

EVOSTC ANNUAL PROJECT REPORT

Project Number: 090814

Project Title: Seabird predation on juvenile herring in Prince William Sound

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Time period covered: FY09

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Project website:

www.pwssc.org/research/biological/seabirds/SeabirdOnHerring.htm

Work Performed and Preliminary Results:

During FY2009, diurnal surveys of seabird distribution and abundance in Prince William Sound (PWS) were performed during 5-13 November 2008 and 17-24 March 2009 cruises. In conjunction with hydroacoustic surveys for herring (EVOS 090830 R. Thorne, PI) we surveyed 105 km in November 2008 and 115 km in March 2009. Both cruises focused on 7 bays in PWS known historically to hold large overwintering aggregations of juvenile herring: the four bays sampled as part of the EVOS Sound Ecosystem Assessment (SEA) program (Eaglek, Simpson, Whale, and Zaikof Bays), as well as and Port Fidalgo, Port Gravina, and Sawmill Bay. A second vessel sampled fish in and around the acoustic transects to determine species composition and age of fish schools. Additional fish composition data was collected by Alaska Department of Fish and Game as part of their herring stocks monitoring program; these data will be provided to our project in late summer 2009.

Seabird data from the five cruises (March 2007, 2008, 2009 and November 2007, 2008) have been converted into densities (birds/km²) for each species or species group. Seabird densities have been calculated by bay, per transect and per km to enable analysis at different spatial scales. Hydroacoustic data was obtained from PI Thorne for November 2008 this spring, and more recently for the March 2009 cruise. We have categorized hydroacoustic transects into density of fish for depth bands of 0-5m, 6-20m, 21-50m, and >50m. Fish composition data for March 2009 has not yet been provided by PI Thorne or ADFG.

The focus of this project is to survey seabirds and match their distribution with hydroacoustic data, but in addition we are also collecting unique winter data on seabird distribution and behavior throughout PWS. We collected data while on transit between bays to evaluate seabird habitat use outside of the bays. For winter 2008-2009, we collected 96 km and 374 km while in transit between bays during the November and March cruises, respectively. We have also placed bird observers on cruises run by NOAA's Auke Bay Lab (Humpback Whale predation on herring, EVOS 090804, S. Rice, PI). Observers participated in four whale cruises during the 2008-2009 winter: September and October 2008, and January and March 2009 for a total of 999 km of transect observations. Seabird data from the whale cruises have been converted into densities (birds/km²) for each species or species group.

We assessed foraging effort for Marbled Murrelets using focal observations in November 2008 and January 2009 during daylight hours. Average dive duration in January was 31.0 ± 1.7 seconds (N = 86 dives), and was not significantly different from dive duration observed during November 2008 (t-test, P = 0.68). These dive durations were similar to those recorded for murrelets at Naked Island, PWS during summer, where birds were eating primarily juvenile sand lance and some herring (Kuletz 2005), and suggests that murrelets forage at similar water depths throughout the year. In contrast, murrelets at Jackpot Bay, PWS had significantly longer dives, and were diving deeper for larger juvenile herring (Kuletz 2005).

Substantial progress has been made on the manuscript, "Seabird habitat associations during the non-breeding season in Prince William Sound, Alaska". Neil Dawson is the lead author on this paper. He has processed data from all cruises prior to March 2009 (4 herring cruises, Table 1; and 5 whale cruises. Environmental variables for each km of survey track have also been entered. Variables include habitat (inside bay, mouth of bay or passage, passage, and open water), distance to shore, depth, substrate, distance to eelgrass and kelp beds, wave exposure, slope of seabed and sea surface temperature. Substrate, eelgrass and kelp beds, and wave exposure data has been obtained from the EVOS Shorezone Mapping project. Bathymetry data has been obtained from the Alaska Ocean Observing System. Sea surface temperature has been input from the NASA Giovanni website. Seabird densities and distributions have been mapped for the major species in ArcMap. The November and March distribution of Marbled Murrelet and Common Murre, two of the most common species observed in winter, are shown below (Fig. 1).

Table 1. Average density per km² of major seabird species on transects in Prince William Sound bays known historically to hold juvenile herring. November 2007, 2008 (n = 189 transect km) and March 2007, 2008 (n = 221 transect km).

