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

Form Rev. 10.3.14

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

15120114-E

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

Long term monitoring of oceanographic conditions in Prince William Sound

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

Robert W. Campbell

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

Feb. 1 2015 – Jan. 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.gulfwatch.org

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

The six planned surveys of Prince William Sound (PWS) were conducted during the reporting period (Table 1), and all 12 standard stations (Figure 1) were occupied. All conductivity, temperature, and depth (CTD) data have been processed, and seasonally detrended anomalies of temperature and salinity at selected depths in central PWS are shown in Figures 2 and 3. Temperatures in central PWS have been above average since late 2013, as has been observed elsewhere in the Gulf of Alaska (see Hopcroft and Danielson/Weingartner reports). It appears that PWS exhibited the same “warm blob” anomaly seen throughout the Gulf of Alaska with approximately the same timing. Salinity anomalies in central PWS were less informative and more variable, but have for the most part tended towards fresh anomalies, presumably reflecting warmer than average summers throughout Alaska during the last two years.

Plankton, nutrient, and chlorophyll-a samples were collected from all stations with no incidents. As of January 2015 All plankton samples have been enumerated from this project (Lower Cook Inlet samples will be done in the first quarter of 2016), and all chlorophyll-a filters have been run (chlorophyll analysis is done shortly after each cruise to minimize storage artefacts). Analysis of nutrient samples is progressing: A Seal Analytical AA3 autoanalyzer was purchased in 2015, and sample analysis continues apace at the writing of this report (~40 samples per day on average); it is expected that the backlog will have been worked through by the second quarter of 2016.

The Autonomous Moored Profiler (AMP) profiling mooring experienced a battery failure at some point during winter storage, and was returned in February 2015 for service. The profiling mooring was deployed in late March, well ahead of the spring bloom (the extraordinarily early spring bloom observed in 2014 led us to plan an early deployment this year). The 2015 deployment was the most successful to date, with daily profiles over most of the growing season, with small gaps due to service periods.

The 2015 time series from the AMP mooring shows the annual cycle of stratification and productivity at previously un-measured scales (Figure 4). Thermal stratification began in late May, and was very strong into late July/August (the temperature in the surface layer was > 16 °C, approximately 4 °C warmer than average). The spring bloom, however, appears to have been quite weak and late in 2015 (which is remarkable because 2014 was also a warmer than average year, had a very early and strong bloom). There was a very short-lived bloom in late April-early May, and subsurface productivity (at the nitricline) into June. High concentrations of nitrate were observed in surface waters through much of May and into June, but did not show corresponding increases in productivity.

Table 1: Status of project milestones for FY14.

Deliverable/Milestone	Status
PWS Survey, Deploy mooring	Conducted 21-22 March 2015
Mooring service	Conducted 13 April 2015
PWS Survey / service mooring	Conducted 23-25 April 2015
PWS Survey / service mooring	Conducted 23-25 May 2015
Mooring service	Conducted 25 June 2015
PWS Survey / service mooring	Conducted 24-25 July 2015
Mooring service	Conducted 2 September 2015
Mooring retrieval / service in Cordova	Conducted 6 September 2015
Mooring deployment	Conducted 18 September 2015
PWS Survey	Conducted 25-26 September 2015
Mooring retrieval	Conducted 22 October 2015
PWS / Seabird mortality Survey	Conducted 6-8 January 2016
CTD data processed	Completed January 2016
Chlorophyll-a samples processed	Completed January 2016
Plankton samples enumerated	Completed January 2016 (this project)/ March 2016 (Doroff)

