ATTACHMENT C **EVOSTC Annual Project Report Form**

Form Rev. 8.30.18

1. Program Number:

18120114-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, 2018-January 31, 2019

5. Date of Report:

April 1, 2019

6. Project Website (if applicable):

www.gulfwatchalaska.org

7. Summary of Work Performed:

The Continuous Plankton Recorder (CPR) was deployed on six transects during 2018, between April and October (Table 1). Environmental data (temperature, salinity and chlorophyll a fluorescence) were collected on the first four of these transects via the CTD-F (Conductivity, Temperature, Depth, Fluorescence) attached to the CPR. Unfortunately, on the August transect the CPR was lost while deployed from the ship in transit, together with the attached CTD-F. We do not know the reason, but an impact with submerged debris is the most likely cause. While a replacement CPR was sent out from the Marine Biological Association to finish the plankton sampling field season there is no spare CTD-F. A temperature logger was loaned to us for the final two transects and provided a record of temperature.

Table 1. CPR sampling in 2018.

Sampling Dates	Environmental data collected?	Status of Sample Analysis
14-16 April	Yes: T, S and Chl a	Undergoing final QC.
17-19 May	Yes: T, S and Chl a	Undergoing final QC.
16-18 June.	Yes: T, S and Chl a	Undergoing final QC.
19-21 July	Yes: T, S and Chl a	Provisional data available.
August	No	Equipment lost
24-26 Sept	Yes: T	Provisional data available.
20-22 Oct	Yes: T	Provisional data available.

Analysis during the last year has focused on investigating the impacts of the marine heat wave of 2014-2016 on the lower trophic levels and assessing whether 2017 (and eventually 2018 once the data are finalized) changed to more typical plankton communities. For example, bulk metrics of phytoplankton and zooplankton abundance show that the years 2014 to 2016 had very low numbers of large diatoms but high numbers of zooplankton (Fig. 1). This could be the result of top down impacts with the abundant zooplankton consuming the diatoms, however, in 2017 large diatoms were very numerous and zooplankton were still abundant. Instead it suggests that the larger diatoms did poorly in the heatwave years while zooplankton as a combined group, did well.

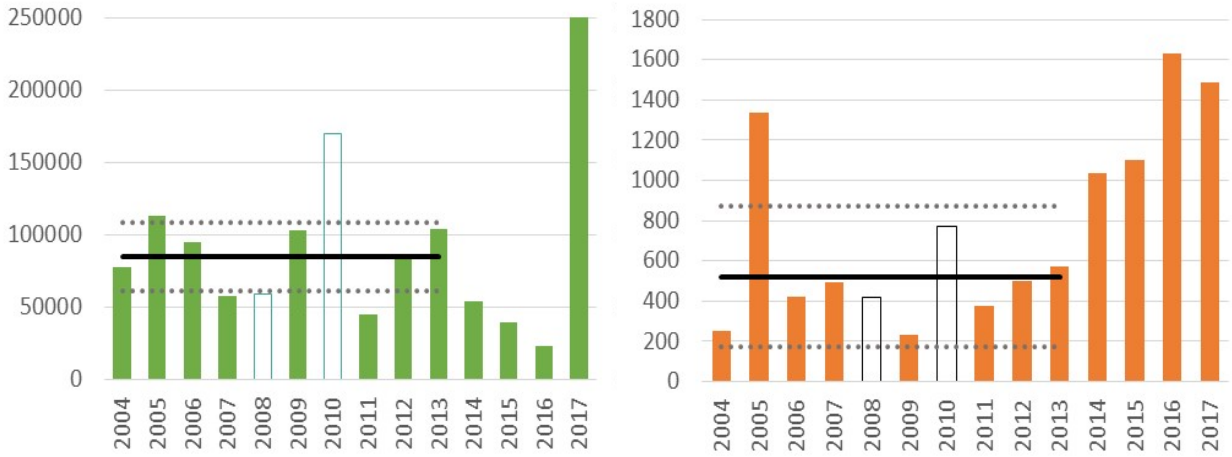

Figure 1. Total diatom abundance (left, cells per sample in green) and total zooplankton abundance (right, organisms per sample in orange) for CPR samples collected on the shelf outside Cook Inlet and in lower Cook Inlet. The solid line in each case is the mean of the years before the heat wave (2004-2013) and the dashed lines are 1 standard deviation from this mean. Unfilled bars are years when sampling was reduced.

