Castle Rock National Wildlife Refuge
Information Synthesis

FINAL REPORT

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For the USFWS
Humboldt Bay National Wildlife Refuge Complex

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SUMMARY

Castle Rock, an island on the outer coast of Del Norte County, California, is managed by the U.S. Fish and Wildlife Service as part of the Humboldt Bay National Wildlife Refuge (NWR) Complex. The Humboldt Bay NWR is undergoing a process to develop a Comprehensive Conservation Plan (CCP) for the Complex. This document was prepared to collate information on Castle Rock that will help facilitate and guide the CCP planning process. The 14 acre island has an interesting cultural history from its use for Native American subsistence, to use by early settlers as an offshore sheep pasture. Castle Rock was a delightful find for early ornithologists and oologists, and under private ownership throughout much of the 19th century, was spared from some of the most offensive development plans imaginable. Discovery of the island's importance to a species once thought to be extinct, the Aleutian Cackling Goose, brought Castle Rock into the Refuge system in 1980, where its natural resource values will be preserved in perpetuity.

Castle Rock is the largest, most structurally diverse nearshore island in California. The refuge provides habitat for thousands of breeding and migrating seabirds and marine mammals, and remains a primary staging area for the fully recovered Aleutian Cackling Goose. Exceptional habitat diversity, a rich marine environment, and the island's protected status combine to render it a seabird colony of great national significance. It is one of only five sites in the Pacific coast California Current System that supports more than 100,000 nesting seabirds. Eleven species of seabirds, one shorebird, and two pinniped species breed on the island. Two species protected under the Endangered Species Act, the Brown Pelican and the Steller Sea Lion, use the island regularly but do not breed there. Six other bird species present have other forms of state or federal special status. Breeding populations of many seabirds on the island, including the Common Murre, Brandt's Cormorant, Pelagic Cormorant and Pigeon Guillemot were at historically high levels during the last surveys in 2004. In contrast, the Tufted Puffin, a species highly valued by the public, may be headed for extirpation on the refuge. The current status of nocturnal cavity nesting species, including the Leach's and Fork-tailed storm-petrels, Cassin's and Rhinoceros Aukelts, is unknown. The Leach's Storm-petrel was the most abundant bird on the island at the turn of the century, but its status as a breeding bird on the island has not been confirmed in decades.

Management of Castle Rock NWR has been problematic due to the dilemma of how the island's natural resources can be monitored and managed without causing damaging disturbance to sensitive habitat and wildlife. Additionally, the refuge has never had a dedicated budget for wildlife or habitat monitoring. Other management concerns include preservation of habitat diversity, especially vegetation and soils, from degradation by native wildlife. There is a need for additional local outreach, to help reduce potential for human disturbance at the island. Education and outreach would also boost public awareness and enjoyment of the refuge, which is easily viewed from the mainland shore. There is tremendous opportunity to accomplish refuge goals and objectives in cooperation with other larger-scale management and conservation initiatives at this time. It is hoped that the development of a CCP for Castle Rock NWR will help give this unique gem among the Refuge System an opportunity to shine.

ACKNOWLEDGEMENTS

It has been a pleasure working with the many dedicated Refuge Managers of Castle Rock over the years, including Eric Nelson, Kevin Foerster, Kim Forrest, and Richard Guadagno. These managers have always demonstrated concern and responsibility for their outlying refuge and made the most of limited financial resources. Tara Zimmerman and Maura Naughton, USFWS, Migratory Birds and Habitat Programs, were instrumental in funding the first seabird monitoring effort aimed solely at Castle Rock. Craig Strong, Crescent Coastal Research, was an important partner in that project. Harry Carter, CBC; Phil Capitolo, HSU; and Gerry McChesney; USFWS have consistently and generously shared data and forwarded detailed reports on results of broad scale aerial surveys that provide key information for this report. Paul Springer, Aleutian Canada Goose Recovery Team; Roy Lowe, USFWS, Oregon Coast Refuges, and Stan Harris, HSU have provided historical perspective, relevant documents, and conversations that have enhanced my knowledge of Castle Rock. Dave Pitkin, USFWS, has provided updates on seabird work the Oregon refuges. Robin Brown, ODFW, and Mark Lowry, NMFS, SWFSC, extracted some of the pinniped data specific to Castle Rock for use in this and other reports. Curtiss Clumpner contributed information resources and encouragement. Finally, I thank project leader Harry Carter and fellow seabird crew members of 1989, Gerry McChesney, Craig Strong, and Mike Parker, for the memories and great adventure of sharing a night on Castle Rock with the seabirds.

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I. INTRODUCTION

Purpose and Need for Information

The Humboldt Bay National Wildlife Refuge (NWR) Complex is developing a Comprehensive Conservation Plan (CCP) for the Refuge Complex. The CCP will help guide overall refuge management for the next 15 years. The complex includes Humboldt Bay NWR as well as Castle Rock NWR. Castle Rock is a 14-acre nearshore island located in Del Norte County, California, less than a mile northwest of Crescent City. Castle Rock hosts one of the largest and most diverse assemblages of breeding seabirds on the Pacific coast and provides a critical roost for thousands of Aluetian Cackling geese prior to their transoceanic migration. The purpose of this document is to collate information pertaining to Castle Rock that will help facilitate and guide the CCP planning process for the refuge.

Castle Rock NWR is unusual within the refuge system. The island is so rich with sensitive wildlife species and fragile habitat that it can accommodate no direct public access and very limited access for research, monitoring and management. The original concept for management of the island was to leave it alone with the caveat that direct management may be needed in the future. The dilemma is that some of the island's most sensitive resources cannot be monitored without some level of presence on the island. In the absence of monitoring, it cannot be determined if management intervention is warranted. In this document, we 1) gather information on the natural resources of Castle Rock, 2) review existing monitoring programs and status of key species, and 3) identify management concerns and conservation partners to help develop a context for refuge planning with respect to other planning efforts and regulatory entities.

Castle Rock is one of only two islands on the outer coast of California included in the National Wildlife Refuge System. These two refuges, Southeast Farallon Island (SEFI) and Castle Rock, are the two largest, most important seabird colonies in the state. SEFI has a long continuous history of human occupation. Research and monitoring takes place year round on the island primarily through a cooperative agreement with Point Reyes Bird Observatory Conservation Science (PRBO). Castle Rock has never had a management plan, long-term monitoring program or dedicated budget. Seabird monitoring at Castle Rock has taken place

through short-term projects and large-scale cooperative monitoring efforts aimed at selected species.

II. HISTORY

Native American Presence

'Ee-nii-k'wvt' was the name given to Castle Rock by the Native Americans of the region, the Tolowa, and translates to "Ground There Upon" (L. Bommelyn, pers. comm.). The Tolowa had a subsistence relationship with Castle Rock but were not known to ever reside on the island. During the 1800's the Tolowa occupied a large village site on the headland adjacent to Castle Rock at Pt. St. George. An intensive study of the village site was made by Gould (1966). Gould's findings incorporated archaeological evidence, oral history and historical data in an attempt to reconstruct the culture of the people living at Point St. George.

"Ta'giatun" or "Land laying outward place" is one of the names given to Point St. George, and is described as a "...place for shellfish gathering; also camping place for sea-lion expeditions..." (Gould 1966). The intertidal regions surrounding the point were used by the Tolowa for gathering shellfish and seaweed. The people also engaged in sea lion hunting expeditions offshore. Dugout canoes, 30-40 feet long, were used for regular trips to the St. George Reef and presumably, Castle Rock. Marine mammal species included in the native diet at the village on the Point were whales, sea otter, Steller sea lion, California sea lion, northern fur seal, and harbor seal. The Steller sea lion was the most common mammalian species in archaeological digs at the site, and appeared to be of major importance to the people. Gould stated that birds were clearly part of the regular diet and were taken whenever possible. Certain times of year, bird eggs and immature birds were harvested in large numbers. The most common bird bones found were those of immature cormorants.

Oral history describes the seasonal taking of flightless cormorants from nesting islands around Point St. George, in more recent times (Gould 1966). At Castle Rock, May was egg gathering time (Calla et al. 2005). Men in canoes made expeditions to the island, scaled the cliffs, and marked a (circular) area with stones. They then threw all the eggs inside of the area off the cliff. Ten days later, they would return and collect the new eggs, knowing that they were fresh. The eggs were probably common murre. Eggs were also blown and used for ornamental purposes, strung in a garland to decorate homes.

White settlement of the Crescent City area began in the 1850's. The general destruction of the native population followed rapidly; by 1856 there were only an estimated 316 Tolowa survivors (Gould 1966). The village at Pt. St. George was abandoned about the mid-1850's, prior to intensive white settlement of the area, but use of Point St. George for subsistence continued after the village was abandoned. Shell middens are present at Point St. George, but there are no recorded archaeological sites on Castle Rock itself (USFWS 1978).

Post-settlement History

The only recorded uses of Castle Rock by white people were grazing sheep and egg-collecting. The island was initially claimed by the U.S. Government around the turn of the century. A private shepherd grazed sheep on the island from about 1900 to about 1920 (Osborne 1972). Sheep were periodically transported to and from the island by boat during extreme minus tides. A 12x12 wooden cabin was constructed on the east end of the island. Fraser, an early ornithologist/egg collector, reported that no sheep were present by the time of his visit, in the 1930's (*in* Osborne 1972).

Several egg collectors visited the island from at least 1917 to 1961. These early oologists left valuable notes in some cases. Clay (1901-1953) visited the island at various times from 1917-1934. Talmage visited in the mid-1930's but lost all of his field notes and specimens in a fire (Osborne 1972). Early ornithological accounts were also provided by Zerlag and Fraser (1940).

Castle Rock was purchased from the U.S. Government in 1937. The intent of the first private owners was to quarry the island for rock to build coastal highways and jetties. Rocky quarrying did take place on Point St. George during the 1950's and 1960's. The southwest tip of the point was dynamited to supply the U.S. Army Corps of Engineers with material for the breakwater at Crescent City Harbor. As late as the 1970's, speculators were contemplating guano mining, rocky quarrying and construction of a tourist attraction on Castle Rock, (Sowls et al. 1980) but for various reasons, none of these plans ever proceeded (USFWS 1978). The island remained in private ownership until 1979.

FWS Acquisition

The USFWS proposed to purchase Castle Rock in 1978 to protect critical habitat for the then endangered Aleutian Canada Goose (USFWS 1978). The geese were first detected using Castle Rock in spring 1975 and it was later determined that the island and nearby mainland pastures were the spring staging ground for virtually the entire population of Aleutian Canada Geese (Woolington et al. 1979). The island was recommended for critical habitat status in 1977 (USFWS 1991). A negative declaration for the purchase of the island was completed in 1978 (USFWS 1978). The original proposal included lease acquisition, MOU, and Cooperative Agreements to also preserve nearly 800 acres of grazing habitat on Pt. St. George. While Castle Rock's value to seabirds and marine mammals was recognized, protection of "other indigenous wildlife" species and habitat was stated as a secondary benefit to acquisition.

In 1979, The Nature Conservancy (TNC) purchased Castle Rock from the G. E. Kibbe Estate. The Service purchased the island from TNC by fee acquisition in 1980 for $41, 250.00, using funds from the Land and Water Conservation Fund. The island is administered by the Humboldt Bay NWR Complex.

To mitigate the loss in property taxes, Del Norte County was to receive an annual payment in accordance with the Refuge Revenue Sharing Act of 1964. The County was to receive ether _ of 1 percent of the value of Castle Rock, or 25% of net receipts from economic uses-whichever was greater (USFWS 1978).

Early Refuge Activities and Management

The focus of early refuge management at Castle Rock was conservation and research on the Aleutian Cackling Goose. The island was visited numerous times after the annual departure of geese to search for bands and carcasses (P. Springer, pers. comm.). The publication of the first statewide survey of seabird colonies, conducted by Sowls et al. (1980), brought attention to the great importance of the island as a seabird colony. Field biologists in Sowls et al. (1980) did not land on the island, but derived estimates based on aerial, boat, and historic surveys. As

appreciation for the sensitivity of the island grew, refuge managers precluded most access to the island and adopted an informal "leave it alone" management plan. Two visits to the island were made by boat in 1989 during the second statewide seabird survey to update estimates of nocturnal cavity nesting seabirds (Carter et al. 1992). Access to the island for research or monitoring was not allowed again until 2005, when projects led by Humboldt State University (R. Golightly, HSU) required several visits to the island. Landings were made by U.S. Coast Guard helicopter onto rocky substrate in the northwestern part of the island

Cultural Resources

There are no known Native American cultural resources on Castle Rock. The wood remaining from the shepherd's cabin might be considered as a historic relic or cultural resource.

Photo of murres and cormorants courtesy of Calfornia Department of Fish and Game, Castle Rock ca. 1970's.

III. PHYSICAL DESCRIPTION

Legal Description

The legal description for the location of Castle Rock is: 2.25 miles W., 1.25 miles N. Battery Pt. Light. SW 1/4, Sec. 28, T 16 N, R 1 W, Del Norte County. The island is named ACastle Rock≅ on the U.S. Coast Nautical and Geodetic Charts, as well as the USGS Charts. Some historic documents and contemporary locals refer to the island as ACastle Island.≅

Geographic and Geologic Characteristics

Castle Rock is located 0.6 miles south of Pt. St. George, and 1.5 miles north of the Crescent City Harbor in Del Norte County. It is the second largest island in northern California after Southeast Farallon Island. Castle Rock covers 13-14 acres (5.26 hectares) and is 235 feet high at its peak. The geologic characteristics of the island were described by Osborne (1972) and the USFWS (1978) as follows: Castle Rock is associated with the Smith River Plain and emerged marine terrace. The plain covers an area of about 60 square miles and is composed of geologic formations from the Jurassic age to recent times. Castle Rock is of the Franciscan Formation. It has a base of pillow basalt which extends 200 feet high on the west end. The east end of the island is largely greywacke and shale. The south and west aspects of the island are largely barren cliffs. The northwest portion of the island slopes downward to the water at a 30 degree angle. There is soil on the northern and eastern slopes of the island. A rocky yellow-sandy subsoil exists on the relatively flat portions of the island. This soil layer is reportedly up to 25 feet deep and is the product of late Pleistocene era deposits. The topsoil above this has been described as a dark organic humus layer 6-12 inches deep (Osborne 1972).

There are faults in the island running north-south which have been eroded by waves forming large caves on the southern side. Near the east side of the island, one of these faults has collapsed forming an open “pit” 100 feet in diameter and connected to the sea by a cave.

Climate

The northern California coastal climate is Mediterranean in character, with moderate temperatures, heavy precipitation and many foggy days throughout the year. The Crescent City area receives about 66 inches of precipitation annually (National Weather Service data, www.weather.gov), more than 90% from October through April. Prevailing winds are from the north and northwest. Winter storms can bring winds—generally from the south or southwest—sometimes exceeding 55-75 miles per hour.

Ocean Climate

Castle Rock lies in the eastern boundary current named the California Current System (CCS). The following is partly summarized from USFWS (2005).

The CCS is a complex and highly productive system of oceanographic processes that support a great diversity and abundance of marine life, including millions of breeding and migrant seabirds. Surface flow along the northern California coast is generally northward during winter, but during the spring there is a dramatic transition, as the current shifts to predominantly southward (Hickey 1998). The combination of a southward moving current and strong northwest winds causes cold nutrient rich water to rise to the surface, setting primary productivity into motion. Upwelling is a key feature influencing the overall productivity of eastern boundary currents (Huyer 1983). Upwelling is seasonally predictable, but its strength is subject to great annual variation. Upwelling along the California coast is greatest in spring and summer, coincident with seabird breeding seasons. Contours of the coastline, ocean floor topography and weather all contribute to spatial and temporal variability in the system.

Large scale oceanographic events affect primary productivity and food webs in dynamic current systems. Examples of relatively short term perturbations in the CCS are El Niño Southern Oscillation (ENSO) and La Niña Southern Oscillation (LNSO) events. Declines and increases in zooplankton, squid and fish populations that compose the food webs of most seabirds in the Pacific Ocean can be linked directly to a variety of physical oceanographic changes that occur during ENSO events. Under El

Niño conditions, upwelling is weak or absent, water is warm and nutrient-poor, biological productivity in the upper water column declines markedly, and species may occur outside of their usual range (Barber and Chavez 1986). The inverse of El Niño is La Niña, when upwelling is particularly strong, the ocean is cool, and there are generally positive effects on food web development.

