

**EVOSTC FY17-FY21 INVITATION FOR PROPOSALS
FY20 (YEAR 9) CONTINUING PROJECT PROPOSAL SUMMARY PAGE**

Project Number and Title

Gulf Watch Alaska: Environmental Drivers Component Project

20120114-G—Long-term monitoring of oceanographic conditions in Prince William Sound

Primary Investigator(s) and Affiliation(s)

Robert W. Campbell, Prince William Sound Science Center

Date Proposal Submitted

August 16, 2019

Project Abstract

This project will continue physical and biological measurements to assess trends in the marine environment and bottom-up impacts on the marine ecosystem of Prince William Sound (PWS). Regular (~6 per year) vessel-based surveys of PWS will be conducted to maintain ongoing time series observations of physical (temperature, salinity, turbidity), biogeochemical (nitrate, phosphate, silicate, dissolved oxygen), and biological (chlorophyll-a concentration, zooplankton abundance and composition) parameters in several parts of PWS. Sampling sites include central PWS, the entrances (Hinchinbrook Entrance and Montague Strait), and four priority bays that were part of the *Exxon Valdez* Oil Spill Trustee Council-funded Sound Ecosystem Assessment project in the 1990s and the ongoing Herring Research and Monitoring project.

Additionally, an autonomous profiling mooring will be deployed in central PWS to provide high frequency (twice daily) depth-specific measurements of the surface layer that will be telemetered out in near real-time. The profiler will include measurements that complement the survey activities (temperature, salinity, oxygen, nitrate, chlorophyll-a, turbidity). An *in situ* plankton camera was recently developed for the profiler and will be used to enumerate zooplankton, large phytoplankton and other particles, with some taxonomic discrimination.

Spring and early summer observations in PWS indicate the timing of the spring bloom was near the climatological average and is continuing a trend towards lower productivity over time. Surface layer water temperatures returned to above average in 2018/2019. Plankton assemblages shifted towards warm water taxa following the 2014-2015 marine heat wave, but cool water taxa became more common in 2018. We are not proposing any major changes to this project for FY20.

EVOSTC Funding Requested* (must include 9% GA)

FY17	FY18	FY19	FY20	FY21	TOTAL
\$218,700	\$223,400	\$228,300	\$233,300	\$238,500	\$1,142,300

Non-EVOSTC Funds to be used, please include source and amount per source: (see Section 6C for details)

FY17	FY18	FY19	FY20	FY21	TOTAL
\$300,000	\$300,000	\$275,000	\$275,000	\$275,000	\$1,425,000

1. PROJECT EXECUTIVE SUMMARY

The Environmental Drivers component of the Gulf Watch Alaska (GWA) program provides the spatial and temporal context for understanding change in the physical and chemical environment. Abiotic environmental changes will mediate lower trophic level (phytoplankton and zooplankton) productivity changes and subsequently propagate to mid and upper trophic level consumers. As in the first 5 years of GWA, this observation network consists of five interconnected projects distributed across the spill-impacted Gulf of Alaska (GOA). The focus of this project is oceanographic surveys of Prince William Sound (PWS) bays and entrances that builds upon 4 decades of prior work.

Within PWS, variations in annual productivity have been posited to vary with changes in upwelling/downwelling and the track of the Alaska Coastal Current (ACC; the River-Lake hypothesis of Cooney 2001a). Some support was found for the hypothesis for some years (1981-1991), but not in others (Eslinger et al. 2001). The hypothesis has not been revisited since 2001. In the greater GOA, it has been suggested that salmon returns are mechanistically linked to zooplankton and phytoplankton productivity via large scale atmospheric and oceanographic processes (the Optimal Stability Window hypothesis of Gargett 1997). It has been suggested that retrospective data are lacking to test the hypothesis, but that long time series of hydrographic profiles and biological observations are one way to move forward (Gargett et al. 1998). Additional hypotheses include assessing the role of turbidity. The southern coast of Alaska is currently losing ice mass at some of the highest rates on earth (Jacob et al. 2012), which may be accompanied by increases in surface layer turbidity, which could then retard phytoplankton growth rates. Similarly, increases in freshwater inputs can be expected to have an impact on the timing of springtime stability, and the depth of the annual mixed layer where productivity occurs.

