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

Form Rev. 10.3.14

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

15120114- 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, 2015-January 31, 2016

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

March 1, 2016

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 were 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 Prince William Sound during summer, and, 3) relate abundance and distribution of forage species to abiotic characteristics of the marine environment.

During this reporting period we conducted field work in June-July 2015. We completed the second year of the July aerial-acoustic survey that takes into account the advantages and limitations of previous forage fish work. We worked closely with a commercial herring spotting pilot and the herring research and monitoring program. The sampling grid repeated in 2015 was based on 2010-2012 school density (Figure 1) and was meant to simplify the aerial data collection and processing effort, increase certainty in aerial-derived species identification through on-the-ground validation, and estimate biomass of schools in the water by using hydroacoustics. This plan was submitted to the workspace in June 2014 and was reviewed by the Gulf Watch Alaska (GWA) science review team.

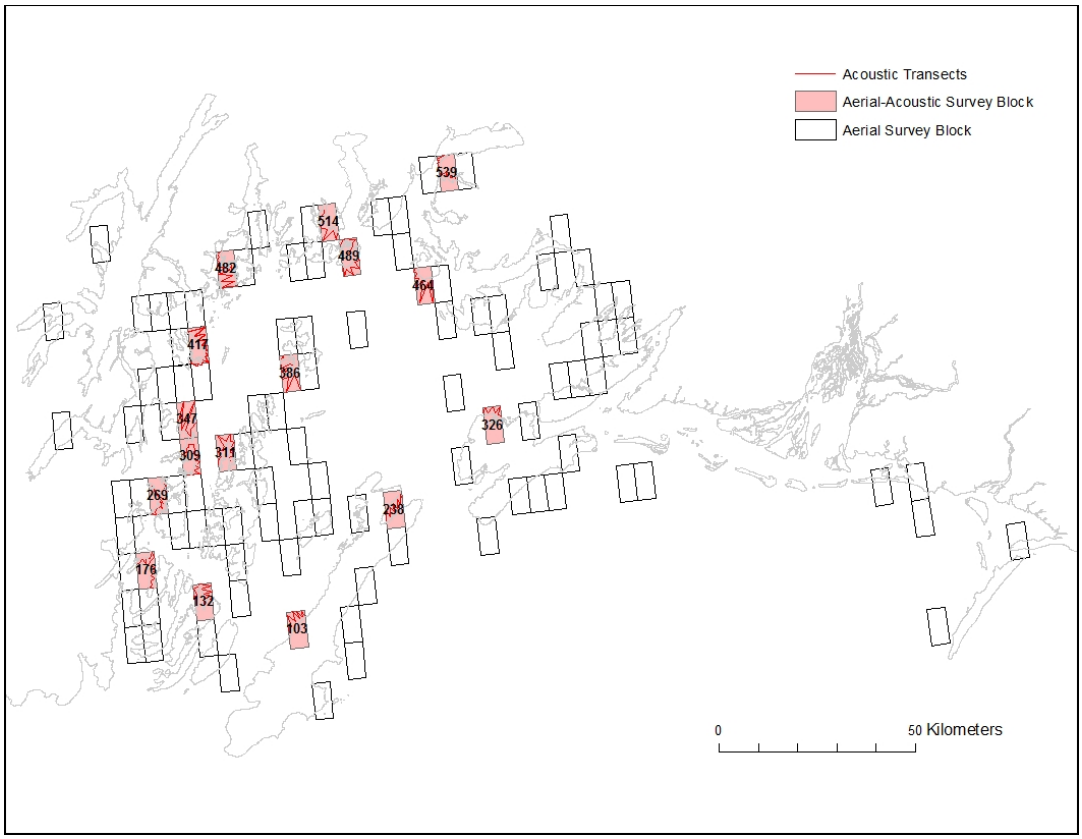

Figure 1. Aerial-acoustic survey conducted in July 2015. Fish schools were counted in aerial survey blocks (outlined in black) and hydroacoustic surveys were conducted in a random subset of blocks identified as persistent, high-density forage fish school areas from historical aerial surveys in Prince William Sound.

We provided survey equipment and technical support during the juvenile herring surveys in June 2015 (Figure 2). We also conducted the aerial-acoustic forage fish survey in July. Working closely with the Prince William Sound Science Center aerial survey team, we counted fish schools within low-high density sample boxes and ran hydroacoustic transects in 16 high density sample boxes located throughout Prince William Sound. We used several methods to verify species identification for aerial surveys and hydroacoustics including midwater trawl, cast nets, jigs, purse seines and underwater cameras.