Seabird responses can vary in relation to the intensity and timing of oceanographic perturbations. Life history and demographic parameters affected by El Niño and La Niña include reproductive success, adult mortality, mortality of hatch-year birds, colony attendance, and breeding effort (Hodder and Graybill 1985, Boekelheide and Ainley 1989, Wilson 1991).

There are other natural cycles that occur on scales of decades or centuries. In the North Pacific, one of these longer term marine climate shifts is called the Pacific Decadal Oscillation (PDO). The PDO is "an El Niño-like phenomenon operating on time scales of decades" comprised of a 50-60 year periodicity of “warm” and “cold” phases (Francis and Hare 1994, Mantua et al. 1997). Biological communities have responded to PDO-related ocean warming and cooling in the Pacific Ocean. However there have been few studies of the effects of low frequency ocean climate shifts on seabirds (Sydeman et al. 2001).
The USFWS Seabird Conservation Plan (2005) recognized that “an increased understanding of the fundamental processes affecting the ocean habitats and food webs of seabirds is key to effective management and sound conservation decisions for seabirds.”

Castle Rock during winter. Aerial photograph taken on 25 February 2006 by D.Jaques from a U.S. Coast Guard helicopter.

IV. NATURAL RESOURCES

Biotic Overview

Castle Rock is the largest, most structurally diverse island on the California coast north of Southeast Farallon Island. It is unique among the more than 1,000 offshore rocks and islands in the state in that it has so many types of habitat on one large island within an extremely productive region of the Pacific Ocean. Castle Rock's habitat features include relatively deep topsoil, vegetated terraces, sheer rock cliffs, talus slopes, as well as protected sandy beach and reef habitat. These features allow it to host more than 100,000 breeding seabirds of 11 species, haulout grounds for all pinnipeds that commonly occur in the region, and a secure night roost for nearly the entire Aleutian Cackling Goose population during its recovery.

The refuge supports one of the largest populations of nocturnal cavity nesting seabirds in California and one of the most important colonies of Common Murres on the Pacific coast (Carter et al. 1992, USFWS 2005). It is one of only five sites in the California Current System that supports more than 100,000 nesting seabirds. One species of shorebird, the Black Oystercatcher, also nests at Castle Rock. The island is important to non-breeding seabirds as well. It serves as a communal roost for thousands of Brown Pelicans during migration, and has become one of the most important resting sites for this state and federally listed species on the northern California coast.

Four species of pinnipeds occur regularly at Castle Rock and its associated reef. Two seals, the Elephant Seal and Harbor Seal breed at the refuge. The island represents the northernmost colony site in the Pacific Ocean where Elephant Seals regularly and successfully breed. In addition, Castle Rock is part of one of the largest haul-outs for California Sea Lion in northern California and a key haul-out for a local breeding population of the federally endangered Steller Sea Lion.

Castle Rock NWR is fringed by a lush intertidal zone and surrounded by waters rich with marine resources.

Special Status Species

Threatened and Endangered Species

Two species at Castle Rock are currently protected by the Endangered Species Act (ESA); the California Brown Pelican and the Steller Sea Lion (Table 1). In addition, the Peregrine Falcon, a federally recovered species, remains listed with the state of California. The Marbled Murrelet is a federally Threatened species, but it occurs outside the refuge, in the waters surrounding Castle Rock. The Aleutian Cackling Goose and the Gray Whale were both formerly listed, but now recovered species.

California Brown Pelican (*Pelecanus occidentalis*)
The Brown Pelican became endangered on the U.S. Pacific coast due to pesticide contamination of marine waters near breeding colonies in southern Calfornia (USFWS 1983). Breeding populations have generally recovered and both the State of California and the USFWS are conducting a status review of the species. Non-breeding pelicans roost communally on Castle Rock but have never been known to nest north of Monterey, California (USFWS 1983). They can be expected from April to December, but are most abundant at Castle Rock in fall (September-November). As many as 3,660 pelicans have been counted on the island (D. Jaques, unpubl. field notes). The island is a key night roost for pelicans in the Crescent City area. As with other major night roosts, any intentional or incidental harassment of pelicans on the island may be considered a violation of the Endangered Species Act. Consultation with the appropriate USFWS personnel will be necessary to determine if an Incidental Take Permit is required for visits to the island when pelicans are expected to be disturbed. Incidental take permits have been required for research at a seabird colony in the Columbia River where large numbers of pelicans roost.

Steller Sea Lion (*Eumatopias jubatus*)
This species is discussed in the section on Marine Mammals.

Peregrine Falcon (*Falco peregrinus*)
This species is discussed in the section on Other Species.

Table 1. Threatened or Endangered species that occur or have occurred at Castle Rock NWR or adjacent marine waters. * indicates adjacent waters only.

	Scientific Name	Federal Status	California State Status	Notes
Brown Pelican	*Pelecanus occidentalis californicus*	FE 10/13/70	SE 6/27/71	State and Federal status review in progress
Aleutian Cackling Goose	*Branta (Canadensis) leucopareia*	Delisted 3/20/01 FT 12/12/90 FE 03/11/67		
American Peregrine Falcon	*Falco peregrinus tundrius*	Delisted 8/25/99 FE 6/2/70	SE 6/27/71	
Marbled Murrelet *	*Brachyramphus marmoratus*	FT 9/30/92	SE 3/12/92	Surrounding waters only
Steller Sea Lion	*Eumatopius jubatus*	FT 4/5/90		
Gray Whale *	*Eschrichtuius robustus*	Delisted 6/15/94 FE 6/2/70		Surrounding waters only

State Species of Special Concern (SSC)

Five bird species of "Special Concern," designated by the California Department of Fish and Game (CDFG), nest at Castle Rock (Table 2). State species of Special Concern are animals that are not listed under the federal ESA or the California ESA. They are either 1) declining at a rate that could result in listing or 2) a species that historically occurred in low numbers and currently faces known threats to persistence. The designation is intended to result in special consideration of these species to avoid future listing and focus research and management attention on them. The official SSC list is from 1978 (Remsen 1978), but there is an updated list, prepared by PRBO in 2003 that is still under review by the CDFG. In the draft revision , the Fork-tailed Storm-petrel and Tufted Puffin have become of increased concern, the Cassin's Auklet has been

added, and the Double-crested Cormorant has been dropped from the list (see www.dfg.gov).

Table 2. Draft list of Bird Species of Special Concern in California that occur at Castle Rock NWR (Prepared by PRBO for CDFG, 17 October 2003) compared to existing list.

2003 DRAFT List	Old List (Remsen 1978)
First Priority Fork-tailed Storm-petrel Tufted Puffin	*First Priority* None
Second Priority Cassin's Auklet	*Second Priority* Fork-tailed Storm-petrel Double-crested cormorant Tufted Puffin
Third Priority Rhinoceros Auklet	*Third Priority* Rhinoceros auklet

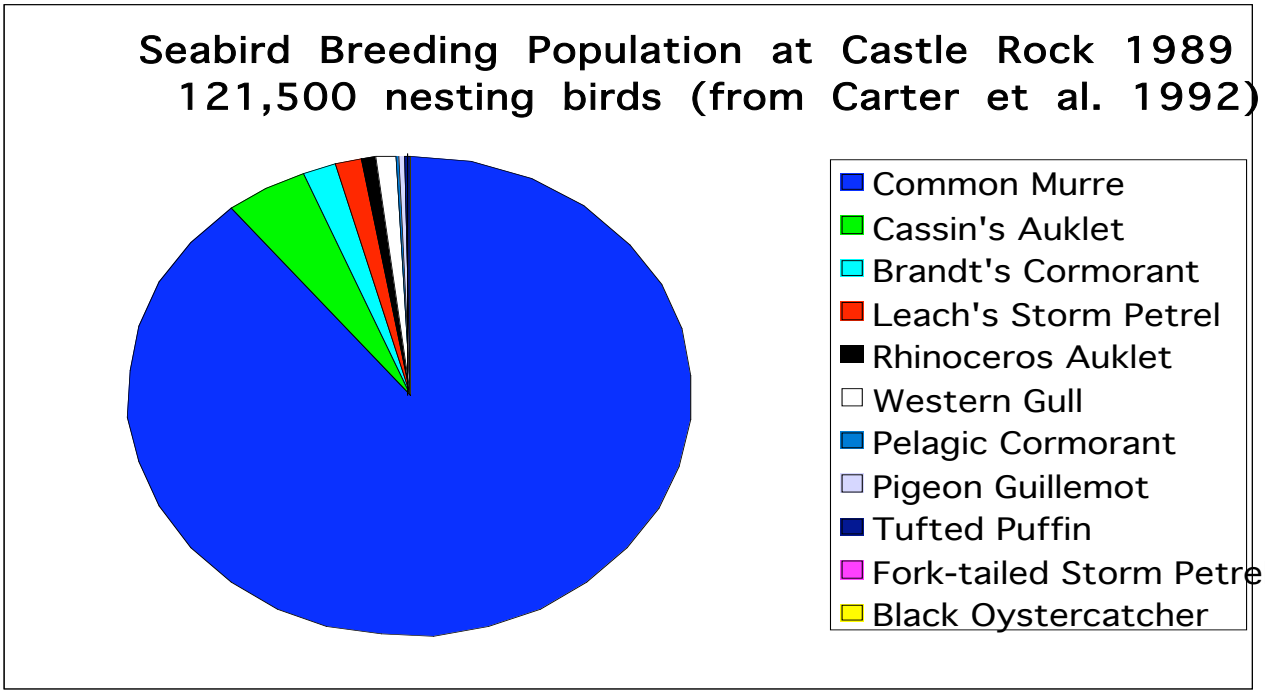
USFWS Bird Species of Conservation Concern

Three bird species recognized as USWFS species of "Conservation Concern" occur at Castle Rock (Table 3). The 1988 amendment to the Fish and Wildlife Conservation Act mandates that the USFWS identify species, subspecies,and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. The goal is to prevent additional ESA bird listings by implementing proactive management and conservation actions among Federal, State, and private partners. Development of research, monitoring, and management initiatives are other goals associated with this listing effort. The most recent list of these species was compiled in 2002 (USFWS 2002), and updated the list from 1995. The list was derived from conservation assessment scores from three different bird conservation initiatives.

Both the Black Oystercatcher and Cassin's Auklet have been added to the list since 1995.

Table 3. List of Castle Rock birds that are recognized as USFWS Bird Species of Conservation Concern.

Bird Conservation Region: Coastal California (2002)	Region One (Pacific Region) Birds of Conservation Concern 2002
Peregrine Falcon Black Oystercatcher Cassin's Auklet	Peregrine Falcon Black Oystercatcher



Relative abundance of seabird species breeding at Castle Rock from the most recent all-inclusive survey. Tabular data are presented in Carter et al. 1992.

V. VEGETATION

General Description

Osborne (1972) developed a rough map of the major cover types and listed the most common plant species on Castle Rock based on island visits in 1970. John Sawyer visited the island in 1984 and developed a plant list (Table 4). Both investigators described changes in vegetation and soil erosion.

In the early 1970's, Osborne (1972) found two primary plant cover types on the eastern flat (meadow) and northern slopes, an area dominated by *Lasthenia maritime, Poa annua, Spergularia macrotheca, and Coronopis diymus* and an area covered with a dense growth of *Calamagrostis nutkaensis* and a host of mixed herbs. In 1984, Sawyer noted that the meadow was covered with *Spergularia macrotheca* and *Lasthenia*. Clumps of *Calamagrostris* in the plains in areas with deeper soils were intermixed with other coastal scrub plants such as *Angelica hendersonii, Juncus,* and *Carex*.

Plants growing in rocky areas included *Dudleya farinosa, Bromus sp.,* and *Erigeron glaucus.* Sawyer noted only *Erigeron* and *Polypodium scouleri* growing in the rocky areas. The protected portion of the north side of the island supported *Montia perfoliata*, *Synthris reniformis*, and *Polypodium scouleri*, with a few pockets of *Distichlis spicata*.

Historic Changes

Over the last century, the area covered with nootka reedgrass (*Calamagrostis)* has receded and been replaced with *Lasthenia* and *Spergularia*. *Calamagrostis* may no longer exist on the island. Photographs taken in 1935 show reedgrass growing over most of the meadow, covering an estimated 3 acres (Osborne 1972). By 1961, the area covered in reedgrass was reduced by about 50%. In 1970, the area covered in reedgrass was estimated at 1 acre, or 1/3 of the area of the meadow (Osborne 1972). By 1984, the hummocks of *Calamagrotstis* were mostly dead. “Rhizomes and roots were all that was left of the once extensive populations” (Sawyer 1984). In 1989, there

were only a few tussoks remaining on the east end of the island (Carter et al. 1992). By 2000, there was no evidence of this grass species as viewed from shore or boat (D. Jaques, unpubl field notes).

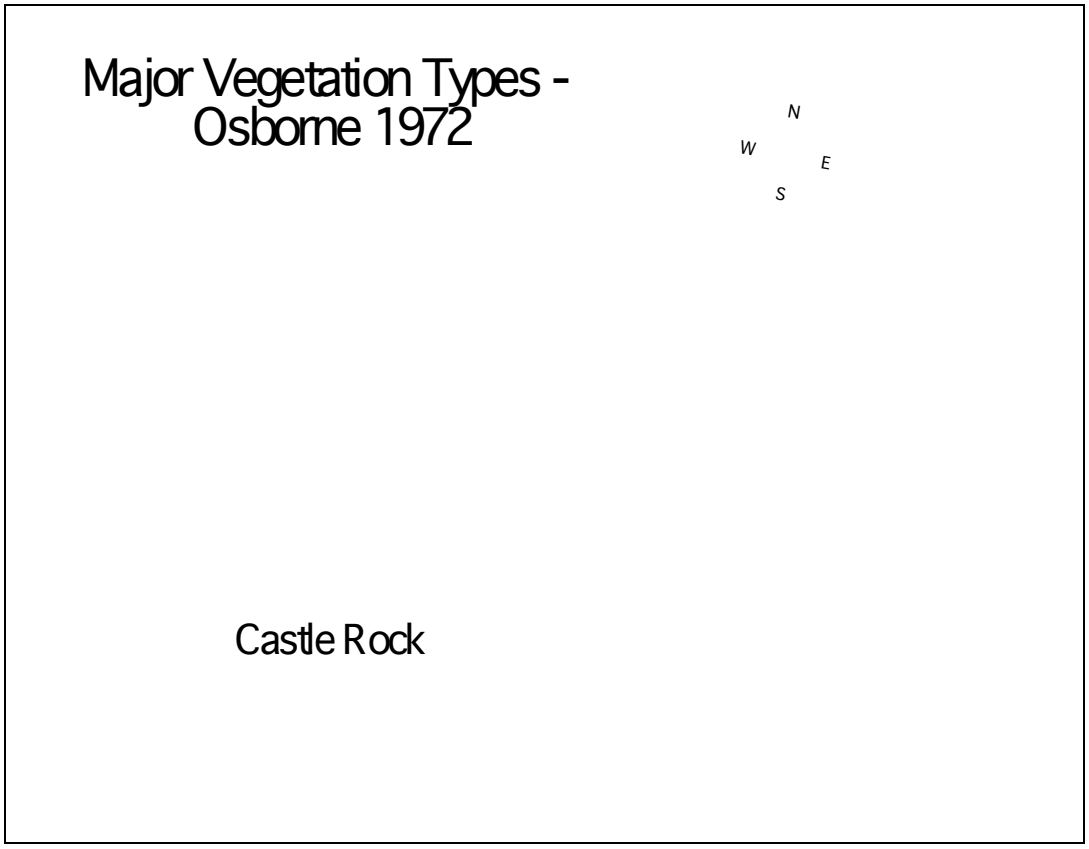
The cause of the decrease in *Calamagrostis* has been attributed to the increase in the Brandt's Cormorant breeding population on Castle Rock (Osborne 1972). Osborne observed cormorants using reedgrass almost exclusively for nesting material when it was readily available. He also suggested that Canada geese might be having some impacts on vegetative changes at Castle Rock. At that time, only up to 600 geese were using the island for roosting and grazing. Sawyer (1984) stated that the loss of reedgrass was indicative of a more extensive problem of heavy erosion of the habitat overall.

