastal marshes, estuaries, and ocean beaches (Glick et al. 2007). The consequence of these changes and losses in Oregon's marine environment include direct loss of habitat through coastal inundation and flooding, changes in species biogeography, including marine wildlife species (e.g., phytoplankton, krill, forage fish, seabirds, pinnipeds) and invasive species (e.g., animals, plants, microbes, pathogens). Although there is no certainty regarding the precise nature and rate of changes to Oregon's marine environment, it is clear that changes in the environment have the potential for serious social, economic, and environmental impacts. The monitoring and research of potential climate change impacts on refuge species and habitats is complex and difficult and will require cooperation from numerous public and private organizations to analyze all the factors that could affect the region's wildlife and habitat.

Many seabird colonies are located immediately adjacent to the coastline and some are connected to the beach at low tides. Human disturbance impacts to nesting seabirds at these sites are of great concern. The Refuge Complex has initiated and maintained a number of extensive outreach and educational efforts designed to prevent or lessen human disturbance impacts at seabird colonies (see Chapter 5). At some locations such as Yaquina Head, Seal Rock, and Heceta Head, seabird nesting populations have shown significant growth following outreach and education efforts designed to lessen human impacts. Efforts to continue to protect seabirds and pinnipeds

on the Refuges from human disturbance will need to continue and expand as land development continues to increase and more tourists visit the Oregon coast.

Predation of seabirds, particularly by non-native and native mammalian predators, has been documented to have negative effects on nesting seabirds on the Oregon coast (USFWS 2005a; A. Pollard unpublished data). Many of the rocks and islands impacted by these mammals are connected or within swimming distance during low tides and are easily accessible to predators. The Oregon coast is experiencing rapid human growth in residential, commercial and recreational development. As the human population increases and lands are developed there will likely be accompanying increased range expansion and population sizes of predators, such as red foxes, raccoons, feral cats, and rats, that find beneficial aspects of human refuse as a food resource and infrastructure that can be used as shelter or breeding sites. In recent years, a reduction in the number of seabirds nesting at some mainland sites has been noted and may be due, in part, to predation by red foxes, feral cats, and raccoons, which are often attracted to areas of public use such as Harris State Beach Park and Bandon's waterfront on the south coast and YHONA to the north.

Bald eagles nesting near seabird colonies prey predominantly on seabirds for food (DeGange and Nelson 1982; Sherrod et al. 1976). Bald eagles in Oregon have been increasing steadily since the 1970s. The net increase in the Oregon population was 8.9% in 2007, with an average annual increase of 6.9% from 1995 through 2004. Along the Oregon coast, the nesting bald eagle population increased 17% from 2003 through 2007 (Isaacs and Anthony 2008). Since 1994, disturbance at common murre and Brandt's cormorant colonies from increasing numbers of bald eagles on Oregon's north and central coast has resulted in colony abandonment, population declines, and redistribution (R. Lowe pers. com.; Naughton et al. 2007). This successfully recovered eagle population is expected to continue a positive growth trend in Oregon, and it is unknown what level of influence this increasing population of predators will have on seabird populations and demography. Cooperative research efforts with the Refuges, OSU, and Oregon Sea Grant, to quantify the effects of bald eagles on common murre reproductive output at Yaquina Head were started in 2007. Preliminary results indicate that eagle foraging disturbance was high prior to incubation initiation by the murres (OSU unpublished data). Continuation of this research and expansion to the entire Oregon coast is needed to determine if changes in seabird populations are affected by direct mortality and disturbance, secondary predators (e.g., gulls, ravens) during eagle disturbance events, or immature eagle foraging and loafing patterns. In addition, research should also focus on developing long-term population and range trends for seabird species, such as the common murre, facing impacts from the expanding bald eagle population.

4.2.2.9 Endangered, threatened, and sensitive species

4.2.2.9.1 State or federally listed species known to occur on refuges

One goal of the Refuge System is "to conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered." In the policy clarifying the mission of the Refuge System, it is stated "We protect and manage candidate and proposed species to enhance their status and help preclude the need for listing."

In accordance with the above, the CCP team considered any species with federal or state status in the planning process. Table 4-10 lists the species that are state or federally listed that are known to occur on the Refuges. Other state-listed species may occur but have not been documented.

Listed species that are suspected to have occupied refuge lands historically are also part of this target. Discussion on the listed species follows Table 4-10.

Table 4-10. Federal and State listed species known to occur or very likely to occur on Oregon Islands, Three Arch Rocks, and Cape Meares National Wildlife Refuges.

