

Form Rev. 10.3.14

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

12120114-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 2014 – Jan. 31 2015

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

February 2014

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

[www.gulfwatch.org](http://www.gulfwatch.org)

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

The six planned surveys of Prince William Sound were conducted during the reporting period (table 1), and all 12 standard stations (fig.1) were occupied. All CTD data has been processed, and seasonally detrended anomalies of temperature and salinity at selected depths in central PWS are shown in fig. 2 and 3. In central PWS, temperatures were generally above average in 2014, with the largest anomalies at depth (~100 m); the anomalies were fairly large, but not record-setting like the anomalies observed in the Gulf of Alaska this year (see Hopcroft and Weingartner reports). Salinity in central PWS was above average in the first half of 2014, but consistently lower than average for the latter part of the year, presumably reflecting a warmer than average summer throughout Alaska.

Plankton, nutrient, and chlorophyll-a samples were collected from all stations with no incidents. As of January 2014 All plankton samples have been enumerated from this project (Lower Cook Inlet samples will be done in Q1 of 2015), and all chlorophyll-a filters have been run (chlorophyll analysis is done immediately after each cruise to minimize storage artefacts). Analysis of the nutrient samples continues to lag behind expectations – protocols for capillary electrophoretic (CE) analysis of macronutrients were in development by a chemistry technician at PWSSC for much of 2014, with limited success. All nutrient samples are being kept in frozen storage, and are stable indefinitely (they are 0.2  $\mu\text{m}$  filtered prior to freezing). Catching up on the backlog is a priority, and given the lack of progress with the CE methodology, we began working through the backlog using standard wet-chemical techniques in Q3 of 2014. A proposal for the purchase of an automated nutrient analyzer is in progress, and a technician is expected to be hired in 2015 to assist with working through the backlog.

Spring deployment of the AMP profiling mooring was delayed somewhat by delays in the delivery of new syntactic foam insulation, and a new 1.5 kW battery from Bluefin Robotics (a software malfunction in 2013 completely discharged the battery and destroyed the cells); the mooring was deployed on April

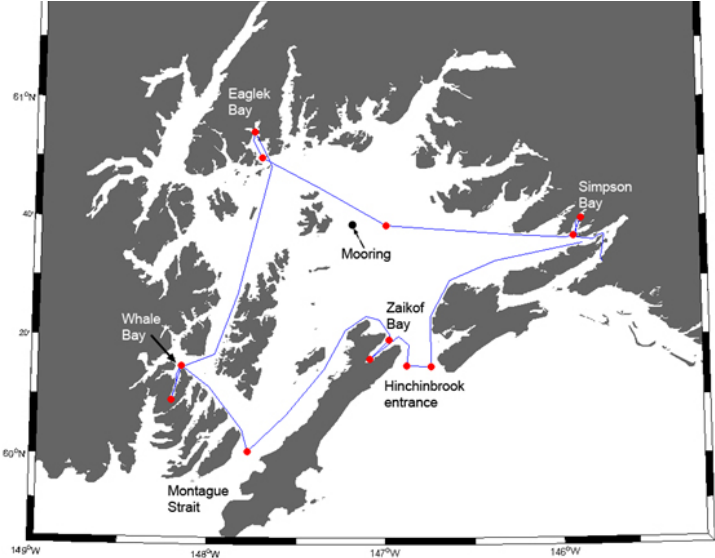
21. Following a number of very slow casts followed by a winch malfunction, the mooring was serviced on April 30<sup>th</sup> to adjust ballast and to provide more buoyancy. The system was in place for most of May and June, conducting daily casts from ~60 m to the surface. The last cast was done June 24<sup>th</sup>, after which the system was disabled by corrosion in a faulty bulkhead connector that severed the power connection. The mooring was retrieved, and the controller housing was sent back to the manufacturer in July to be repaired. It is currently operational.

The daily profiles show the setup of the seasonal thermocline as surface heating was mixed downward by wind mixing events (fig. 4). Profiles of chlorophyll-a (fig. 5) and nitrate (fig. 6) however show that the main bloom had already occurred by late April (low chlorophyll and low surface nitrate). Examination of the MODIS surface chlorophyll-a record suggests that the bloom in the central sound was very early in 2014, starting in late March and into April (fig. 7); prior observations of the bloom (e.g. Eslinger et al 2001, Fish. Oceanogr. 10[suppl. 1] :81-96) have observed it occurring well into April. The AMP system did capture several smaller productivity events that corresponded to wind mixing events in June that were visible in both the chlorophyll-a and nitrate profiles (and the satellite record). It is planned to deploy the AMP system much earlier in 2015 (mid March) to try to better capture the spring bloom.