Thousands of roosting Aleutian Cackling Geese and breeding seabirds impact the short term status of vegetation at Castle Rock, and long-term impacts are likely. The geese cause a general browning of the spring vegetation due to trampling, foraging, and intensive output of fecal matter. The vegetation greens up and grows back lushly by the peak incubation time of most seabirds. Breeding seabirds, and lack of summer rain, cause a second death or annual regression of vegetative growth due to use of island plants for nest material, trampling, and inundation by guano. By mid to late summer, the island appears more white and brown than green. Temporary losses of vegetation are likely to affect long-term soil erosion on the island (Osborne 1972, Sawyer 1984, Jaques and Strong 2001) particularly during the rainy season. Accelerated soil erosion is likely to have long-term negative impacts on burrow nesting seabird habitat.

To date there has been no assessment of the native versus non-native plant community at Castle Rock. The USFWS Seabird Conservation Plan (2005) states that non-native plants can displace native plants and may limit or degrade seabird nesting habitat. Many invasive plants have shallow root systems that do not stabilize the soil as well as native vegetation and consequently effect burrow stability. Plants that have been identified as problematic to seabirds at other California seabird colonies include New Zealand spinach (*Tetragonia tetragonioides*) and cheeseweed (USFWS 2005).

Table 4. John O. Sawyer's list of "The Plants Recognized or Collected from Castle Rock, Del Norte, Co. CA." Prepared October 16, 1984. Humboldt State University.

Achillea millefolium spp. Arenicola
Angelica hersonii
Calamagrostis nutkanensis
Calandrinia ciliata
Carex obnupta
Circium vulgare
Coronopus didymus
Daucus carota
Distichlis spicata
Erigeron glaucus
Juncus lesuerii
Lashenia minor ssp. Maritime
Matricaria matricarioides
Plantago lanceolata
Polypodium scouleri
Raphanus sativus
Rumex acetosella
Rumex crispus
Spergularia macrotheca
Sonchus oleraceus
Stachys chamissonis
Trifolium wormskioldii



Historic vegetative cover map of Castle Rock. Figure adapted from Osborne (1972) and converted into ArcView format by D. Jaques.

VI. SEABIRDS

Overview and Relative Importance

Castle Rock NWR provides habitat for one of the largest, most diverse, and densely populated seabird breeding colonies in the California Current System (CCS). It is one of only five sites in the CCS that supports more than 100,000 nesting seabirds. The refuge is known as the second largest seabird colony south of Alaska, behind Southeast Farallon Island (SEFI). The ranking is based on population levels that include very rough historical estimates for nocturnal cavity nesting seabirds, whose status is currently unknown. Common Murres, however, comprise the majority of the breeding seabird population at both Castle rock and SEFI. Due to annual variability in murre breeding effort between the two sites, Castle Rock may rank as the largest seabird colony south of Alaska in some years (see below).

The relative importance of Castle Rock on a statewide and regional scale has been established by large-scale inventories. Two statewide surveys of all breeding species have been conducted in California, in 1975-1980 (Sowls et al 1980) and in 1989-91 (Carter et. al. 1992). The last statewide inventories of all species in Oregon and Washington were conducted in 1988 and 1978-1982, respectively (USFWS in prep, Speich and Wahl 1989). More recently, large-scale inventories have focused on aerial surveys of only murres and cormorants.

Castle Rock NWR was the second largest seabird colony in California, following closely behind the Farallon Islands NWR during the last statewide survey. The total breeding population estimate at Castle Rock was 122,000 birds in 1989, compared to about 128,000 at SEFI (Carter et al. 1992). In 2004, the Castle Rock murre estimate alone was over 138,000 birds (Capitolo et al. 2006). Total seabird abundance data is not available for comparison with SEFI that year. Castle Rock supports about 8,600 breeding birds per acre, compared to about 1,300 birds per acre at SEFI. Eleven species of seabirds breed at Castle Rock, and represent all of the of the island-breeding seabird species in California north of Pt. Reyes. Five are surface nesters: the Common Murre, the Brandt's, Pelagic and Double-crested Cormorants, and Western Gull. The

remaining 6 species are cavity nesters: Fork-tailed and Leach's Storm-petrels, Cassin's Auklet, Pigeon Guillemot, Rhinoceros Auklet, and Tufted Puffin. One species of shorebird, the Black Oystercatcher, also breeds on the island. Castle Rock is the site of the largest Common Murre colony in California (Capitolo et al. 2006) and supported substantial portions of the California total of 6 species during the last statewide survey: Fork-tailed Storm petrel (24%), Leach's Storm-petrel (19%), Common Murre (31%), Cassin's Auklet (10%), Rhinoceros Auklet (58%), and Tufted Puffin (30 %) (Carter et al. 1992).

Common Murres are the most abundant breeding seabird in the California Current System. There are only three colony sites in the CCS that have supported >100,000 murres: Southeast Farallon Island (SEFI), Castle Rock and the Three Arch Rock Complex in Oregon (USFWS 2005). However, due to disturbance to seabirds by Bald Eagles in the past several years at Three Arch Rocks, the most recent murre estimates are well below 100,000 (D.Pitkin, USWS, pers.comm.). The only other seabird colonies in the CCS that harbor >100,000 breeding birds are large Leach's Storm-petrel colonies in southern Oregon (Goat Island, and North Crook Point Rock).

Historic Populations and Early Ornithological Investigations

The first historical accounts of seabird populations on Castle Rock came from the field notes of Clay, an egg-collector in the early 1900's (Clay, 1901-1953 MS). Clay first visited the island in 1916 and spent the two weeks on the island in late July 1917. He stayed in the small cabin that had been constructed when sheep grazed on Castle Rock. He reported that Leach's storm-petrels were nesting by the "tens of thousands" on the island at that time. Fork-tailed storm-petrels and Tufted Puffin were present and breeding. Clay returned in May, 1934 and 1935. Another egg-collector, T. Fraser, visited the island around the same time. Collectively, nine seabird species were observed, and the list expanded to include Common Murre, Brandt's Cormorant, Western Gull, Cassin's Auklet. A third ornithologist, Robert Talmage (*in* Osborne 1972) also visited the island in the mid 1930's. He observed a few Double-crested Cormorants, and described their breeding status as sporadic. He looked for Rhinoceros Auklet without success. Osborne observed breeding

Rhinoceros Auklets on Castle Rock in 1969-1970. Black Oystercatchers have bred in small numbers on the island since at least the 1930's (*in* Osborne 1972). All of the contemporary seabird species breeding on Castle Rock were present during the early 1900's, as recorded in the notes of early ornithologists.

Table 5. Early Naturalist/Oologist accounts of birds at Castle Rock.

Date of visit	Who	Purpose	Document	Comments
1917, July	Clay	bird/egg collection	Unpublished field notes 1907-1953	Tens of thousands of Leach's Storm-petrel breed under large tufts of grass; 4 breeding seabird species
pre-1935	Fraser	bird/egg collection	Fraser 1934	8 breeding seabird species, plus BLOY. Did not include CAAU, DCCO. RHAU
1934, May	Clay	bird/egg collection	Unpublished field notes 1901-1953	Peregrine Falcon nesting
1934, May	Clay	bird/egg collection	Unpublished field notes 1907-1953	1st mention of CAAU
1935, June	Zerlang and Fraser		Zerlang and Fraser 1940	mentioned only BLOY
Mid 1930's	Talmadge		in Osborne 1972 (pers. comm)	1st mention of DCCO breeding "sporadically," did not find RHAU.. PEFA eyrie with evidence of feeding on petrels
1938, June	Martin		Martin 1938.	Observed LHSP, did not find FTSP, CAAU
1956, 1961 May	Stevens	egg collector	In Carter et al. 2001	

Seabird Research

The most thorough study of the history, population status and ecology of seabirds at Castle Rock was conducted as part of a master's thesis by Osborne (1972). Some of the data and ideas presented by Osborne remain the best available sources of information for the refuge. As part of a larger study on the Cassin's Auklet, Thoreson visited Castle Rock in 1959 (Thoreson 1964). Most other seabird work at Castle Rock has been

conducted from remote platforms, e.g. boat, airplane, or shore as part of larger inventory and monitoring efforts (Table 6). The first landing on the island for seabird work after refuge establishment was in 1989, during the California seabird breeding catalog field effort (Carter et al. 1992). The island was visited for 2 nights in August-September for the primary purpose of deriving population estimates for nocturnal cavity nesting species using mist-netting and burrow counts. No further access to the island was granted for the next 15 years. The informal "hands-off" refuge management policy changed in 2006 when the FWS and Humboldt State University (HSU) initiated a currently ongoing research program that required several trips to the island (E. Nelson, USFWS, pers. comm.).

Recent Seabird Monitoring

Broad-scale aerial surveys of three surface nesting species, the Common Murre, Brandt's Cormorant, and Double-crested Cormorant, have been conducted in California annually since 1987 (Carter et al. 1996, Capitolo et al. 2004, 2006). Surveys in recent years have been supported largely by the Apex Houston Trustee Council, which includes members from USFWS, NOAA, and CDFG. A subset of the seabird colonies photographed have been designated to be counted annually. Photographs from other colonies are labeled and archived. Photographs of seabirds at Castle Rock have only been counted when there is special funding available to do so (G. McChesney, USFWS, pers. comm.).

Following the 1989 statewide inventory and atlas project (Carter et al. 1992), population status of selected species at Castle Rock were updated in 1997-1999 (Jaques and Strong 2001) and 2003-2004 (Capitolo et al. 2004). The USFWS Office of Migratory Bird Management supported surveys of surface nesting and diurnal burrow-nesting species at the refuge in 1997, 1998, and 1999. As part of this effort, aerial photographs taken at Castle Rock from the broad-scale inventories of Common Murres and Brandt's Cormorants were analyzed and counted for the years of the study. Other species were surveyed from boat and shore. Data on breeding phenology, breeding success, and effects of oceanographic variability were collected from boat and shore. New techniques were established for monitoring several species.

The population status of Brandt's and Double-crested Cormorants, and Common Murres at Castle Rock was updated again in 2003 as part of a Region-wide inventory and analysis of population trends coordinated and partly sponsored by the Office of Migratory Birds (Capitolo et al. 2004).

In 2004, the Humboldt Bay NWR complex supported limited, early season surveys of breeding seabirds from boat and shore (Jaques 2004). In conjunction with that work, Crescent Coastal Research (CCR) and PRBO (J. Thayer) collaborated on additional surveys throughout the breeding season, using methods similar to those employed in 1997-1999. Counts of Common Murres from aerial photographs were also completed that year as part of a larger monitoring program (Capitolo et al. 2006).

Population status of the nocturnal seabirds, Leach's and Fork-tailed Storm-petrels, Cassin's Auklet, and Rhinoceros Auklet has only been evaluated quantitatively 1-2 times, depending on the species, since 1970 (Sowls et al. 1980 and Carter et al. 1992). Current status of this entire group of species is unknown. The burrows on the island were counted in September 1989 and ascribed to species roughly by size and shape. Extrapolations of burrow density were made for certain regions of the meadow that were too fragile to inspect directly.

General Seabird Population Status

Population estimates for all breeding seabirds on Castle Rock have are available for only 3 years, 1970, 1979, and 1989 (Table 7). In addition, estimates for most diurnal nesting species were derived in 1997-1999 (Table 8) and again in 2004. Total numbers of breeding seabirds estimated at Castle Rock have ranged from 92,000 to more than 140,000 birds. The Common Murre has consistently been the most abundant breeding seabird on the island since 1970, comprising about 90% of the total seabird population. The Cassin's Auklet has been thought to be the second most numerous species, but population estimates have been relatively crude. The Brandt's Cormorant is the second most abundant surface-nesting species. In 2004, counts of the Common Murre, Brandt's and Pelagic Cormorant, and Pigeon Guillemot at

Castle Rock were the highest recorded over the past few decades (Capitolo et al. 2006, Jaques 2004). .

Seabird populations are thought to fluctuate along with ocean conditions and other natural and anthropogenic factors. Existing data on Common Murres and Brandt's Cormorant nesting at Castle Rock has been adequate to show some of this fluctuation but not to be able to associate it with causal factors. During the 1997-1999 Castle Rock monitoring effort, these two key species appeared to be in a state of "long-term" decline, although it was clear that breeding was affected by the 1997-1998 ENSO (Jaques and Strong 2001), which was the strongest ENSO event on record. The next series of surveys in 2001-2004 indicated either a rebound or relative long-term stability, depending on interpretation, in these same species (Capitolo et al. 2006). After a strong La Nina and hypothesized shift of the PDO back to a cool era in 1998-1999, colony data from the Farallon Islands demonstrated an increase in productivity for six species of seabird (Schwing et al. 2002). However, at Castle Rock, questions on comparability of data due to photograph quality and methods were raised (Capitolo et al. 2004a), confounding any correlation between seabird breeding effort and environmental conditions. Data collection at Castle Rock has probably not been adequate to determine the effects of short and long term variability in ocean conditions, other natural factors, or potential anthropogenic effects for any seabirds.

Available data on diurnal cavity nesting species at Castle Rock has indicated a fairly stable Pigeon Guillemot population but declining Tufted Puffin numbers (Jaques and Strong 2001, Jaques 2004). The status of nocturnal cavity-nesting species is unknown. The Leach's Storm-petrel may or may not be extirpated at Castle Rock (Carter et al. 1992, USFWS 2005). Information on each species nesting at Castle Rock is summarized in the following section.

Common Murres rafting in the waters around Castle Rock. Photo by D. Jaques.

Table 6. Seabird Studies of Castle Rock.

Year	Principal Investigator	Purpose	Document	Comments
1959, April, August	Thoresen	Cassin's Auklet study	Thoresen 1964	CAAU chronology, habitat use: found burrows in clay soil under rank tufts of grass. About 50 pair. Did not see petrels.
1970, May, July August	Osborne, HSU	Island ecology and avian use	Osborne 1972	First comprehensive quantitative assessment of seabird population; bird and vegetation maps produced. Estimates for all cavity nesting species. Documented major loss of vegetation and soil, loss of habitat for petrels, primary cause believed to be nesting BRCO.

1979, 1980	Sowls et. al., USFWS	Statewide Seabird survey	Sowls, et al. 1980	Most survey effort from boat and air. Used Osborne's estimates for nocturnal cavity nesting species.
1981, 1982	Briggs et al. MMS	North-Central California seabird surveys	Briggs et al. 1983	Common Murre aerial photo population estimate
1984, October	Sawyer, HSU	General vegetation status assessment	Sawyer 1984	Calmagrostis still present but in decline, extensive soil erosion, burrow nesting habitat rapidly becoming reduced in quality and amount.
1986	Carter, Takekawa	Common Murre estimate	Takekawa et al. 1990	Trend based on comparison of spatial extent of murre colonies
1987-88	Carter	Common Murre monitoring	Carter et al. 2000	Photos taken, no estimates made.
1989	Carter et al., USFWS	Statewide seabird survey	Carter et al. 1992	Photos counted for all surface nesting species, cavity nesting species estimated by fall burrow/crevice count. No Leach's storm-petrels found in mist-netting efforts.
1990, 1993-1996, 2000-2002	Apex Houston	Common Murre monitoring	Carter et al. 1996	COMU photos taken, no estimates made. BRCO colonies also photographed.
1997-1999	Crescent Coastal Research/ FWS	Seabird population status, monitoring program development	Jaques and Strong, 1998, 1999, 2001	Diurnal species only. First use of mainland based observations for population assessment, in addition to air and boat methods. Mapped puffin burrows. Established several new survey protocols. Documented ENSO effects.
2003-2004	HSU/FWS	Pacific Coast BRCO, DCCO population assessment, California COMU census	Capitolo et al. 2004a, 2006	Aerial photos from Apex Houston project counted, 2001, 2003, and 2004 COMU, BRCO, and DCCO population assessed.