The goal of this project is to continue the time series of oceanographic observations in PWS that began in 2009 under the GWA program and to continue to put that new data into context with a 45-year conductivity-temperature-depth (CTD) database that was assembled during the first five years of GWA (Campbell 2018; Fig. 1). These data will be used to observe and describe how the region changes in response to the 2013-2016 marine heat wave (aka “the Blob”) over the next few years, and to begin to address the many hypotheses for the mechanisms that are driving productivity in the region. In addition to more traditional vessel-based surveys to assess spatial variability of environmental drivers, a state-of-the-art autonomous profiling mooring will be used to observe the annual cycle of physical, biogeochemical, and biological metrics in central PWS at very high frequency.

During the first 5 years of this project (16120114-E), we conducted an exhaustive effort to compile all historical CTD casts in the region (Campbell 2018). That database has been continually combined with the data collected by the GWA program and contains 23,914 unique profiles dating back to 1974 (Fig. 1). Analysis of the anomalies in temperature shows a warming trend over the last 45 years at most depths (Fig. 2). The temperature trend at the surface is flat, presumably due to enhanced inputs of cold meltwater at the surface along the margin of the GOA (Campbell 2018).

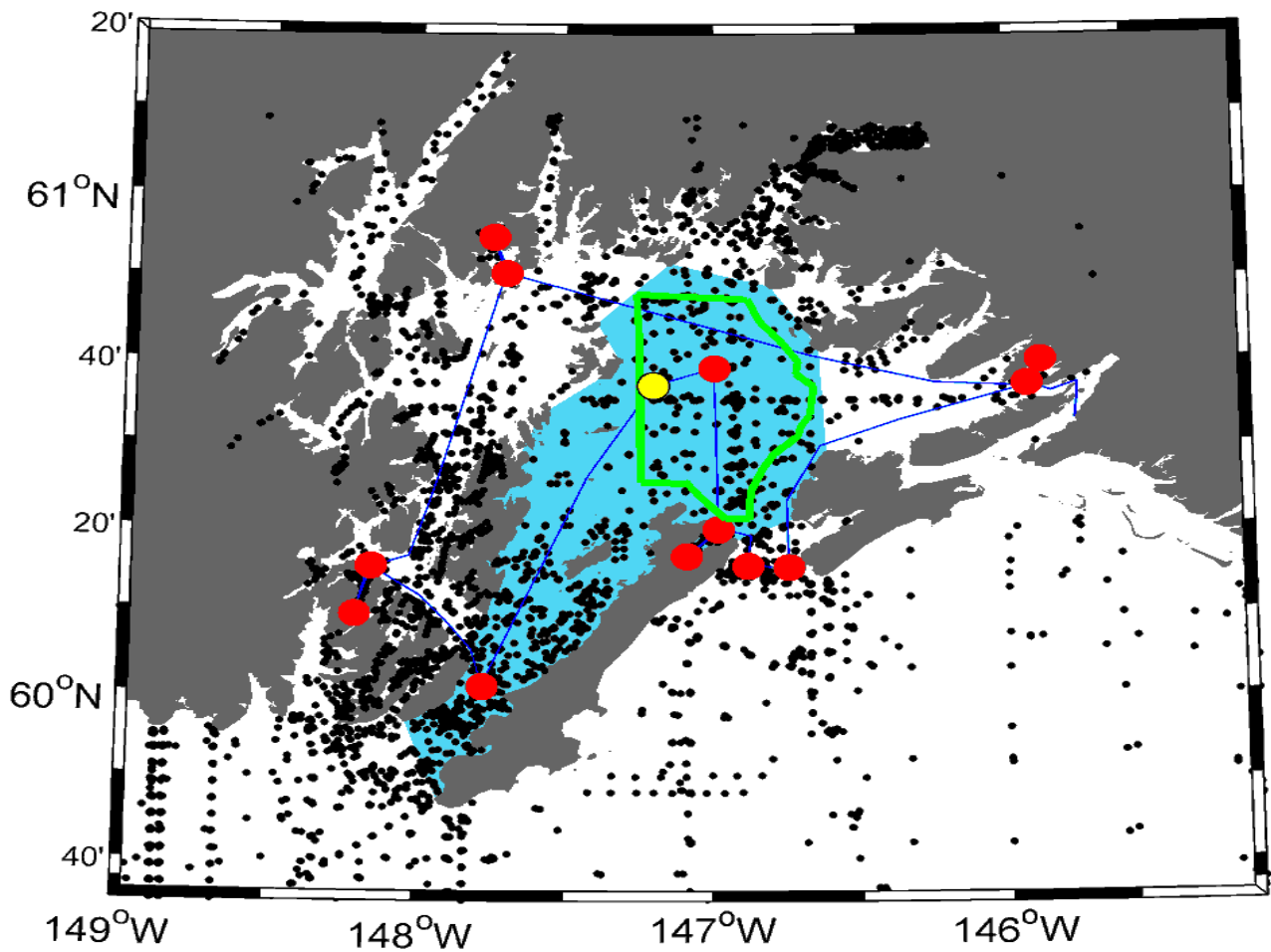


Figure 1. Prince William Sound. Black dots indicate the position of CTD casts done from 1974-2019. Red dots indicate the stations visited during vessel surveys (this study), and the blue line indicates the standard vessel track. The yellow dot indicates the position of the autonomous profiling mooring. The blue area is the “central PWS” region and was the area used to determine anomalies (see Fig. 2). The green polygon is the area within which MODIS/seaWiFS chlorophyll data were averaged.

In late 2013, temperature anomalies shifted to primarily positive (Fig. 2), like those observed throughout the GOA (Bond et al. 2015). Anomalies within PWS in 2015 were as much as 2 °C above average (4° above average at the profiler site), which appears to have caused numerous changes in the marine ecosystem including observations of rare southern species; mortality events in birds, mammals and starfish; and larger than average blooms of toxin producing phytoplankton. Temperature trends in 2017 suggested a return to temperatures near the long-term average, but anomalies in 2018 and 2019 were again primarily positive (Fig. 2).