**Table 1: Status of project milestones for FY14.**

<b>Deliverable/Milestone</b>	<b>Status</b>
PWS Survey, Deploy mooring	Conducted 14-15 April 2014
Mooring service	Conducted 21 April 2014
Re-deploy mooring	Conducted 30 April 2014
PWS Survey / service mooring	Conducted 15/16 May 2014
PWS Survey / service mooring	Conducted 24-25 June 2014
Retrieve mooring	Conducted 15 July 2014
PWS Survey	Conducted 19-20 August 2014
PWS Survey	Conducted 1-2 October 2014
PWS Survey	Conducted 25-26 November 2014
CTD data processed	Completed December 2014
Chlorophyll-a samples processed	Completed December 2014
Plankton samples enumerated	Completed January 2014 (this project)/ March 2015 (Doroff)

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



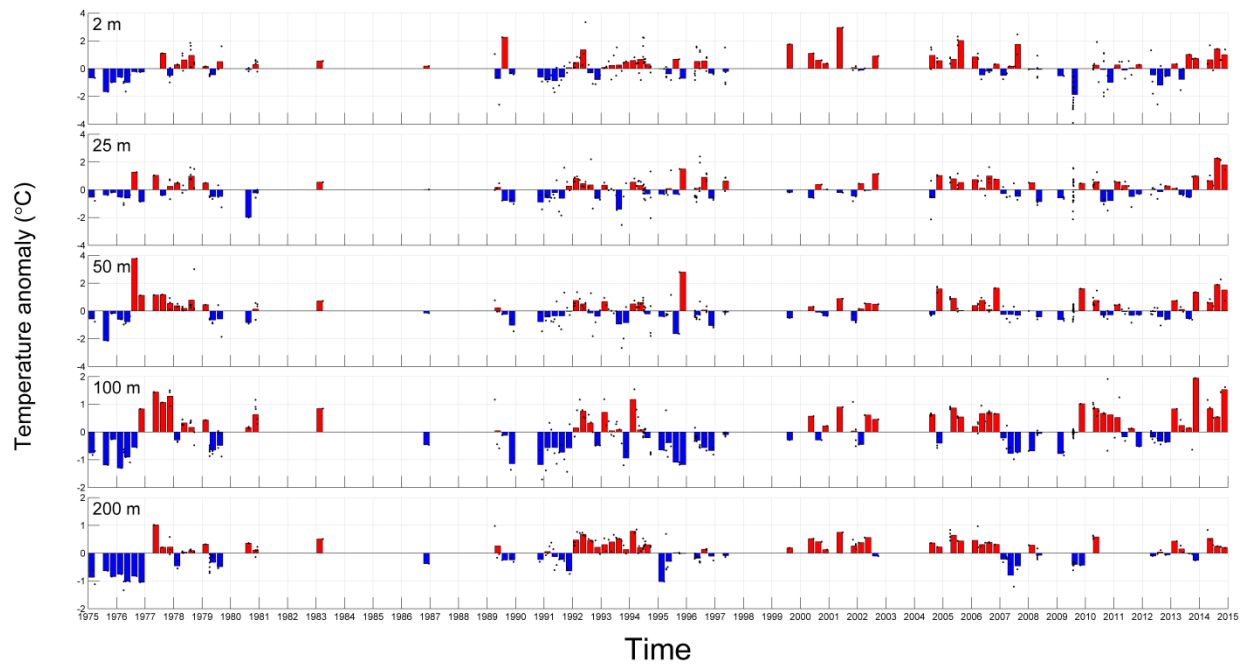


Figure 2: Temperature anomaly time series at selected depths in central Prince William Sound. Anomalies were calculated as the residual from a second order cosine fit to Julian day (for all years data) and thus represent seasonally detrended values. Vertical bars indicate quarterly average anomalies, and black dots represent individual observations.