Table 7. Complete seabird breeding population estimates on Castle Rock, 1970 to 1989. Data are from Osborne (1972) (a) , Sowls et al. (1980) (b) and Carter et al. (1992) (c).

	Estimated Number of Nesting Birds		
Species	1970 (a)	1979-80 (b)	1989 (c)
Fork-tailed Storm-petrel	<200	100	100
Leach's Storm-petrel	5,000	5,000	1,646
Brandt's Cormorant	1,758	2,200	2,490
Pelagic Cormorant	100	340	392
Black Oystercatcher	2	6	4
Western Gull	1,200	1,350	1,370
Common Murre	80,000	126,000	108,318
Pigeon Guillemot	250	800	360
Cassin's Auklet	3,600	3,600	5,638
Rhinoceros Auklet	150	200	1,034
Tufted Puffin	50	100	82
TOTAL	92,310	140,596	121,434

Table 8. Population estimates for surface nesting and diurnal cavity nesting species at Castle Rock, 1979-1999 from Jaques and Strong (2001) (a), Capitolo et al. 2006 (b), and Jaques (2004) (c). The murre estimate is the raw count times a correction factor of 1.67; the cormorant estimate is derived from the number of nests directly counted times 2.

Species	Year				
	1997 (a)	1998 (a)	1999 (a)	2003 (b)	2004
Common Murre	75,246	51,138	97,996	104,381	138,104(b)
Pigeon Guillemot	288	269	260	nd	324(c)
Tufted Puffin	12	6	24	nd	9(c)
Brandt's Cormorant	1,638	1,380	1,208	2,068	3,122(b)

Double-crested Cormorant	44	58	80	272	116(b)
Pelagic Cormorant	372	80	308	nd	534(c)
Western Gull	nd	662	698	nd	nd

Species Accounts

Fork-tailed Storm-petrel (*Oceanodroma furcata)*

The Fork-tailed Storm-petrel (FTSP) is widely distributed throughout the North Pacific and is separated into two subspecies. O.f. *plumbea* breeds along the west coast of North America from southern Alaska to northern California (Osborne 1972, Harrison 1983). There are about 5,000 breeding birds in Region 1, with an estimated 400 in California (USFWS 2005). Populations in California appear to have decreased in recent times (Carter et al. 1992). The FTSP is a pelagic seabird that feeds primarily offshore, near the continental shelf break in summer, further offshore in the non-breeding season (Briggs et al. 1987). Their diet consists of planktonic crustaceans, and fish and animal detritus from the ocean surface (Boersma and Silva 2001). They breed colonially in crevices and burrows on rocky islands and are nocturnally active at breeding colonies (Boersma et al. 1980).

Castle Rock is near the southern limit of the species range and according to very limited historic information, appears to be the second largest FTSP colony in California (Carter et al. 1992). The breeding population at Castle Rock has never been scientifically assessed due to inherent survey difficulties. Presence has been established through 2 nights of mist-netting as well as auditory cues. In 1970 (16 May), Osborne captured 2 birds and suggested that the total population was probably less than 100 pair. There was no stated basis for the rough estimate, but it may have been related to numbers of birds caught per unit time in comparison to Leach's storm petrels (see Leach's account). The next mist netting effort took place in 1989, (Sept. 12-13). Six birds were captured in a mist-net located in the "saddle" of the meadow. Birds also were heard calling near the east end of the island on 21-22 August. Sowls (1980) and Carter et al. (1992) have used Osborne's statement as

a population estimate for Castle Rock, but Osborne officially listed the status on Castle Rock as "present in the breeding season, numbers unknown" (Table 4, Osborne 1972). Until new information is collected, the only valid statement that can be made is that they are "present."

It is clear from the historical accounts that Leach's Storm-petrels (LHSP) were much more abundant than FTSP. Osborne stated that FTSP appeared to comprise less than 2 percent of the petrel population on islands where both species nested. Limited descriptions also suggest that FTSP may be more closely associated with the rocky crevice habitat on Castle Rock than soil burrow habitat. Clay searched the island for FTSP in July 1917 and eventually found 2 young birds on the south side of the island after rolling boulders and lifting grass hummocks. In May 1935 he returned and found 2 birds sitting on eggs in a deep rock crack Martin (1938) visited the island in June 1938, but did not detect FTSP. Both described great night flights of LHSP.

It is not possible to determine trends for FTSP on Castle Rock with the available data. Vegetation changes, soil erosion and loss of burrow breeding habitat may have reduced available nesting habitat (Carter et al. 1992). Of eight known historic nesting sites in northern California, two have been lost due to habitat changes (Osborne 1972, Sowls et al. 1980, Carter et al. 1992). The only colony where true population estimates have been generated in California is Little River Rock (Harris 1974). FWS (2005) states that populations in CA have shown a decrease in historic times. This assessment is evidently based on the extirpation of the species at 2 historic sites, and speculation about habitat changes at other islands, rather than actual population estimates.

Fork-tailed Storm-petrels are one of the earliest breeding seabirds in northern California. First landfall at Little River rock was 25 February (Harris 1974). Egg dates range from 22 March to 18 June (Clay 1925, Dawson 1923, Harris 1974). Local chick records range from 11 June to 9 August (*in* Osborne 1972).

Leach's Storm-petrel *(Oceanodroma leucorhoa)*

The Leach's Storm-petrel (LHSP) is one of the most widely distributed procellariform species in the northern hemisphere. They breed from Japan to Guadalupe Mexico in the Pacific, and also in the Atlantic (Huntington et al. 1996). The subspecies in northern California is *O.l. leucorhoa*. The population estimate for Region One is nearly 500,000 birds, with about 90% of these breeding in Oregon. The number of storm petrel colonies in California north of Cape Mendocino was reduced from 11 historic sites to 5 known sites by 1969 (Harris 1974). There has been evidence of a continued decline of this species in California (Carter et al. 1992). The LHSP is a pelagic seabird that is most abundant seaward of the continental shelf; closer to shore during the breeding season. Diet includes plankton and small nekton, concentrated at the surface. These petrels nest in burrows or crevices. They feed during the day and move to and from breeding colonies only at night.

LHSP arrive at northern California breeding colonies and begin courtship activities early in the spring. The earliest landfall detected in the region was 12 February (Osborne 1972) and Harris (1974) found courtship and intensive burrow construction from March to May. Eggs have been reported from 7 May to 24 July (Clay MS, 1901-1953). Small numbers of birds may be found at northern California colonies as late as October (Osborne 1972).

Castle Rock historically supported "tens of thousands" of LHSP (Clay MS). This species is either extirpated on the island, as suggested in USFWS (2005), or present in greatly reduced numbers (see Carter et al. 1992). Quantitative data for this species at Castle Rock are extremely limited and subject to interpretation. During 2 overnight visits to Castle Rock in 1989 (August 13 and September 13), no LHSP were seen, heard or captured in mist nets. Harris (1974) placed peak fledging for LHSP in northern Calfornia from late August through September and caught LHSP in mist nets through October in Humboldt County. However, because there were nearly 700 burrows with small openings at Castle Rock, Carter et al. (1992) considered the LHSP present and estimated a population of about 2,400 birds. The only other population estimate for the species was derived from one night of mist-netting (66 birds in 2 hours) and observation of "several thousand" birds in May 1970 (Osborne 1972).

Habitat changes including a decrease in vegetative diversity and cover, and associated soil erosion have likely had negative effects on this species (Carter et al. 1992). LHSP have been extirpated from 3 other northern California islands due to soil erosion (Osborne 1972).

LHSP at Castle Rock were strongly associated with *Calamagrostis* vegetation on the east end of the island. Osborne (1972) estimated 2500 pairs of Leach's Storm Petrel nesting under the grass and found their burrows nowhere else on Castle Rock. That vegetation now appears to be extirpated from the island. The vegetation on the refuge is directly affected by surface-nesting seabirds and non-breeding Aleutian Cackling Geese.

Double-crested Cormorant (*Phalacrocorax auritus)*

The Double-crested Cormorant on the Pacific coast (*P.a. albociliatus)* is one of five subspecies recognized in North America. The breeding range of this population extends from Mexico to Canada. Post-breeding dispersal occurs along the Pacific coast, but major migratory movements have not been described. Since the 1970's, numbers of this species have increased significantly in many regions of North America. The continental population has been estimated at about 2 million birds (USFWS 2003). Many negative impacts have been associated with this increase, prompting legal and illegal actions to control numbers in various places of the U.S. (Wires et al. 2001). The USFWS has proposed a new depredation order to address public resource conflicts (USFWS 2003).

On the California coast, the total number of Double-crested Cormorant nests in 2001-2003 was about 6,500 at 42 colonies (Capitolo et al. 2004b). This nest count was 48% higher than in 1989-91 and 592% higher than in 1975-1980. One of the 3 largest colonies in northern California is located just north of Castle Rock at Prince Island.

The Double-crested Cormorant uses a variety of nest habitat types. They construct nests of vegetation in trees, islands, and a variety of artificial structures. They are known to denude vegetation and have negative

affects on habitats shared with other species. DCCO nest earlier than other coastal cormorants (Ainley and Boekelheide 1990, Carter et al. 1992). Egg laying may begin as early as late March in northern California; hatching takes place from late April to mid-August (Sowls et al. 1980).

Double-crested Cormorants were first documented nesting at Castle Rock in 1997 (Jaques and Strong 2001). The colony increased from 29 nests in 1997 to an estimated 136 nests in 2003 (Capitolo et al. 2004b) .

DCCO were observed building nests on 11 April 1997 in tall vegetation at the southeastern rim of the island (Jaques and Strong 2001). After 1997, it was not possible to see all nests from shore. Large chicks were observed creching in the nesting area in mid-late July each year from 1997-1999.

Since at least 2001, DCCO have been counted from aerial photographs; methods are reported in Capitolo et al. 2004a). Nesting has moved from exclusively the eastern rim of the refuge to various regions including the western peak of the island (P. Capitolo, UCSC, pers. comm.). Capitolo et al. (2004b) reported that it is difficult to distinguish DCCO nests from BRCO nests in the aerial photographs of Castle Rock because few stick nests were obvious there. Jaques (2004) observed that cormorants use vegetation from the island itself to build nests, and that the there was no tall vegetative growth remaining on the eastern rim by 2004. Capitolo et al. (2004b) recommended that future DCCO censuses at Castle Rock should include a combination of aerial, ground and boat-based observations for increased accuracy.

DCCO productivity and chronology is relatively immune to variability in ocean conditions compared to other cormorants (see Capitolo et al. 2004a). The DCCO was one of only two seabird species breeding on Castle Rock that did not demonstrate a negative response to ENSO conditions in 1998 (Jaques and Strong 2001). There was no apparent effect of the 2003 ENSO on this species breeding status in California (Capitolo et al. 2004a). The consistent increase in the DCCO population in northern California likely reflects the fact that DCCO forage opportunistically in estuaries and fresh water bodies as well as coastal waters of the region (Capitolo et al. 2004a, Carter et al. 2001, Ainely and Boekelheide 1990, Jaques and Strong 2001).

The establishment and expansion of Double-crested Cormorants as breeders on Castle Rock may have undesirable effects on the island overall by altering vegetation composition and storm-petrel nesting habitat. Double-crested cormorants initially nested directly on top of the remnant stand of grass (*Calamagrostis nutkaensis)* under which the Leach's Storm-petrels historically nested (Jaques and Strong 2001). Growth of a Double-crested Cormorant colony established in 1972 on Little River Rock, Humboldt County resulted in a greatly reduced population of Leach's Storm-petrels at that site (Harris 1974, 1991; Smith 1986; Carter et al. 1992). Due to the potential impact on island diversity that growth of the Double-crested cormorant colony was expected to have, Jaques and Strong (2001) considered this species more a management problem than asset at Castle Rock. Consideration of management action such as use of cormorant (and goose) exclosures and re-establishment of desirable vegetation were recommended.

Brandt's Cormorant (*Phalacrocorax penicillatus*)

The Brandt's Cormorant (BRCO) breeds only along the West Coast of North America; Approximately 75% of the population breeds in California and Oregon; some small colonies have occurred as far north as Alaska, and others exist as far south as southern Baja California. No subspecies are recognized (Wallace and Wallace 1998). Post breeding dispersal takes place out of central California but no consistent movement pattern or direction has been established (Briggs et al. 1987). The total population is estimated at more than 100,000 birds (USFWS 2005). A statewide nest count in California in 2001-2003 totaled 27,000 nests at 97 active colonies. These data indicated a 29% decline in the population between 1989-1991 and 2001-2004, but were similar to numbers reported in 1975-1980 (Capitolo et al. 2004a).

BRCO nest in colonies on islands or cliffs with relatively flat ledges (Wallace and Wallace 1998). Nests are made of terrestrial plants or seaweed collected from the land or sea, or stolen from other nests. In northern California, Farallon weed (*Lasthenia minor*), and nootka reedgrass (*Calamagrostis nutkaensis*) are used to build nests, along with marine algae (Osborne 1972). Nest building in northern California generally begins in April and eggs are laid in May (Osborne 1972, Carter

et al. 1992). Breeding chronology may be related to the onset of upwelling at different locations (Boekelheide et al. 1990). Nesting can be significantly depressed during ENSO and post-ENSO years; the degree of response has been related to intensity and timing of warm events. BRCO will abandon nest sites en masse if food supplies decline midseason (Boekelheide et al. 1990).

Castle Rock NWR supported the third largest colony of Brandt's Cormorant in California during the last series of statewide surveys in 2003(Capitolo et al. 2004a). This was a decrease of about 9% since the 1989 survey. The statewide population reportedly declined 25% from 1989 to 2003. In 2004, the numbers of BRCO nests at Castle Rock increased. There were 1,561 nests present (Capitolo et al. 2006), which was the greatest number of nests ever recorded at the island.

Jaques and Strong (2001) reported much lower BRCO nest counts at Castle Rock in 1997-1999 (604-819 nests), but breeding during much of that period was strongly affected by ENSO conditions. Major nest abandonment occurred in 1998. Nest counts at Castle Rock in 1970 and 1980 totaled 879 and 1100, respectively (Osborne 1972, Sowls 1980). These data probably reflect fluctuation in the population related to oceanographic variability and availability of prey, however, BRCO surveys have probably not been frequent or consistent enough to correlate long-term trends with environmental factors (see discussion in Capitolo et al. 2004). No major disturbances or oil spill impacts have been documented for this breeding population.

BRCO nest and subcolony locations on Castle Rock have shifted on an annual basis (Jaques and Strong 2001, Jaques 2004), making it impossible to use specific subcolonies as an index to the annual population. Shore-based monitoring of BRCO subcolonies has been used successfully as a method to gain productivity indexes for the species (Jaques and Strong 2001, Thayer 2004).

BRCO roost on Castle Rock in March and begin forming colonies as early as the first week of April. Roosting Aleutian Geese and BRCO overlap

during this period, but Jaques (2004) found no evidence of direct interference between geese and cormorants.

Brandt's Cormorants use vegetation growing on Castle Rock for building nests (Osborne 1972, Jaques and Strong 2001, Jaques 2004). Historically, BRCO preferred *Calamagrostris*, but as it is no longer available they use *Lasthenia* and other plants. A major loss of protective vegetation and soil was reported at Castle Rock in the early 1970's by Osborne (1972). Osborne believed that the primary cause of the habitat degradation was removal of vegetation by nesting Brandt's cormorants.

Pelagic Cormorant (*Phalacrocorax pelagicus)*

The Pelagic Cormorant breeds from northern Baja California to the Bering Sea and south in the Northwest Pacific to Japan (Hobson 1997). The subspecies *P.p. resplenens* breeds from Baja to British Columbia. About 29,000 birds, more than 40% of the global population breeds in Washington, Oregon and California (USFWS 2005). Pelagic cormorants nest on cliff ledges on islands and mainland shores and occasionally use artificial structures (Carter et al. 1992, Hobson 1997). The species is very sensitive to changes in oceanographic conditions such as ENSO events, and breeding effort and success can vary greatly on an annual basis (Ainley and Boekelheide 1990). Food supply also influences laying dates and variations in hatching and fledging dates in California (Boekelheide et al. 1990). PECO are extremely vulnerable to human disturbance at breeding areas (Verbeek 1982, Siegel-Causey and Litvinenko 1993).