We provided several written reports, presentations and interviews during this reporting period. In addition to project annual reports and work plans (February 2015, August 2015), we also highlighted this work in a lecture for the University of Alaska Fairbanks School of Fisheries and Ocean Sciences graduate seminar series (March 2015). We worked with the pelagic team and program leads to summarize recommendations for future work at the GWA principal investigators meeting in November. We uploaded available 2014 datasets to the Ocean Workspace and also updated the Morpho metadata. We co-authored a poster at the Alaska Marine Science Symposium on the GWA pelagic program.

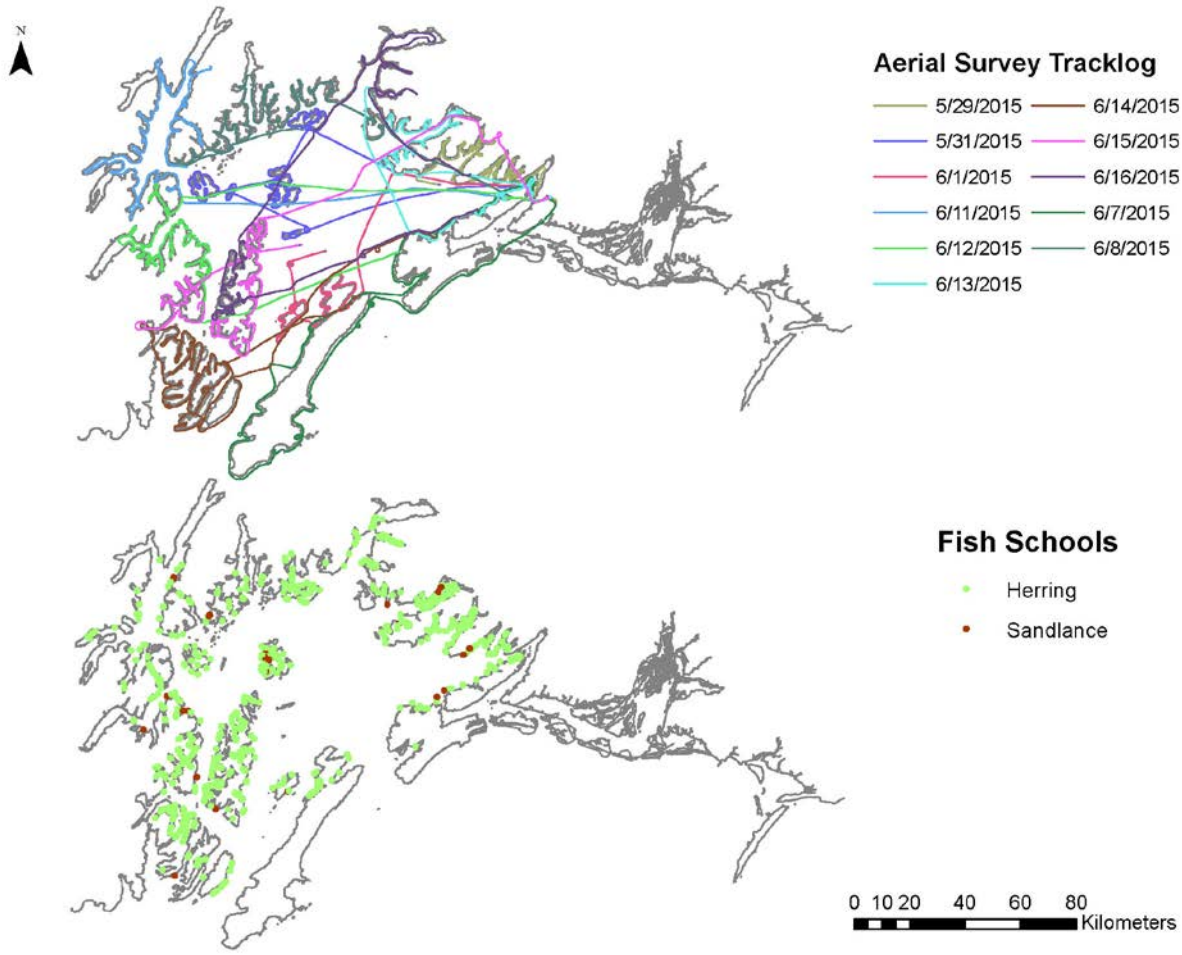

Figure 2. June 2015 aerial survey effort by date (top), and distribution of school observations by species (bottom). These surveys were conducted in collaboration with Scott Pegau (Herring Research and Monitoring Program, Prince William Sound Science Center).