Species or Species Group	November	March
Loons	3.49	3.24
Red-necked Grebe	0.40	1.40
Horned Grebe	0.46	0.76
Cormorants	1.51	9.11
Mergansers	2.23	6.49
Large Gulls	9.07	5.96
Mew Gull	2.28	2.01
Black-legged Kittiwake	3.07	4.29
Common Murre	3.58	34.76
Murrelets	4.12	1.85
Pigeon Guillemot	0.37	0.59
Total	30.58	70.46

In addition to our progress on the manuscript, we used our daytime observations to develop a simple model for winter herring consumption by seabirds in PWS. We estimated that as much as 4,343 metric tons of herring are consumed by seabirds, with predation on juvenile herring estimated at 1,569 metric tons. We cannot estimate what proportion of the total juvenile herring biomass this represents because there is no juvenile herring population estimate. Using 2008 estimates of herring spawning biomass, seabirds may consume each winter as much as 14% of the adult herring population, with Common Murres consuming the greatest quantity. Because Common Murres also show the greatest increase in numbers between fall and winter (Table 1, Fig. 1), and exhibit high variability in abundance among bays and years, they have become a focal species for this study. These preliminary estimates as well as future data and analyses that further develop and improve our seabird consumption model will be provided to Kiefer's life-cycle model.

Future Work:

Lead author on the seabird distribution, N. Dawson, left his employment at the Science Center in March 2009, but he has continued to work on this manuscript. We foresee submitting this manuscript by January 2010. Bishop is taking the lead on a paper on forage flocks. A replacement for Neil Dawson has been hired and will begin work in October 2009. That person will continue the development of the seabird consumption model. We are waiting for fish school composition data from March 2009 from Thorne and ADFG, in addition to fish density data for 0-5m depth for March 2007. Once that data has been received, we can continue our analyses on the relationship between seabird densities and fish density and fish school composition. The final report will be submitted by March 31, 2010.

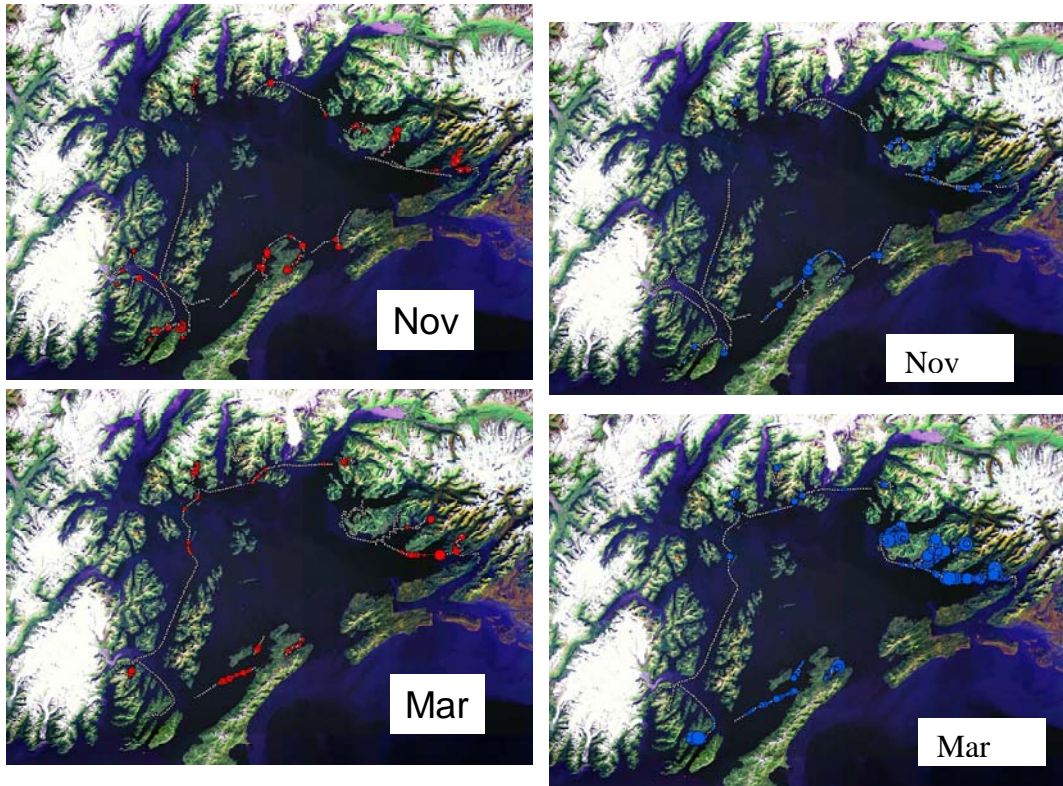


Fig. 1. Left: Marbled murrelet distribution; Right: Common Murre distribution. November 2007, 2008 and March 2007, 2008.

