ATTACHMENT C ***EVOSTC Annual Project Report Form***

Form Rev. 10.3.14

1. Project Number: *See*, Reporting Policy at III (C) (1).

12120114- O

2. Project Title: *See*, Reporting Policy at III (C) (2).

LTM Program – Monitoring long-term changes in forage fish distribution, abundance, and body condition in Prince William Sound

3. Principal Investigator(s) Names: *See*, Reporting Policy at III (C) (3).

Mayumi Arimitsu and John Piatt

4. Time Period Covered by the Report: *See*, Reporting Policy at III (C) (4).

February 1, 2014-January 31, 2015

5. Date of Report: *See*, Reporting Policy at III (C) (5).

Feb 13, 2015

6. Project Website (if applicable): *See*, Reporting Policy at III (C) (6).

www.gulfwatchalaska.org

7. Summary of Work Performed: *See*, Reporting Policy at III (C) (7).

As originally proposed, the objectives of this work are to 1) identify robust indices for monitoring forage fish populations over time and devise a sampling strategy for long term monitoring of those indices, 2) assess the current distribution, abundance, species composition, and body condition of forage fishes (other than herring) in selected areas of Prince William Sound at selected times of the year, and 3) relate abundance and distribution of forage species to abiotic characteristics of the marine environment.

During this reporting period we made significant progress on a new aerial-acoustic survey design that takes into account the advantages and limitations of previous forage fish work. We worked closely with a commercial herring spotting pilot, ADF&G biologists familiar with aerial surveys for fish and other taxa, and the herring program lead. The new sampling grid is based on 2010-2012 school density (Fig. 1) and is meant to simplify the aerial data collection and processing effort, increase certainty in aerial-derived species ID through on-the-ground validation, and estimate biomass of schools in the water with hydroacoustics. This plan was submitted to the workspace in June and reviewed by the GWA science review team.

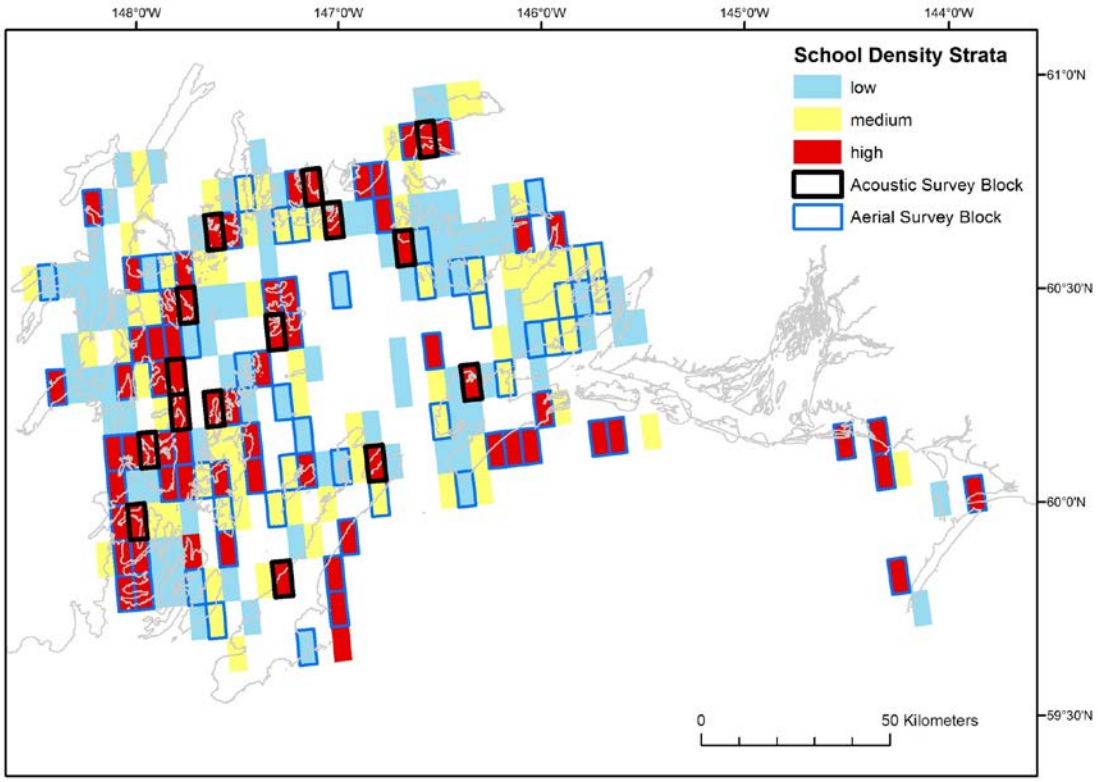

Figure 1. Density strata showing the distribution of forage fish schools (colored blocks are the number of schools/km flown, weighted by persistence over time) during July shoreline aerial survey counts in 2010-12 (E. Brown, unpublished data). Forage fish aerial survey blocks (outlined in blue) were randomly selected for sampling based on variability of density within each strata. Acoustic survey blocks (outlined in black) were randomly selected for sampling from the high density stratum.