To investigate the changes in the communities at the level of individual taxa, we calculated Community Temperature Indices (CTI, e.g., Devictor et al. 2008) for phytoplankton and zooplankton. This approach utilizes abundance data for each individual taxon and the in situ temperature from the physical data collected via instruments attached to the CPR to first calculate a Species Temperature Index for each taxon. Then, to assess how communities shift over time, the CTI is calculated for each sample and averaged for the year. The results are shown below (Fig. 2). The relationship with sea surface temperature (SST) demonstrates a shift to communities comprising organisms that live in warmer waters when SST is higher, although for phytoplankton this is only significant if 2015 is excluded (note that because the abundance of phytoplankton was very low in 2015 and 2016, this index may not be as sensitive here since many taxa were simply not present). What is noticeable, however, is that while there is a clear shift towards warmer communities the heatwave years of 2014-2016 were not noticeably different from the preceding warm period in 2004-05.

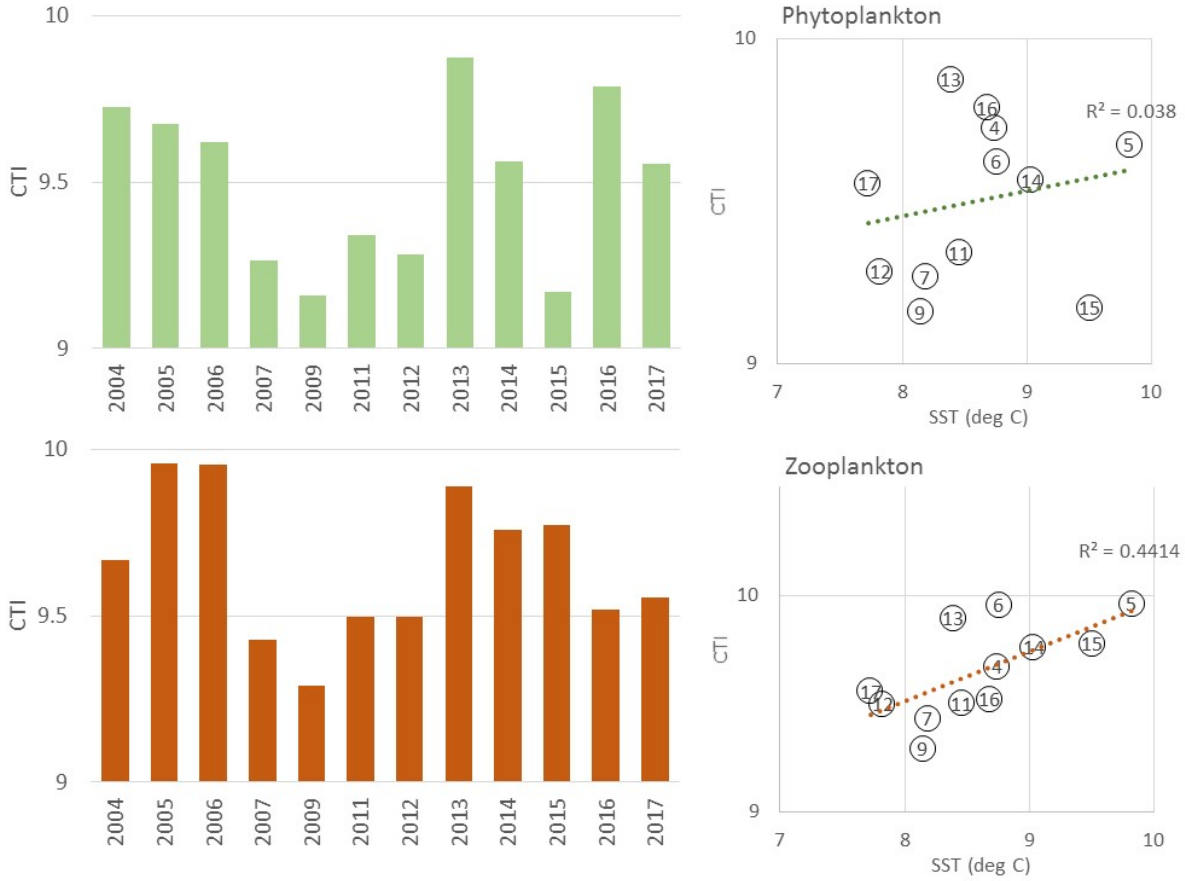

Figure 2. Annual mean Community Temperature Index for phytoplankton (top) and zooplankton (lower) on the left together with the relationship between these values and the mean annual SST from the GAK1 dataset (right) with years shown in the center of each symbol.

The results for 2017 suggest that plankton are not yet typical in terms of abundance, although the CTI values are now in the middle of the range seen. This work will be written up for publication once the 2018 data are finalized.

8. Coordination/Collaboration:

A. Projects Within a Trustee Council-funded program

1. Within the Program

Data contributions have been made, and are ongoing, to Gulf Watch Alaska cross-program synthesis manuscripts led by Arimitsu (18120114-C) and Suryan (18120114-A).

2. Across Programs

a. Herring Research and Monitoring

None.

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.

c. Lingering Oil

None.

B. Projects not Within a Trustee Council-funded program

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).

Batten contributed a presentation to, and participated in, the Ocean Sciences 2018 workshop "To unpathed waters, undreamed shores: Current and future marine research in the Gulf of Alaska" initiated by the NPRB and led by O. Ormseth (NOAA).

C. With Trustee or Management Agencies

