Restoration notebook

November 1998 *Exxon Valdez* Oil Spill Trustee Council

Black Oystercatcher

Haematopus bachmani

Photo courtesy U.S. Fish & Wildlife Service

By Brad A. Andres
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The black oystercatcher is a large, dark shorebird that inhabits rocky shorelines along the Pacific coast of North America. Its long orange-red bill, bright yellow eyes, and large pink feet give the oystercatcher a comical appearance. Oystercatchers breed from the western Aleutian Islands in Alaska south to central Baja, California. Within Alaska, they have ranged northward to the Pribilof Islands in winter and to Round Island, Bristol Bay, to nest in the summer. Ranges of the black oystercatcher and the brown-and-white American oystercatcher overlap in Baja California.[1]

Black oystercatchers are dependent on marine shorelines for their life requirements and are most abundant along low-sloping gravel or rocky shorelines. Because this habitat is limited or occurs in patches, they are distributed unevenly and are uncommon throughout their range. The entire world population is estimated at about 11,000 individuals. More than 50% of that population occurs in Alaska and about 1,500-2,000 individuals reside in Southcoastal Alaska.[2] Direct and indirect effects of human disturbance to shoreline habitats probably have reduced the black oystercatcher population from historical levels.

Oystercatchers are uncommon to fairly common inhabitants of Prince William Sound (PWS).[3] Pre-spill population levels of oystercatchers in PWS were estimated at 500-900 individuals. These estimates are imprecise and no information is available on pre-spill population trends. Historical population size in PWS is thought to be similar to the present-day level.

Although oystercatchers are generally resident across their range, most individuals join post-breeding flocks that remain near their nesting areas throughout the winter. Individuals in northern populations might undertake longer migrations than those in southern populations. Only about 25% of the oystercatchers breeding in PWS remain there in the winter, but locations of oystercatchers that leave PWS in winter is unknown. Flocks, consisting of non-breeders and failed breeders, increase throughout July and August, depart PWS in September, and return the following March and April.

Vital Statistics

Population
Approx. 1,000 PWS; 1,500-2,000 Southcoastal Alaska

Population Trend
Unknown

Lifespan
15+ years

Adult Size
Body length, 43-48 cm; Bill length, 68-74 mm; Weight, 507-603 g

Breeding Season
Lays eggs May-June; Fledges July-August

Incubation/Fledging
Chicks hatch in 26-28 days; Chicks capable of flight at 38-40 days

Clutch Size
1-4 eggs, but usually 3

Chick Weights
Hatch semi-precocial at 32-36 g; Fledge at approx. 400-450 g

Maturity
4-5 years at first breeding

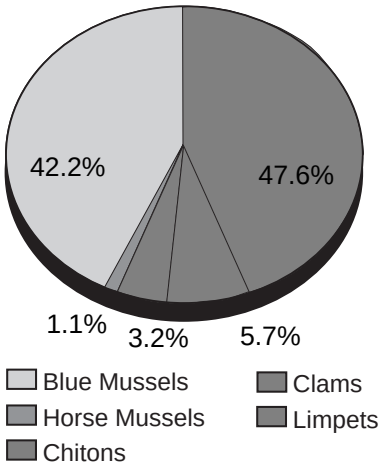
Plumage's
Dark grayish brown (nearly black) year-round

Diet
Bay mussels, limpets, clams, chitons, horse mussels, barnacles

Habitat Use

Breeding habitat of black oystercatchers ranges from mixed sand and gravel beaches to exposed rocky headlands. The southern limit of their range coincides with a change of rocky shores to sandy beaches.[1] Oystercatchers avoid vegetated habitats and are most abundant on non-forested islands. Highest local densities occur on small, flat islands.[4,5,6] The highest breeding densities in Alaska occur on non-forested islands dominated by gently sloping beaches of shell or gravel. Much of PWS, however, is characterized by steep, rugged shorelines, and oystercatchers there are most abundant along shorelines where small, offshore rocks are numerous. Common to all oystercatcher habitats is the presence of low-sloping or level surfaces for feeding. The retreat of glaciers, which exposes gravel moraines, and uplift from earthquakes can create new oystercatcher nesting habitat.[5] In winter, oystercatcher flocks tend to concentrate on protected tidal flats where dense mussel beds occur.[7]

Diet of Black Oystercatcher Chicks in Prince William Sound



Oystercatchers primarily feed on intertidal marine invertebrates such as clams and mussels and other mollusks (limpets, whelks, and chitons). They also will eat crabs, sea urchins, isopods, and barnacles. Contrary to the English name, oysters are rarely eaten and are unimportant in their diets.