Species	Federal*	Oregon*	Current Occurrence on Refuges
California brown pelican	Endangered	Endangered	Common visitor; roosting on rocks and islands
Black oystercatcher	Species of Concern	Sensitive-Vulnerable	Resident; breeds on rocks and islands
Marbled murrelet	Threatened	Threatened	Possible breeder in old-growth forest at Cape Meares NWR
Bald eagle	Species of Concern	Threatened	Common year-round; forages on seabirds. Nests at Cape Meares NWR
American peregrine falcon	Species of Concern	Species of Concern	Common year-round; nests on all three NWRs
Aleutian cackling goose	Species of Concern	Species of Concern	Migrant during spring and fall; winters on Haystack Rock at Pacific City
Northern spotted owl	Threatened	Threatened	Formerly occurred on Cape Meares NWR; no reliable observations in decades
Steller sea lion	Threatened	Unknown	Common throughout year; breeds on Oregon Islands and Three Arch Rocks NWRs

* Federal status of species located at http://ecos.fws/Endangered/wildlife.html
* Oregon status of species located at http://www.dfw.state.or.us/

4.2.2.9.2 Condition and trends of federally listed species and habitats utilized on refuges

The California brown pelican breeds in southern California and Mexico during the winter and early spring and migrates north to Oregon and Washington where it is common from late spring through fall. In Oregon brown pelicans use refuge rocks and islands as secure roosting sites. It is rarely seen inland or far out at sea as the species forages for small fish in the nearshore coastal waters. The primary reason for severe declines in the U.S. population, and for designating the species as endangered, was DDT contamination in the 1960s and early 1970s. The pesticide DDT and its principal metabolite DDE are not easily broken down and accumulate in the tissues of species at the top of the food chain (USFWS 1983). Since banning of these organochlorine pesticides, brown pelican abundance has shown a dramatic recovery, and although annual reproductive success varies widely, populations have remained generally stable for at least 20 years (USFWS 2007b). Therefore, the Service proposed to remove the brown pelican from the List of Endangered and Threatened Wildlife because it no longer meets the definition of endangered or threatened (USFWS 2008a, 2008b).

The black oystercatcher is a Service Focal Species for priority conservation efforts due to its restricted population size and range, susceptibility to human-caused disturbances, and lack of baseline natural history and ecological data to assess management actions and conservation status (Tessler et al. 2007). The black oystercatcher is also listed as a species of high concern within the national, state, and regional shorebird conservation plans (USFWS 2000). As an obligate rocky shore species and good keystone species it has been monitored along the central Oregon coast, including below Cape Meares, since 1997 by the Service. Statewide monitoring for this species has occurred since 2005, determining that the south coast has the largest portion of the breeding

Peregrine falcon perched on a cliff. (Dave Ledig/USFWS)

population (Elliott-Smith et al. 2007). Reproductive output during this period has shown a stable population with interannual variability and no significant trend over the study period (USFWS unpublished data). Because of this species' status as a species of concern, refuge staff will continue to assist the Service's Ecological Services Division and USGS with monitoring of population trends.

The marbled murrelet, a small oceanic seabird that nests in the coastal, old-growth forests of the Pacific Northwest, is listed as a threatened species under the Endangered Species Act (ESA) for the lower 48 states (USFWS 1997). The birds were disappearing rapidly from California, Oregon, and Washington as its coastal habitat came under pressure from logging and human development. The three northwestern states marbled murrelet population is estimated at 17,000 to 27,000 and has continued to decline (4–7% per year) and fragment over the last 10 years (McShane et al. 2004). The Canada population is estimated to be between 54,000 to 92,000, and Alaska has approximately 270,000 individuals and has experienced a 70% decline during the past 25 years (Piatt et al. 2007). The Service identified 3.6 million acres in California, Oregon, and Washington as critical habitat to aid in the recovery process (USFWS 2006). Marbled murrelet surveys in 1989 and 1990 detected this species at Cape Meares NWR and adjacent state park (USFWS unpublished data). The old-growth habitat at Cape Meares is considered potential breeding habitat, but breeding surveys have not occured.

Bald eagles are year-round residents of the Refuges. They forage over or perch on rocks and islands were they actively pursue and capture seabirds. This activity is most common during spring and summer seabird breeding season. An active bald eagle nest has been present at Cape Meares since 1985 (Isaacs and Anthony 2008). In 1973, the bald eagle was listed as threatened in Oregon (43 Federal Register [FR] 6230–6233) and in June 2007 it was delisted in the lower 48 states (72 FR 37345–37372). There are almost 10,000 breeding pairs in the lower 48 states, and more than 40,000 individuals reside in Alaska (USFWS 2007c).

The American peregrine falcon was removed from the federal endangered species list in August 1999 (64 FR 46541–46558), and from the state of Oregon list in 2007. The peregrine falcon breeds, loafs, and forages on the coastal habitat found on the three refuges. The Refuge Complex initiated reproductive success monitoring efforts in 1993 at peregrine eyries at Three Arch Rocks and Cape Meares NWRs. In 2004, the monitoring effort was expanded with the inclusion of 15 newly re-occupied south and north coast eyries (USFWS unpublished data). This coastwide nesting success data are combined with state and nationwide efforts to monitor population trends in a national post-delisting monitoring program that was initiated in 2002 (Isaacs 2007; USFWS 2003). Monitoring surveys will be conducted on the Refuges every three years and will be added to the national effort that will review the status of the species in 2015.

The Aleutian cackling goose was delisted 2001 and currently uses Three Arch Rocks and Oregon Islands NWRs as foraging and nocturnal roosting habitat. The rocks and islands are important for staging Aleutian cackling geese as they prepare for migration to breeding grounds. Geese occupy the refuge islands mainly from January through April, with peak numbers in March in California and in early April for Oregon (USFWS unpublished data). The unique Semidi Islands subpopulation of Aleutian cackling geese, numbering approximately 140 birds, winters at Nestucca Bay from October-April and uses Haystack Rock at Pacific City as their nocturnal roosting site. The overall population of Aleutian cackling geese has recovered from a low of 790 in 1973 to the current estimated population of 114,000 (USFWS unpublished data).