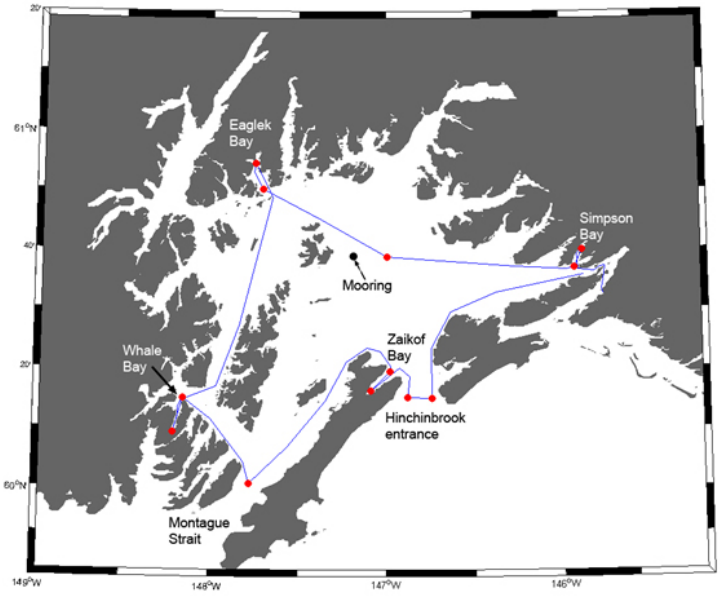

Figure 1: Map of the standard cruise track and stations, and the location of the AMP mooring.