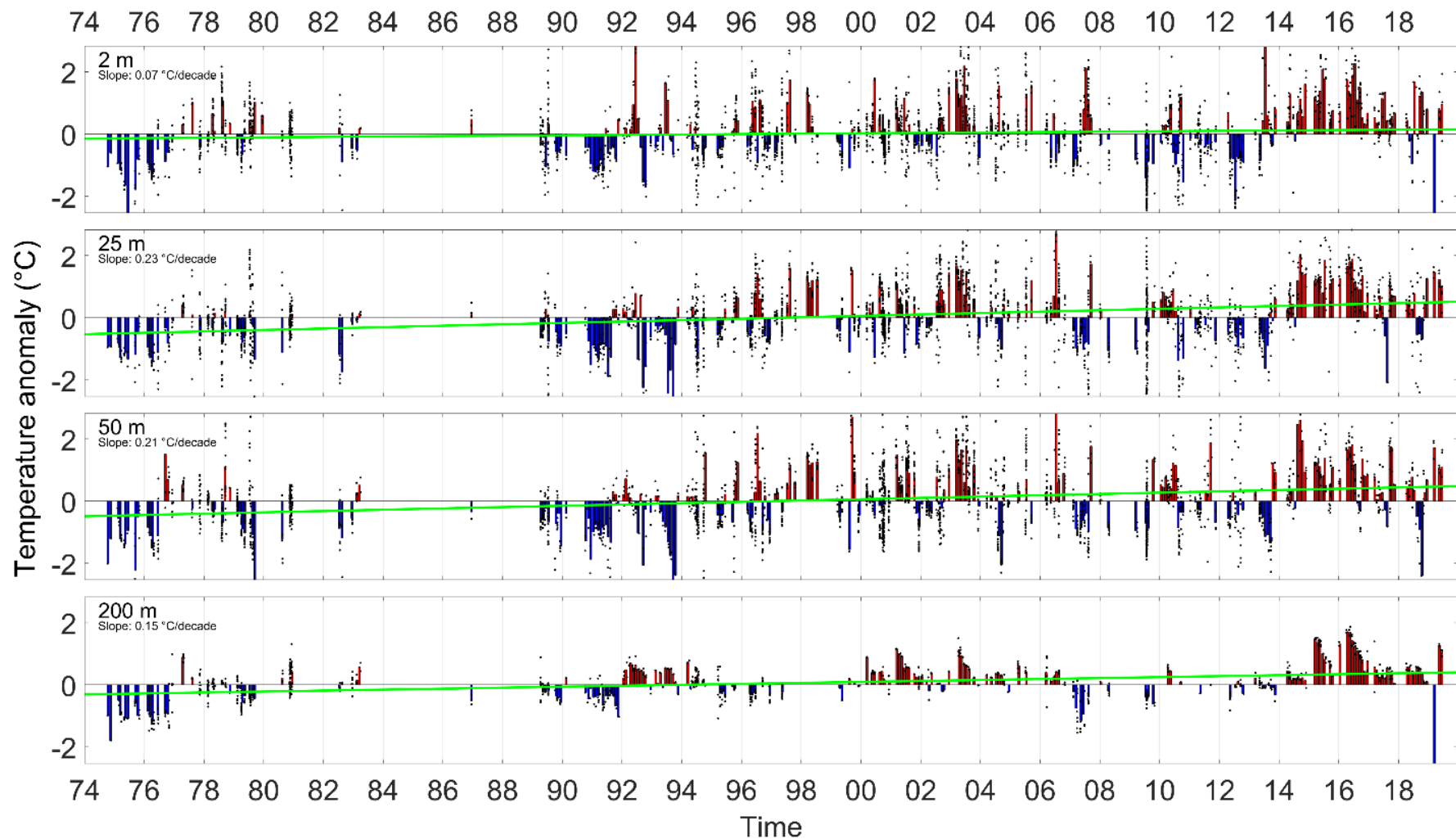


Figure 2. Temperature anomalies at four selected depths in central PWS (the blue-shaded area in Fig. 1). Anomalies were calculated as the residual to a second order cosine curve fit to all years data (to remove seasonality: Campbell 2018). Black points are observations, bars are quarterly averages, and the green line indicates the linear trend. Slopes with text in black are significantly different from zero ($p < 0.05$).

A time series of surface chlorophyll concentrations in central PWS was assembled from sea-viewing wide field-of-view sensor (seaWiFS) and moderate resolution imaging spectroradiometer (MODIS) satellite chlorophyll products (downloaded from the National Oceanic and Atmospheric Administration (NOAA) CoastWatch Program and the National Aeronautics and Space Administration's (NASA's) Goddard Space Flight Center OceanColor Web). Examination of the satellite chlorophyll records from central PWS (Fig. 3) shows that the spring phytoplankton bloom in 2014 was much earlier and stronger than average, but the spring bloom since then has been more modest. In general, the magnitude of the spring bloom has been declining over the last two decades, but there is not any indication that the timing of the bloom has changed (Fig. 4).