We observed differences in marine habitat, forage fish and marine bird distribution between 2012-13 (cooler) and 2014-15 (warmer) years. Age-1 capelin made up a smaller proportion of trawl catches in warmer years compared to cooler years (Figure 3). Our findings are consistent with the long-term dataset from Middleton Island that shows lower capelin proportion in diets in recent warm years (Figure 3). Capelin is a cold-water species that responds quickly to climate change and are known to use glaciated fjords as cold water refuge. All of the capelin we caught in 2015 were near glaciers in Columbia and Unakwik bays.

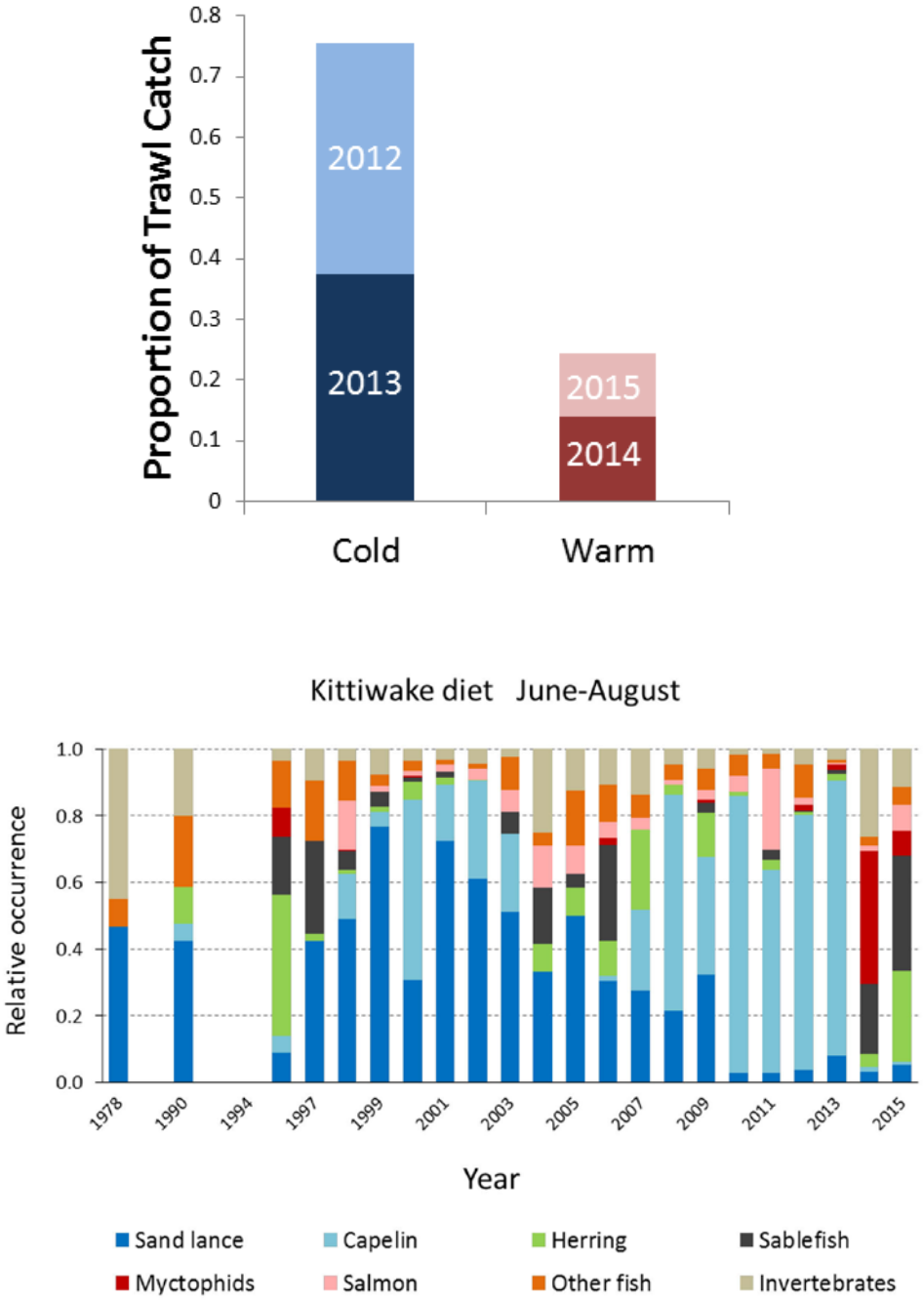

Figure 3. Proportion of age-1 capelin in trawl catches in cooler (2012-13) and warmer (2014-15) years of the GWA forage fish study in Prince William Sound (top). Relative occurrence of forage fish species in black-legged kittiwake diets at Middleton Island from 1978 – 2015 (bottom, long-term data courtesy of Scott Hatch (Institute for Seabird Research and Conservation).