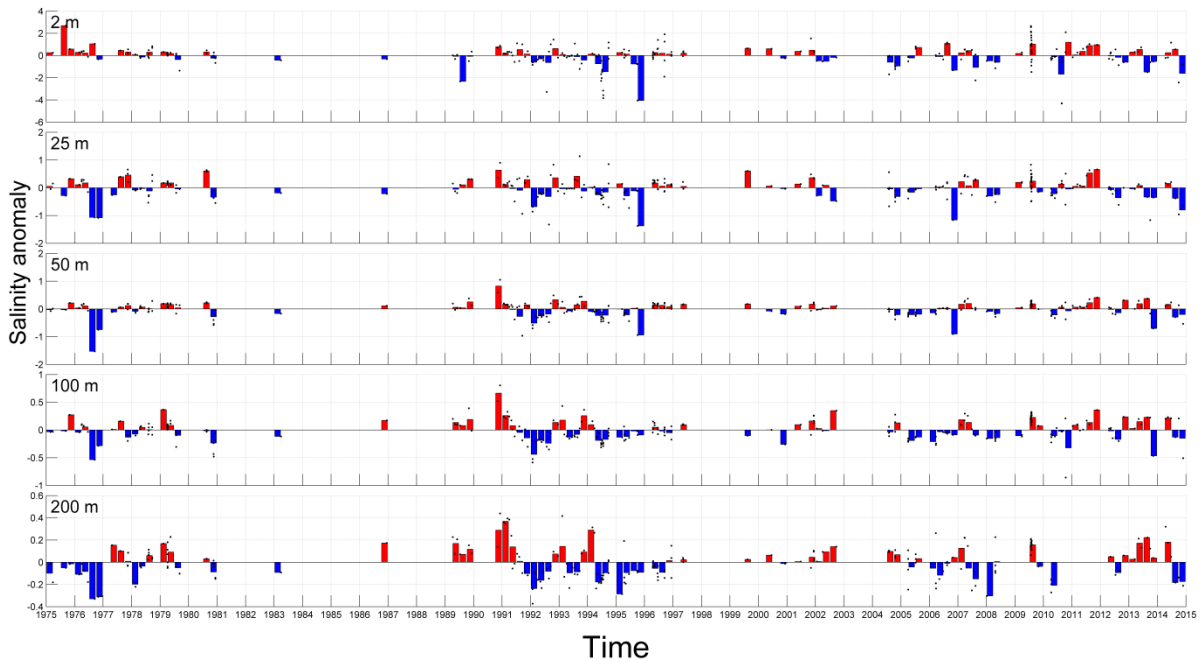


Figure 3: Salinity anomaly time series at selected depths in central Prince William Sound. Anomalies were calculated as described in fig. 2.

