

Killer Whale Feeding Ecology and Non-Predatory Interactions with other Marine Mammals in the Glacier Bay Region of Alaska

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Abstract. Populations of killer whales in southeastern Alaska overlap with populations inhabiting Prince William Sound, Alaska and British Columbia, Canada. We synthesize the results of a 20-year study in Glacier Bay and Icy Strait, Alaska. Individuals were photo-identified and predation events documented. Foraging strategies of killer whales were compared to those documented in similar studies in adjacent areas. One hundred twenty of the resident form of killer whales, 150 of the West Coast transients, 13 of the Gulf of Alaska transients and 14 of the offshore form were photo-identified in the study area. Residents preyed primarily on silver salmon and Pacific halibut. The prey of transients were harbor seals (40 percent), harbor porpoise (23 percent), Steller sea lions (16 percent), seabirds (14 percent), Dall's porpoise (5 percent) and minke whale (2 percent). Humpback whales were observed closely approaching transient groups that were attacking other marine mammals. Non-predatory interactions also occurred between killer whales and Steller sea lions.

Introduction

Killer whale populations in southeastern Alaska have been photo-identified since 1984 (Leatherwood and others, 1984). Year-round work in the Glacier Bay/Icy Strait area began in 1988 to determine the populations' size, structure, ranges and feeding habits. This paper includes photo-identification data from 1986 through 2005 and predation data through 2003 collected by the authors and other biologists working for Glacier Bay National Park and Preserve. Populations that inhabit Prince William Sound, Alaska and populations that frequent British Columbia, Canada overlap in southeastern Alaska. Similar long-term studies of the killer whale diet have been conducted in these adjacent areas, and we compared those results with our findings.

This study will provide data that will be used in mathematical models of killer whale predation by region in Alaska. As marine mammal numbers decline in other areas, it is important to compare that with data from southeastern Alaska where many marine mammal populations have been stable or increasing. These estimates are needed to understand the role that predation by killer whales plays in the decline and recovery of marine mammals such as the endangered Steller sea lion.

Methods

Small vessels powered by outboard engines were used to survey for killer whales. Searches for killer whales were based on historical and current sighting information. Photographs for individual identification were taken of the left side of



Figure 1. Transient killer whale cow and calf photographed in Icy Strait, Alaska (Photograph by Dena Matkin, North Gulf Oceanic Society.)

each whale showing details of the dorsal fin and saddle patch (fig. 1). Nikon cameras equipped with an autofocus, 300 mm lens were used with high speed black and white 1,600 ASA film. Photographs were taken at a speed greater than 1/1,000 second. Photographic negatives were examined under a stereomicroscope by Graeme Ellis at the Pacific Biological Station, Nanaimo, B.C. for final identification. To obtain whale vocalizations, the vessel moved at least 200 m ahead of the whales, the engine was shut off and a hydrophone with a built in pre-amplifier lowered to a depth of 10 m. Vocalizations were recorded with a Marantz cassette recorder. Prey was identified by direct observation, photographs or genetic analysis of prey remains by Lance Barrett-Lennard at the Vancouver Aquarium.

Results

We identified 120 residents, 150 West Coast transients, 13 Gulf of Alaska transients (Saulitis and others, 2005), and 14 individuals of the offshore form. AF and AG pods were

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the most commonly encountered residents in the Glacier Bay region. They traveled regularly between southeastern Alaska and Prince William Sound, intermingling with Prince William Sound resident pods that are most closely related to the northern residents of British Columbia (Matkin and others, 1997). Residents ate silver salmon (*Onchorhynchus kisutch*) and Pacific halibut (*Hippoglossus stenolepis*). AG pod females and young were identified attempting to take Pacific halibut from a sport fishing line in Icy Strait in 2004. AG pod was photographed in southeastern Alaska every month of the year.

West Coast transients were the most commonly encountered of all types in Glacier Bay and Icy Strait. Gulf of Alaska transients began to be encountered in southeastern Alaska in 1995, and were documented swimming with West Coast transients in Glacier Bay in 2001. It is not yet known if these two types interbreed. West Coast transients ranged a minimum of 2,600 km from southeastern Alaska, south to central California (Goley and Straley, 1994). Other West Coast transients traveled 700 km from the Glacier Bay region to British Columbia three times in less than ten months (Ford and Ellis, 1999). Traveling and foraging in groups of one to 35 individuals, transient use of Glacier Bay peaked in June and July.