Although the distribution of marine bird survey effort differed by year, transects conducted in conjunction with forage fish surveys throughout the Sound suggested an unusually inshore distribution of common murres in 2015 compared to 2012-2013 (Figure 4). The summer inshore distribution of common murres in 2015 was coincident with a mass mortality event later in the year and may have been an early warning sign. Unusually large numbers of subadult murres were observed on both summer surveys and in the winter die-off.

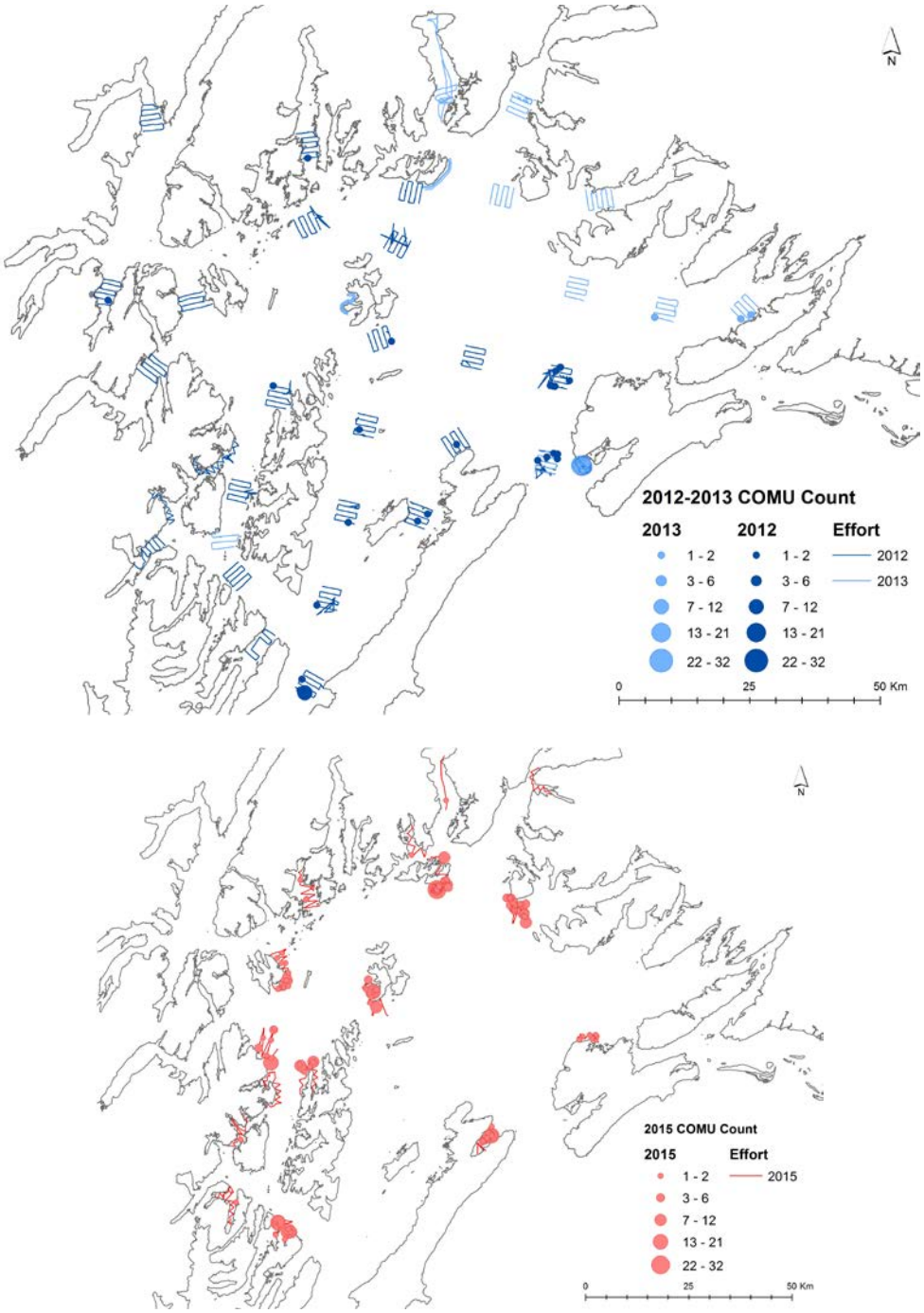

Figure 4. Common murre (COMU) distribution on marine bird transects conducted in conjunction with forage fish surveys in Prince William Sound in July 2012, 2013 and 2015. Transect layout (lines) differed among years due to changes in the forage fish survey design.