Coordination/Collaboration:

Our project relies on seabird surveys being performed onboard vessels associated with two EVOS projects: hydroacoustic surveys for herring (EVOS 090830, PI Thorne), and humpback whale predation on herring (EVOS 090804, PI Rice). EVOS 090830 provides our project with data from the hydroacoustic surveys and age composition of fish schools. Additional data on age composition of fish schools has been obtained from ADFG herring surveys (PI Steve Moffitt). The Humpback Whale predation on herring project provides our project with whale sightings and fish observations (jigging, dipnetting) associated with the sightings. EVOS 090811 (PWS herring forage contingency, PI Tom Kline) is providing our study with information on the condition and caloric content of year 1 juvenile herring before and after winter, data that will be used in modeling seabird consumption.

Our information on seabird predators will provide data for EVOS 090810 (PI D. Kiefer) "An Ecosystem Model of Prince William Sound Herring: A Management & Restoration Tool". Our information is being gathered in conjunction with the only juvenile herring surveys planned for PWS, and should be completely compatible with models utilizing the juvenile herring survey data. Data from our surveys will also be submitted to the North Pacific Pelagic Seabird Database (USFWS and USGS, Anchorage, Alaska).

Community Involvement/TEK & Resource Management Applications:

Field Notes is a dynamic weekly radio show of 5-7 minute talks on regionally relevant science topics. Written and recorded by Prince William Sound Science Center's Allen Marquette, each program explores one topic. Program topics range from local PWSSC research projects to more general topics such as astronomy, why birds migrate, and impacts of marine debris. *Field Notes* is aired on KCHU

Terminal Radio, the listener-supported public radio for Prince William Sound and the Copper River Valley. The station reaches more than 10,000 listeners, including the PWS communities of Valdez, Cordova, Tatitlek, and Chenega Bay and the interior communities of Glennallen, Copper Center, McCarthy and Kenny Lake. *Field Notes* is aired every Sunday afternoon and Thursday evening. Often a program is rebroadcast multiple times both the week of its first airing, as well as at other times throughout the year. Some *Field Notes* programs are picked up and broadcast by other public radio stations in Alaska. Once a program has aired, the audio clip is also available on the PWSSC web site

A piece on our project entitled, "The Prince William Sound Winter Seabird Surveys in Prince William Sound" was aired on KCHU Public Radio several times during February 2009. The program can be heard online at:

<http://www.pwssc.org/education/community/Completed%20Field%20Notes%20Programs/3-25-09%20Winter%20Seabird%20Surveys%20in%20PWS.mp3>

A project Poster with preliminary findings has also been produced and prominently displayed for visitors to the Prince William Sound Science Center.

Information Transfer:

Posters and Publications:

Bishop, M.A., K. Kuletz, N. Dawson, R. Thorne. 2009. Winter Consumption Of Pacific Herring By Seabirds in Prince William Sound. Alaska Marine Science Symposium. Anchorage, January; Poster.

Dawson, N., M.A. Bishop, K. Kuletz, R. Thorne. 2009. Winter Consumption of Pacific Herring by Seabirds in Prince William Sound. Pacific Seabird Group, Japan, February; poster.

Dawson, N. Winter Work in Prince William Sound: reasons not to hibernate. The Breakwater (newsletter of the Prince William Sound Science Center. Winter 2009.

Presentations:

Bishop, Mary Anne and Kathy Kuletz. Seabird predation on juvenile herring in Prince William Sound. EVOS Herring Working Group, December 2008, Anchorage.

Website:

A webpage has been set up on the project, available since June 2008.

<http://www.pwssc.org/research/biological/seabirds/SeabirdOnHerring.htm>

Budget Changes:

For Prince William Sound Science Center (PWSSC), the estimated FY09 costs remain the same as in the FY07 original proposal except for PWSSC administrative overhead. Originally the overhead was estimated at 25.6%, however for FY09 the federally approved overhead is estimated at 28.82%.