

ATTACHMENT B. Annual Project Report Form (Revised 11.21.19)

1. Project Number:

19120114-D

2. Project Title:

Continuous Plankton Recorder monitoring of plankton populations on the Alaskan Shelf

3. Principal Investigator(s) Names:

Sonia Batten, Marine Biological Association, UK

Robin Brown, North Pacific Marine Science Organization

4. Time Period Covered by the Report:

February 1, 2019-January 31, 2020

5. Date of Report:

March 2020

6. Project Website (if applicable):

www.gulfwatchalaska.org

7. Summary of Work Performed:

The continuous plankton recorder (CPR) was deployed on six transects as planned in 2019, monthly from April to September. All six transects were successful although in June the instrument was recovered early, on the outer shelf (Fig. 1). Location of the ship's transect continues to be consistent from month to month. At the time of writing, provisional plankton data for all months are available and the remaining samples are undergoing analysis and QC. A temperature logger recorded in situ temperature on each transect.

Although only some of the data are available at this time, preliminary analyses suggest that the plankton resemble conditions during the recent marine heatwave. The synthesis report chapter (Arimitsu et al. 2019) suggested that during the marine heatwave an absence of forage fish led to a top down effect on the plankton such that zooplankton were not grazed as greatly and so were more abundant. In turn they exerted a heavy grazing pressure on the diatoms which were consequently low in abundance. As Fig. 2 shows, the provisional results for 2019 suggest a similar situation to that of 2015/2016.

Other evidence showing the plankton were experiencing warm conditions in 2019 is shown in Fig. 3; Firstly, the mean size of copepods was much smaller than average (i.e., smaller species were more abundant) and secondly, the abundance of a particular

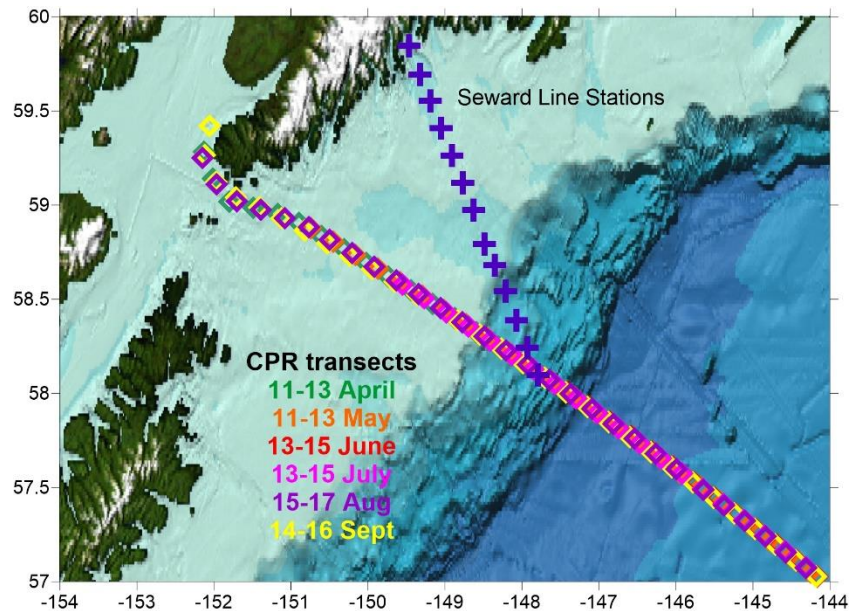


Figure 1. Location of monthly CPR transects in 2019, with the Seward Line stations also shown.

