

Foraging and Prey Differences Between Populations of Bigg's Killer Whales (Mammal-eating "Transients") in the Western and Eastern Aleutian Islands

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Fig. 1a. Male Bigg's killer whale carrying prey remains from a Baird's beaked whale carcass. Photo by David Ellifrit.



Fig. 1b. Female Bigg's killer whale biting the carcass of a Baird's beaked whale in the Rat Islands, in the western Aleutians

INTRODUCTION

- NMML's Cetacean Assessment and Ecology Program has a continuing project to study predation on marine mammals by Bigg's killer whales (mammal-eating "transient"-type killer whales) in the Aleutian Islands, initiated in 2001 to investigate the potential role of killer whales in the decline of the western stock of Steller sea lions.
- Steller sea lions population trends have stabilized and increased in the eastern Aleutians, but have continued to decline in the western Aleutians. Therefore our recent predation studies have focused on the central and western Aleutians.
- Our recent genetic analyses indicate population structure across this region, with at least one population in the eastern Aleutians and another in the western Aleutians/Russia (Parsons et al. 2013)
- Through the use of stable isotopes, we are investigating whether Bigg's killer whales in the western Aleutian population have a similar diet as the eastern Aleutian population.

EASTERN ALEUTIAN ISLANDS

- Predation on Steller sea lions in the eastern Aleutians has been visually observed to be ~14% of all transient predation events, and also includes migrating gray whales, northern fur seals, and minke whales.
- Nitrogen and carbon stable isotope values of Bigg's killer whales there are consistent with that diet. (Herman et al. 2005, Krahn et al. 2007)
- Acoustic recorders at sea lion rookeries and satellite tagging of killer whales have confirmed foraging movements consistent with some predation on Steller sea lions in the eastern Aleutians.
- For example, transient killer whales were heard regularly at an acoustic recorder at the Ugamak Island Steller sea lion rookery near Unimak Pass, a kill of a sea lion by a killer whale has been observed at that rookery, and satellite tag locations of a Bigg's killer whale showed it to be foraging in areas adjacent to that same rookery.

NEW INFORMATION FROM THE CENTRAL AND WESTERN ALEUTIAN ISLANDS

- In contrast, a more limited set of observations in the western-half of the Aleutian Islands has documented predation on Dall's porpoise, Baird's beaked whale (Fig. 1), sea otters and squid.
- Nitrogen SI ratios from skin samples from Bigg's killer whales collected in the western Aleutians have values that are apparently too low to reflect a diet composed exclusively of marine mammals, suggesting the western population forages in a different way than the eastern population (Fig. 2). These low values are consistent with predation on some species of squid.
- Nitrogen SI ratios of Bigg's killer whales in the central Aleutians (Delarof Islands/Tanaga) show both low and high values, suggesting overlap there of an eastern and western populations (Fig 3).
- Location-only satellite tags have also elucidated two dramatically different foraging strategies.
 - Some Bigg's killer whales have been documented moving ~1,000 nautical miles south of the Aleutians (far outside the range of Steller sea lions) (Fig 4).
 - Other Bigg's killer whales remained in a single location over deep water at the head of a submarine canyon for an entire month (Fig. 5a, b), a foraging behavior not previously observed in transient killer whales.
- Both strategies suggest Bigg's killer whales in this area spend considerable time foraging for prey other than SSLs.
- Although we have often seen sperm whales and beaked whales in habitat over submarine canyons in the Aleutian Islands, their stable isotope values from the central Aleutians are too high to be substantial prey of Bigg's killer whales there.
- A month spent foraging over a submarine canyon, combined with the squid predation observation, and the stable isotope data summarized above, suggests the hypothesis that these whales were foraging on squid.

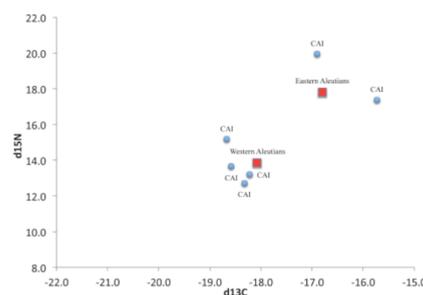


Fig 2. The red squares represent the average nitrogen and carbon stable isotope ratios in Bigg's killer whales from the eastern Aleutians (east of Samalga Pass) and western Aleutians (west of Amchitka Pass). The blue circles represent stable isotope values from individual Bigg's killer whales in the central Aleutians (CAI), which fall close to either the eastern values or western values, but not intermediate.

