

Dramatic Changes in the Number of Black Oystercatchers Nesting in Sitka Sound, Alaska

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Introduction

The Black Oystercatcher (*Haematopus bachmani*) is a large shorebird that nests and feeds exclusively along marine shorelines of the Pacific Ocean coast of North America. Total population size is about 10,000 individuals, and >50% of the population breeds in Alaska (Andres and Falxa 1995, Tessler *et al.* 2009). Because Black Oystercatchers are dependent upon marine shorelines for their life's requirements, they are vulnerable to a variety of anthropogenic shoreline disturbances, natural shoreline changes, and coastal ecological shifts (Tessler *et al.* 2009). These vulnerabilities and their small population size have caused the Black Oystercatcher to be considered a species of high conservation concern, at multiple scales, by numerous agencies and organizations in the U.S. and Canada. As a result, interest in the conservation and management of Black Oystercatchers has increased in the last several years.

In 1940, J. Dan Webster, as part of his Cornell University's Master of Science degree, conducted the first intensive study of Black Oystercatchers breeding in Sitka Sound, Alaska (Webster 1941a). He produced several papers describing the breeding biology, chick growth, and feeding habits of Black Oystercatchers (Webster 1941b, 1941c, 1942, 1943). During his investigations, he surveyed Sitka Sound's shoreline between Fred's Creek and Kita Island (Figure 1) to estimate the number of breeding-season Black Oystercatchers, which was accomplished by rowboat with his brother's help. He also recorded breeding status of oystercatchers he encountered and the characteristics of the nest sites he discovered. Results of the survey work yielded 76 breeding (38 pairs) and 26 non-breeding Black Oystercatchers in his study area.

Returning to Sitka Sound in 1994, Webster briefly re-surveyed part of his 1941 study area and found a dramatic decrease in the population of breeding Black Oystercatchers (perhaps only 4 pairs; J. D. Webster, pers. comm.). He was not able, however, to thoroughly cover his study area or measure any shoreline variables that might have explained the decrease in Black Oystercatcher numbers.

Since the 1940s, there have been numerous anthropogenic changes to Sitka Sound. The human population of Sitka increased from 2,000 individuals to 8,889 in 2008, and there was also a large, temporary population increase World War II. In addition, an off-shore airport was constructed during World War II, marine recreation activities greatly expanded, a pulp mill was constructed and operated for 35 years, and Sitka became a major cruise ship destination. Because of these changes and Webster's preliminary finding of dramatically fewer Black Oystercatchers inhabiting Sitka Sound, we initiated a study in 2007 to estimate the magnitude of the decrease in breeding-season population of Black Oystercatchers inhabiting Sitka Sound and

determine if changes in the shoreline environment had reduced availability of Black Oystercatchers nest sites in Sitka Sound.

Methods

Using maps and descriptions provided in Webster's thesis (1941a), we visited all off-shore rocks or beach segments that were previously identified in his study area as being used by nesting Black Oystercatchers, and we explored previously unused locations that appear suitable for nesting by oystercatchers (N = 25 total sites). Many of these locations were used by multiple nesting pairs. For each nest site at each current and historic nesting location, we recorded breeding activity as one of the following: no birds, non-territorial birds (number), territorial pair, nest with eggs (enumerated if present), or pair with chicks (enumerated if present). Coordinates of all nest sites and locations were recorded, and we photographed several nest rocks to compare with Webster's thesis photos (1941a). At each current or historical nest site, we also recorded the presence or absence of logs washed ashore into the supratidal zone, vegetation successional stage, and the presence or absence of human construction.

To assess temporal changes in Black Oystercatcher numbers, we used a pair *t*-test to compare the numbers of pairs and occupancy of pairs on individual rocks, or beach segments, between 1940 and 2007; locations represented the primary sampling unit. Although we intended to use logistic regression to examine effects of environmental shoreline conditions, the sparse number of pairs recorded in 2007 prohibited this approach.