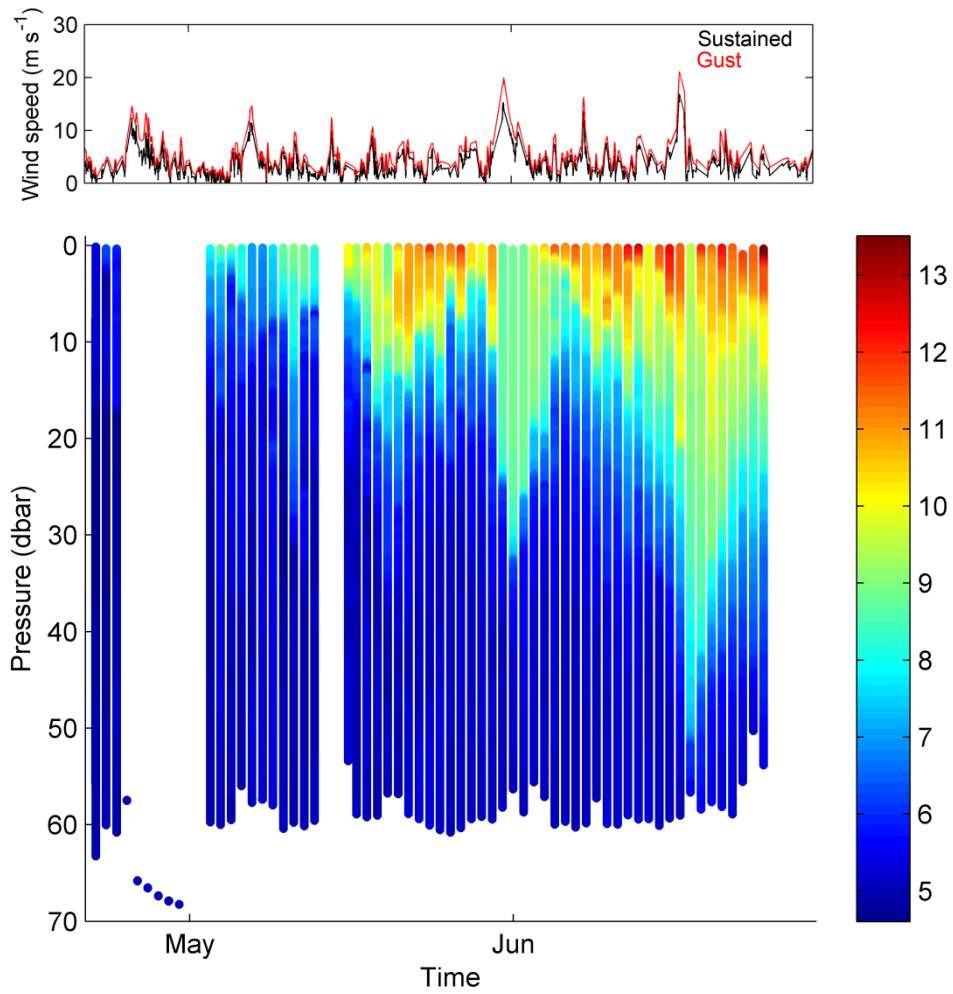
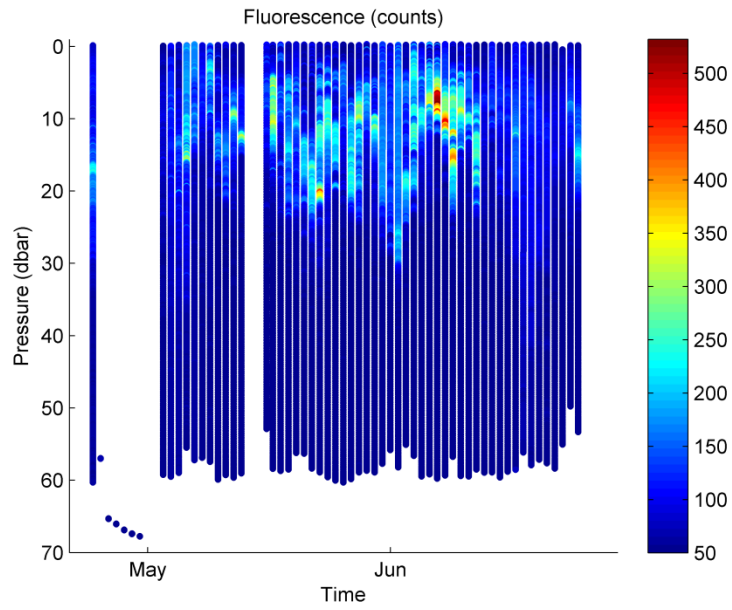
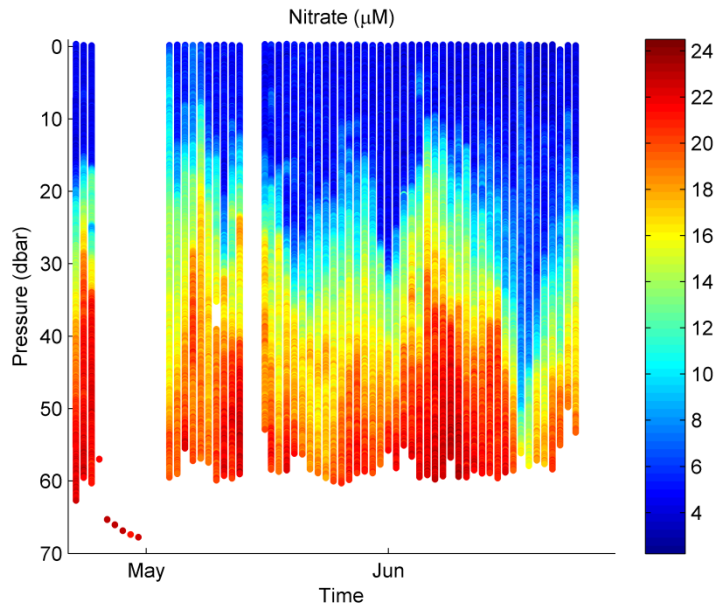


Figure 4: Top panel: Sustained (black) and gust (red) wind speeds at NDBC buoy 46060 in central PWS, 2014. Bottom Panel: Temperature profiles conducted by the AMP system during the same period. Each colored dot corresponds to the temperature scale to the right, no smoothing or interpolation was done.



