

EVOSTC ANNUAL PROJECT REPORT

Project Number: 10100132-G

Project Title: PWS Herring Survey: Top-down regulation by predatory fish on juvenile herring in Prince William Sound

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Time period covered: FY12

Date of Report: August 22 2012

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Project website: <http://www.pwssc.org/research/biological/PacificHerring/pacificherring.shtml>

Work Performed

The focus of this project is to assess the potential for fish predators to regulate juvenile herring recruitment. We used a combination of traditional field surveys and gut content analyses to examine the suite of fish preying on juvenile herring. Our study is designed to complement and expand on other concurrent herring studies that are part of the integrated Prince William Sound herring survey program.

Since FY2010, surveys for fish preying on juvenile herring have been conducted 6 times: 12-19 November 2009, 17-23 March 2010, 2-14 November 2010, 8-18 March 2011, 14-22 November 2011 and 14-23 March 2012. Cruises primarily focused on five bays in Prince William Sound (fig. 1) 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 Lower Herring Bay. Cruises opportunistically expanded upon these original sites and added 4-5 more sampling bays to the cruise tracks as time allowed. Our field research was conducted in conjunction with multi-project cruises including surveys of juvenile herring biomass, fish and seabird predators, plankton, oceanographic conditions in nursery bays, as well as sampling of juvenile herring schools for species composition, energetics and disease.

Sampling methodology has developed since the November 2009 pilot study and fishing during the subsequent cruises, the latter of which consisted solely of gillnetting and longlining. The methodology employed during the final two cruises was identical to that described for the November 2010 and March 2011 cruises (2011 EVOSTC annual report).

Longline sets were preceded by the setting of two different size gillnets perpendicular to shore approximate to sunset and sunrise (one evening and one morning set per bay) and soaked for three hours. Gillnets consisted of one net with three, 40' x 16' panels of 0.12, 0.20, and 0.44 mm mesh stretched and one net with three, 30' x 25' panels of 0.23, 0.40, and 0.47 mm mesh stretched.

Each longline consisted of a 530 m (1 skate) mainline with approximately 200 gangions (exact number recorded for each set). Each gangion was ~60 cm long with approximately equal numbers of #13/0, #11/0 and #9/0 offset-shank circular hooks baited with a non-local species of squid.

All fish captured were measured for total length and weight prior to removal of stomachs for dietary analyses. Stomachs were individually wrapped in cheesecloth and first preserved in 10% formalin, then transferred to 50% isopropanol until analyses could be performed. All gut contents were shipped to the Fisheries Ecology Lab at the Dauphin Island Sea Lab, University of South Alabama. Stomach contents are currently being analyzed and otoliths found in stomachs or collected from unidentifiable fish have been sent to another lab for further identification. Stomach samples from the November 2009 – March 2011 cruises have been completed and data compilation and analyses are

on-going. Preliminary sorts of gut contents from November 2011 and March 2012 will be complete by late summer 2012 and final otolith and other bone identifications will be complete by late fall 2012. To date, all catch data has been edited and entered into an Access database. Gillnet data has been proofed, and longline data will be proofed in September 2012.

Preliminary data

The number of fish caught has increased substantially since the first two cruises (Table 1), which can be attributed to both refinements to sampling methodologies (eg., multiple hook and mesh sizes) and an increase in the numbers of bays sampled during those cruises. The majority of fishes caught during sampling were caught in longline sets (Table 1). The distributions of these catches have varied by gear type, cruise and bay. A total of 50 fish species have been caught over the course of the six cruises though not all of these species were caught during each cruise. The full species list (common names) and an example of the distribution of species caught in one bay over all six cruises is provided in figure 2. Catches were dominated in nearly all bays and on each cruise by gadids with the exception of Simpson Bay whose catches were composed largely of flatfishes (primarily yellowfin sole, *Pleuronectes asper*). The gadid category is composed of Pacific tomcod (*Microgadus proximus*), saffron cod (*Eleginus gracils*), Pacific cod (*Gadus macrocephalus*) and walleye pollock (*Theragramma chalcogramma*), with the latter two species dominating the gadid catches in most bays.

Analysis of predator stomach samples is on-going, but analysis of the fish prey items found in fish stomachs from the first four cruises has found herring to represent a substantial portion of fish stomach contents (Fig.3). Herring represented nearly one quarter of all fish found in predator stomachs. Meanwhile, gadids comprised well over the majority of the fish found in fish stomachs. Well over half of the gadids found in stomachs were consumed by gadids (primarily Pacific cod) and more than half of the herring consumed were eaten by Pacific cod. Thus, preliminary results show Pacific cod to be the predominant piscivore in the nearshore areas of Prince William Sound during the winter. We are currently in the process of compiling the non-fish prey items from this study as well and we are using these data to put together an estimate of consumption of juvenile herring by Pacific cod.