Pelagic Cormorants breed on cliff ledges all around the shoreline of Castle Rock. Breeding activity has increased greatly since 1970 when about 50 nests were reported (Osborne 1972). A record 267 nests was found during the most recent survey in 2004, indicating a breeding population of 534 birds (Jaques 2004, PRBO unpubl. data 2004). The breeding population ranged between 300-400 birds during 5 surveys conducted from 1979 to 1999, with the exception of 1998 (Sowls et al. 1980, Carter et al. 1992, Jaques and Strong 2001). In 1998, only 25 nests were built, presumably due to ENSO conditions that year (Jaques and Strong 2001).

The best method to survey Pelagic Cormorants at Castle Rock is a combination of boat and shore-based surveys. Pelagic Cormorant nests generally do not show up in aerial photographs of the refuge due to their location on steep shadowy cliffs. A nearby colony has been used as a surrogate for Castle Rock to gain an index to annual productivity, since it is not feasible to monitor an adequate sample of nests from boat or shore-based vantage points at Castle Rock (Jaques and Strong 2001).

Western Gull (*Larus occidentalis*)

The Western Gull is endemic to the west coast of North America and breeds from central Baja California to southern Washington (Pierotti and Annett 1995). There are 2 subspecies, *L.o. occidentalis* occurs on the outer Pacific coast. The total population has been estimated at 80,000 to 126,000 breeding birds (*in* USFWS 2005); including about 62,000 birds in California (Carter et al. 1992). Numbers have increased in California since the early 1900's (Pierroti and Annett 1995). The statewide survey in 1989-91 indicated that the population has continued to grow since 1975-80 (Carter et al. 1992). Most California Western Gulls breed on the Channel Islands and Southeast Farrallon Island NWR. The relatively small population size and limited range of the Western Gull make it a vulnerable species worthy of regional management concern (Pierotti and Annette 1995, USFWS 2005).

Castle Rock NWR supports the largest Western Gull colony in California north of the Farallon Islands and represented 2% of the statewide breeding population in 1989 with 1,370 breeding birds (Carter et al. 1992). This was a slight increase over 1970 and 1979-80 (Table 7). Jaques and Strong (2001) counted 349 gull nests from aerial photographs in 1999. Gulls nest all over the island in thick vegetation as well as on rocky outcrops and cliff ledges. The aerial survey technique did not provide complete coverage of the island and was not comparable to the boat survey method used by Carter et al. (1992) in late May 1989. However, a combined boat- shore based survey in early June 1999 resulted in even lower numbers. The closure of the Crescent City dump in the 1990's may very well have impacted the large gull population at Castle Rock through a reduction in food (see Spear 1993, Jaques and Strong 2001) but no adequate gull surveys have been done at the colony

since 1989. A combined aerial, boat and shore-based census technique, conducted in late May when vegetation is still relatively low, would be the best method for updating the status of the Western Gull at the refuge.

Common Murre (*Uria aalge*)

The Common Murre is one of the most abundant seabirds in the Northern Hemisphere, with a breeding population of 13 to 21 million birds (Ainley et al. 2002). It is also one of the most intensively studied avian species in the world; all aspects of its natural history have been investigated. Five subspecies are recognized; *U.a. californica* breeds from British Columbia to central California. Common Murre breeding populations in California have been monitored more thoroughly than any other coastal nesting seabird in the state, partly due to availability of funding from oil spill settlements. Murres in central California have been depressed due to gill net fisheries, oil spills and ENSO events (Carter et al. 2001). The most recent surveys of sample colonies indicate that the murre population in northern California is currently experiencing a general long term increasing trend (Capitolo et al. 2006).

Castle Rock NWR supports the largest Common Murre breeding colony in the state of California, and these birds comprise about 90% of the total seabird population on the refuge. Recent aerial survey data suggest that the population has fluctuated since 1989, but has not declined over the longer term. Murre numbers at Castle Rock and other northern California colonies were low during 1997-1999, a period of anomalous ocean conditions (Jaques and Strong in 2001, Capitolo et al. 2004). Counts of murres were comparable to 1989 numbers during 2001 and 2003 (Capitolo et al. 2006). The most recent raw count in 2004 was significantly greater than any counts over the past few decades (Capitolo et al. 2006), indicating a healthy, possibly growing breeding population of murres on Castle Rock. Adjusting the raw count of 82,697 birds by the standard *k* correction factor (Carter et al. 2001) results in an estimate of 138,104 murres present in 2004.

A shift in distribution of nesting murres on Castle Rock was described by Capitolo et al. (2004). More birds nested on the east end compared to 1989 (Carter et al. 1992) and fewer nested on the steep west end. Capitolo et al. (2004) noted that the vegetation on the east end of the

island was reduced by murres and cormorants, as observed by Osborne (1972) .

Common Murre breeding season attendance patterns at the refuge were monitored by shore-based observations of subcolonies during 1997-1999 (Jaques and Strong 2001). Ratios of adults with dependent chicks at sea were used as an indicator of annual productivity during the same period. Common Murre chicks at Castle Rock have fledged from about mid-June to mid-July. Based on colony attendance patterns and censuses of murres on the water, peak fledging in 1999 appeared to be the last week of June through the first week of July.

Murres attend Castle Rock throughout the winter, beginning by mid-November, but attendance patterns have not been methodically evaluated. Pre-breeding season attendance at the colony was monitored in 2004 in conjunction with observations of roosting Aleutian Geese (Jaques 2004). Murres were present at dawn each morning in March and April and overlapped with thousands of geese departing the roost.

Pigeon Guillemot (*Cepphus columba*)

The Pigeon Guillemot (PIGU) is endemic to the North Pacific and occurs from Alaska to southern California (Ewins 1993). There are 5 recognized subspecies; *C.c. eureka* breeds in Oregon and California. The California breeding population was estimated at about 15,500 birds nesting at 235 colonies during the most recent statewide survey in 1989 (Careter et al. 1992). PIGU are a diurnally active, cavity nesting species (Ewins 1993). The statewide Pigeon Guillemot population appeared to be stable from about 1979 to 1989, however, estimates for Del Norte and Humboldt County had decreased by about 40% over the 10 year period (Carter et al. 1992). Competition for nest sites with an expanding Rhinoceros Auklet population may cause declines in Pigeon Guillemot numbers where nest sites are limited (Ainley and Boekelheide 1990).

Castle Rock supports the largest PIGU colony in northern California and has accounted for 2% of the statewide population (Carter et al. 1992). PIGU nest in rock crevices as well as burrows in the soil at Castle Rock. The greatest concentration of birds occurs in the talus slope on the east end of the island. The PIGU breeding population at the refuge has been monitored by counting birds visible outside of burrows early in the breeding season, prior to egg-

laying. Data collected during the 2 statewide surveys indicated a decline in the Castle Rock population between 1979 and 1989 (Sowls et al. 1980, Carter et al. 1992). Jaques and Strong used a combination of boat and shore-based surveys to census PIGU at Castle Rock. Peak raw counts of PIGU from 1997-1999 were similar to 1989 (Jaques and Strong 2001). The most recent PIGU survey in 2004 indicated a 20% increase in the population since 1999 (Jaques 2004). The 2004 census of 324 birds was the highest raw count obtained since 1979. No guillemot breeding colonies have ever been monitored on an annual basis in the Humboldt-Del Norte area. With annual monitoring, Castle Rock could serve as an important indicator for the species in northern California.

Cassin's Auklet (*Ptychoramphus aleuticus*)

The Cassin's Auklet breeds from the Aleutian Islands, Alaska, south to Baja California. During the non-breeding season, these alcids spend most of their time at sea, often seaward of the continental shelf (Manuwal and Thoresen 1993). Individuals may visit the breeding colony in any month at southerly breeding colonies. They feed primarily on small crustaceans, and also squid and fish. Cassin's auklets nest in shallow burrows, small rock crevices, or under trees on the ground. They move to and from nest sites at night to avoid predation. There are two subspecies; the northerly population, *P.a. aleuticus* occurs in the CCS. The core of the population breeds in British Columbia. Population declines have been reported in Canada and California. Introduction of predators and changes in food supply are cited as major causes of population change. The species will accept artificial nest boxes, which have been used as a research tool.

The 1989 statewide survey provided the first standardized population estimates for Cassin's Auklets in northern California (Carter et al. 1992). Burrow counts on Castle Rock were conducted on 12-13 September. Potential Cassin's Auklet burrows were those that were visually judged to be likely based on size and shape. The estimate was based on direct counts of burrows for most of the island, and indirect estimates for plots in an area where it was not possible to walk without crushing burrows. The average burrow density was 1.07/m^2. A total 4,466 burrow and crevice sites were considered to be used by this species, after application of burrow occupancy correction factor, (L value = 75%) a population estimate of 5,638 birds was derived. This was an increase from the 3,600 birds estimated by Osborne (1971). Osborne based his estimate

on a plot that contained 154 burrows, or 0.17 burrows/meter^2. He extrapolated this density to a 3 acre area to derive his estimate. The plot used by Osborne was predominately vegetated by the "*Baeria-Poa*," cover type, however, he stated that burrow densities in the *Calmagrostis* vegetation appeared to be greater. Due to difficulty in comparing methods, Carter considered that numbers of CAAU have "increased slightly or remained the same since 1970." It seems clear that there has been an increase in the species since 1959, however, when only 100 breeding birds were estimated (Thoreson 1964).

The presence of CAAU at Castle Rock was first noted by Clay in 1934. Thoreson found a juvenile CAAU in a burrow in late August, 1958 (Thoreson 1964). Thoreson placed 25 artificial burrows constructed of wood on Castle Rock in October, 1958. He returned on 26 April 1959 and found that none of the boxes were occupied. An inspection of 5 burrows on the same date found 2 CAAU incubating eggs. Thoreson discontinued further investigations on Castle Rock due to hazardous landing conditions on the island and because "none of the auklet burrows was sufficiently shallow to observe without great disturbance and certain desertion by the birds."

Rhinoceros Auklet (*Cerorhinca moncerata*)

The Rhinoceros Auklet (RHAU) breeds in the North Pacific from the Channel Islands in southern California up through the Aleutian Islands and south to Japan (Gaston and Dechesne 1996). The North American population is roughly estimated at about 1 million birds. About 73% of this population breeds in British Columbia. The species was historically extirpated from Oregon and California; recolonization of islands in the region began in the 1960's and 1970's. The most recent estimate for California was about 1,800 birds at 32 colonies (Carter et al. 1992). RHAU move south after breeding and the majority of the eastern Pacific nesting population appears to winter in central and southern California (Briggs et al. 1987).

The RHAU is difficult to census because it nests in cavities and is mainly nocturnal or crepuscular in nest visitations. The population at Castle Rock was estimated by counting burrows and crevices on the island after the

breeding season (Carter et al. 1992). In 1989, an estimate of 1,034 birds was derived from counts of potential sites. This count represented an increase in the population since 1970, and 58% of the statewide estimate. Jaques and Strong (2001) reported densities of up to 8.0 RHAU per km^2 in the waters between Crescent City Harbor and Castle Rock in July.

Tufted Puffin (*Fratercula cirrhata*)

Tufted Puffins (TUPU) have historically bred from the Channel Islands in southern California along the Pacific coast to the Aleutian Islands and down to Japan (Piatt and Kitaysky 2002). The world breeding population is estimated at nearly 3 million birds; about 80% of which nest in North America. Puffins were historically far more abundant in California than they are in the present day (Ainley and Lewis 1974, Ainely and Boekelheide 1990, McChesney et al. 1995). The state population is estimated at less than 300 breeding birds (Carter et al. 1992), compared to about 5,000 in Oregon and 22,000 in Washington (Piatt and Kitaysky 2002). TUPU numbers are declining throughout Region 1 and British Columbia, but increasing in Alaska. Causes for recent declines have not been determined; however tens of thousands were killed in offshore fishing nets from the 1950's to 1990's (DeGange and Day 1991). An unknown level of fisheries bycatch continues off of Alaska, Russia and Japan (DeGange et al. 1993). The TUPU winters offshore throughout the North Pacific. Winter and spring population peaks offshore in California were estimated at 10,000 to 20,000 birds (Briggs et al. 1987).

The TUPU is a diurnally active cavity nester. Nests are typically excavated in deep, vegetated soil on steep slopes or plateaus, but birds will use rocky crevices for nesting when available (Piatt and Kitaysky 2002). Populations are monitored by direct counts of birds as well as burrow/plot counts.

Castle Rock supported an estimated 50% of the California state Tufted Puffin population in 1979-80 (Sowls et al. 1980). Castle Rock was thought to be the largest TUPU colony in California in 1989-1991, with an estimated 82 breeding birds (Carter et al. 1992). This estimate was derived by applying a (2.4) correction factor to a high instantaneous

count of 34 birds. The sporadic record of direct counts for Tufted Puffins at Castle Rock indicates a gradual decline since at least 1970. In 1970, up to 56 puffins were counted (Osborne 1972), compared to a peak count of 24 birds in 1999 (Jaques and Strong 2001) and a peak count of 9 birds in 2004 (Jaques 2004). The trend suggests that the species may become extirpated as a breeding bird at the refuge.

Changes in prey conditions, competition with Rhinoceros Auklets (Ainley et al 1994, McChesney et al. 1995), and habitat degradation due to soil erosion have been cited as possible causes for population suppression in central California and Oregon. These factors may be relevant at Castle Rock as well. Rhinoceros Auklet numbers at Castle Rock increased greatly from 1979-1989 (Carter et al. 1992). In addition, Western Gulls interfere with puffins at Castle Rock (Jaques and Strong 2001). Large gulls are one of the primary problems for puffins in other areas (Nettleship 1972, Vermeer 1979). Tufted Puffins rely on vegetation to help shield them from diurnal interference and piracy from gulls. Changes in vegetation cover and height have occurred at Castle Rock due to geese, surface nesting seabirds, and sea lions. Erosion of soils in burrow nesting areas has occurred in denuded areas. Thus, other native species may be degrading the quality of the habitat for puffins and indirectly exacerbating problems with Western Gulls.

Tufted Puffins arrived to Castle Rock during the first week of April in 2004 (Jaques 2004). The birds occupy nest habitat about 1 week after arriving (Piatt and Kitaysky 2002). Eggs are expected to be laid at Castle Rock by early to mid-May and the incubation period is estimated at about 42-43 days based on other studies (Boone 1986, Ainley and Boekelheide 1990). Thus, hatching is expected in late June. The average nestling period is 48 days (Piatt and Kitaysky 2002) which would place expected fledging from Castle Rock in August. The breeding season for puffins on Goat Island extended 6 months, from mid-April to mid-September (Boone 1986).

Seabird Management Summary

Burrow nesting seabirds have historically received the least attention at Castle Rock and are the most likely to be facing long-term declines due to ecological changes occurring on the island. As surface nesting species have increased, habitat for burrow nesting species has decreased, through a variety of mechanisms. A habitat-oriented management focus, beginning with vegetation mapping and historic analysis of changes in cover types, could be initiated despite lack of current population estimates for petrels and auklets. Active management on a portion of the island may be required to restore and maintain vegetation on the refuge. A plan for preservation and restoration of high quality burrow nesting habitat would help ensure continued survival of several species.

Management priorities for the seabirds at Castle Rock might be developed by taking into consideration regional, state and local concerns, the significance of the island to the species, the current status of the species on the island, the importance of maintaining species diversity on the refuge, feasibility, as well as other parameters. Ranking species by level of management concern at Castle Rock may help focus planning efforts (Table 9). Unfortunately, many of the species that are likely to be of highest priority at Castle Rock are also the most difficult and expensive to monitor.

Table 9. Regional, state, and local conservation and management status of seabirds breeding at Castle Rock. The ranking for Castle Rock is hypothetical, based on a variety of parameters that have been discussed in this document.