Feeding

Oystercatchers primarily feed on intertidal marine invertebrates, especially bivalves (clams and mussels) and other mollusks (limpets, whelks, and chitons). They also will eat crabs, sea urchins, isopods, and barnacles. Contrary to the English name, oysters are rarely eaten and are unimportant in their diets.[8] In PWS, the most important food items are bay and horse mussels, clams, limpets, barnacles, and chitons. Mussels (36%) and limpets (49%) are the most numerous prey items taken by oystercatchers.

Access to foraging habitat is strongly dependent on tides and wave action. Almost all feeding is done at low tide, and oystercatchers focus their feeding in the mid-intertidal zone where mussels and limpets are abundant. Along steep rocky shorelines, breeding birds may commute to feeding areas that are farther than 1 km from their nest.

Close inspection of an oystercatcher's bill reveals its importance for capturing prey. A feeding bird will locate a mussel that has its valves separated and will capture it by cutting the adductor muscle with a quick jab of the scissor-like bill. Soft parts are removed with bill tips and swallowed. PWS oystercatchers only rarely

Photo courtesy Brad A. Andres

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hammer mussels with their bills to fracture the valves. Limpets and chitons are dislodged from rocks by quick jabs of a flattened bill tip. Tenacious limpets or chitons are pried off rocks with the bill tip. Once removed, prey are flipped over and the soft tissue is removed.

Prey selection is highly variable in PWS and determined by the availability of invertebrates in the immediate environment. Few limpets smaller than 10 mm are taken and large bivalves (70 mm or more) are rarely taken. Large bivalves appear difficult to handle and can actually trap the bird's bill. When available, mussels are preferred.[9,10]

Breeding

Monogamous pairs establish well-defined, composite feeding and nesting territories and occupy the same territory year after year. Pairs appear to select territories that combine an appropriate nest site, usually located above the highest high tide level, with adequate foraging areas. Breeding pairs are intolerant of intruding oystercatchers and other intertidal foragers (e.g., shorebirds, gulls, crows). Pairs will use a variety of dramatic displays and calls to discourage interlopers. In Alaska, some pairs begin to establish territories in early to mid-March.[11]

Pairs build their nests 1-3 weeks before egg laying and continue into incubation.[12,13] Oystercatchers fabricate their nests of rock flakes, pebbles, or shell fragments by tossing items toward the nest bowl with a sideward and backward flick of the bill. Flakes are occasionally carried and tossed forward from bill. Pairs generally avoid placing nests in vegetation and will use the same nest bowl in consecutive years. Multiple nests are sometimes made and the female chooses which one to use.[11,13] Nest building is generally done by males, but the female assumes an increased role during incubation. Most nests in PWS are comprised of a mixture of rock flakes and shell fragments, but I have also found eggs laid in an old mew gull nest and in a nest made from broken mussel shells in a sea otter scat. In British Columbia, one pair was even reported nesting on a gravel rooftop along the waterfront.[14]

Female oystercatchers normally lay 1-3, and rarely, four eggs. The eggs are oval or pear-shaped and are larger than chicken eggs; the average length is 56.2 mm and average breadth is 38.6 mm. Background color of the eggs is creamy-buff to olive-buff and the eggs are variably spotted, blotched, or scrawled with brownish-black or purplish-gray. Dark markings camouflage the eggs and are often denser at the larger end of the egg. Females will lay a replacement clutch if the first clutch is destroyed by predators.

Photo courtesy Brad A. Andres

Oystercatchers fabricate their nests of rock flakes, pebbles, or shell fragments by tossing items toward the nest bowl with a sideward and backward flick of the bill. Females lay 1-3 and, rarely, four eggs. Incubation lasts from 26-32 days.

Females assume most of the incubation duty initially after laying, but males increase their duty later in the incubation period. Eggs are covered 90-98% of the time and are uncovered only during incubation changes, brief muscular stretches, or interactions with other oystercatchers or predators. Males and females change incubation duty frequently throughout each day.[12] Mates change even more frequently during low-tide foraging periods and, occasionally, hunger appears to motivate the incubating bird to call to its mate for relief.