Future Work

The Access database has been set up and all catch data has been entered. Final proofing of the longline data will take place in September 2012. Diet data will continue to be entered into the Access database as stomach sample results are obtained. Diet samples from the November 2011 and March 2012 cruises are being analyzed. We will also continue our on-going development of a bioenergetics model that estimates consumption of juvenile herring by Prince William Sound fish predators. When more diet analyses are available, this model will be further refined and implemented.

Coordination/Collaboration

Our project is part of the Prince William Sound Herring Survey Group. Field work is conducted concurrent with energetics, disease, and hydroacoustic herring surveys, and avian predator observations. Principal investigator Bishop and research assistant Jordan Watson attended the April 2012 Herring Survey Group meeting in Cordova. In addition, Principal investigator Bishop and research assistant Watson attended and presented research findings at a fall 2011 web-in-air meeting on top down regulation of herring populations in Prince William Sound sponsored by NOAA's Auke Bay Lab.

Community Involvement/TEK & Resource Management Applications

Research assistant Jordan Watson presented our research findings in a talk called “Can fish sticks and fast food save herring in Prince William Sound” to the Cordova community at a public lecture in April 2012.

Research assistant Jordan Watson presented our research findings in a talk in April 2012 at the annual 2012 herring PI meeting in Cordova, Alaska.

Research assistant Jordan Watson presented our research findings at a fall 2011 meeting on top down regulation of herring populations in Prince William Sound.

Information Transfer

Publications in review:

Watson, J.T., M.A. Bishop, and S.P. Powers. Pacific cod predation on Pacific herring during winter in Prince William Sound. Submitted to Fisheries Oceanography.

Vollenweider J.J., R.A. Heintz, M.A. Bishop, and J.T. Watson. Age-dependent winter energetics of juvenile Pacific herring in the Gulf of Alaska. Submitted to Fisheries Oceanography.

Posters:

Watson, J.T., M.A. Bishop, S.P. Powers, B.F. Reynolds, and S. Bosarge. 2012. Nearshore piscivory during winter in Prince William Sound. Alaska Marine Science Symposium. January 2012, Anchorage.

Popular Press:

Watson, J.T. 2011. A fish eat fish world. The Breakwater. (newsletter of PWS Science Center)

Watson, J.T. 2012. It's a fish eat fish world. *Delta Sound Connections*. (This annual, free newspaper on science activities in Prince William Sound and the Copper River Delta prepared for general distribution to tourists visiting the area.)

Public Radio:

Our fish predators on herring project was featured in a March 2012 “Field Notes” radio program prepared by Allen Marquette, an educator at the Prince William Sound Science Center. The program was 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. The *Field Notes* program for each week is aired on Sunday afternoon and Thursday evening. A recording can be listened to online at:

<http://pwssc.org/education/community/Completed%20Field%20Notes%20Programs/3-17-12%20Fish%20predation%20on%20herring%20part%202.mp3>

Our project is featured on the on the Prince William Sound Science Center's web site, under the PWS Herring Group web page:

<http://www.pwssc.org/research/biological/PacificHerring/pacificherring.shtml>

Budget Changes: No major budget changes are anticipated at this time.

Table 1. Numbers of fish caught by cruise and by gear type.

Cruise	Gillnet	Longline	Total
Nov 2009	15	93	108
Mar 2010	5	200	205
Nov 2010	381	372	753
Mar 2011	99	416	515
Nov 2011	139	187	326
Mar 2012	55	312	367
Total	694	1580	2274