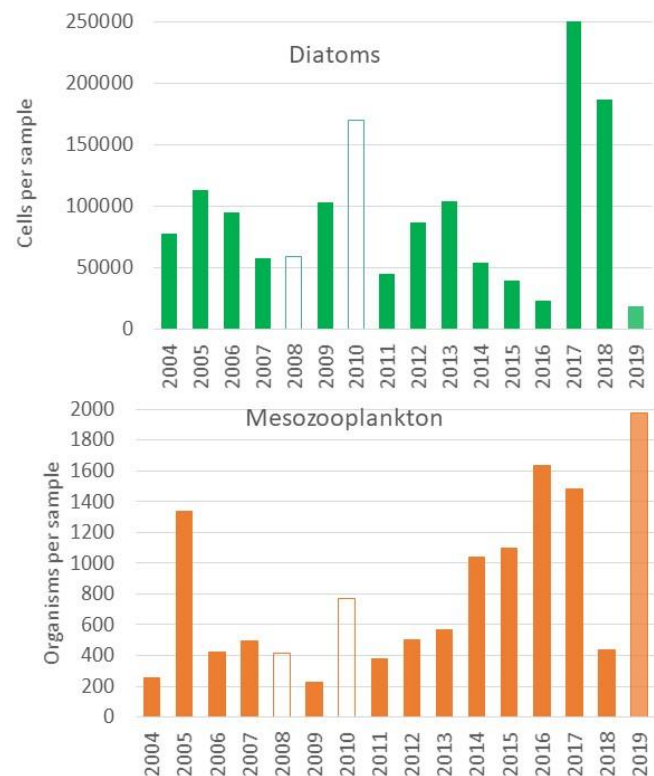


Figure 2. Mean annual diatom (top) and zooplankton (lower) abundance, Unfilled years are when sampling was sub-optimal. 2019 data are preliminary.

copepod species indicative of warmer conditions (*Calanus pacificus*) looks to be high in 2019 (Fig. 3).

In summary, these results suggest that the marine heat wave impacts continue to be felt (or are re-occurring) and are influencing the lower trophic levels. This is likely to have impacts on ecosystem functioning.

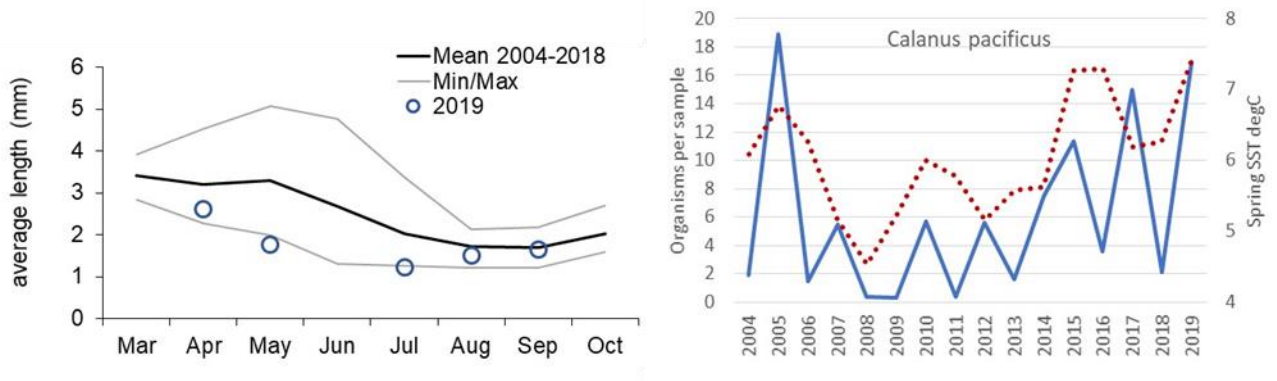


Figure 3. Left panel shows the mean monthly copepod length through 2019 (smaller than average in each month except September) and right panel shows the mean annual abundance of the warm water indicator, *Calanus pacificus*, (blue line) together with spring sea surface temperature (SST) (March to June) from the GAK1 mooring (red line).

8. Coordination/Collaboration:

A. Long-term Monitoring and Research Program Projects

1. Within the Program

This project contributed data to two chapters (Chapter 3 Synchronous collapse of forage species disrupts trophic transfer during a prolonged heatwave and Chapter 4 Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska) of the draft program synthesis report (The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska) submitted to EVOSTC and currently under review.