We provided survey equipment and technical support during the juvenile herring surveys in June (Fig. 2). We also conducted the aerial-acoustic forage fish survey in July. Working closely with the PWSSC aerial survey team, we counted fish schools within 107 low-high density sample boxes and ran hydroacoustic transects in 15 high density sample boxes located throughout the Sound. We used several methods to verify species ID for aerial surveys and hydroacoustics including midwater trawl, cast nets, jigs, purse seines and underwater cameras. We also coordinated with the whale survey crew to estimate distribution and density of whale prey near Montague Strait, Green Island and Port Chalmers in July. This work motivated us to look for and subsequently quantify krill and capelin near feeding predators. We also documented humpback whales feeding on young of the year herring near Montague Island. In September, when humpback whale numbers tend to increase in the Southern Montague area, we conducted an additional survey with the whale crew. We documented considerable differences in whale prey density and depth distribution between July and September 2014.

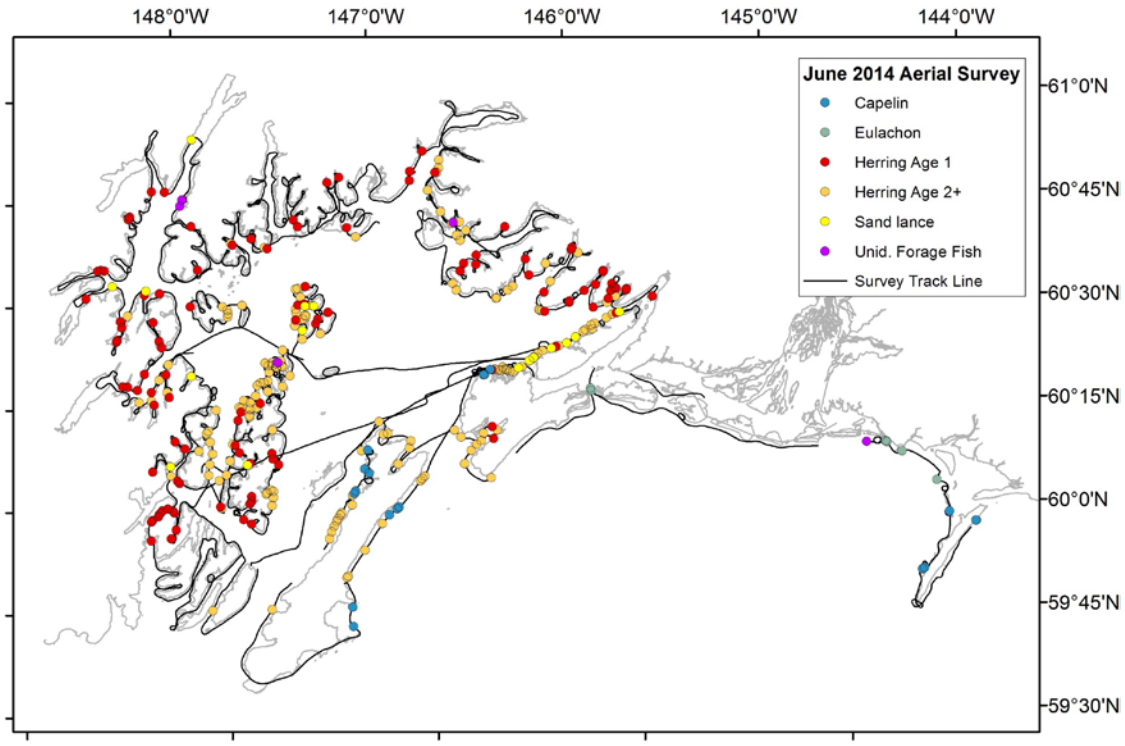

Figure 2. Distribution of age 1 herring and other forage fish during June 2014 shoreline aerial survey.