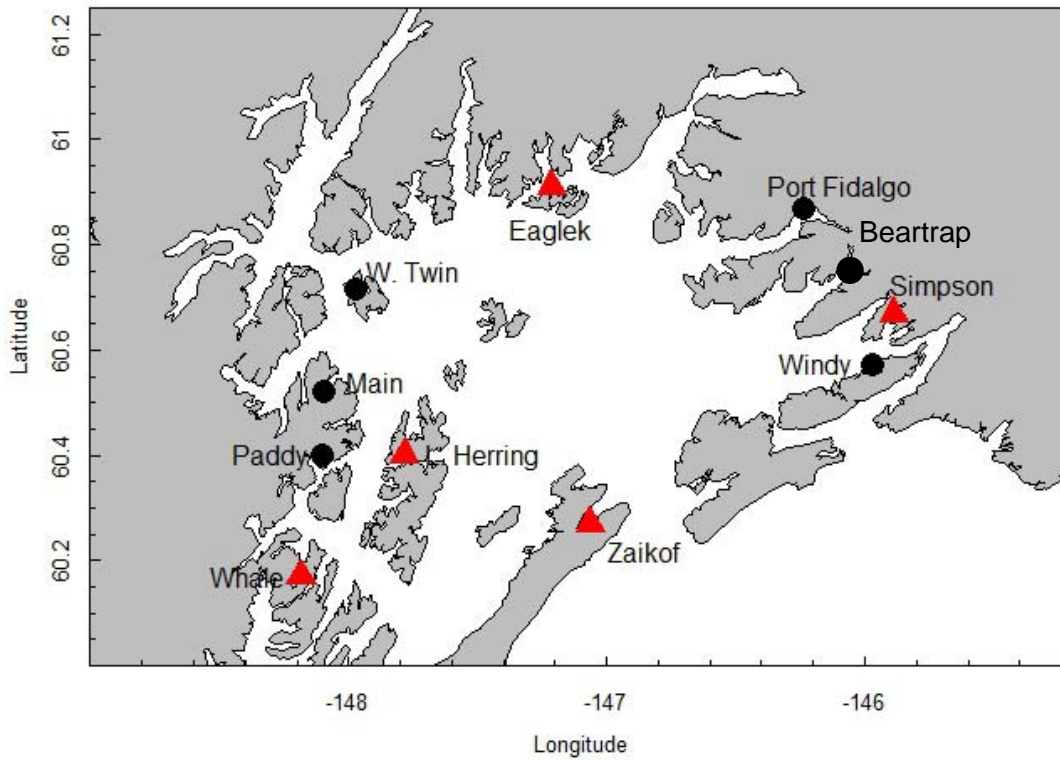


Figure 1. Sampling sites from 6 herring predator cruises. Red triangles were sampled during all cruises; black circles were sampled during at least one cruise.