Results

Webster (1941a) located 38 Black Oystercatcher pairs breeding in Sitka Sound in 1940, but we found only eight pairs in 2007 (Table 1). Similarly, significantly fewer (binomial test, $p = 0.0007$) nesting locations were occupied by breeding pairs in 2007 than in 1940 (Table 2).

Only four locations were occupied in both years, and we found pairs at three locations not recorded by Webster in 1940. There was a significant ($p = 0.0001$) loss of 1.2 pairs ($SE = 0.3$) from each nesting location ($t = -4.77$, $p < 0.0001$, $df = 24$). Reductions in the number and occupancy of pairs were greatest (100%) at nesting locations close to Sitka and those where rogue mill logs had washed ashore (Table 1). We believe that washed-up logs eliminated nesting habitat for four breeding Black Oystercatcher pairs on Kruzof Island, and development and disturbance by humans eliminated 18 nesting pairs close to Sitka. Although breeding pairs disappeared at nesting locations distant from Sitka, losses were not as great (a net loss of eight pairs). We do not believe that vegetation succession on nest rocks had eliminated nest site potential (see Figure 2 for an example).

Discussion

Clearly, human development caused the loss of the majority of breeding Black Oystercatcher pairs in Sitka Sound. This occurred through the beaching of logs that escaped from mill operations, and the construction of the airport, homes, and other facilities around Sitka. The logs washed ashore on Kruzof Island occurred at density that eliminated nesting substrate. Building of recreation cabins on the Kruzof Island shoreline might have also increased the level of disturbance to a level that made the beach undesirable for nesting Black Oystercatchers. Close to Sitka, several homes were constructed on islands where Webster found Black Oystercatcher pair nesting in 1940. Constant boat traffic by residents and recreationists may also have caused other pairs to abandon nesting locations close to town; human activities have caused Black Oystercatchers to abandon nesting locations in other parts of their range (see Tessler *et al.* 2007, Andres and Falxa 1995)

Away from the town of Sitka, we are less certain about what factors have caused

abandonment of nesting locations used by Black Oystercatcher. We have no evidence that vegetation succession caused formerly used nest sites to become unsuitable. Although past pulp mill operation in Silver Bay negatively affected water quality, and possibly oystercatcher prey, effects were localized in areas not used by oystercatchers, and water quality has improved in the last decade (Alaska Department of Environmental Conservation 1999). The role that predation plays in limiting oystercatcher population growth is not fully known, but predators appear to strongly influence nest success in Prince William Sound and Middleton Island, Alaska (Andres 1999, Guzzetti 2008; see Tessler *et al.* 2007). Because most Black Oystercatchers nest on offshore rocks in Sitka Sound, they are likely more vulnerable to predation by birds than mammals. Although there is little information on changes in avian predator numbers in Southeast Alaska, Bald Eagles (*Haliaeetus leucocephalus*) there increased from 7,000 to 12,000 individuals between 1967 and 1997 (Jacobson and Hodges 1999).

Black Oystercatcher nests are prone to flooding, and wakes caused by large ships are known to flood nests (see Tessler *et al.* 2007). Increased cruise ship traffic might have a negative effect on nest success of Black Oystercatchers breeding in Sitka Sound; the three, novel nesting locations found in 2007 were all on very tall off-shore rocks, which may have offered some protection from flooding from ship wakes. As discussed in the Black Oystercatcher Conservation Action Plan (Tessler *et al.* 2007), more information is needed to fully understand the effects increased tour boat and cruise ship traffic have on flooding of Black Oystercatcher nest sites in southern Alaska and British Columbia.

Human presence where Black Oystercatchers nest has a well-established, negative influence on productivity of Black Oystercatchers, which operates through a variety of mechanisms such as home construction, free-ranging domestic animals, and egg trampling.

Cruise ships and tour boats can extend these human-induced, negative effects on Black Oystercatchers into previously undisturbed areas. Coupled with deleterious effects of invasive predators and unknown effects of sea level change, continued assessment and evaluation of Black Oystercatcher response to these threats, through a well-constructed monitoring program, is clearly warranted.