Species	USFWS BCC	USFWS Conservation Classification-Regional	California Species of Conservation Concern-	Level of Management Concern at Castle Rock NWR
Fork-tailed Storm-petrel		Currently Not at Risk	First Priority	Unknown
Leach's Storm-petrel		Low		Unknown
Double-crested Cormorant		Currently Not at Risk		Moderate
Brandt's Cormorant		Moderate		Moderate

Pelagic Cormorant		High Concern		Low
Black Oystercatcher	BCC-CA Coast and Region 1	NA		Low
Western Gull		Low		Moderate
Common Murre		Moderate		High
Pigeon Guillemot		Moderate		Low
Cassin's Auklet	BCC-California Coast	High Concern	Second Priority	High
Rhinoceros Auklet		High Concern	Third Priority	High
Tufted Puffin		Moderate	First Priority	High

IX. MARINE MAMMALS

Species Overview

Four species of pinnipeds regularly occur at Castle Rock, the Steller sea lion (*Eumatopias jubatus*), California sea lion (*Zalophus californicus*), Pacific harbor seal (*Phoca vitulina*), and Northern elephant seal (*Mirounga angustirostris*). Harbor and elephant seals breed on the island, and both California and Steller sea lions use the island regularly as a seasonal non-breeding haul-out. The Steller sea lion is the only federally listed endangered marine mammal found at the refuge. The Northern fur seal (*Callorhinus ursinus*) may occur at the refuge rarely, but the species has not been documented hauled out on the island. North American River Otter (*Lontra canadensis*) are common on the beaches and ocean waters just off Pt. St. George, but river otter have not been documented on Castle Rock.

Gray Whales (*Eschrictus robustus*) and Harbor Porpoise (*Phocoena phocoena*) are the most common cetaceans inhabiting the waters surrounding Castle Rock. Gray Whales are abundant in the area during migration, and sightings of small numbers of these whales occur year round. Gray Whales have been observed feeding within 1 km offshore in the Crescent City area (Jaques and Strong unpubl.) and they likely feed in the waters immediately surrounding Castle Rock.

Research and Monitoring Overview

The National Marine Fisheries Service (NMFS) is the primary entity monitoring pinnipeds at Castle Rock. The Southwest Fisheries Science Center (SWFSC) conducts a "Pinniped Aerial Surveys Project" that includes censuses at the refuge. Surveys are flown for breeding elephant seals in February, harbor seals in May-July, and Steller's and California sea lions in July. Surveys are conducted at an altitude of either 750-800 feet, or 1400 feet, depending on the camera equipment used and sensitivity of the island. The pinniped species being censused is then counted as a biologist looks through a 7-30X zoom binocular microscope as the large format color transparency photograph is illuminated on a light table. Animals of each age/sex class are marked on a clear acetate plastic overlay with different colored pens as each animal is counted to assure that all are counted and to prevent double counting the same animal. Stock assessment reports are produced and are available online at NOAA swfsc.noaa.gov. The reports generally do not provide specific information for Castle Rock. Data provided in this report were provided by Mark Lowry, SWFSC.

The Oregon Department of Fish and Wildlife (ODFW) (contact: Robin Brown, Hatfield Marine Station, Newport, Oregon) has worked cooperatively with NMFS on research related to the Steller sea lion. Intensive research has taken place on the nearby breeding rookery at Southwest Seal Island, but results specific to Castle Rock have been limited to the annual aerial surveys led by NMFS.

Table 10. Pinniped monitoring at Castle Rock.

Year	Principal Investigator	Purpose	Document	Comments
1980-82	Bonnell et al.	North-central CA pinniped survey	Bonnell et al. 1983	
1981-2001 June.	CDFG	Annual statewide harbor seal survey	Beeson and Hannan 1994	Long term monitoring conducted by CDFG. Discontinued prior to 2002. NMFS took on the project in 2002.

1985	Griswold	Pinniped study, northern CA	Griswold 1985	Graduate study, pinnipeds in Humboldt and Del Norte
1994-1995, winter	Jaques and Strong	Elephant seal Status	Jaques and Strong 1994, 1995	First quantitative documentation of E-seal breeding population, counted other pinnipeds
1998-2003, July	NMFS, SWFSC	Statewide sea lion survey	Unpubl. data, NMFS, Lowry et al.	Aerial photographic surveys of California and Steller sea lions, Stock Assessment
2002-May-July	NMFS, SWFSC	Statewide harbor seal survey	Unpubl. data, NMFS, Lowry et al.	Aerial photographic surveys of harbor seals. Not sure if annual or not.
2004	NMFS, SWFSC	Elephant seal survey	Unpubl. data, NMFS, Lowry et al.	Aerial photographic survey of elephant seals, to include Castle Rock for first time, pending sufficient funding.

Pacific Harbor Seal

Distribution and Status. The eastern North Pacific subspecies of harbor seal (*P.v. richardsi*) ranges from Baja, California, Mexico to the Pribilof Islands in Alaska. Three separate stocks have been identified for management purposes: 1) inland waters of Washington State, 2) Oregon and Washington coast, and 3) California. Harbor Seals are generally non-migratory but move locally in relation to factors such as tides, weather, season, food availability, and reproduction (*in* Carretta et al. 2004).

Pacific Harbor seals have increased rapidly since the passage of the Marine Mammal Protection Act (MMPA) in 1972. The California stock may have reached its environmental carrying capacity (Carretta et al. 2004). Harbor Seals are not considered Adepleted≅ or Astrategic≅ under the MMPA.

Habitat Associations. Harbor seals occur in nearshore coastal and estuarine habitats. They feed in marine, estuarine, and occasionally, fresh waters. They haul out on relatively flat substrates, including rock reefs, sandspits, and mudflats. Peak numbers haul out at low tides, particularly in the afternoon (Le Boeuf and Bonnell 1980). Harbor seals have displayed strong fidelity for haulout sites (Carretta et al. 2004).

Breeding Biology and Chronology. Breeding takes place from March to June in California; peak pupping occurs in April and May. Courtship and mating appear to take place in the water. Females give birth on land, often at low tide. Pups are able to swim at birth. After pups are born, the females form nursery areas away from the main colony for about 2 weeks. Pups are nursed for 4-6 weeks. Adult seals breed again soon after weaning. (Knudtson 1974, Shaughnessy and Fay 1977, Loughlin 1978, Newby 1978).

Monitoring. The population is monitored by aerial surveys conducted during the peak molting period in late June-early July. CDFG initiated an annual statewide aerial harbor seal survey in 1981 in conjunction with NMFS (Beeson and Hanan 1994). NMFS became lead agency conducting the surveys in 2002. The NMFS surveys are photographic aerial surveys conducted at a minimum of 700 ft. altitude (Lowry 2005). Large format photographic transparencies are counted with a binocular microscope, as described above. Stock assessment reports are produced and are available online at NOAA swfsc.noaa.gov. A complete pup count is not possible at any given rookery because harbor seals are precocious and may enter the water almost immediately after birth. Population size is estimated by counting the number of seals ashore during the peak haul-out period and multiplying this count by a correction factor. Based on the most recent harbor seal counts (Lowry et al. 2005) and a correction factor developed by the CDFG, the harbor seal population in California is estimated at 34,233 animals (Carretta et al. 2005).

Status at Castle Rock. Castle Rock is a year-round haulout, nursery area, and probable breeding site for the Pacific harbor seal. The refuge was one of 563 haulout sites documented for the species in California during the 2004 statewide survey (Lowry et al. 2005). The haulout on the refuge (109 seals) was larger than the statewide average (51.1 animals). The reef (513 seals) was one of the largest haulouts in northern California (Table 11).

Pupping has been documented on the reef adjacent to Castle Rock NWR, but pupping has not been documented on the refuge itself. NMFS refers to the inner reef as Castle Rock shoals. Data for the reef and Castle Rock have been often been lumped as “vicinity of Castle Rock.” Bonnell et al. (1983) found peaks in harbor seals in the area during summer. Summer

counts by the CDFG during 1983-1994 were variable, ranging from 542 to 139 seals, with no apparent trend. Jaques and Strong (1995) counted harbor seals from aerial photographic surveys in winter 1994 and early spring 1995 and found the species only on the reef, not on the NWR (83 and 165 seals on the reef, respectively). Small numbers of Harbor seals, including some nursing pups regularly haul out around the rim of the NWR in summer (Jaques and Strong unpubl.).

Table 11. Counts of harbor seals taken from 126 mm format aerial color photographs taken in the Castle Rock vicinity during 2004. GPS data format Deg NAD83. Data are from Appendix 1, Carretta et al. 2005. The table shows the type and format of data collected at Castle Rock by NMFS.

Degrees latitude	Degrees longitude	Section	Location of haulout site	Date	Time	Tide height	Count of seals onshore	Count of seals in water
41.765	124.244	Northern CA	Vicinity of Castle Rock, Crescent City	5-Jul-04	10:49	-0.03	61	1
41.763	124.244	Northern CA	Vicinity of Castle Rock, Crescent City	5-Jul-04	10:39	-0.03	109	4
41.746	124.205	Northern CA	Vicinity of Castle Rock, Crescent City	5-Jul-04	10:38	-0.09	13	0
41.749	124.219	Northern CA	Vicinity of Castle Rock, Crescent City	5-Jul-04	10:46	-0.03	513	3

Northern Fur Seal

Northern fur seals range widely in the North Pacific. About 75% of the population breeds on the Pribilof Islands in Alaska and less than 1% breed in California (Carretta et al. 2004). Fur seal rookeries in California have been gradually recovering from near decimation by the fur seal trade. Breeding was discovered in 1968 on San Miguel Island, and this population grew to about 4,000 animals by 2002. Breeding at SW Farallon Island NWR was discovered in 1996, and in a large population increase in 2006, 180 animals were present and 80 pups were born. The marked females observed breeding at the Farallones in 2006 were all from the Pribilofs.

Following breeding in Alaska, females and pups migrate through the Aleutian Islands into the North Pacific Ocean, often to Oregon and Washington waters. They primarily remain at sea, feeding well offshore until returning to breeding rookeries. They are rarely seen from shore in

the continental United States, but individuals do occasionally haul out on various islands (Angliss and Lodge 2004).

Northern fur seals may have historically occurred at Castle Rock, and probably occasionally haul out at the refuge, but records have not been found to corroborate this. An unusual influx of fur seals occurred in the Crescent City area during winter 2006-2007. Seven malnourished northern fur seal pups were recovered in the Crescent City area from November to January 2007 (www.northcoastmmc.org). The pups were taken in for rehabilitation at the North Coast Marine Mammal Center. Fur seals are negatively affected by strong El Ninos (Melin and DeLong 2000) and the pup starvation event along the north coast probably reflected a year of particularly poor ocean conditions rather than increased association with the nearshore environment. However, a return of fur seals to other historical breeding rookeries in northern California, besides the Farallones, is possible. More careful pinniped monitoring at Castle Rock might reveal more information about the species status in this region.

California Sea Lion

Distribution and Status. California sea lions of the subspecies (*Zalophus californianus californianus*) range from southern Mexico to British Columbia, Canada. They breed mainly on offshore islands, ranging from southern California's Channel Islands south to Mexico, although a few pups have been born on Año Nuevo and the Farallon Islands in central California. There is a fall northward migration along the coast and more rapid southward migration in spring.

The U.S. stock was most recently estimated at 138,881 animals (Carretta et al. 2004). The population has experienced an annual growth rate of approximately 6% since at least 1975. The species is not listed under the Endangered Species Act and is not Adepleted≅ or listed as Astrategic≅ stock under the MMPA.

Habitat. California sea lions occur primarily on rocky islands within a few km of shore. They are able to climb to the upper reaches of many islands and can affect vegetation and erosion on islands with fragile topsoil.

Breeding. California Sea Lions on the U.S. Pacific coast are primarily from the stock that breeds on islands in southern California, although males that breed in Baja, California, Mexico may also spend most of the year in the U.S. (Carretta et al. 2004, Lowry et al. 1992).

Monitoring. NOAA conducts photographic aerial surveys of this species in July as part of the Pinniped Aerial Surveys Project (NMFS SWFSC). The entire population cannot be counted because all age and sex classes are never ashore at the same time. In lieu of counting all sea lions, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population. Censuses are conducted in July after all pups have been born.

Status at Castle Rock. Castle Rock is used by California sea lions year round (Mate 1973; Griswold 1985) and was historically the northmost haul-out site during the breeding season (Mate 1973) and the southernmost overwintering site in northern California (Griswold 1985). Bonnell (1981) identified Castle Rock and associated shoals as one of the largest California sea lion hauling grounds in central and northern California. Use of Castle Rock by non-breeding sea lions has likely increased along with the overall West Coast population; however, few data are available to reflect this trend. Breeding season censuses made by NMFS are highly variable, possibly due to differences in survey date. Data appear to indicate that numbers of sea lions at Castle Rock in early July are very low, but that post-breeding influx to the island begins by mid-July (Table 12). Griswold (1985) made 72 censuses of pinnipeds at Castle Rock during 1984. During his study, July was the period of lowest *Zalophus* abundance; numbers increased in August and were highest during fall and winter, then dropped off again during April. The mean count during July was 11 animals, compared to about 280 on average during September-October. Historic counts made by Bonnell (1983) were higher, with about 1,500 and 570 animals present in October and January, respectively.

The most recent non-breeding season counts of pinnipeds at Castle Rock were made in 1994-1995. Jaques and Strong (1995) conducted aerial photographic surveys of sea lions during March 1994 and January 1995

incidental to an elephant seal survey. During January, a total 1,277 *Zalophus* were counted, with the majority of the animals (83%) on the main island rather than the associated reef. Sea lions climb up to the top of the eastern edge of Castle Rock during winter weather conditions and can be packed very densely on the upper areas of "the Pit" during storms and high swells (Griswold 1985).

Zalophus haul out primarily on the east side of Castle Rock, particularly on the beach, outer slopes and rim of the "pit," as well as rock outcrops associated with the cove on the south side of the island. Accelerated erosion of any soil covered areas used by sea lions is to be expected, particularly sloping areas such as the "access slope."

Table 12. Counts of California Sea Lions taken from 126 mm aerial color photographs taken at Castle Rock and reef during July 2000-2004 by NMFS. Data are from Carretta et al. 2005.

Latitidue	Longitude	Location name	Date	Count
41.45.8	124.14.7	Castle Rock	8 July 2000	37
41.45.8	124.14.7	Castle Rock	17 July 2001	380
41:46.0	124.14.7	Castle Rock	9 July 2002	2
41.46.0	124.14.6	Castle Rock	12 July 2003	644
41:45.7	124.14.8	Castle Rock	5 July 2004	2

Steller Sea Lion

Distribution and Population Trends. Steller sea lions (*Eumatopius jubatus*) range along the North Pacific rim from northern Japan to central California. The species was divided into two distinct population segments (DPS) in 1997 (NMFS 2006). Castle Rock occurs in the range of the eastern stock (eastern DPS), which includes the population from central California coast north to Cape Suckling, southeast Alaska. Both the eastern and western stocks were listed as federally threatened in 1990 (55 FR 49204); the western stock was subsequently upgraded to endangered status in 1997. The Steller sea lion is also listed as Adepleted≅ under the U.S. Marine Mammal Protection Act and is classified as a Astrategic≅ stock. Critical habitat was designated in 1993.

Steller Sea Lions historically occurred at five major rookeries in California, from the Channel Islands to the St. George Reef (NMFS 2006).

The Steller sea lion eastern DPS is currently between 45,000 and 51,000 animals, and has been increasing at 3% per year for the past 30 years with variation in trends within the range (NMFS 2006). Numbers have decreased at the southern extent of the range in southern and central California, but have increased in northern California and Oregon (NMFS 2006). The Steller Sea Lion Recovery Team has recommended that a status review be initiated to determine whether to de-list the eastern DPS of Steller sea lions (NMFS 2006).

Habitat Associations. Steller sea lion rookeries (e.g. regular breeding areas) are typically located on remote offshore islands and reefs and require adequate areas above high water levels where young pups can survive most weather conditions (*in* NOAA 2006). Female sea lions appear to select birthing habitat that is gently sloping and protected from waves. A haulout is defined as an area used by adult sea lions during times other than the breeding season and by non-breeding adults and subadults throughout the year. Birthing occasionally takes place at haulouts, but a true rookery has been defined as a site where 25-50 pups are born each year (R. Brown, ODFW, pers.comm.). Sea lions use traditional locations from year to year. Factors that influence habitat suitability include substrate, exposure, proximity to food resources, oceanographic conditions, season, and human activities (NMFS 2006).