Incubation lasts from 26-32 days and is usually 26-28 days. Eggs hatch within 4-6 hours of each other, not necessarily in the order they were laid.[13] Chicks are mobile, heavily downy, and weigh 32-36 g at hatch.[6,15] Newly-hatched chicks are brooded almost continuously during the first 24-48 hours and intermittently until they are 20-23 days old. Although both mates tend their young, most brooding is done by the female.

Hatching success (eggs hatched/eggs laid) varies from 34-70% across the oystercatcher's range. In PWS, hatching success is variable among years and among areas. Across their

range, oystercatchers produce from 0.25 to 0.95 young per pair annually.

Predation on oystercatcher eggs and young by birds and mammals is significant and may be a strong force for nesting on offshore rocks. In southcoastal Alaska, egg predators include American mink, river otter, sea otter, red fox, brown bear (possibly), glaucous-winged gull, northwestern crow, and common raven. All egg predators also prey on small oystercatcher chicks, and common ravens, bald eagles, and foxes also take larger chicks. Young chicks respond to parental alarm calls by hiding under rocks, lying flat against the substrate, or running short distances to cover. When they are 21 days old, chicks tend to run from terrestrial predators, although fleeing chicks seldom venture into heavy vegetation. Chicks older than 25 days sometimes swim and dive (using their wings) to escape predators.

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Unlike most shorebirds, black oystercatcher adults provide food for their young. One parent guards or broods chicks while the other parent forages for its offspring. Parental alertness is needed because pairs in PWS routinely travel more than 1 km to forage for themselves and their chicks. Food items delivered to chicks range from small limpets to much-larger clams. Adults use their bills to cut large items into smaller pieces for the chicks. Not all adult oystercatchers are good parents. Some routinely provide chicks with more food than they can eat, whereas others will neglect chicks to the point of starvation. Chicks are slow to learn how to feed on their own. Fifty-day-old chicks receive more than half of their nutritional biomass from their parents. Adults in PWS have been observed feeding chicks that were 75 days old.[16]

Oystercatchers delay breeding until they are 4-5 years old. Unpaired birds are observed prospecting for nest sites during the breeding season in PWS. Because of the long duration of parental care, only a single brood is raised during the season. The lifespan of oystercatchers, however, can be greater than 15 years.

Conservation

Continual disturbance from human activities is the greatest threat to breeding black oystercatchers. Disturbance often prevents pairs from nesting or causes them to abandon their nest sites. For 100 years, disturbance by humans and domestic animals precluded oystercatchers from breeding on South Farallon Island, California; 20 breeding pairs were re-established within 5-7 years after major disturbances were eliminated.[17] A similar response was noted on Destruction Island, Washington, where breeding pairs increased from four to 12 within seven years of lighthouse automation.[6] Human-induced habitat alteration might have caused local extirpations from islands around Sitka, Alaska, where breeding numbers declined from 102 individuals in 1940 to 4 individuals in 1985.[18]

The introduction of foxes has caused local extirpation of breeding oystercatchers in the Aleutian Islands, Alaska.[19] High populations of natural predators also can affect oystercatcher population dynamics and habitat use. On Cleland Island, British Columbia, a recent increase in the number of glaucous-winged gulls has been coupled with a decrease in the number of breeding oystercatchers.[20] In PWS, black oystercatcher pairs either avoided nesting around glaucous-winged gull colonies or never raised a successful brood when they did nest nearby.

Immediate Effects of the Oil Spill

Because of their shoreline habits, black oystercatchers are highly vulnerable to spilled oil. Estimates of direct mortality due to the *Exxon Valdez* spill varied markedly depending on the techniques used to assess losses. Nine oystercatcher carcasses were retrieved from the entire spill area during beach surveys for injured wildlife in 1989, but some carcasses may have been overlooked in the large volume of oil on the beaches. Morgue counts and field experiments were used to estimate direct seabird mortality caused by the oil spill. By this method, approximately 50 black oystercatchers, 3.6% of the population inhabiting the entire spill zone, were directly killed by oil.[21,22] Population losses estimated from boat-based surveys for marine birds

in PWS were much greater.[23] Along shorelines in the oiled zone, estimated losses based on pre- and post-spill counts were 10-57% of the population.