2. Across Programs

a. Herring Research and Monitoring

We continue to provide plankton indices as updates to Dr. Pegau (annual anomalies, incremented abundance time series). A current focus is on spring/early summer plankton abundances as a contributing factor to herring recruitment success.

b. Data Management

This project coordinates with the data management program by submitting data and preparing metadata for publication on the Gulf of Alaska Data Portal and DataONE within the timeframes required.

B. Individual Projects

Collaboration continues with groups associated with the other members of the North Pacific CPR Consortium, such as Fisheries and Oceans Canada and the North Pacific Research Board (NPRB).

C. With Trustee or Management Agencies

Contributed indicators to NOAA's Gulf of Alaska Ecosystem Status Report to the North Pacific Fisheries Management Council for 2019 (Zador et al. 2019, <https://access.afsc.noaa.gov/REFM/REEM/ecoweb/index.php>).

9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

1. Peer-reviewed Publications

Samples collected under this project were used in stable isotope studies which resulted in the following publication:

Espinasse, B., Hunt, B.P.V., Batten, S.D., and Pakhomov, E. 2019. Defining isoscapes in the Northeast Pacific as an index of ocean productivity. *Global Ecology and Biogeography*. DOI: 10.1111/geb.13022.

2. Reports

Arimitsu, M., J. Piatt, R.M. Suryan, S. Batten, M.A. Bishop, R.W. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R.R. Hopcroft, K.J. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, R.S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. 2019. Chapter 3 Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. In M.R. Suryan, M.R. Lindeberg, and D.R. Aderhold, eds. *The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska*. Gulf Watch Alaska Long-Term Monitoring Program Draft Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Batten, S. 2019. Continuous Plankton Recorder monitoring of plankton populations on the Alaskan Shelf. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-D. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Batten, S. 2019. Continuous Plankton Recorder data from the Northeast Pacific, 2000-2018. In Zador, S., E. Yasumiishi, and G.A. Whitehouse, editors. *Ecosystem Status Report 2019 Gulf of Alaska*. North Pacific Fishery Management Council, Anchorage, AK.

Suryan, R.M., M. Arimitsu, H. Coletti, R.R. Hopcroft, M.R. Lindeberg, S. Batten, M.A. Bishop, R. Brenner, R. Campbell, D. Cushing, S. Danielson, D. Esler, T. Gelatt, S. Hatch, S. Haught, K. Holderied, K. Iken, D. Irons, D. Kimmel, B. Konar, K. Kuletz, B. Laurel,

J.M. Maniscalco, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, S. Pegau, J. Piatt, L. Rogers, A. Schaefer, J. Straley, K. Seeney, M. Szymkowiak, B. Weitzman, J. Bodkin, and S. Zador. 2019. Chapter 4 Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska. In M.R. Suryan, M.R. Lindeberg, and D.R. Aderhold, eds. *The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska*. Gulf Watch Alaska Long-Term Monitoring Program Draft Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

3. Popular articles

Batten, S., S. Chiba, and W. Sydeman. 2020. Two decades of the North Pacific CPR program. *PICES Press* 18:18-21.

Fisher, J., D. Kimmel, T. Ross, S. Batten, E. Bjorkstedt, M. Galbraith, K. Jacobson, J. Keister, A. Sastri, K. Suchy, S. Zeman, and I. Perry. 2020. Copepod responses to, and recovery from, the recent marine heatwave in the Northeast Pacific. *PICES Press* 18:68-71.

Suryan, R., S. Batten, R. Campbell, and S. Danielson. 2019. What does the future hold for the Gulf of Alaska? *Delta Sound Connections* 2019-2020. https://pwssc.org/wp-content/uploads/2019/05/DSC-2019_WEB.pdf

B. Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

1. Conferences and Workshops

Batten, S.D. et al. 2019. Two decades of the North Pacific CPR Survey. Poster presentation, OceanObs19, Honolulu, HI, September.