**Figure 5: Fluorescence profiles at the AMP site (same axes as fig. 4). Fluorescence is given in digital counts, which are linearly proportional to chlorophyll concentration.**



**Figure 6: Profiles of nitrate concentration ( $\mu\text{M}$ ) at the AMP site (same axes as fig. 4 and 5).**

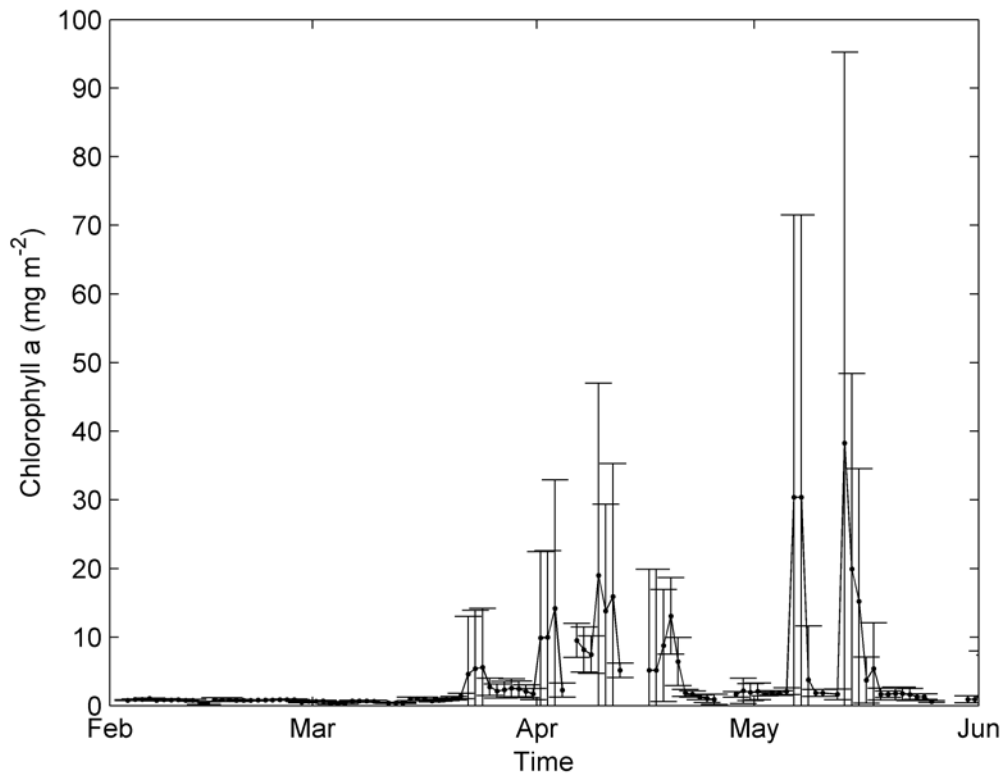


Figure 7: Surface chlorophyll time series in central Prince William Sound, spring 2014. Three day MODIS Aqua composite chl-a products were downloaded from the NOAA Coastwatch West Coast Regional Node (see [http://coastwatch.pfeg.noaa.gov/infog/MB\\_chla\\_las.html](http://coastwatch.pfeg.noaa.gov/infog/MB_chla_las.html) for more information). Data were subsetted to a square grid in central Prince William Sound ( $147^{\circ} 16.2' \text{ W} < \text{longitude} < 147^{\circ} 40.2' \text{ W}$  and  $60^{\circ} 29.4' \text{ N} < \text{latitude} < 60^{\circ} 40.2' \text{ N}$ ), and mean (point) and standard deviations (bars) calculated for all extant pixels (i.e. ignoring cloud-obscured pixels).

**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 12120114G (“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) were collected from several locations during 2014 surveys.

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).
- Water samples were collected during several surveys to test for isotopes stemming from the 2011 Fukushima nuclear accident (project website: <http://www.ourradioactiveocean.org/>).

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

- Campbell, R.W. 2014. State of the Sound: Trends in the surface oceanography of Prince William Sound. Poster presented at Alaska Marine Science Symposium, January 2014.
- 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 2014.
- 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).

The operational protocols for this project have been revised following comments from the advisory committee and re-uploaded to the workspace.

**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 FY12 and 13 that needed to be spent down. The unspent salary is currently being drawn down and will also be 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 \$1000/year budgeted.