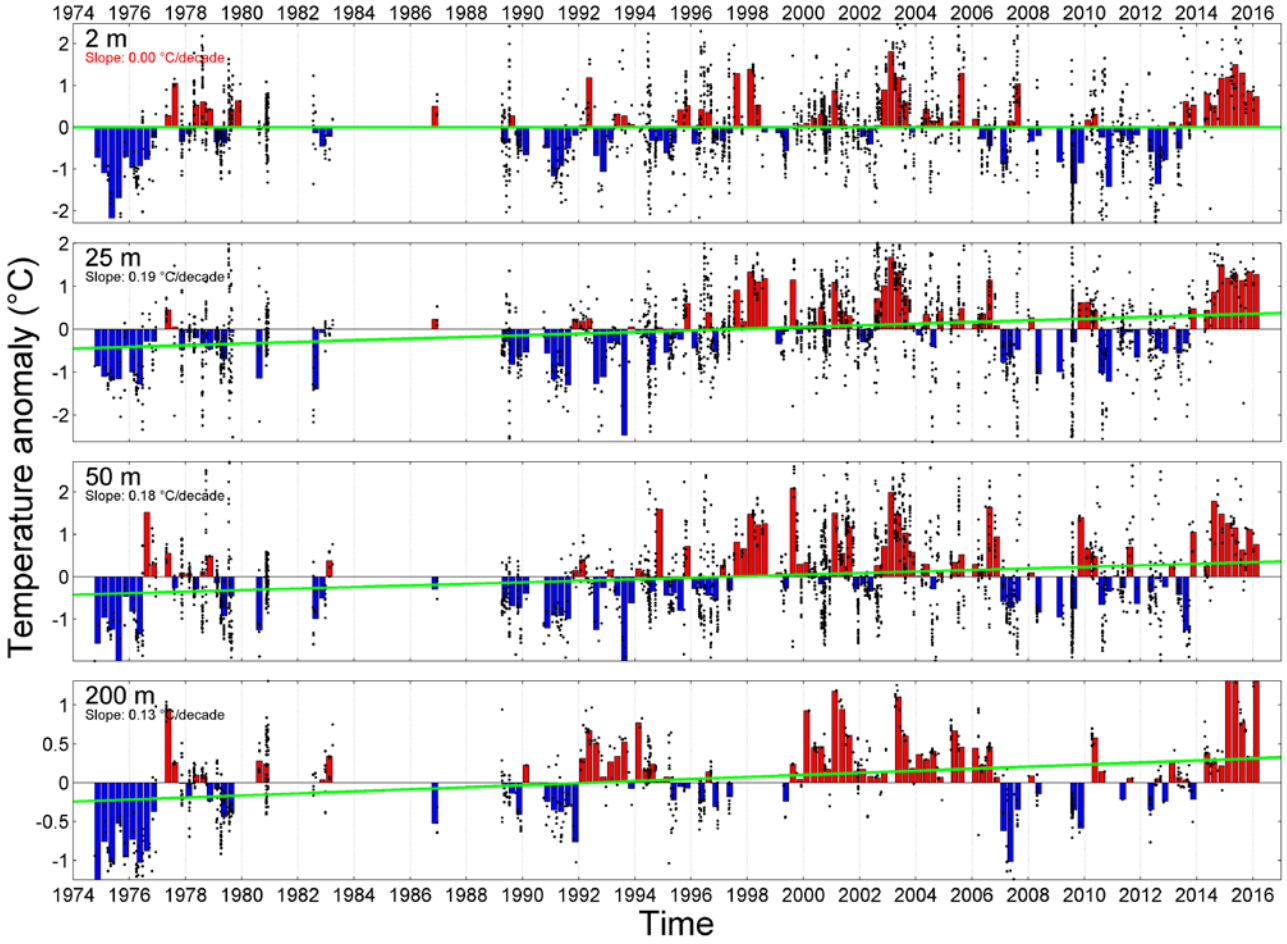

Figure 2: Temperature anomaly time series at selected depths in central Prince William Sound. Anomalies were calculated as the residual from a second order cosine fit to Julian day (for all years data) and thus represent seasonally detrended values. Vertical bars indicate quarterly average anomalies, black dots represent individual observations, the green line indicates the linear trend. Red text for the slope indicates that the slope is not significantly different from zero ($p>0.05$).