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Table 1. Differences in the number of Black Oystercatcher pairs breeding in Sitka Sound, Alaska, between 1940 and 2007. Sample sizes are nesting locations.

| Breeding pairs | 1940 ¹ | 2007 | Change in breeding pairs | | | | df |
|------------------------|-------------------|------|--------------------------|------|----------|----------|----|
| | | | mean | SE | <i>t</i> | <i>P</i> | |
| All sites | 38 | 8 | -1.20 | 0.25 | -4.77 | <0.0001 | 24 |
| Near Sitka/ rogue logs | 18 | 0 | -1.83 | 0.32 | -5.70 | <0.0001 | 11 |
| Distant | 16 | 8 | -0.62 | 0.31 | -1.98 | 0.0711 | 12 |

¹ from Webster 1941a

Table 2. Differences in occupancy of nesting locations by Black Oystercatchers breeding in Sitka Sound, Alaska, in 1940 and 2007.

| | 1940 ¹ only | 2007 only | Both years | Proportion of all locations occupied in 2007 (H ₀ = 0.5) | <i>P</i> | N |
|-----------------------|---------------------------|--------------|---------------|--|----------|----|
| | | | | | | |
| All sites | 18 | 3 | 4 | 0.143 | 0.0007 | 21 |
| Near Sitka/rogue logs | 12 | 0 | 0 | 0.000 | 0.0002 | 12 |
| Distant | 6 | 3 | 4 | 0.333 | 0.2539 | 9 |