The northern spotted owl primarily inhabits old-growth forests in the northern portion of the Pacific coast from southern British Columbia to northern California. Historically, the greatest threat to this species is the loss of old-growth and mature late-seral forests that contain large dead trees for nesting and prey habitat. In 1989 and 1990, the Service reviewed its status and proposed listing the species as threatened throughout its range in northern California, Oregon, and Washington (55 FR 26114–26194). Protection of the owl under the Endangered Species Act has led to significant changes to forest practices and land management in the northwest and has curtailed logging in old-growth forest. Currently, there are 3,000 to 5,000 pairs remaining in the states of Washington, Oregon, and California, and the population continues to decline 3.7% per year (Nickerbocker 2007). This species has not been observed or reported at Cape Meares NWR for more than several decades; however, the old-growth habitat has suitable characteristics for nesting but likely represents too small of an area.

The Steller sea lion is divided into the western (Gulf of Alaska, Bering Sea, Russia, and Japan) and eastern (California, Oregon, British Columbia, and southeast Alaska) stocks based on genetic evidence and population trends (Bickham et al. 1996; Loughlin 1997). The western stock has declined 70 to 80% since the 1970s and was listed as endangered in 1990 (62 FR 24345–24355). The eastern stock, which occurs in Oregon, was listed as threatened in 1990 (55 FR 49204). Suspected causes of the precipitous decline include over-fishing of prey stocks, orca predation, disease, climate change, and human interactions (NOAA 2007a, 2007b). The eastern stock's total

population size was 46,000 to 58,000 and increasing at 3% per year (NOAA 2007c; Pitcher et al. 2007). The Steller sea lion use refuge rocks, reefs, and islands within Oregon Islands and Three Arch Rocks NWRs, as haul-out areas year round (R. Lowe pers. com.) The Rogue Reef Unit and Orford Reef Unit of Oregon Islands NWR support breeding rookeries of Steller sea lions and 1,128 pups were produced in 2002 (Pitcher et al. 2007). In addition, small numbers of pups (fewer than 10) are born annually on Seal Rock at Three Arch Rocks NWR (R. Brown pers. com.)

4.2.2.9.3 Key ecological attributes and threats

Key ecological attributes and threats differ for each listed species and are not described here in the interest of space. Recovery plans and other species-specific documents are the best source for in depth information on these species.

4.2.2.10 Pinnipeds

4.2.2.10.1 Description and location

The Oregon Islands and Three Arch Rocks NWRs' primary purposes are the protection and conservation of pinnipeds and colonial nesting seabirds (E.O. No. 4364 and 699). Steller and California sea lions and harbor seals haul out on many rocks, reefs and islands associated with Oregon Islands and Three Arch Rocks NWRs. Steller sea lions breed and pup at Rogue and Orford Reefs. Harbor seals breed and pup at many refuge rocks, reefs, and islands along the Oregon coast. Northern elephant seals haul out and pup (fewer than 15 individuals) on Shell Island within the Simpson Reef Unit of Oregon Islands NWR near Cape Arago.

4.2.2.10.2 Condition and trends

Results from ODFW and NOAA Fisheries Service studies indicate the Steller sea lions in Oregon are year-round residents and have breeding rookeries at several sites on the Refuges. At least 10 haul-out sites are used on a regular basis, with reproductive activities occurring primarily at Orford and Rogue Reefs. An additional small number of pups (fewer than 10) are born each year on Seal Rock at Three Arch Rocks NWR on the north coast (R. Brown pers. com.) Recent counts of Steller sea lions (4,000–5,000) in Oregon have increased from counts made in the late 1970s (2,000–2,500). Annual peak counts occur during the June and July reproductive season. Winter counts range from 1,000 to 1,500 statewide. In 1994, 2,696 adults and juveniles and 423 pups were counted at the two major south coast rookeries (Rogue Reef and Orford Reef). Population estimates using aerial photography in 2002 determined Oregon's Steller sea lion population at 4,169 nonpups and 1,136 pups (Pitcher et al. 2007). Steller sea lions marked as newborn pups on Rogue Reef have been resighted at various ages (6 months–5 years) at haul-out areas from northern California through Washington, British Columbia, southeast Alaska, and the eastern and central Gulf of Alaska (NMFS 2008).

Peak counts of California sea lions in Oregon have increased from 1,000 to 2,000 in the late 1970s to 5,000 to 7,000 into 2000 (ODFW unpublished data). California sea lions are found in greatest abundance on the south coast of Oregon at Rogue Reef and Orford Reef (500–1,000), at Cape Arago and Sea Lion Caves on the central coast (2,000–3,000), and at Cascade Head and the south jetty of the Columbia River on the north coast (2,000–3,000). Peak number estimates can vary between annual surveys from 100 to 1,000 individuals due to seasonal migration (S. Riemer pers. com.) California sea lion numbers fluctuate seasonally, with peaks occurring in fall and spring as males move north from California breeding sites in the fall and then back south in the spring. Recently, researchers have observed more females than in the past, and in general, the sea lions

appear to return earlier compared to historical accounts (ODFW unpublished data). Continuous counts occur at the East Mooring Basin in Astoria, Oregon, where branding work occurs.

