

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

15120114-A

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

Continuous Plankton Recorder Sampling

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

Sonia Batten and Robin Brown

**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](http://www.gulfwatchalaska.org)

Information on the whole North Pacific continuous plankton recorder (CPR) survey available at:  
<http://pices.int/projects/tcprstnp/default.aspx>

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

Six transects were sampled in 2016 as planned, the dates and status of sample processing are given in the table below. The final section of the May transect had a mechanical failure, otherwise all samples were collected successfully. Owing to the ship dry-docking in early September the sampling season was shortened and the final 3 transects were sampled quite close together. Temperature data were also collected on all transects. Sample processing and quality control (QC) review is ongoing, with all samples to the end of June finalized.

#### Impacts of the anomalous warming.

Many examples of the impacts of the anomalous warming could be given, but the figures below show firstly the very warm temperatures measured in the surface waters of the shelf in spring 2015 (Figure 1). Temperatures along the first transect in April were almost 2°C higher than other years for which we have temperature logger data. By late summer waters were still warm, although 2014 may have been warmer at this time of year. There were clear changes in the plankton resulting from this warming. As well as a change in diatom community composition towards a higher proportion of pennate diatoms, there was a very high abundance of small copepods in spring (Figure 2). Small copepods were more numerous than in any other spring that we have sampled and their high numbers are thought to be a combination of the warmth advancing their seasonality to earlier in the year, and also favoring their productivity. They can have multiple generations in one season. In spring 2015 they made up over 90% of the zooplankton community, by numbers, which has never before been recorded in our data at this time of year. However, although numerous they are

individually smaller than many other species usually present in the spring and do not store the energy-rich lipids that larger copepods accumulate to use for over-wintering. They are therefore a less energy-dense food for predators. We would expect to see changes in productivity of higher trophic levels resulting from these changes in the plankton

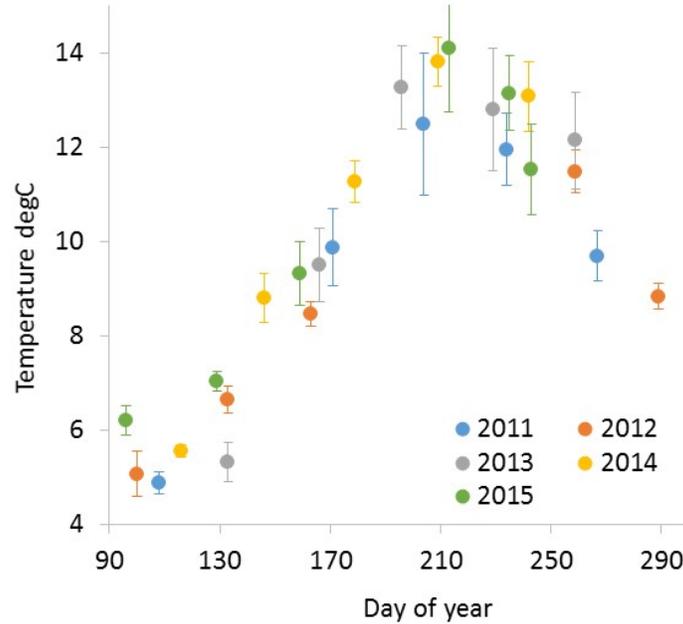


Figure 1. Mean (and standard deviation) near-surface temperature on the Alaskan shelf from loggers on the CPR for each transect sampled 2011-2015.

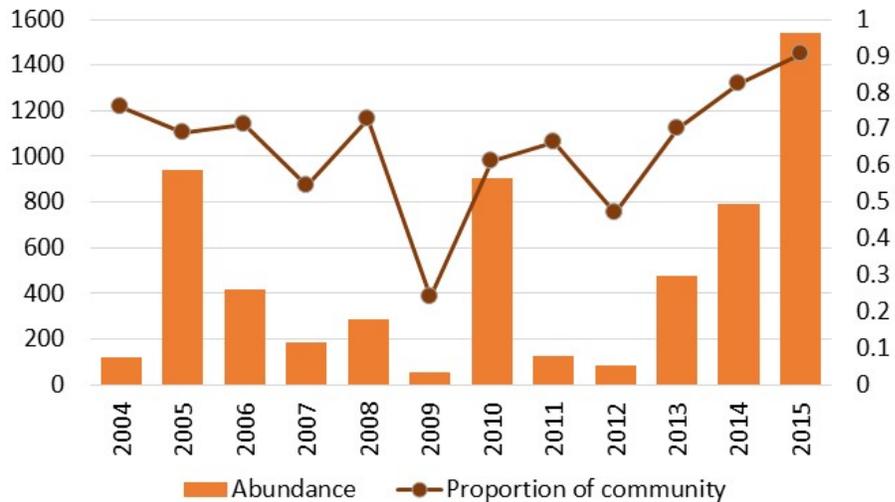


Figure 2. Mean spring (March to June) abundance (# per sample, left hand axis) of small copepods each year on the Alaskan shelf (bars) together with their contribution (as a proportion) to the total zooplankton population (line, right-hand axis).

<b>Deliverable/Milestone</b>	<b>Status</b>
Set up for start of field season, ship gear	Completed
Sample 6 transects, March to September	Completed: Transect 1: 4-6 <sup>th</sup> April Transect 2: 7-9 <sup>th</sup> May Transect 3: 6-8 <sup>th</sup> June Transect 4: 30 <sup>th</sup> July-1 <sup>st</sup> Aug Transect 5: 20-23 <sup>rd</sup> Aug Transect 6: 30 <sup>th</sup> Aug-1 <sup>st</sup> Sept
Process samples	All samples to June have been finalized and QC'd. Provisional data available for July-September samples.

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

During 2015 we collaborated with researchers from the Herring Research and Monitoring Program to write up the study on plankton indices and first year herring growth. At the time of completing this report we have submitted a revised manuscript addressing minor review comments and we expect it to be accepted for publication in Fisheries Oceanography very soon. Details of the publication are given below.

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

Publications

Batten, S.D., Moffitt, S., Pegau, W.S., and Campbell, R. Plankton indices explain interannual variability in Prince William Sound herring first year growth. Fisheries Oceanography (in review).

Conference and workshop presentations and attendance during the reporting period

Dr. Batten gave an oral presentation at the 2015 Annual North Pacific Marine Science Organization (PICES) Meeting “The effects of the anomalous warming on lower trophic levels in the NE Pacific.” Presentation is available here: <https://pices.int/publications/presentations/PICES-2015/2015-S2/S2-1200-Batten.pdf>.

Dr. Batten attended the 2<sup>nd</sup> Pacific Anomalies Workshop in January 2016 and presented a poster entitled “The effects of the anomalous warming on lower trophic levels in the NE Pacific, from Continuous Plankton Recorder sampling.”

Dr. Batten gave a talk at the January 2016 Alaska Marine Science Symposium entitled “The effects of the anomalous warming on the lower trophic levels.”

Data and/or information products developed during the reporting period

Contribution to the National Oceanic and Atmospheric Administration (NOAA) Ecosystem Considerations report, <http://access.afsc.noaa.gov/reem/ecoweb/index.cfm>.

Data sets and associated metadata have been uploaded to the Gulf Watch Alaska program's data portal:

- Finalized 2014 plankton data (2015 will be uploaded later in 2016 when all 2015 data have been finalized).
- 2015 along-transect temperature data were uploaded.

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

N/A

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

Please see provided program work book.