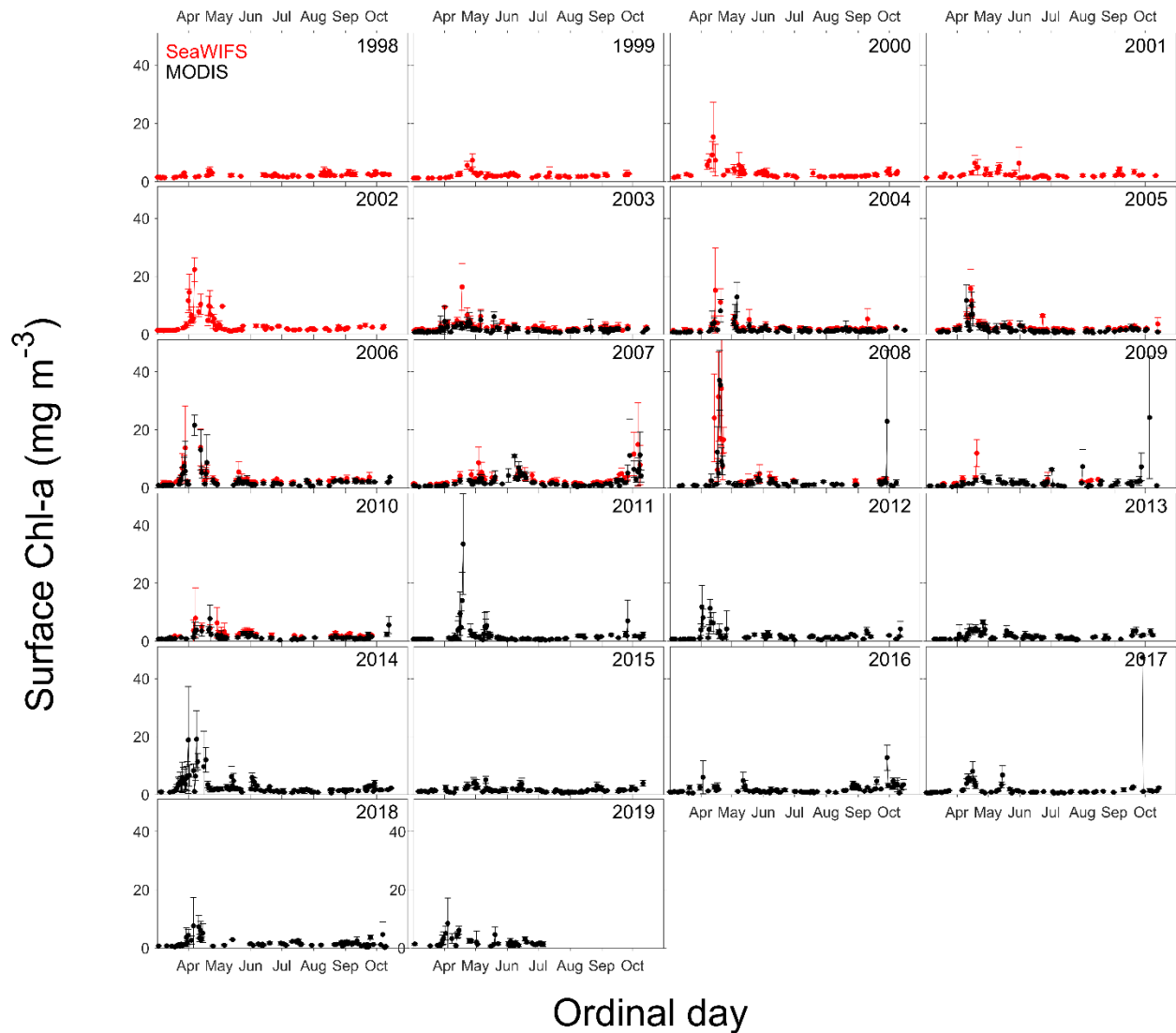


Figure 3. Surface chlorophyll-a time series in central PWS. Data are daily mean and standard deviation within non-cloud-masked pixels in central PWS (inside the green polygon in Fig. 1). The seaWiFS and MODIS data were examined for an offset between the two during years when the two time series overlapped (2003-2010). SeaWiFS chlorophyll estimates tended to be slightly lower than MODIS estimates (slope = 0.88, intercept = 0.7749) and were adjusted to make the estimates comparable. Data were downloaded from the NOAA CoastWatch Program/NASA's Goddard Space Flight Center OceanColor Web (<https://coastwatch.pfeg.noaa.gov/erddap/griddap/index.html>; data products erdMBchla1day and erdSW2018chla1day).