Historic population levels of harbor seals in Oregon are unknown. The distribution and abundance of harbor seals in Oregon were monitored from 1977 to 2003 by ODFW through aerial photographic surveys. Harbor seals on shore were counted each year during the reproductive period. Mean annual counts of nonpups (adults and subadults) were used as an index of population size and the trend in the counts was modeled using exponential (density-independent) and generalized logistic (density-dependent) growth models. The population grew following protection under the Marine Mammal Protection Act of 1972, until stabilizing in the early 1990s. The estimated absolute abundance of harbor seals (all age classes) during the 2002 reproductive period was 10,087. The current predicted population size for harbor seals in Oregon is above its estimated maximum net productivity level and hence within its optimum sustainable population range. The ODFW speculates that recent increases in ocean productivity in the eastern Pacific Ocean may lead to an increase in carrying capacity and renewed growth in Oregon's harbor seal population (Brown et al. 2005).

Elephant seals are found occasionally in Oregon either resting or molting on refuge rocks, reefs, and islands and adjacent sandy beaches. Elephant seals do not generally breed in Oregon; however, there is one pupping site in Oregon at Shell Island near Cape Arago State Park where elephant seals haul out year-round and pup. The majority of the elephant seals in Oregon observed at locations other than Cape Arago are subadult animals that come to shore to molt.

4.2.2.10.3 Key ecological attributes and threats

Key ecological attributes and threats, most of which occur off of the Refuges, differ for each listed species and are not described here in the interest of space. Recovery plans and other species specific documents are the best source for in depth information on these species.

4.3 Current Wildlife and Habitat Research and Monitoring Efforts

The National Wildlife Refuge System Administration Act (16 U.S.C. 668dd–688ee), as amended, requires the Service to monitor the status and trends of fish, wildlife, and plants on each refuge in the Refuge System. The Oregon Coast Refuge Complex has relatively limited staff but extensive responsibilities managing six NWRs, resulting in insufficient capacity to carry out well-designed population inventories and assessments and report impacts of management actions. For many species and habitats, baseline inventories have not yet been conducted. The Service needs to provide additional staff to address the biological complexity of the Complex's six refuges. The 2008 Staffing Plan Model for the Refuge Complex identifies the need for an additional 21 employees, not including additional law enforcement personnel needs, to effectively manage the six Refuges within the Complex. The 2008 Staffing Plan calls for an additional six biologists for the Refuge Complex; however, due to budget constraints a single permanent full-time biologist continues to coordinate the biological program for the Complex. The CCP Implementation Plan (Appendix G) identifies staffing proposals over the 15-year life of this CCP, for administration of the Complex's various management programs.

The Refuge Complex is continuing to conduct boat, ground, and aerial seabird surveys (e.g., cormorants, common murre, pigeon guillemot, tufted puffin, western and glaucous-winged gulls/hybrids, black oystercatcher, small nocturnal burrow-nesting species) along the coast of Oregon (Naughton et al. 2007; USFWS unpublished data). In addition, the Refuge Complex

assists other agencies (NOAA, USGS) in surveying listed or delisted threatened/endangered species (e.g., Steller sea lion, brown pelican, peregrine falcon, Aleutian cackling goose).

Over the past 40 years the Refuge Complex has conducted seabird surveys and continues to standardize the effort, both in technique and timing (Takekawa et al. 1990) to more accurately census and monitor breeding seabirds. Survey methods vary by species, location, size of colony, logistics, and personnel/organization conducting the surveys. Surveys are conducted from boats, aircraft, and land. Land or ground surveys are conducted from remote vantage points or from within the colony. In general, four techniques are used: (1) counts of nests, either directly or from aerial photographs; (2) counts of adult birds on or around the colony, either directly or from aerial photographs; (3) sampling to estimate burrow density and occupancy rates, combined with estimates of colony area; and (4) crude estimates of nests, birds, or burrows.

Seabird colony estimates are based on actual nest counts that provide the most accurate information, and this method is currently used on all counts of pelagic cormorants, Brandt's cormorants, double-crested cormorants, and western/glaucous-winged gulls. Direct nest or burrow counts are also employed whenever possible to estimate tufted puffin populations, but their burrow-nesting habits make the results less reliable.

Estimates based on the total number of adults present on the colony are used for those species whose nests are difficult to find and for species that nest in dense colonies, where it is difficult, or impossible, to distinguish breeding from nonbreeding individuals. Pigeon guillemots and black oystercatchers are often quite conspicuous around nesting colonies, but their actual nest sites are difficult to locate. Common murres nest in large, dense colonies, and estimates of colony size for this species are based on counts of adult birds on the colony (from aerial photographs), adjusted by a correction factor, to account for breeding birds away from the colony and nonbreeding birds in attendance.

Burrow-nesting species are the most difficult to survey, and colonies are directly sampled to estimate burrow density and occupancy rates. The area of the colony is estimated in the field or from aerial photographs. Density of active burrows is combined with estimates of colony area to generate colony estimates. Protocols and procedures have not been standardized for burrow-nesting species even though they comprise 38% of the 1.3 million seabirds that nest along the Oregon coast (Naughton et al. 2007). The Refuge Complex has begun investigations to determine methods for monitoring small nocturnal burrow nesting species (e.g., Leach's and fork-tailed storm-petrels, rhinoceros and Cassin's auklets), but much work remains to be done.