We provided several written reports, presentations and interviews during this reporting period. In addition to project annual reports and work plans (Feb 2014, Aug 2014), we participated in the Gulf Watch Alaska synthesis effort by summarizing historical and current information on forage fish throughout the EVOS affected area (including APEX, SEA and HRM work in Cook Inlet, Kenai Peninsula, Prince William Sound, and Gulf of Alaska). We worked with the pelagic team and program leads to summarize recommendations for future work at the GWA PI meeting in Novemeber. We uploaded 2013 dataset to the AOOS workspace and also updated the Morpho metadata. We also provided updates and slides for the EVOSTC joint science workshop. We presented two posters at the Alaska Marine Science Symposium on our field work. We were interviewed for a Gulf Watch Alaska curriculum unit by education specialists at the Alaska Sealife Center, and by a University of Oregon journalism student for a climate change study.

Deliverable/Milestone	Status
Submitted 2013 annual report	completed
Submitted proposed protocol changes and study plan	completed
2013 data with morpho metadata uploaded to workspace	completed
Juvenile herring aerial survey support	completed
Forage fish aerial-acoustic survey	completed

Year 4 project plan	completed
Humpback Whale prey hydroacoustic survey	completed
GWA Synthesis – forage fish chapter	completed
PI meeting in Anchorage	completed
PI Meeting at AMSS	completed
Poster presentations at AMSS	completed

8. Coordination/Collaboration: *See*, Reporting Policy at III (C) (8).

We coordinated closely with Scott Pegau, HRM program coordinator, to conduct aerial surveys in summer 2014. We provided data recorders, cameras, and technical support for June age 1 herring survey, and July aerial-acoustic survey for forage fish.

We collaborated with John Moran and Jan Straley, the humpback whale PIs, and Mary Anne Bishop, a seabird survey PI, to estimate prey density and depth distribution with hydroacoustics-trawl sampling in July and September 2014. Using a NOAA chartered vessel (F/V Montague) along with the usual whale research platform (M/V Auklet), USGS portable SIMRAD EK60 38-120 kHz hydroacoustic system, and PWSSC Aluette trawl system, we sampled prey (juvenile and adult herring, krill) near large groups of feeding whales and feeding marine birds from Montague Strait to Port Gravina. Greater collaboration between the humpback whale, herring, marine bird and forage fish programs facilitate greater efficiency in data collection and improved understanding of the pelagic system in Prince William Sound.

9. Information and Data Transfer: *See*, Reporting Policy at III (C) (9).

- Arimitsu, M and J Piatt. 2014. Forage fish populations in Prince William Sound: Designing efficient monitoring techniques to detect change. Pp. 3-35 to 3-46 *in*: (Hoem Neher, T., B. Ballachey, K. Hoffman, et al., eds.) Quantifying temporal and spatial variability across the Northern Gulf of Alaska to understand mechanisms of change. Science synthesis report for the Gulf Watch Alaska Program.
- Arimitsu, M and J Piatt. 2014. Influence of tidewater glaciers on marine ecosystems. Public seminar for the Alaska Coastal Rainforest Center Lecture Series. Juneau, AK. Mar 12, 2014.
- Arimitsu, M. 2014. Coastal marine ecosystem research in the Gulf of Alaska. Lecture for University of Alaska Southeast undergrad seminar. Juneau, AK. Mar 28, 2014.
- Arimitsu, M. and J Piatt. 2014. Forage fish synthesis overview. GWA Principle Investigators meeting, Anchorage, AK, Nov. 18, 2014.
- Pegau, W, M Arimitsu, and M Collins. 2015.Aerial surveys provide age-1 herring and forage fish indices for monitoring in Prince William Sound. Poster presentation at the Alaska Marine Science Symposium. Anchorage, AK. Jan 19, 2015.
- Moran, J, J Straley, and M Arimitsu. 2015. Humpback whales as indicators of herring movements in Prince William Sound. Poster presentation at the Alaska Marine Science Symposium. Anchorage, AK. Jan 19, 2015.

10. Response to EVOSTC Review, Recommendations and Comments: *See*, Reporting Policy at III (C) (10).

There were no recommendations for this project.

11. Budget: *See,* Reporting Policy at III (C) (11).

Current expenditures of some line items exceed ± 10% deviation from the originally-proposed amount in cases where reporting accounts lagged behind actual expenses, inconsistency between federal and EVOS fiscal year start date, and because the USGS budget system categories (particularly commodities and equipment) differ from those shown in the EVOS proposal. However, all expenditures are all within keeping to our planned budget, despite significant changes to survey design (as discussed above). We expect to use all proposed funds by the end of the project.