New transient whales continue to be sighted (fig. 2). However, the rate of discovery of new transient whales slowed to just three whales in 2001 from a peak of 19 whales in 1988.

Some West Coast transients have a long history of use of Glacier Bay. For example, T85 is a transient cow that was photo-documented in Glacier Bay every year since 1988. She had a calf in 1992, another in 1995 and a third calf in 2005. She was identified in the Glacier Bay area five times in June 2000 with her first two offspring. T85 frequently associated with the male T40 (originally called T2), who was the first killer whale photo-identified in this study in 1986. T87 is an adult male transient photo-identified in association with the female T88 since 1988. They were documented in Glacier Bay every year but two.

We recorded 43 kill incidents by West Coast transients (fig. 3). At 40 percent, the harbor seal (*Phoca vitulina*) was the primary prey in the Glacier Bay/Icy Strait region. Harbor porpoise (*Phocoena phocoena*) were 23 percent, Dall's porpoise (*Phocoenoides dalli*) 5 percent, Steller sea lions (*Eumetopias jubatus*) 16 percent, seabirds 14 percent, and minke whale (*Balaenoptera acutorostrata*) 2 percent of the transients' diet.

A lack of predatory behavior of killer whales toward sea otters (*Enhydra lutris*) was noted. On 95 occasions, killer whales were observed in close proximity to sea otters they could have attacked, but the two species appeared to ignore one another. On only four occasions, sea otters reacted to the presence of killer whales by looking around, porpoising away or diving into kelp beds. In 2004, four young transients (ages 3 to 11) harassed a sea otter in Glacier Bay. They left it alive after attempting to hit it with the edge of their tail flukes for over an hour.

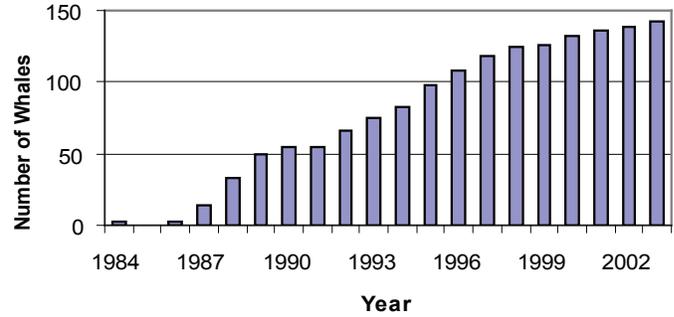


Figure 2. Rate of discovery of new transient whales in southeastern Alaska 1984-2003.

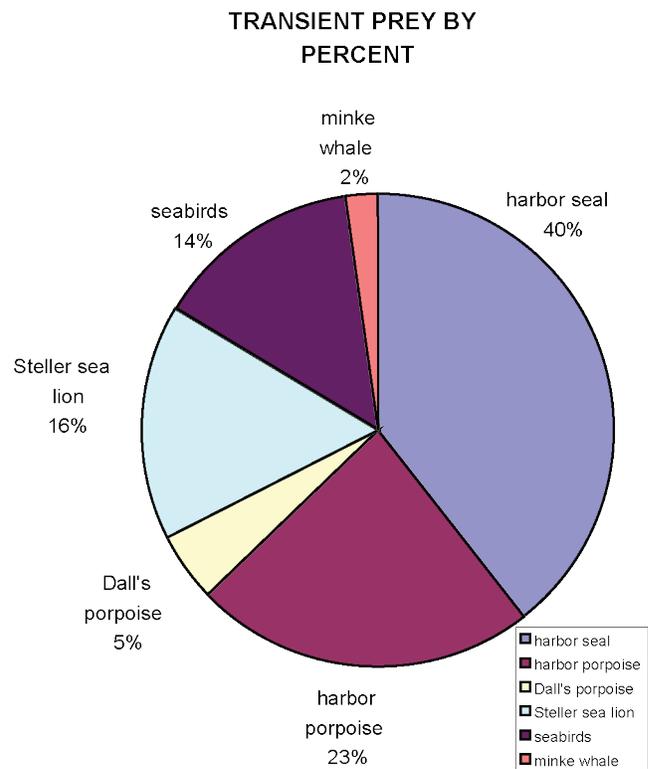


Figure 3. Percent of prey species taken by West Coast transients in southeastern Alaska.