Breeding. The Steller sea lion pupping and breeding season extends from late May to early July (*in* NOAA 2006). Adult females give birth to a single pup and then breed with territorial males about 11-14 days postpartum. Females with pups begin dispersing from rookeries to haulouts when the pups are about 2.5 months of age. Adult males that breed in California move north after the breeding season and are rarely seen in California or Oregon except from May through August. Females tend pups for several months following dispersal from breeding rookeries. Juveniles part with their mothers and begin to disperse in association with weaning, at about 8 months of age (NMFS 2006).

Steller sea lions are not known to migrate, but may disperse widely outside the breeding season (NMFS 2006).

Monitoring. Monitoring and management oversight of the Steller sea lion falls primarily under the jurisdiction of the NMFS Alaska Fisheries Science Center and Alaska Regional Office. Standardized counts of the species in California have been conducted since 1996 by the SWFCS and ODFW during aerial surveys in late June-early July as described above. Productivity and movements of the local breeding population in northern California have also been studied by remote surveillance cameras and marking animals by branding. Since July 2001, Steller sea lion pups have been tagged and branded at rookeries in southern Oregon and northern California to determine survival, movements, and distribution of yearlings and juveniles. A cohort of 180 pups was branded at St. George Reef, California, in July 2004. Bimonthly vessel and land-based surveys to resight branded sea lions were conducted in northern California, Oregon and Washington (www.afsc.noaa.gov/Quarterly/jas2004). Due to a lawsuit by the Humane Society, branding activities have been halted since 2005, but low take and no-take research activities, such as remote sensing were allowed to resume as of May 2006 (www.fakr.noaa.gov/protectedresources/stellers/litigation).

Status at Castle Rock. Castle Rock NWR and its adjacent shoals are a traditional seasonal haulout for the Steller sea lion. The area is one of 41 haulout sites noted in California (2002 statewide survey, *in* NOAA 2006). Data from NMFS July aerial surveys from 2000-2005, indicate that use of Castle Rock is variable and possibly increasing (Table 13). A high count of 918 individuals occurred at Castle Rock and Castle Rock shoals collectively in July, 2004 (M. Lowry, NOAA, unpublished data). The NMFS data indicate that 716 of these animals were on Castle Rock itself. On the same date in July, 1,092 non-pups and 444 pups were recorded nearby on the St. George Reef. Most of the Steller sea lions using the refuge are either immature animals or nursing females with dependent pups (R. Brown, ODFW, unpubl. data, Jaques and Strong 1995). Only a few winter counts of the species are available. Jaques and Strong (1995) counted 203 Steller sea lions from aerial photographs in January 1995, including 36 females with nursing pups. Griswold (1985) had a peak count of about 200 Steller's at Castle Rock in November.

The Steller sea lion breeding rookery on the St. George Reef is on Southwest Seal Rock, about 7 km west of Castle Rock at (41^0 49'00" N, 124^0 21'00" W). The Southwest Seal rookery is one of 5 major rookeries in California and comprises a significant portion of total California

production. Numbers of pups born there have ranged from 293 to 444 in recent years. The population at the site has been increasing at an annual rate of about 4% since the mid 1970's (Robin Brown, ODFW; Table 13) and appears to be at a fairly high level relative to historical measures (NMFS 2006). During 2004, 444 pups and 738 nonpups were counted there. The St. George Reef was not designated as critical habitat for the species (NMFS 2006), nor was the haulout at Castle Rock.

The growing Steller sea lion breeding population at St. George Reef is near its physical capacity and may be on the verge of expanding to nearby sites (R. Brown, ODFW). Some pupping appears to have taken place at Northwest Seal Rock (R. Brown, M.DeAngelis, NMFS, *in* Jaques 2006), but Castle Rock offers more suitable habitat for a new colony in this vicinity.

There is post-breeding movement of animals from the rookery at Southwest Seal Rock. Many females with nursing pups move to Northwest Seal Rock by August (CCR 2001), however, most *Eumatopias* depart Northwest Seal Rock for the winter, presumably due to high surf conditions. In contrast, the species is present at Castle Rock NWR and associated shoals year round, where haulout habitat is more protected from winter conditions (Griswold 1985, Jaques and Strong 1995).

Mate (1973) reported that Castle Rock was a breeding rookery for Steller Sea Lions, but further details were not provided. The potential for future breeding on the refuge by this listed species seems high and would represent a positive step in recovery of the Eastern population.

Prevention of disturbances to Steller sea lions during the pre-breeding and breeding season would be a step towards encouraging establishment of the island as a rookery. Any activities that may have negative effects on this species are subject to review and permitting under the ESA and MMPA by the NMFS Office of Protected Resources. Coordination of refuge planning and research with NMFS, Office of Protected Resouces, La Jolla will ensure compliance with the MMPA and ESA regarding this sensitive species.

Table 13. Steller sea lion count data for the St. George Reef and Castle Rock, July 5-17, 2000-2004. Preliminary data from M. Lowry, National Marine Fisheries Service, Southwest Fisheries Science Center.

	2000	2001	2002	2003	2004
NW Seal Island	334	335	175	220	354
SW Seal Island non-pups	532	455	541	583	738
SW Seal pups	293	338	367	458	444
Castle Rock and shoals	12	66	692	100	918

Northern Elephant Seal (*Mirounga angustirostris*)

Distribution and Status. Northern elephant seals in the California stock range from Baja California (Mexico) to the Gulf of Alaska. They breed and give birth in California and Baja California (Mexico), primarily on offshore islands (Stewart et al. 1994), from December to March (Stewart and Huber 1993). Populations of northern elephant seals in the U.S. and Mexico were all originally derived from a few tens or a few hundreds of individuals surviving in Mexico after being nearly hunted to extinction (Stewart et al. 1994). The current population estimate is over 100,000 animals in California alone (Carretta et al. 2005). As the population has recovered, breeding colonies formed along the California coast. Most of the stock in the U.S. currently breeds on the southern California Channel Islands; about 20% of the pups have been born in central California in recent years (Carretta et al. 2005). The breeding range expanded as far north as Oregon by 1993 (Hodder 1998). Based on trends in pupcounts, northern elephant seal colonies were continuing to grow in California through 2001 (Figure 2), but appear to be stable or slowly decreasing in Mexico (Stewart et al. 1994.)

Male elephant seals feed in the Gulf of Alaska, near the eastern Aleutian Islands, and females feed further south, south of 45°N (Stewart and Huber 1993; Le Boeuf et al. 1993). Adults return to land between March and August to molt, with males returning later than females. Adults

return to their feeding areas again between their spring/summer molting and their winter breeding seasons.

Monitoring. The NMFS SWFSC monitors elephant seals in California under the "Pinniped Aerial Surveys Project" described above. Photographic flights take place during Februrary. The flights include southern and central California, but do not extend as far north as peripheral colonies in northern California and Oregon.

A complete population count of elephant seals is not possible because all age classes are not ashore at the same time. Elephant seal population size is typically estimated by counting the number of pups produced and multiplying by the inverse of the expected ratio of pups to total animals (see Carretta et al. 2005). Based on an estimated 28,845 pups born in California in 2001 and use of a 3.5 multiplier, the California stock was approximately 101,000 in 2001.

Breeding. Elephant seal breeding rookeries occur on relatively flat sand beaches either on islands or relatively isolated coastal mainland areas. Females give birth first when 3-5 years old (*in* Barlow 1993). Males reach prime breeding condition at 9-12 years of age. Pregnant females come ashore to give birth from December through February. Seals mate about 24 days after birthing. Pups are abandoned on beaches when they are about 1 month old but remain at the rookery for another 1-3 months prior to going to sea. Juveniles and adults return to molt from March to August. Most elephant seals return to their natal rookeries when they start breeding (Huber et al. 1991).

Status at Castle Rock. Elephant Seals breed on Castle Rock and the associated shoals, but the population has not been regularly monitored by NMFS or any other entity. Although breeding was evident as early as 1978 (Griswold 1985), aerial surveys to confirm that the island was a breeding rookery did not take place until 1994-1995 (Jaques and Strong 1995). No surveys have taken place since that date. The breeding area on the refuge is largely out of view from the mainland shore or boat.

The first record on elephant seals on the island was made by Osborne (1972) who observed up to 6 elephant seals there in 1970. A young elephant seal pup washed up a nearby Crescent City beach in 1978

(Griswold 1985). Bonnell et al. (1983) counted up to 4 elephant seals on Castle Rock and inner reef during aerial surveys in January 1982, and speculated that one pup may have been born there that year. Pre-weaned pups have washed up on the mainland regularly since about 1985 (D. Wood, Northcoast Marine Mammal Center (NCMMC), pers. com). Sightings of tagged animals indicate that it was initially colonized by immigrants from Ano Nuevo Island.

Aerial surveys in 1994-1995 confirmed that the elephant seal breeding population at Castle Rock was relatively small and that breeding takes place on both the main island and inner reef (Jaques and Strong 1995). Up to 52 nonpups and 11 pups were counted at the rookery in January 1995 (Table 14). Most elephant seals on the refuge were on the flat beach inside the pit. There is very little suitable elephant seal habitat on the refuge and this factor likely limits the size of the breeding population. Pup mortality appears to be high, as evidenced by the number of pups that wash off the site during winter storms. Many of these animals are rehabilitated and released by the NCMMC.

The Castle Rock rookery is nearly 500 km from the nearest successful breeding site at Pt. Reyes (see Allen et al. 1989). Although Castle Rock is not, and probably never will be a large colony, its position at the periphery of the breeding range makes it an interesting site for this species. Since elephant seals at Castle Rock are not monitored by any other entity, the refuge may want to consider conducting an aerial survey program to document changes in this northerly breeding population over time.

Table 14. Numbers of northern elephant seals (*Mirounga angustriostris*) counted from aerial photographic surveys at Castle Rock and Castle Rock shoals in 1994-1995 (From Jaques and Strong 1995).

		Castle Rock	Castle Rock Shoals	Total
January 20, 1995	Bull	1		1
	Subadult male	6		6
	Female	34	11	45
	Pup	3	*	3

	Total	44	11	55
Februrary 4, 1995	Bull	1	1	2
	Subadult male	4		4
	Female	24	17	41
	Pup	4	7	11
	Total	33	25	58
March 17, 1994	Adult	2	3	5
	Pup	9	2	11
	Total	11	5	16

Marine Mammal Permits

Activities that may have negative effects on any marine mammal species at Castle Rock are subject to review by the NMFS under the MMPA. An Incidental Take Permit covering four species of pinnipeds may be required for certain kinds of research, monitoring, or management actions at Castle Rock NWR. In addition, an endangered species permit may be required for actions that may affect the Steller Sea Lion. Information on these permits is provided at www.nmfs.noaa.gov/pr/permits/incidental.htm, and www.nmfs.noaa.gov/pr/permits/esa_permits.htm and is excerpted as follows:

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 et seq.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Permission may be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses and that the permissible methods of taking and requirements pertaining to the monitoring and reporting of such takings are set forth. NMFS has defined ``negligible impact'' in 50 CFR 216.103 as ``...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to,

adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Subsection 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The MMPA defines ``harassment'' as:
any act of pursuit, torment, or annoyance which (a) has the potential to injure a marine mammal or marine mammal stock in the wild; or (b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral
patterns, including, but not limited to migration, breathing, nursing, breeding, feeding, or sheltering.

Subsection 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

FOR FURTHER INFORMATION CONTACT: Kenneth R. Hollingshead, Office of Protected Resources, NMFS, (301) 713-2055, or Christina Fahy, NMFS, (562) 980-4023.

IIX. OTHER WILDLIFE SPECIES

Aleutian Cackling Goose (*Branta hutchinsii leucopareia*)

The Aleutian Cackling Goose uses Castle Rock NWR as a night roost and minor foraging area during migration and staging in the Crescent City area. This bird was formerly considered a subspecies of the Canada Goose and was known as the Aleutian Canada Goose (*Branta canadensis leucopareia*). The Aleutian Canada Goose was designated an endangered species in 1967 (USFWS 1991). The population had plummeted by the 1930's due to predation by introduced foxes on the nesting islands in Alaska (66 FR 15643). By 1967, the only known remaining nesting site in the Aleutian Islands was Buldir, and the population was thought to number less than 1,000 birds. Smaller populations were later found on one of the Semidi Islands and another island in the Aleutians. The importance of the Crescent City area to the remnant population was first discovered in March 1975, when a flock of 790 birds were discovered at Pt. St. George (Woolington et al. 1979). Woolington documented use patterns at Castle Rock from fall 1975 to spring 1977. These studies revealed that the entire known Western Aleutian Islands population staged in the Crescent City area during late March to early April prior to migration to Alaska, and that Castle Rock was their primary night roost. The FWS proposal to acquire Castle Rock in 1978 was spurred by knowledge of its critical importance to the goose (USFWS 1978).

Recovery actions for the goose were initiated in 1974 and included predator control on the Aleutian islands, artificial propagation, translocation, hunting closures, and non-breeding habitat protection and management (USFWS 1991). The geese responded rapidly to these management efforts, and in 1990, with a population of about 7,000 birds, the subspecies was reclassified from endangered to threatened (55 FR 51106). After 1990, the population continued to grow at a rate of about 20% per year to an estimated 33,500 birds in 2000. In March 2001, the goose was removed from the endangered species list (66 FR 15643).

The large spring staging population in Crescent City has foraged heavily on private pastures. This has caused depredation complaints, changes in public land practices, and the formation of the Aleutian Canada Goose Working Group. As part of this group, the USFWS, Migratory Birds and

refuges, has been working with the California Department of Fish and Game, California Department of Parks and Recreation, and private stakeholders to manage public lands as short grass pastures to provide more goose forage and has become involved in other actions to alleviate depredation concerns. As efforts to haze the growing population of birds off of private pastures in Crescent City became more intense and coordinated, spring migrants dispersed to new staging areas in Humboldt County, CA and Curry County, OR. Changes in grazing practices on Humboldt NWR in 2000 resulted in a large increase in goose use on the refuge (Lyon 2000). The goose became a game species in Fall 2002, immediately following delisting. The population was estimated at 75,000 individuals in 2004 (Bachman and Nelson 2004).

Castle Rock played an important role in efforts to estimate the size of the goose population throughout the recovery period. From 1975 to 1994, counts of birds flying off the roost at dawn during peak spring staging were used as a key means to assess the status of the population. Indirect estimates, using ratios of marked to unmarked birds, have been considered more reliable in more recent years due to population dispersion. Goose-use of the Crescent City area, including Castle Rock, declined as the population increased in Humboldt Bay and southern Oregon (Bachman and Nelson 2004). Peak counts of 27,570 and 27,200 birds were recorded roosting on Castle Rock in March 1999 and 2000, respectively (Strong and Jaques 1999, Lyon 2000). In comparison, the peak count in 2004 was about 20,000 birds (Jaques 2004).

Vegetative changes on Castle Rock occur annually due to grazing and roosting activities by the geese. Concern about the potential impacts of geese on vegetation and seabird habitat at Castle Rock were first mentioned by Osborne (1972) following the observation of 600 Canada Geese (presumably Aleutians) on the island in 1970. Visible changes in the island's vegetation and declines in numbers of some breeding seabird species prompted management concern regarding potential negative impacts of the growing population of geese on the island's seabirds and sensitive habitats (Carter et al. 1992, Jaques and Strong 1998). Jaques (2004) conducted a preliminary examination of spatial and temporal relationships between selected breeding seabirds and roosting geese and suggested that night roosting geese are probably not a significant concern for surface nesting seabirds, but may represent an important negative impact on burrow nesting species such as the Tufted Puffin.

Changes in vegetation and soil erosion due to goose use of the refuge may be affecting other species including the Leach's storm-petrel and Cassin's Auklet. Research projects being conducted out of Humboldt State University (R. Golightly et al.) are expected to provide new population estimates for nocturnal seabird species and may help determine if the goose is having negative impacts on breeding seabirds.