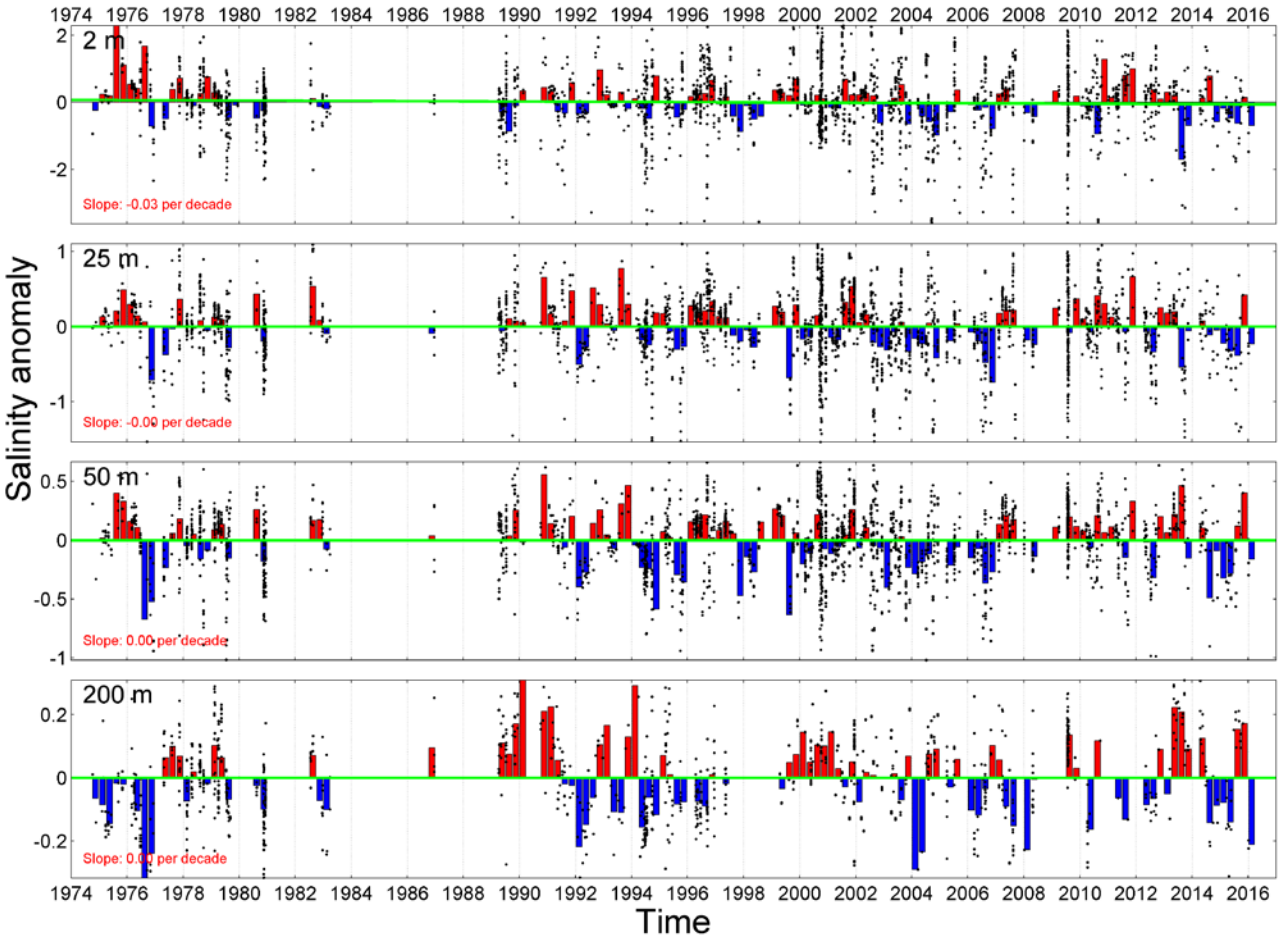

Figure 3: Salinity anomaly time series at selected depths in central Prince William Sound. Anomalies were calculated as described in Figure 2.