Batten, S.D. et al. 2019. Two decades of the North Pacific CPR Survey. Poster presentation, PICES Annual meeting, Victoria, BC, October.

Batten, S.D., A.W. Walne, and P. Hélaouët. 2019. Impact of the Marine Heat Wave on Gulf of Alaska plankton communities. Invited speaker, PICES Annual meeting, Victoria, BC, October.

Batten, S.D. et al. 2020. Two decades of the North Pacific CPR Survey. Poster presentation, Alaska Marine Science Symposium, Anchorage, AK, January.

2. Public presentations

No new contributions for this reporting period.

C. Data and/or Information Products Developed During the Reporting Period, if Applicable

No new contributions for this reporting period.

D. Data Sets and Associated Metadata that have been Uploaded to the Program’s Data Portal

All Data and metadata from 2018 surveys (plankton counts and physical data) have been uploaded to the Research Workspace and made available on the Gulf of Alaska data portal (<https://portal.aos.org/gulf-of-alaska#metadata/87f56b09-2c7d-4373-944e-94de748b6d4b/project/files>).

10. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comment (FY20): *This project continues to do very good work. We appreciate the leveraged funding and continued collaboration with other EVOSTC projects and continues to produce important scientific publications. We again note the comparison of physical processes with herring in the GOA (2016 paper) which provides a good example of what analyses and synthesis can be achieved with these types of higher trophic data.*

PI Response (FY20): Thank you for your comments.

Science Panel Comment: *The Science Panel would like to note that the PI’s 2016 Fisheries Oceanography paper is a great example on how to present synthesis of data across trophic levels. The PI presented and discussed the preliminary results well. This project continues to produce valuable data and the Science Panel appreciates that this project has a diversity of other funding sources.*

PI Response: Thank you for your comments.

11. Budget:

Please see provided program workbook. There are no deviations from anticipated cumulative spending.

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	\$35.82	\$36.89	\$38.00	\$39.1	\$40.3	\$190.2	\$110.7
Travel	\$1.11	\$1.15	\$1.18	\$1.22	\$1.25	\$5.9	\$3.4
Contractual	\$9.97	\$10.26	\$10.57	\$10.89	\$11.22	\$52.9	\$30.8
Commodities	\$3.24	\$3.34	\$3.44	\$3.5	\$3.65	\$17.2	\$10.0
Equipment	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Indirect Costs (40%)	\$ 20	\$ 21	\$ 21	\$ 22	\$ 23	\$106.5	\$62.0
SUBTOTAL	\$70.2	\$72.3	\$74.5	\$76.7	\$79.0	\$372.7	\$217.0
General Administration (9% of subtotal)	\$6.3	\$6.5	\$6.7	\$6.9	\$7.1	\$33.5	N/A
PROJECT TOTAL	\$76.5	\$78.8	\$81.2	\$83.6	\$86.1	\$406.2	
Other Resources (Cost Share Funds)	\$183.7	\$183.9	\$186.3	\$188.3	\$190.3	\$932.5	

LITERATURE CITED

- Arimitsu, M., J. Piatt, R.M. Suryan, S. Batten, M.A. Bishop, R.W. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R.R. Hopcroft, K.J. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, R.S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. 2019. Chapter 3 Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. In M.R. Suryan, M.R. Lindeberg, and D.R. Aderhold, eds. *The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska*. Gulf Watch Alaska Long-Term Monitoring Program Draft Synthesis Report (*Exxon Valdez* Oil Spill Trustee Council Program 19120114). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Zador, S., E. Yasumiishi, and G.A. Whitehouse. 2019. Ecosystem Status Report 2019 Gulf of Alaska. North Pacific Fishery Management Council, Anchorage, AK.