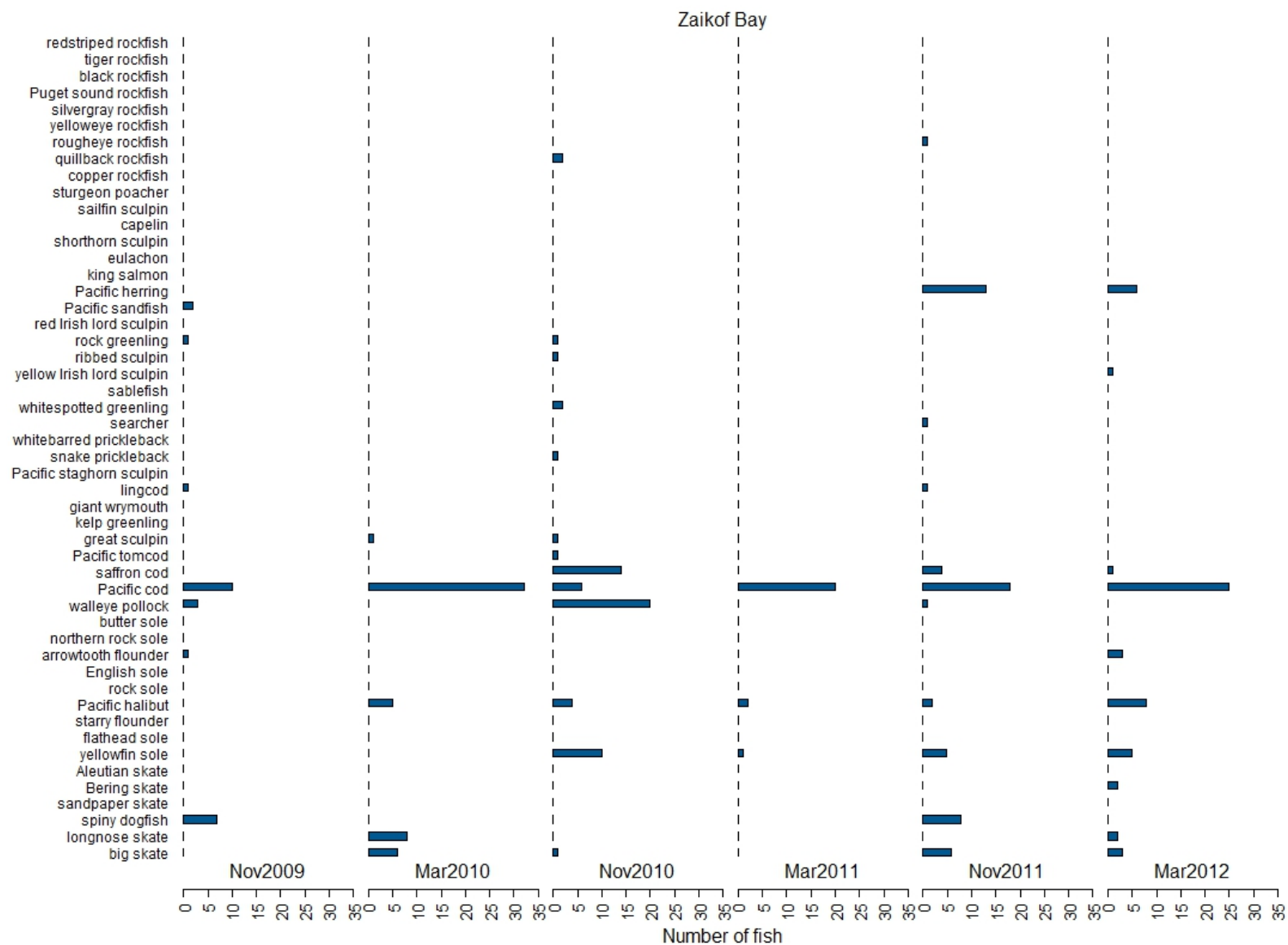
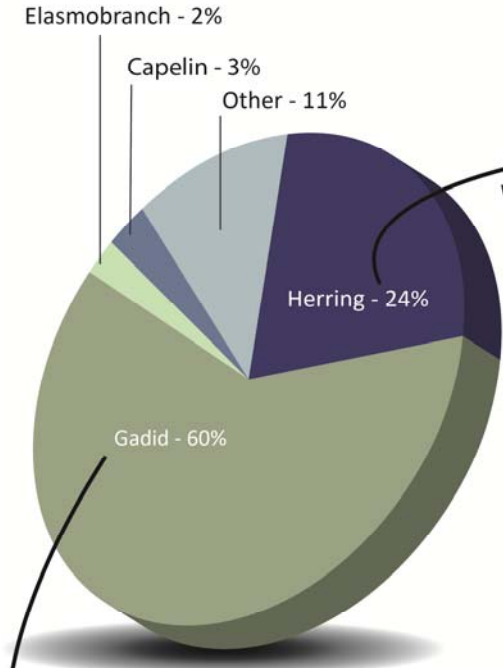
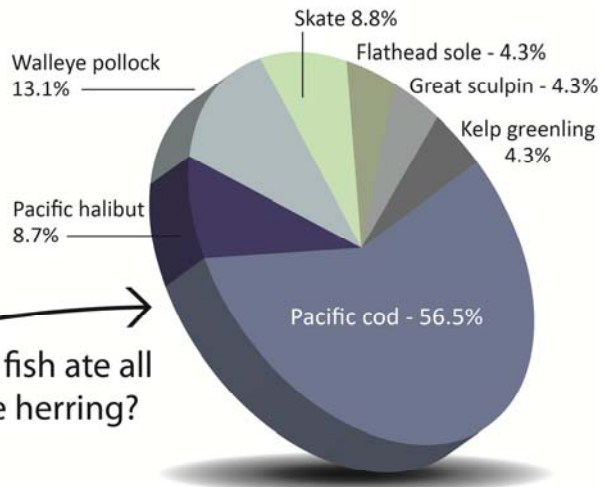


Figure 2. Number and species of fish caught at Whale Bay using all gear types during each of the six cruises. Species list represents all species caught at all locations throughout the sampling period.

What types of fish were found in 464 stomachs?



Which fish ate all those herring?



Which fish ate all those gadids?

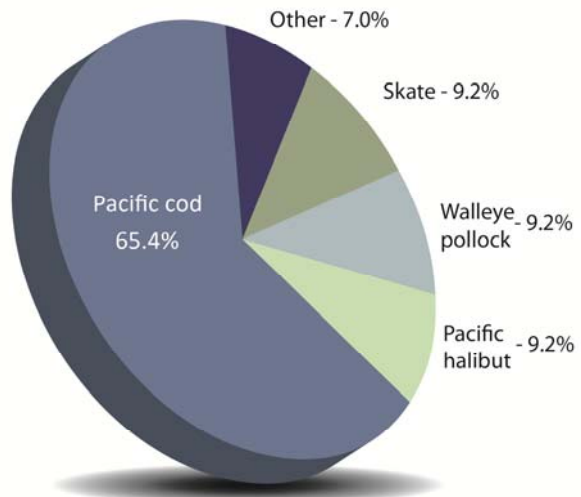


Figure 3. Analysis of fish prey items found within fish stomachs sampled during the first four cruises.