Contributed three indicators to NOAA's Gulf of Alaska Ecosystem Status Report to the North Pacific Fisheries Management Council (Zador and Yasumiishi 2018).

9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

Batten, S.D., Raitsos, D.E., Danielson, S., Hopcroft, R.R., Coyle, K. and McQuatters-Gollop, A. 2018. Interannual variability in lower trophic levels on the Alaskan Shelf. Deep Sea Research II. 147, 58-68.

Batten, S.D. 2018. Continuous plankton recorder data from the northeast Pacific through 2017 *in* Zador, S. G., and E. M. Yasumiishi. 2018. Ecosystem Status Report 2018: Gulf of Alaska. Report to the North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99301. https://www.fisheries.noaa.gov/resource/data/2018-status-gulf-alaska-ecosystem

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

Batten, S.D. 2018. Lower Trophic Level Variability Across the Subarctic North Pacific, From Continuous Plankton Recorder Sampling. Oral presentation, RS41A-04, Ocean Sciences February 2018, Portland, Oregon.

Batten, S.D, Walne, A., and Helaouet, P. 2019. Impact of the marine heat wave on Gulf of Alaska plankton communities. Has normal service now been resumed? Oral presentation, Alaska Marine Science Symposium, January 2019, Anchorage, Alaska.

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

None

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

All Data and metadata from 2017 surveys (plankton counts and CTD-F physical data) have been uploaded to the Research Workspace and made available on the Gulf of Alaska data portal.

10. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comments (EVOSTC FY18 Work Plan): The EVOSTC Science Review Panel had no project specific comments.

11. Budget:

No deviations in budget. Please see budget spreadsheet.

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	$72.7
Travel	$1.11	$1.15	$1.18	$1.22	$1.25	$5.9	$2.3
Contractual	$9.97	$10.26	$10.57	$10.89	$11.22	$52.9	$20.2
Commodities	$3.24	$3.34	$3.44	$3.5	$3.65	$17.2	$6.6
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	$40.7
SUBTOTAL	$70.2	$72.3	$74.5	$76.7	$79.0	$372.7	$142.5
General Administration (9% of	$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

Devictor, V., Julliard, R., Couvet, D. & Jiguet, F. (2008). Birds are tracking climate warming, but not fast enough. Proceedings. Biological sciences / The Royal Society. 275. 2743-8. 10.1098/rspb.2008.0878.

Zador, S. G., and E. M. Yasumiishi. 2018. Ecosystem Status Report 2018: Gulf of Alaska. Report, North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99301. https://www.fisheries.noaa.gov/resource/data/2018-status-gulf-alaska-ecosystem