Major roosts of federally listed threatened brown pelican are found on Oregon Islands and Three Arch Rocks NWRs and other estuaries managed by the Refuge Complex. At Oregon Islands and Three Arch Rocks NWRs, monitoring efforts to assist in the recovery of this species started in 1987 (R. Lowe pers. com.) Annual aerial counts during the fall at coastal rocks, reefs, islands, and estuaries have documented a positive population trend of roosting pelicans from 4,622 in 1988 to 18,589 during the 2007 survey (USFWS unpublished data). Continuation of these annual aerial surveys will assist the Service in determining if the California brown pelican population is recovered to the level of delisting under the ESA (USFWS 1983). If this species is delisted, section 4(g)(1) of the ESA requires the Service to implement a plan to effectively monitor the status of all species that have been recovered and delisted. To assist in these recovery efforts, the continuation of annual monitoring efforts will document the population numbers of pelicans along the coast of Oregon during the tenure of this CCP.

The recently delisted peregrine falcon breeds, loafs, and forages on the coastal habitat found on all three coastal Refuges. The Refuge Complex initiated reproductive success monitoring efforts in 1993 at peregrine eyries at Three Arch Rocks and Cape Meares NWRs. In 2004, the monitoring effort was expanded with the inclusion of 15 newly re-occupied south and north coast eyries (USFWS unpublished data). This coast wide nesting success data is combined with state and nationwide efforts to monitor population trends in a national post-delisting monitoring program that was initiated in 2002 (Isaacs 2007; USFWS 2003). Monitoring surveys will be conducted on the Refuges every three years and will be added to the national effort that will review the status of the species in 2015.

The Aleutian cackling goose was recently delisted and currently uses the vegetated islands associated with the Oregon Islands NWR, along with private and public coastal short-grass pasturelands along the coast of northern California and Oregon (e.g., Nestucca Bay NWR). The ESA requires that the Service monitor population levels of formerly listed species for five years after delisting (USFWS 2001). Post-delisting monitoring efforts by the Refuge involve assisting the Service's monitoring plan in surveying the spring migration population by conducting direct counts of geese as they leave their roosts and through indirect population estimations based on the marked to unmarked ratio of neck-collared birds (Ross et al. 2007). Current annual monitoring of this subspecies is conducted as part of the Aleutian Cackling Goose Monitoring Program that is funded and managed by the Service's Division of Migratory Bird Management to assess management actions (e.g., hunting, land acquisition) that may affect population levels.

The ODFW and NOAA Fisheries Service are continuing to conduct surveys of pinniped populations that use the Refuges and adjacent mainland areas. The Refuge Complex supports this work by issuing Special Use Permits and reporting marked animals. The Refuge works closely with ODFW and NOAA Fisheries Service personnel on research associated with Steller sea lions within Oregon Islands NWR. The research is investigating population dynamics, recruitment, survivorship, and dispersal of young of this threatened species.

4.4 References

Achterman, G.L., R. Davis-Born, I. Rolston, and L. Gaines. 2005. Oregon coastal community water supply assessment. Institute for Natural Resources, Oregon State University. 43 pp.

Anderson, V.D. 2006. Creatures of empire: how domestic animals transformed America. Oxford University Press. pp. 147-148.

Ashmole, N.P., M.J. Ashmole, and K.E.L. Simmons. 1994. Seabird conservation and feral cats on Ascension Island, South Atlantic. Pages 94-121 in: D.N. Nettleship, J. Burger, and M. Gochfeld, eds. Seabirds on islands: threats, case studies and action plans. BirdLife Conservation Series no. 1.

Atkinson, I.A.E. 1985. The spread of commensal species of Rattus to oceanic islands and their effects on island avifaunas. Pages 35-81 iIn: P.J. Moors, ed. Conservation of Island birds: case studies for the management of threatened island species. International Council on Bird Preservation Technical Publication No. 3.

Bailey, E.P. and J.L. Trapp. 1984. A second wild breeding population of the Aleutian Canada goose. American Birds 38(3):284-286.

Barbour, M. and A.F. Johnson. 1977. Beach and dune. Pages 223-270 in: M. Barbour and J. Major, eds. Terrestrial vegetation of California. New York: John Wiley & Sons.

Barth, J.A., B.A. Menge, J. Lubchenco, F. Chan, J.M. Bane, A.R. Kirincich, M.A. McManus, K.J. Nielsen, S.D. Pierce, and L. Washburn. 2007. Delayed upwelling alters nearshore coastal ocean ecosystems in the northern California current. Proceedings of the National Academy of Sciences of the United States of America 104:3719-3724.

Bax, N., A. Williamson, M. Aguero, E. Gonzalez, and W. Geeves. 2003. Marine invasive alien species: a threat to global biodiversity. Marine Policy 27(4):313-323.

BCMF (British Columbia Ministry of Forests) and BCMELP (British Columbia Ministry of Environment, Lands, and Parks). 1995. Biodiversity guidebook. B.C. Forest Practices Code. Victoria, B.C.

Bickham, J.W., J.C. Patton, and T.R. Loughlin. 1996. High variability for control-region sequences in an marine mammal: Implications for conservation and biogeography of Steller sea lions (*Eumetopias jubatus*). Journal of Mammalogy 77(1):95-108.