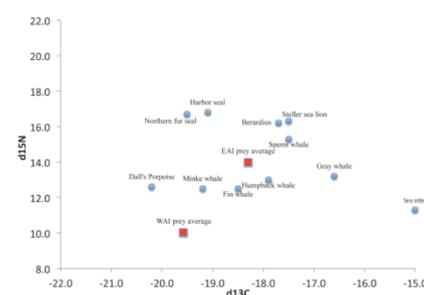


Fig. 3. Average stable isotope value of Bigg's killer whale prey in the western Aleutians (WAI prey average) and the eastern Aleutians (EAI prey average), as predicted from analysis of killer whale biopsy samples, plotted with average values from potential marine mammal prey. Note that the western Aleutians average prey value for nitrogen is below (at a lower trophic level) all the potential marine mammal prey, suggesting their diet contains other prey such as squid. Sea otter data are courtesy of Seth Newsome and Tim Tinker.

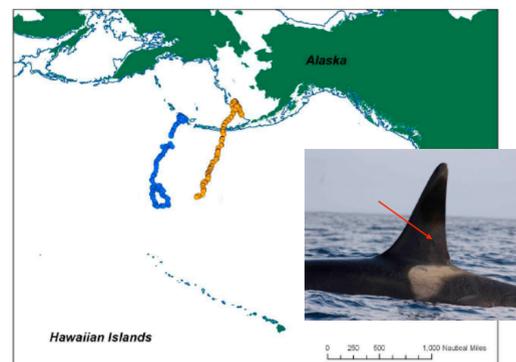


Fig 4. Long-range southern movements of Bigg's killer whales from location-only satellite tags, tagged near Kiska Island in the western Aleutians and near St. Paul in the Pribilof Islands. Both whales traveled >1000 nm south in the summer.

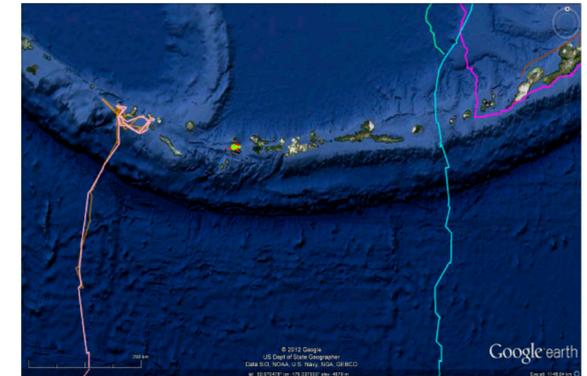


Fig. 5a. Movements of Bigg's killer whales from location-only satellite tags in the Aleutian Islands, showing the very restricted movements for two whales (red and yellow/green lines) tagged in the Delarof Islands in the central Aleutians for one month. Other Bigg's killer whales have shown dramatically greater movements over similar time periods, with one whale (magenta line) moving from Unimak Islands east to the Islands of the Four Mountains and then north to the Pribilofs, one whale (light blue) moving from the Pribilofs >1000nm south of the Aleutians, and two whales (pink and brown line) moving from Kiska to >1000nm south of the Aleutians.

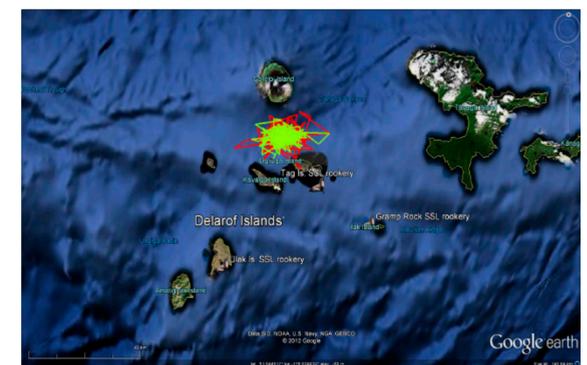


Fig. 5b. Detail of restricted movements of two Bigg's killer whales in the Delarof Islands at the head of a submarine canyon (in ~800m depth water).

ONGOING AND FUTURE WORK

- With funding from the **North Pacific Fisheries Foundation**, we are also investigating predation in the central and western Aleutians by deploying 3 passive acoustic recorders adjacent to Steller sea lion rookeries. These data will be used to document diurnal and seasonal patterns of occurrence by Bigg's killer whales at rookeries, and whether predation attacks are heard, as have been heard on a recorder deployed in the eastern Aleutians.
- With funding from the **Pollock Conservation Cooperative Research Center**, we are attempting to deploy Mk10-A satellite-linked depth tags (Wildlife Computers) incorporated into the LIMPET (Low Impact Minimally Percutaneous External-electronics Transmitter) configuration (Andrews et al. 2011) on Bigg's killer whales in the central and western Aleutians to determine if they are diving to depths consistent with predation on squid.

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