¹ from Webster 1941a

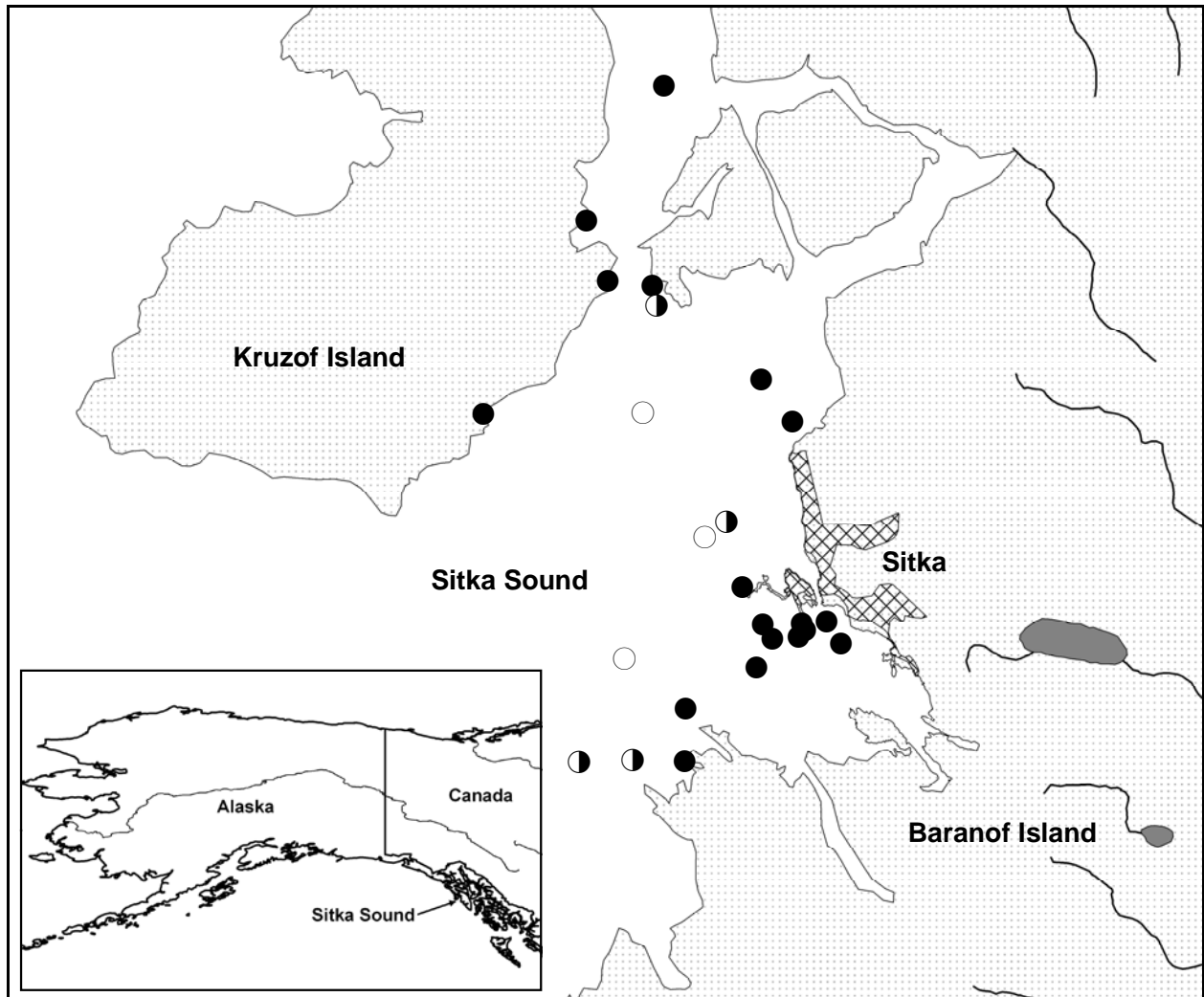


Figure 1. Location of Black Oystercatcher breeding area in Sitka Sound, Alaska, surveyed in 1940 and 2007. Solid circles indicate breeding pairs were present only in 1940, open circles present only in 2007, and half-filled circles present in both years.

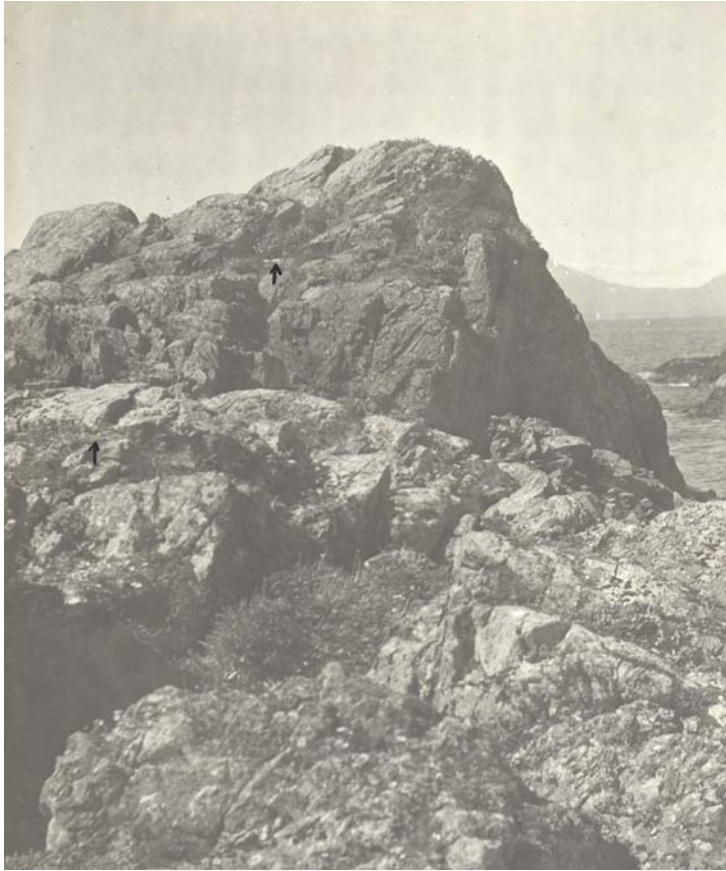


Figure 2. Example of lack of plant succession on rocks used by Black Oystercatchers nesting in Sitka Sound, Alaska. Images were taken in 1940 and 2007 (dated) at different angles.