Birkhead, T.R. 1978. Attendance patterns of guillemots (*Uria aalge*) at breeding colonies at Skomer Island. Ibis 120:219-229.

Bolsinger, C.L. and K.L. Waddell. 1993. Area of old-growth forests in California, Oregon, and Washington. U.S. Forest Service Research Bulletin PNW-RB-197. 32 pp.

Bourne, W.R.P. 1981. Rats as avian predators: discussion. Atoll Resources Bulletin 255:69-72.

Brown R.F., B.E. Wright, S.D. Riemer, and J. Laake. 2005. Trends in abundance and current status of harbor seals in Oregon: 1977-2003. Marine Mammal Science 21(4):657-670.

Carter, H.R., U.W. Wilson, R.W. Lowe, M.S. Rodway, D.A. Manuwal, J.E. Tekekawa, and J.L. Yee. 2001. Population trends of the common murre (*Uria aalge californica*). In: D. A. Manuwal, H. R. Carter, T. S. Zimmerman, and D. L. Orthmeyer, eds. Biology and conservation of the common murre in California, Oregon, Washington, and British Columbia. Volume 1: Natural history and population trends. Information and Technology Report USGS/BRD/ITR-2000-0012. U.S. Geological Survey. Washington, D.C.

Chen, J., J.F. Franklin, and T.A. Spies. 1990. Microclimatic pattern and basic biological responses to the clearcut edges of old-growth Douglas-fir stands. Northwest Environment 6(2):424-425.

Clark, D.A. 1981. Foraging patterns of black rats across a desert-montane forest gradient in the Galapagos Islands. Biotropica 13:182-194.

Cornell University and AOU (American Ornithologists' Union). 2008. The Birds of North America online. Species accounts. Available at: http://bna.birds.cornell.edu/bna.

Davis, T. 1996. Distribution, abundance, microhabitat use, and interspecific relationships amoung terrestrial salamanders on Vancouver Island, British Columbia. Ph.D. dissertation. University of Victoria, Victoria, BC.

Defenders of Wildlife. 2006. Refuges at risk; the threat of global warming. Washington, D.C. 20 pp.

DeGange, A.R. and J.W. Nelson. 1982. Bald eagle predation on nocturnal seabirds. Journal of Field Ornithology 53(4):407-409.

Elliott-Smith, E., S.M. Haig, and N. Holcomb. 2007. Black oystercatcher reproductive success on the Oregon coast final report. U.S. Geological Survey. Corvallis, OR. 17 pp.

Flagella, M.M., M. Verlaque, A. Soria, and M.C. Buia. 2007. Macroalgal survival in ballast water tanks. Marine Pollution Bulletin 54(9):1395-1401.

French, B. 2008. Report for special use permit. Ascending the giants, report to USFWS. 2 pp.

Gaston, A.J. 1994. Status of the ancient murrelet (*Synthliboramphus antiquus*) in Canada and the effects of introduced predators. Canadian Field-Naturalist 108:211-222.

Glick, P., J. Clough, and B. Nunley. 2007. Sea-level rise and coastal habitats in the Pacific Northwest. An analysis for Puget Sound, southwestern Washington, and northwestern Oregon. National Wildlife Federation. Seattle, WA. 94 pp.

Gomez, D.M., R.G. Anthony, and R.W. Lowe. 1997. Small mammal and amphibian abundance at Cape Meares National Wildlife Refuge – final report. U.S. Fish and Wildlife Service Report. Newport, OR. 34 pp.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume 1. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, VA.

Irons, D.B., T. Anker-Nilssen, A.J. Gaston, G.V. Byrd, K. Falk, G. Gilchrist, M. Hario, M. Hjernquist, Y.V. Krasnov, A. Mosbech, B. Olsen, A. Petersen, J.B. Reid, G.J. Robertson, H. Strom, and K.D. Wohl. 2008. Fluctuations in circumpolar seabird populations linked to climate oscillations. Global Change Biology 14(7):1455-1463.

Isaacs, F.B. 2007. Results of peregrine falcon breeding area monitoring in Oregon, 2003-2006: final report. 5 Feb 2007, Oregon Cooperative Fish and Wildlife Research Unit. Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR.

Isaacs, F.B. and R.G. Anthony. 2008. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River recovery zone, 1971 through 2007. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University. Corvallis, OR.

Jehl, J.R., Jr. 1984. Conservation problems of seabirds in Baja California and the Pacific Northwest. Pages 41-48 in: J.P. Croxall, P.G.H. Evans, and R.W. Schreiber, eds. Status and conservation of the world's seabirds. International Council of Bird Preservation technical publication no. 2.

Kadlec, J.A. 1971. Effects of introducing foxes and raccoons on herring gull colonies. Journal of Wildlife Management 35:625-636.

Kagan, J.S. 2002. Vegetation of Crook Point Unit of Oregon Islands National Wildlife Refuge, Curry County, Oregon. Final report. U.S. Fish and Wildlife Service. Newport, OR. 15 pp.

Kagan, J.S., J.A. Christy, M.P. Murray, and J.A. Titus. 2000. Classification of native vegetation of Oregon. Oregon Natural Heritage Program, Portland, OR. 56 pp.