Other Birds

American Black Oystercatcher (*Haemotopus palliates*). The American black oystercatcher is a traditional breeding species at Castle Rock and is present in the Pt. St. George area much of the year. Oystercatchers were first noted at Castle Rock in 1934 by Fraser (*in* Osborne 1972). These birds nest on the rocky shores of the island. The number of nesting pair ranged from 2-3 in surveys conducted from 1979-1998 (Sowls et al. 1980, Carter et al. 1992, Jaques and Strong 1998).

Peregrine Falcon (*Falco peregrinus*). The Perergrine falcon is a common visitor and historic breeder at Castle Rock. Peregrines were placed on the endangered species list in 1970, following a pesticide-related population crash, and removed from the list in 1999, following recovery (USFWS 2003a). Breeding was first documented by Clay (MS) in May 1934. The nest site was described as being located "on the top edge of a steep grass slope against a sheer overhanging rock wall on the east slope of the island." A 3- week old chick was present at the eyrie. A Peregrine nest with petrel wings around it was documented by Talmage in 1940 (*in* Osborne 1972). Aerial courtship has been seen over Castle Rock in recent years (Jaques and Strong 2001), but breeding has not been documented.

Peregrines forage from various high perches on Castle Rock and have been noted to chase Pigeon Guillemots and flush Common Murres during the breeding season (Jaques and Strong 2001). Peregrines can be seen at Castle Rock all times of year, but seem to be less common during summer (Jaques 2004), when they presumably retreat to breeding territories. Breeding was discovered at another coastal location in Del Norte County in recent years (R. Wallen, Redwood NP, pers. comm.). Peregine Falcons can be an important predator on seabird colonies (Drost and Lewis 1995) and may have been a significant historical seabird

predator when nesting at Castle Rock. There is a strong potential for re-establishment of breeding on the island and this may have ecological implications for the refuge.

Barn Owl (*Tyto alba*). Barn owls were historically present at Castle Rock, but present status is unknown. A barn owl was found in the shepherd's cabin by Fraser in 1934 (*in* Osborne 1972). The cabin has been reduced to a pile of wood on the ground and there have been no recorded detections of Barn owls since then. The Barn owl is a potential predator on storm-petrels and other seabirds at Castle Rock. Barn Owl predation on seabirds as large as Xantus murrelets has been very significant in some years on the Channel Islands (Drost and Lewis 1995).

Common Raven (*Corvus corax*). Common Ravens occur regularly on Castle Rock. A raven nest was observed on the western cliffs of the island in 1999 (CCR unpubl field notes. Active predation by a raven on murre eggs was observed in 2004 (Jaques 2004). A single individual harassed incubating murres on the east slope of the island until it was able to take an egg from under one of them. The raven flew to Point St. George with the egg. It is not known how significant this predator/scavenger is to seabirds at the refuge. Common Ravens were responsible for up to half of all murre eggs lost on study plots in Alaska (Schauer and Murphy 1996).

Other Mammals

Bats. Bats were historically present in shepherd's cabin (*in* Osborne 1972), but their current occurrence is not known.

Deer Mouse (*Peromyscus maniculatus)*. Osborne (1972) reported seeing 2 deer mice on Castle Rock in 1970. The current status of this native mouse at Castle Rock is not known. Mice can be a significant predator for burrow nesting seabirds. Deer mice are an important predator on Xantus murrelets on the Channel Islands (Drost and Lewis 1995). Predation by the related, but slightly larger Keen's mice (*Peromyscus keeni*) was the single greatest cause of egg loss for Rhinoceros Auklets (*Cerorhinca monocerata*) at the seabird colony on Triangle Island, British Columbia in 1998 (Blight et al. 1999). Heaviest predation by mice on Rhinoceros

(and Cassin's) Auklets was suspected to occur in association with egg neglect during poor food years.

House Mouse (*Mus musculus*). This non-native species may be present on Castle Rock. One dead specimen was observed on the island's eastern shore by Osborne (1972).

River Otter (*Lutra Canadensis*). River otters are common along the mainland shore adjacent to Castle Rock but have not been seen on the island itself. An otter was observed preying on birds at sea between Castle Rock and Point St. George (D. Jaques, unpubl. field notes). River otters are a suspected predator on Leach's storm petrel nesting at Prisoner Rock in Humboldt County (Osborne 1972, Sowls et al. 1980, and Carter et al. 1992) and at other seabird colonies in the northeastern Pacific (Duffy 1995).

Reptiles and Amphibians

No information.

Invertebrates

The intertidal region around Castle Rock is very rich with invertebrates, however, no surveys appear to have been conducted around or on the island.

Aleutian Cackling geese flying over Castle Rock seabird colonies, April, 2004. Photo taken from boat by D. Jaques.

IX. MANAGEMENT GOALS AND OBJECTIVES

Formal management goals for Castle Rock have not been established to date. Information provided in this report is intended to help identify goals for the refuge during the CCP process. Some examples of possible goals for consideration are listed below:

CASTLE ROCK MANAGEMENT GOALS:

1. Sustain and protect healthy breeding seabird populations and their habitat
2. Enhance and restore seabird populations and habitat if necessary
3. Develop long-term monitoring programs and support research necessary to make informed conservation and management decisions.
4. Integrate monitoring and management of seabirds with that of larger state, Regional, and other California Current System seabird programs.
5. Protect Aleutian Canada Goose and communal night roost site
6. Protect marine mammals and other wildlife species that use the refuge and surrounding areas
7. Conduct outreach to educate the public, develop stewardship, and

ultimately help protect the natural resources of the refuge.
Integrate outreach with other programs.

USFWS Regional Seabird Conservation Plan

Planning efforts for Castle Rock NWR are likely to mirror many aspects of the Regional seabird conservation plan developed by the The USFWS Office of Migratory Birds (USFWS 2005). The Service has trust responsibilities for the conservation of seabirds as well as site specific management responsibilities associated with the NWRS. The purpose of the regional plan is to identify the Service's priorities for seabird management, monitoring, research, outreach, planning, and coordination. The plan provides guidance to the refuges and refuge participation is key to the success of the plan. The largest seabird colonies in the Region are located on refuges and numerically, over 80% of the seabirds nest on these islands. Excerpts from the plan are presented below:

CONSERVATION PLAN GOALS (from USFWS 2005)

I. Maintain the current abundance, diversity, and distribution of healthy populations of breeding seabirds in the Pacific Region. Enhance population size and distribution of declining, depleted, or extirpated seabird species.

II. Maintain, protect and enhance seabird habitats (breeding, roosting, foraging, migrating and wintering) in sufficient quantity and quality to meet seabird needs.

III. Alleviate or eliminate threats and resolve management conflicts that negatively affect seabirds.

IV. Improve coordination and communication directed towards the conservation of seabirds at all scales: international, national, regional, and local.

V. Increase and improve opportunities for people to view, enjoy, and learn about seabirds of the Pacific Region.

The recommended priorities developed from the plan include:

- Habitat Management
- Threat Management
- Inventory and Monitoring
- Research
- Outreach and Education
- Planning and Coordination

The regional seabird conservation plan states that "habitat protection, habitat restoration, and alleviation of threats are the primary focus of management activities" (USFWS 2005).

The establishment of a seabird monitoring program at Castle Rock should be tied in with the regional effort described below. Potential funding sources that may be used to implement monitoring might be identified as part of the planning process.

"A Region-wide program to assess the status and trends of Pacific Region seabird populations is essential to provide a scientific basis for management decisions. Development of this program will involve establishing and implementing standardized protocols for data collection, analysis, and reporting. The program design must be scientifically sound and statistically capable of detecting trends in sufficient time to implement warranted management actions. The program will comprise two major components: 1) inventories of seabird colonies at long-term intervals (*e.g.,* 10 years) to provide baseline information and document large-scale changes, and, 2) intensive quantitative monitoring of specific demographic parameters for a select group of seabird species ("indicator" or "focal" species) at short-term intervals (*e.g.,* annual, biennial) at specific locations throughout the Region. Emphasis will be placed on Birds of Conservation Concern. Threatened and endangered species will be inventoried and monitored in accordance with respective recovery plans" (USFWS 2005).

In addition, the Service is in the process of developing a Biological Data Management System for NWRs (FWS 2004). The service is also in the process of developing a techniques manual for surveying seabirds in the CCS under contract with Oregon State University.

Some examples of seabird monitoring questions relevant to Castle Rock are:

Will other programs/offices continue to provide aerial photographic coverage of murres, Brandt's and Double-crested Cormorants. How often will funds be available for slide counts?

Can the refuge support a low-budget, but effective monitoring program for species that can be surveyed by shore and boat (as in 97-99). Can interns be trained and supported to do some of the tasks?

What will the criteria be for issuance of Special Use Permits on the island? How will disturbance effects from research and/or management activities be monitored?

Existing Rules and Regulations

MBTA. The Migratory Bird Treaty Act (MBTA) is the domestic law that implements international conventions, or treaties, between the United States and four other countries (Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. The MBTA decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected, unless permitted by regulations.

Any research requests for Castle Rock that involve disruption of nesting, harm of birds, or removal of birds parts will require a permit from the USFWS office of Migratory Birds.

MMPA. The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas. This legislation is the basis for policies preventing the harassment, capture, injury, or killing of all species of cetaceans and pinnipeds, as well as other mammal species that live primarily in the marine environment. The FWS is required to consult with NOAA when there is a chance of take. NOAA definitions are as follows:

> Take: to harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill any marine mammal. Harassment: any act of pursuit, torment, or annoyance which A) has the potential to injure a marine mammal or marine mammal stock in the wild; or B) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption or behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Due to the heavy use of Castle Rock by pinnipeds, refuge management will need to consider this law in regards to in-house research or onsite management activities, outside research requests, public recreation and associated outreach. Further information on the permitting process is provided in the section on Marine Mammals.

NEPA. The National Environmental Protection Act (NEPA) requires all federal actions that could result in significant impact on the environment to be subject to review by federal, tribal, state, and local environmental authorities, as well as affected parties and interested citizens. The Council on Environmental Quality (CEQ) oversees this law to ensure that federal agencies consider the effects of their actions on the quality of the human environment.

ESA. The purpose of the Endangered Species Act (ESA) is to conserve "the ecosystems upon which endangered and threatened species depend" and to conserve and recover listed species. The FWS and NOAA share responsibility for administration of the ESA. Section 7 of the law requires Federal agencies to consult with FWS to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species. The law states that "take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The term "harm" has been defined by the Secretary of the Interior as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering."

Actions at Castle Rock NWR that may involve incidental take of roosting Brown Pelicans and/or Steller Sea Lions would be subject to internal consultation and/or consultation with NMFS.

NHPA The National Historic Preservation Act (NHPA) is the primary federal law providing for the protection and preservation of historic and archaeological properties, and includes those of national, state, and local significance. Section 106 of the Act requires Federal agencies to review all actions that may affect a property listed on the National Register of Historic Places. There are no known historic sites on the refuge.

Interagency Relationships

There are many different governmental and non-governmental entities that may have common goals and overlapping jurisdictions in the vicinity of Castle Rock NWR. Communication and coordination with such groups may strengthen conservation efforts, avoid duplication of effort, and circumvent conflicts. Some of the relevant entities include:

NOAA, NMFS
CDFG: Marine Division
CDFG: Office of Oil Spill Prevention and Response
BLM: California Coastal National Monument
MARINE PROTECTED AREAS: STATE and FEDERAL
NPS: Redwood National and State Parks
Del Norte County: Pt. St. George County Park
The Aleutian Cackling Goose Working Group
The Aleutian Goose Festival
Styvessant and Kure Trustee Councils
Apex Houston Trustee Council
Command Oil Spill Trustee Council- Seabird Protection Program

The California Current Marine Bird Conservation Plan (Chapter 2, Mills et al. 2003) identifies and describes the most important state and federal agencies, legislation, programs, and initiatives that influence the welfare of seabird species in the CCS.

Management Issues, Concerns, and Opportunities

Seabird Monitoring

There is a need to establish a consistent seabird monitoring program at Castle Rock. Management questions associated with this need have been discussed to some extent in the section on seabirds, and include factors such as; 1) how to accomplish the necessary monitoring without causing undue disturbance to sensitive island resources, 2) what should the monitoring frequency and techniques be for given species, 3) how can monitoring be funded, 4) what parameters should govern the issuance of special use permits for research and monitoring, 5) how can the refuge make the most of interagency relationships and larger scale monitoring programs that are already in place. Coordination with Regional USFWS

efforts will be key to development of refuge standards for seabird monitoring. The timely development of the Regional conservation plan and upcoming techniques manual will facilitate efforts to develop a monitoring program at Castle Rock. Projects conducted with oil spill restoration funds from the *Apex Houston* incident, have provided invaluable data for the refuge, and further communication and interaction with oil spill trustee councils may provide means to accomplish necessary elements of a seabird monitoring program at Castle Rock.

Human Disturbance Prevention and Outreach

Very few human disturbance events have been documented at Castle Rock, however due to its close proximity to shore and the Del Norte County airport, the refuge is vulnerable to disturbance from recreational boaters, low-flying aircraft and other potential sources of disturbance. Disturbance to seabird colonies during the breeding season can cause lowered reproductive success, breeding failure, and even colony abandonment. There have been verbal reports of local kayakers paddling through the sea caves and landing at Castle Rock. Staff at other NWR's work with communities, industry, the military, and state agencies to educate these groups on the effects of disturbance, and to enforce regulations that protect nesting seabirds. For example, staff from Oregon Coast NWR Complex meet regularly with U.S. Coast Guard personnel to give presentations on the effects of low level "fly-overs" on seabirds and provide guidelines that the Coast Guard can follow to minimize this disturbance. Oregon Coast NWR Complex also worked with the state to create a buffer zone around the important seabird colonies at Three Arch Rocks. Buoys are placed each spring to restrict all boat traffic within 500 feet of the rock during the breeding season. All seabird NWRs carefully regulate human entry into seabird colonies to minimize disturbance to nesting birds.

Posting signs at potential landing spots on Castle Rock has been considered by refuge managers. Public outreach and education is needed to help prevent illegal landings by uninformed persons, and would help promote stewardship of the island resources by the local community.

Outreach, education, and interpretation efforts may be directed at some of the following: the USCG, the Del Norte County Airport, Del Norte County Planning Department and Department of Parks, Del Norte County School System, Kayaking guides/groups, sport and commercial fishermen. The Aleutian Goose festival held annually in Crescent City provides an excellent opportunity for local outreach.

Habitat Management

A third area of management concern is loss of vegetative diversity, structure, and soil erosion on the refuge. The concern about the vegetation has been primarily due to impacts on burrow nesting species. Management intervention may be needed to maintain or restore healthy

populations of burrow nesting species. Studies by HSU are expected to yield information on the status of burrow nesting species. Regardless of the results of this study, a baseline evaluation of the habitat at Castle Rock would provide a useful management tool. This step may lead to consideration of how to preserve or restore preferred vegetative types and required soil depths. A cover map of the island including vegetation type, rock, soil, and seabird features could be developed with aerial photography, GIS, and ground truthing on the island and at other locations. The only cover map that has ever been produced for the island was made by Osborne in 1970.

Invasive species

There has been no assessment to date of invasive plant or animal species on Castle Rock NWR. Non-native rodents and plants can have serious implications for seabird colonies. Early evaluation of potential negative factors may facilitate long-term management efforts aimed at preserving the ecological integrity of the island.

Public Enjoyment

The primary viewing area for Castle Rock is from Pebble Beach and the mainland at Point St. George. The County of Del Norte and the State Coastal Conservancy have partnered to develop a management plan for the new Point St. George County Park that includes plans for environmental and cultural interpretation and protection as well as habitat restoration and management for the Aleutian cackling goose (www.pointsaintgeorgeplan.net). Castle Rock's assets, environmental sensitivity, and the opportunity for partnership with the USFWS refuges program were not mentioned in the Park's Draft Plan (October 2003). By working with the Point St. George Steering Committee to include Castle Rock as an interpretive element in their development plans, the FWS might gain an ideal and cost-effective means to boost public awareness, appreciation, and stewardship of the refuge.

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Aerial view of sea lions hauled out along the rim of “the pit” on Castle Rock during a winter pinniped census, January 20, 1995. Photo by Jaques and Strong.