In nine cases on the West Coast, humpback whales approached or stayed in the vicinity of groups of killer whales that were attacking marine mammals. Four of these were attacks on Steller sea lions (one from Dolphin, 1987), followed by attacks (or harassment) on humpback whale calves, a minke whale, a grey whale and a harbor seal (seal from Volker Deecke and Harald Yurk, University of British Columbia, oral commun.). More than one-half of these approaches involved just a single humpback. The longest close interaction of humpback and killer whales in Icy Strait occurred during a sea lion kill by six transients. For 50 minutes, three adult

humpbacks participated by lobtailing on or near the sea lion 15 times, making physical contact with it a minimum of 10 times. The transients did not attack the humpbacks, and the humpbacks left the area together.

In six cases, groups of three to 50 Steller sea lions approached West Coast transients, and followed them at distances of 50 m to 100 m. In all but one case, the sea lions outnumbered the killer whales, and in each case, the killer whales swam away from the sea lions.

Discussion and Conclusions

Residents and transients are sympatric ecotypes that have been reproductively isolated from one another for thousands of years. The offshores are more closely related to the residents (Matkin and others, 1999). Residents form large stable matrilineal pods that eat fish, vocalize frequently, have more hooked dorsal fins than the transients and more black inside their white saddle patches (Bigg and others, 1987). We conclude that transient killer whales in southeastern Alaska are year-round foraging specialists upon marine mammals. The transients' diet probably reflects a combination of prey resource availability in a given area and cultural transmission of specific hunting skills for that prey.

In British Columbia, Ford and others (1998) found harbor seals to be the primary West Coast transient prey as well, representing 51 percent of kills. More harbor porpoise than Dall's porpoise were killed, the two combined made up 18 percent of kills. In Prince William Sound, Saulitis and others (2000) found harbor seals (31 percent) second to Dall's and harbor porpoise (45 percent) in part due to those transients foraging farther offshore and a declining seal population. Steller sea lions represented 16 percent and 7 percent of transient kills in the Glacier Bay and British Columbia studies, respectively. Sea lions represented 15 percent of their diet previously in Glacier Bay/Icy Strait (Matkin and Dahlheim, 1995) and in Barrett-Lennard and others (1995). In all areas, transients ignored or harassed sea lions more than twice as often as they achieved successful kills.

There were more than twice as many harassments than kills of seabirds, and birds killed were often left uneaten. In British Columbia, the common murre (*Uria aalge*) was attacked most frequently. In Glacier Bay surf, white-winged and black scoters (*Melanitta perspicillata*, *M. fusca*, *M. nigra*) were eaten, followed by common mergansers (*Mergus merganser*). In both areas, only female and juvenile killer whales attacked seabirds, possibly indicating these were training sessions for the young. Sea otters in all areas were primarily ignored, and rare harassments may occur more for target practice than obtaining food.

Large whale kills are uncommon or rare in British Columbia/southeastern Alaska (Ford and others, 2005) and in Prince William Sound (Craig Matkin, North Gulf Oceanic Society oral commun.). Adult humpback whales were rarely harassed, and occasionally intermingled with transients

attacking another marine mammal, thrashing their tail flukes if within a whale's length of the transients. Groups of Steller sea lions that followed transients may be protected by their aggressive disposition and numbers. Although humpbacks and groups of sea lions were commonly sighted during transient encounters, the transients may prefer to forage for prey that are easier to subdue (Heise and others, 2003).

Management Implications

These data will contribute to refining population estimates, affiliations and ranges of transient killer whales in Alaska. Transient feeding data from southeastern Alaska, where the population of Steller sea lions has been stable or increasing, will be compared to data collected from western Alaska, where Steller sea lions and other marine mammals are declining. Quantitative estimates resulting from this study will expand our understanding of the impact of killer whale predation on the decline and recovery of these populations, and delineate the role of killer whales in the North Pacific ecosystem. Current information about killer whale population dynamics, life histories and feeding habits will assist in management of harbor seal closures in Glacier Bay National Park and Preserve and further illuminate the importance of this area as a productive marine sanctuary.

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An unnamed stream discharges glacial meltwater into Wachusett Inlet. (Photograph by Bill Eichenlaub, National Park Service.)