Keitt, B.S., C. Wilcox, B.R. Tershy, D.A. Corll, and C.J. Donlan. 2002. The effects of feral cats on the population viability of black-vented shearwaters (*Puffinus opisthomelas*) on Natividad Island, Mexico. Animal Conservation 5:217-223.

Kuletz, K.J., S.W. Stephensen, and D.B. Irons. 2003. Changes in distribution and abundance of Kittlitz's murrelets *Branchyramphus brevirostris* relative to glacial recession in Prince William Sound, Alaska. Marine Ornithology 31:133-140.

Lawler, J.J., M. Mathias, A.E. Yahnke, and E.H. Girvetz. 2008. Oregon's biodiversity in a changing climate. Report prepared for the Climate Leadership Initiative, University of Oregon.

LCDC (Land Conservation and Development Commission). 1994. Oregon territorial sea plan. Salem, OR. 250 pp.

Loughlin, T.R. 1997. Using the phylogeographic method to identify Steller sea lion stocks. Pages 159-171 in: A.E. Dizon, S.J. Chivers, and W.F. Perrin, eds. Molecular genetics of marine mammals. Society for Marine Mammals Special Publication no. 3.

Maas-Hebner, K.G. and B.A. Schrader. 2001. The effects of silviculture activities on wildlife and fish populations in Oregon and the Pacific Northwest: an annotated bibliography from 1960 to 1999. Oregon State University, College of Forestry, Forest Research Laboratory, Research Contribution 32. 124 pp.

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report, EDAW, Inc., Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, OR.

Moors, P.J. and I.A.E. Atkinson. 1984. Predation on seabirds by introduced animals and factors affecting its severity. International Council on Bird Preservation Technical Publication No. 2.

Naughton, M.B., D.S. Pitkin, R.W. Lowe, K.J. So, and C.S. Strong. 2007. Catalog of Oregon seabird colonies. Biological Technical Publication Region 1, BTP-R1009-2007. U.S. Department of the Interior, Fish and Wildlife Service. Washington, D.C.

Nickerbocker, B. 2007. Northern spotted owl's decline revives old concerns. Christian Science Monitor. June 27, 2007. 3 pp.

NMFS (National Marine Fisheries Service). 2008. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service. Silver Spring, MD. 325 pp.

NOAA (National Oceanic and Atmospheric Administration). 2007a. Draft revised Steller sea lion recovery plan (*Eumetopias jubatus*). National Marine Fisheries Service. Silver Spring, MD. 305 pp.

NOAA. 2007b. National Marine Mammal Laboratory California Current ecosystems program; Steller sea lion demography. California/Oregon. Available at: http://www.atsc.noaa.gov/nmml/california/research/demographyca.php.

NOAA. 2007c. Draft Pacific marine mammal stock assessment report. Available at: http://www.nmfs.noaa.gov/pr/sars/draft.htm.

NPS (National Park Service). 2001. Ice plant, sea fig (*Carpobrotus chilensis*). Available at: http://www.nps.gov/archive/redw/iceplant.htm.

Nyberg, J.B. and D.W. Janz, eds. 1990. Deer and elk habitats in coastal forests of southern British Columbia. Special Report Series No. 5. British Columbia Ministry of Forestry Research Branch, Victoria, BC.

ODFW (Oregon Department of Fish and Wildlife). 2006. The Oregon conservation strategy. Salem, OR. 372 pp.

Olson, B.E. 1999. Impacts of noxious weeds on ecologic and economic systems. Pages 4-18 in: R.L. Sheley and J.K. Petroff, eds. Biology and management of noxious rangeland weeds. Oregon State University Press, Corvallis, OR.

ONHIC (Oregon Natural Heritage Information Center). 2008. Oregon State University, Institute for Natural Resources. Available at: http://oregonstate.edu/ornhic/data.html.

ONHP (Oregon Natural Heritage Program). 2003. Oregon natural heritage plan. Department of State Lands. Salem, OR. 167 pp.

OSMB (Oregon State Marine Board). 1994. Proposed and adopted regulations. Salem, OR.

Piatt, J.F. and A.S. Kitaysky. 2002. Tufted puffin (*Fratercula cirrhata*). Available at: http://bna.birds.cornell.edu/bna/species/708.

Piatt, J.F., K.J. Kuletz, A.E. Burger, S.A. Hatch, V.L. Friesen, T.P. Birt, M.L. Arimitsu, G.S. Drew, A.M.A. Harding, and K.S. Bixler. 2007. Status review of the marbled murrelet (*Brachyramphus marmoratus*) in Alaska and British Columbia. U.S. Geological Survey Open-File Report 2006-1387. 258 pp.

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

Reichard, S. 2004. Invasive plants in the wildland-urban interface. Pages 235-244 in: S.W. Vince, M.L. Duryea, E.A. Macie, and A. Hermansen, eds. Forests at the wildland-urban interface: conservation and management. Boca Raton, FL: CRC Press.

Riemer, S.D. and R.F. Brown. 1997. Monitoring human-wildlife interactions and disturbance of seabirds and pinnipeds at Three Arch Rocks National Wildlife Refuge, 1993-1994. Wildlife Diversity Program Technical Report #97-6-01. Oregon Department of Fish and Wildlife. 27 pp.