Because few birds occupied territories at the time of the spill, direct lethal effects of the spill on adult oystercatchers were probably minimal. In fact, no oiled adults were observed on Green Island during the summer of 1989. The apparently high losses of birds estimated from the boat-based surveys might have resulted from differences in the behavior of breeding and nonbreeding birds. Unlike territorial breeders, nonbreeding oystercatchers form flocks that gradually expand through the summer season and persist through the winter. Of three known areas where oystercatchers concentrate in PWS, two of these areas occur in unoiled parts of the sound and the other was not sampled by the boat surveys. Failed breeders that dispersed from oiled areas and joined these flocks could have resulted in a large apparent loss of birds from the breeding population.

Despite ambiguities in assessing population loss due to the oil spill, breeding clearly was disrupted in 1989.[24,25] A high proportion of pairs (39%) did not maintain nests into June on oiled Green Island. Lower feeding rates of oystercatchers living on oiled shorelines, and a corresponding higher mortality of mussels, indicates that reduced prey abundance might have contributed to abandonment of breeding sites in 1989.

The fact that some females produced eggs on Green Island in 1989 indicated that impairments to egg production caused by consuming contaminated prey or preening oiled feathers were not too severe. Concentrations of petroleum hydrocarbons in bay mussels were elevated on Green Island in 1989 and provided a pathway of exposure via ingestion. High productivity of pairs after 1990 suggests that any ingestion of oil that occurred in 1989 or 1990 had little effect on the subsequent reproductive performance of oystercatchers on Green Island. Although no oiled eggs were observed in 1989, chicks were observed with oil on them and chick losses from nests on oiled Green Island were greater than from nests on nearby unoiled Montague Island.

Lower productivity at disturbed sites on Green Island in 1990 indicated that disturbance from cleanup operations also was responsible for nest failure and chick mortality of oystercatcher pairs. Workers deployed to clean up floating and beached oil represented a major disturbance to species inhabiting shorelines. In the absence of this disturbance, productivity increased. At most, 27 chicks were produced on Green Island in 1989; 50 chicks were produced in 1991. Because oystercatchers live long, the effects on the population of failure during one or two breeding seasons were probably minimal.

Persistent Effects of the Oil Spill

The persistence of oil in some mussel beds in PWS raised questions regarding the chronic exposure to petroleum hydrocarbons of animals that feed on mussels. Because mussels are important food for intertidal animals, crews intentionally avoided disturbing mussel beds during cleanup operations in 1989. A decade after the spill, oil remains in some mussel beds on low wave-energy, porous substrates. Hydrocarbon concentrations in sediment samples collected from oystercatcher foraging sites in 1993 indicated that pairs breeding in Bay of Isles, in Herring Bay, and on northwestern Knight Island were most susceptible to persistent hydrocarbon exposure.[26]

Although I found that adult oystercatchers inhabiting oiled areas spent the same amount of time foraging as adults inhabiting unoiled ar-

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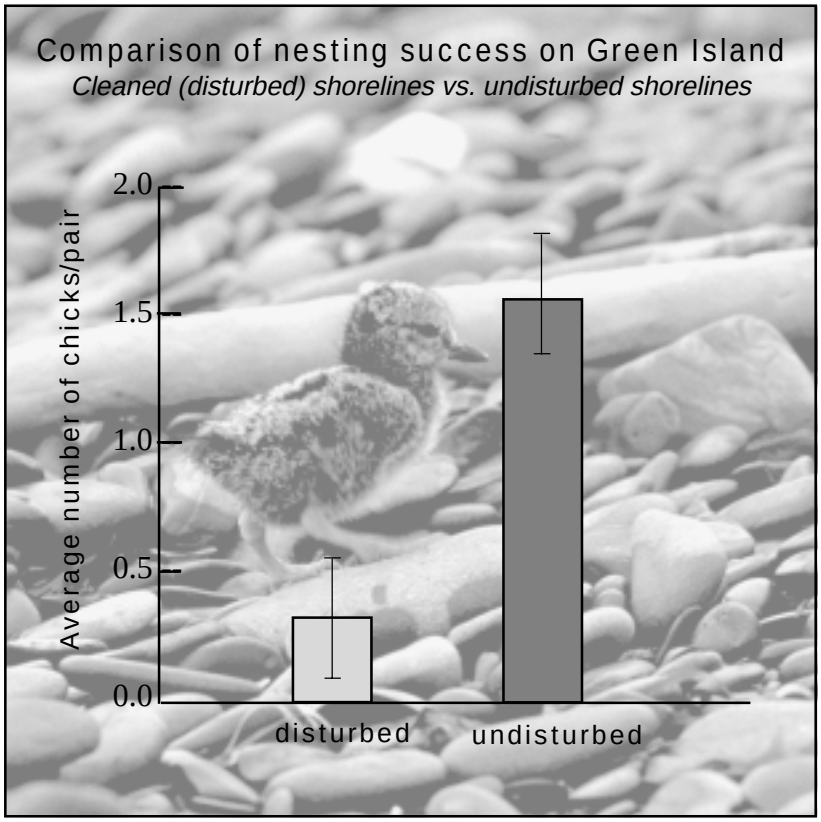