The July distribution of forage fish (all years, all methods) is shown in Figure 5. Walleye pollock and Pacific herring are more widely distributed in Prince William Sound compared to capelin, Pacific sand lance and eulachon.

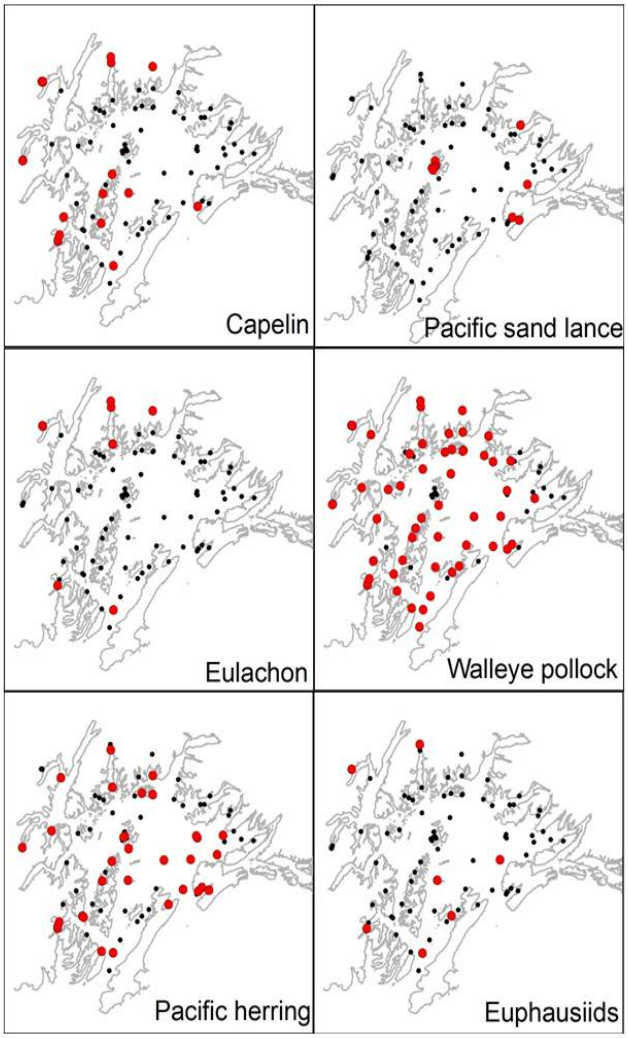

Figure 5. Distribution of forage fish (all methods and years) during July surveys in 2012-2015. Fishing effort (trawl, jig, beach seine, purse seine, dip net, cast net, and gill net) is shown as black circles, and presence is shown as red circles.

Deliverable/Milestone	Status
Submitted 2014 annual report	completed
2014 data with metadata uploaded to workspace	completed
Juvenile herring aerial survey support	completed
Forage fish aerial-acoustic survey	completed
Year 5 project plan	completed
GWA Synthesis	completed
November PI meeting and forage fish update in Anchorage	completed
Poster presentations at Alaska Marine Science Symposium	completed
Workspace data and metadata review with Axiom	Completed

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

We coordinated closely with Scott Pegau, Herring Research and Monitoring program coordinator, to conduct aerial surveys in summer 2015. We provided data recorders, cameras, and technical support for June age-1 herring and forage fish school survey, and July aerial-acoustic survey for forage fish (see Figure 2).

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

We uploaded data to the Ocean Workspace, and also had a data management meeting with Axiom on January 14, 2015.

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

We uploaded the revised version of the study protocol to the Ocean Workspace. We responded to the helpful recommendations and comments from the reviewer by clarifying the text in the protocol.

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

Please see provided program work book.

Current expenditures of some line items deviated from the originally-proposed amount in cases where reporting accounts lagged behind actual expenses, because of inconsistencies between federal and Exxon Valdez Oil Spill Trustee Council fiscal year start dates, and because the US Geological Survey budget system categories (particularly commodities and equipment) differ from those shown. All expenditures are within keeping to our planned budget, despite the approved changes to survey design over the course of the study. We expect to use all proposed funds by the end of the project.