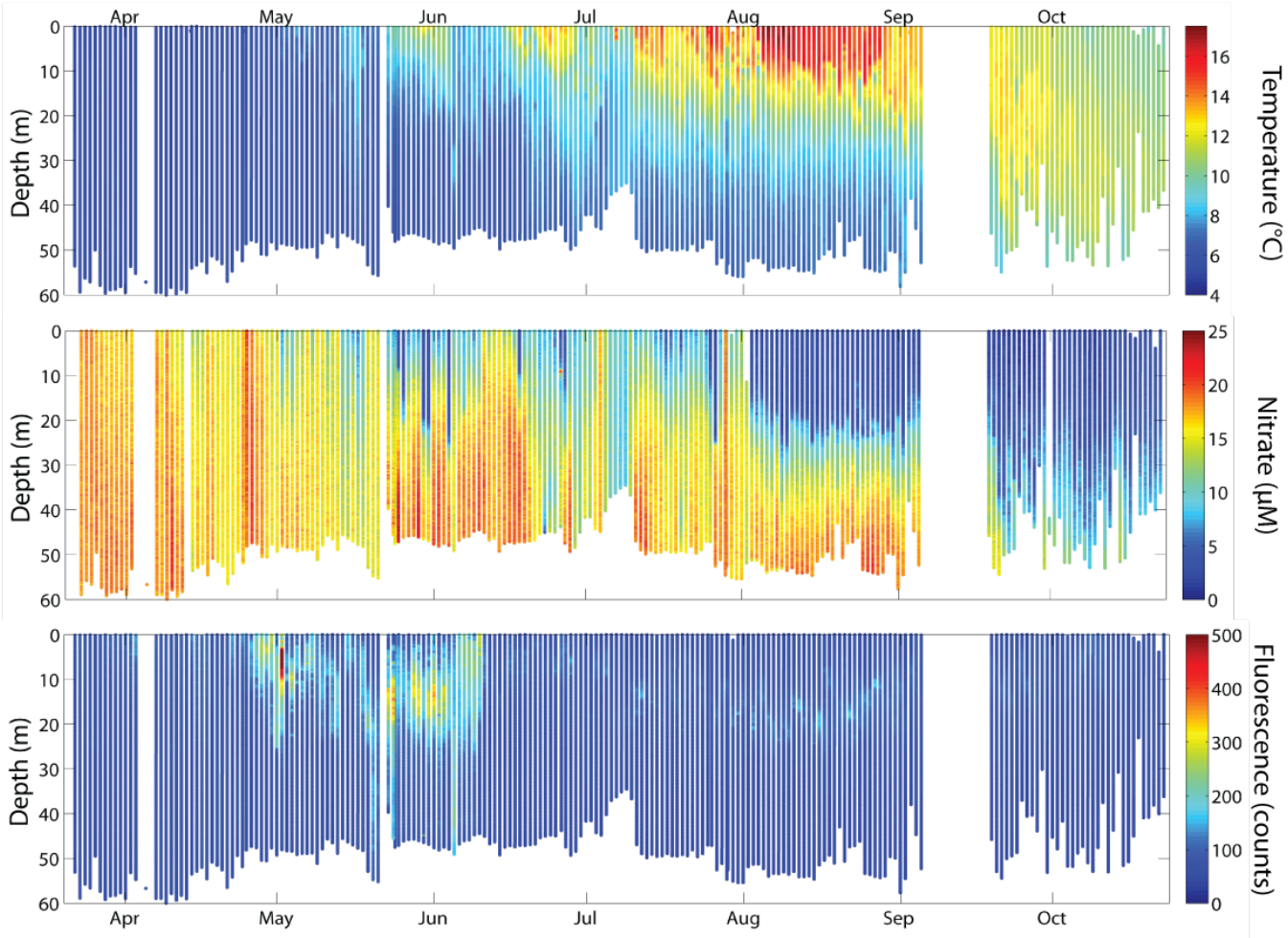

Figure 4: Time series of temperature (top panel), nitrate concentration (middle panel) and chlorophyll-a fluorescence (bottom panel) in the surface layer of PWS in 2015 measured by the AMP profiler. Each vertical line represents a single profile, and colors correspond to values of each observation. Fluorescence is presented as digital counts from the fluorometer, and are linearly proportional to chlorophyll-a concentration.

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

8.A. Within the GWA and Herring Research and Monitoring program:

- All plankton samples collected as part of project 12120114-G ("Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay") are processed and identified by this project.
- Plankton samples for herring disease studies (PI: Paul Hershberger, 1212011-K) were collected from several locations during 2014 surveys.
- Campbell has provided plankton data (and abstracted plankton taxa) to the Herring Condition Monitoring project (Project 12120111-L)
- Campbell collaborated with Sonia Batten (Project 12120114-A) on a publication ("Plankton indices explain interannual variability in Prince William Sound herring first year growth."), manuscript is in review following minor revisions.

8.B. With other EVOSTC funded projects: NA

8.C. With trustee agencies:

- Additional plankton samples were sent to the USGS Marrowstone group for tests for the presence of *Ichthyophonus* life stages.
- Photos were taken at two long term study locations for Alan Mearns (NOAA).
- The January 2016 survey coincided with an unusual mortality event of common murres, first observed in Whittier and the northwestern portion of PWS; NOAA researchers also passed on observations of fewer than average wintering humpback whales in Hawaii. A bird and mammal observer rode along on the January survey, to enumerate and collect seabird carcasses (for USFWS) and to look for whales.

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

- Campbell, R.W. 2016. Surface layer and bloom dynamics in Prince William Sound. Alaska Marine Science Symposium, Anchorage.
- Campbell, R.W. 2016. Effects of the 2013-2015 warm anomaly in Prince William Sound, Alaska. Pacific Anomalies Workshop 2, Seattle.
- Campbell, R.W. 2015. State of the Sound: Oceanography, surface layer dynamics, and plankton blooms in PWS. PWSSC Lecture series, Cordova.
- Campbell, R.W. 2015. Oceanography, surface layer dynamics, and plankton blooms in PWS. PWS Regional Citizens' Advisory Council, Anchorage.
- Campbell, R.W. 2015. State of the Sound: Oceanography, surface layer dynamics, and plankton blooms in PWS. PWSSC Pub Talk, Cordova.
- Campbell, R.W. 2015. Recent trends in the oceanography of Prince William Sound. Poster presented at Alaska Marine Science Symposium, January 2015.
- Joint presentation: Environmental drivers. Gulfwatch AK PI meeting, November 2015.
- All CTD, chlorophyll-a, and zooplankton data collected in FY14 have been uploaded to the ocean workspace.

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

No specific comments or recommendations were made in this project year.

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

Spending on personnel has been slightly behind schedule because Campbell's salary was largely covered by other projects in prior years that needed to be spent down. The unspent salary is currently being drawn down and is also being used for additional technician time for nutrient analysis.

Travel spending has been over budget due to a miscommunication over budgeting during the proposal process. Campbell has been attending both the annual PI meeting in November and the Alaska Marine Science Symposium in January, which has slightly exceeded the budget. Equipment spending was over budget in 2015 because funds from this project were used to contribute towards the purchase of the nutrient autoanalyzer.