Photo courtesy Brad A. Andres

eas, some pairs tended to spend less time foraging on oiled substrates.[26] Thus, the presence of persistent shoreline oil might have dissuaded adult oystercatchers from consuming mussels. The use of multiple foraging sites, including unoiled ones, probably mitigated the negative effects of persistent shoreline oil on the foraging behavior of adults. No difference in breeding success was found between pairs nesting in oiled areas and those nesting along unoiled shorelines. Predation on eggs and young, mainly by common ravens, likely had the largest effect on productivity.

The presence of elevated hydrocarbon concentrations in the feces of chicks provided direct evidence that black oystercatchers were exposed to oil persisting on shorelines of PWS into 1993.[27] The highest concentrations of polycyclic aromatic hydrocarbons (PAHs) were found in chicks that lived in areas with high concentrations of hydrocarbons in the sediment. Hydrocarbon ingestion contributed to slower growth rates of chicks in areas of persistently oiled shoreline on Knight Island. However, lower growth rates did not translate in lower fledging rates in persistently oiled areas. Although some black oystercatchers were known to have been exposed to persistent shoreline oil as late as 1993, areas of contamination were patchily distributed and relatively few chicks were seriously exposed.

Restoration and Recovery

In general, black oystercatchers have reoccupied oiled areas in PWS where they were absent during 1989 and 1990 and appear to be recovering throughout PWS.[24,28,29] However, the number of breeding pairs inhabiting oiled Knight Island decreased by 8% between 1991 and 1993. Thus, reoccupation by oystercatchers of habitats disturbed by the oil spill varied spatially across PWS and may be related to habitat quality independent of oiling severity (i.e., the high quality habitats were reoccupied first).

Low-sloping gravel shorelines support high densities of oystercatchers throughout their range. Steep rocky shorelines with nearby sand-and-gravel beaches and numerous offshore islets are also good indicators of high quality oystercatcher habitat.[30] Acquisition or protection of oystercatcher habitat has taken place from eastern PWS to the southern coast of Kodiak Island. The *Exxon Valdez* Oil Spill Trustee Council has protected about 1,400 miles of shoreline, much of it rated high for oystercatcher habitat. Sheep Bay, Two Moon Bay, Bligh Island, and Chenega Island are considered prime habitat in PWS. Much of the shoreline habitat protected on Afognak, Shuyak and Kodiak islands is rated high or moderate for oystercatchers.

In addition, introduced foxes were eliminated from two of the Shumagin Islands (Simeonof and Chernabura) in the southwestern part of the oil-spill area. Black oystercatchers were present in low densities on both islands, but in much higher densities on nearby fox-free islands. Although the nesting birds have not been surveyed since 1995, when the last of the foxes was removed, the elimination of the introduced predator should result in a large increase in the population of nesting oystercatchers.

Because areas of persistent shoreline oil exposure were restricted, widely distributed, and highly variable, the short-term effects of the oil spill on the black oystercatcher population were probably minimal. The initial research on oystercatchers stopped in 1993 and nothing is known about the longer-term effects of continued exposure to oil persisting in the environment or how such effects as reduced chick growth rates translate into effects on recruitment. During the 1998 breeding season, the Trustee Council sponsored additional fieldwork on oystercatchers in PWS. The purpose of this work was to take a fresh look at the status of oystercatchers and to determine if there was reason for additional fieldwork to assess possible chronic effects. The results of this work were not available at the time of printing.

The localized nature of persistently oiled mussel beds in PWS suggests that treatment of these beds could occur without causing large-scale disturbances to the breeding oystercatcher population. Reoccupation of oiled habitats on Green Island indicates that oystercatchers can recover from major shoreline disturbances. In the event of future shoreline oiling, all affected shorelines should receive initial cleaning to reduce concern for exposure to oil that might persist in fine sediments or underneath mussel beds.

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