Rodgers, J.A., Jr. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25(1):139-145.

Rodway, M.S. 1990. Attendance patterns, hatching chronology, and breeding population of common murres on Triangle Island, British Columbia following the Nestucca oil spill. Canadian Wildlife Service Technical Report Series 87.

Rojek, N.A., M.W.Parker, A.R. Carter, and G.J McClesney. 2007. Aircraft and vessel disturbances to common murres *Uria aalge* at breeding colonies in central California, 1997-1999. Marine Ornithology 35:67-75.

Ross, K.G., D.C. Bachman, and E.T. Nelson. 2007. Aleutian cackling goose monitoring program, 2005-2006. Progress report for the north coast of California and Southern Oregon. Humboldt Bay NWR. Unpublished report. 25 pp.

SCBC (Stewardship Centre for British Columbia). 2003. Coastal shore stewardship: a guide for planners, builders, and developers on Canada's Pacific coast. 94 pp.

Sharrow, S.H., D.N. Uekert, and A.E. Johnson. 1988. Ecology and toxicology of *Senecio* species with special reference to *Senecio jacobaea* and *Senecio longilobus*. Pages 181-197 in: L.F. James, M.H. Ralphs, and D.B. Nielsen, eds. The ecology and economic impact of poisonous plants on livestock production. Boulder, CO: Westview Press.

Sherrod, S.H., C.M. White, and F.S.L. Williamson. 1976. Biology of the bald eagle on Amchitka Island, Alaska. Living Bird 15:143-182.

Slater, P.J.B. 1980. Factors affecting the number of guillemots (*Uria aalge*) on cliffs. Ornis Scandinavica 11:155-163.

Takekawa, J.E., H.R. Carter, and T.E. Harney. 1990. Decline of the common murre in central California. Pages 149-163 in: S. G. Sealy, ed. Auks at sea. Studies in Avian Biology 14.

Tessler, D.F., J.A. Johnson, B.A. Andres, S. Thomas, and R.B. Lanctot. 2007. Black oystercatcher (*Haematopus bachmani*) conservation action plan. International Black Oystercatcher Working Group; Alaska Department of Fish and Game, Anchorage, AK; U.S. Fish and Wildlife Service, Anchorage, AK; and Manomet Center for Conservation Sciences, Manomet, MA. 115 pp.

Timm, R.M. 1994. Norway rats. Pages B105-B120 in: S.E. Hygnstrom, R.M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage, vol. I. University of Nebraska, Lincoln.

USFS (U.S. Forest Service). 2006. Cooperating across boundaries: partnerships to conserve open space in rural America. FS-861. 49 pp.

USFS and BLM (Bureau of Land Management). 1994. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl, volume I. Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 1983. The California brown pelican recovery plan. U.S. Fish and Wildlife Service. Portland, OR. 179 pp.

USFWS. 1991. Proposed addition to Oregon Islands National Wildlife Refuge, Coos County, Oregon; environmental assessment. Portland, OR. 25 pp.

USFWS. 1993. Introduction of foxes to Alaskan islands-history, effects on avifauna, and eradication. Resource Publication 193. USFWS. Washington, D.C.

USFWS. 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, OR. 203 pp.

USFWS. 2000. U.S. shorebird conservation plan. U.S. Fish and Wildlife Service, Division of Migratory Birds. Arlington, VA.

USFWS. 2001. Endangered and threatened wildlife and plants; final rule to remove the Aleutian Canada goose from the federal list of endangered and threatened wildlife. Federal Register 66(54): 15643-15656. Washington, D.C.

USFWS. 2003. American peregrine falcon (*Falco peregrinus anatum*) proposed monitoring plan. U.S. Fish and Wildlife Service. Arlington, VA.

USFWS. 2004. Wildland fire management plan; Oregon Islands NWR. Newport, OR.

USFWS. 2005a. Environmental assessment: mammalian predator damage management to protect seabird colonies on Oregon Islands National Wildlife Refuge, Three Arch Rocks National Wildlife Refuge and adjacent mainland areas. Oregon Coast National Wildlife Refuge Complex. Newport, OR. 130 pp.

USFWS. 2005b. Regional seabird conservation plan, Pacific Region. U.S. Fish and Wildlife Service, Migratory Bird and Habitat Programs. Pacific Region. Portland, OR. 261 pp.

USFWS. 2006. Endangered and threatened wildlife and plants: designation of critical habitat for the marbled murrelet; proposed rule. Federal Register 71(176): 53838-53951, 50 CFR Part 17. Washington, D.C.,

USFWS. 2007a. Washington Islands National Wildlife Refuges: comprehensive conservation plan and environmental assessment. Port Angeles, WA.

USFWS. 2007b. Brown pelican fact sheet. Unpublished report.

USFWS. 2007c. Draft post-delisting monitoring plan for the bald eagle (*Haliaeetus leucocephalus*). U.S. Fish and Wildlife Service. Arlington, VA.

USFWS. 2008a. Secretary Kempthorne announces proposal to remove the brown pelican from the endangered species list, February 8, 2008. U.S. Fish and Wildlife Service news release.

USFWS. 2008b. Brown pelican (*Pelecanus occidentalis*). U.S. Fish and Wildlife Service Endangered Species Program. Arlington, VA. 2 pp.