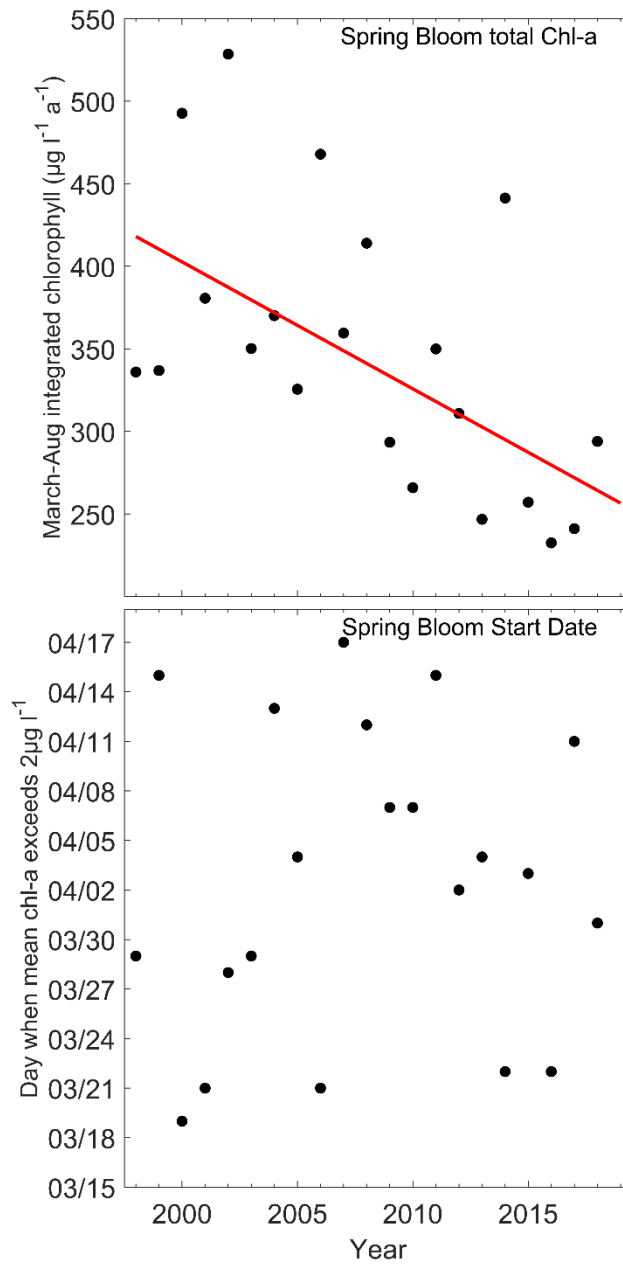


Figure 4. Estimates of the magnitude (top panel) and onset (bottom panel) of the spring bloom in central PWS (same data as figure 3). The magnitude of the bloom was estimated by numerically integrating chlorophyll concentration from March 1 to August 15 in each year using the trapezoid rule. The onset of the bloom was estimated as the day of the year when surface chlorophyll concentrations first exceeded $2 \mu\text{g l}^{-1}$. On dates when there was an estimate from both the seaWiFS (adjusted for offsets) and the MODIS time series available, the midpoint was used.

Analysis of zooplankton samples from FY18 is underway at the time of this report, PWS samples have been completed and Kachemak Bay samples are being processed. Analysis of the 2010 to 2018 samples suggests that there was a shift in zooplankton taxa in PWS during the “Blob” years (Fig. 5). When copepod species are split into the “warm” and “cool” water species assemblages used by Peterson et al. (2017), it is apparent that although changes in overall zooplankton abundance have been relatively small (not different axes scaling in the panels of Fig. 5), abundances of “warm” water copepod species increased, while that of the canonical “cool” water subarctic copepod species decreased. A shift back towards increased cool water species and decreased warm water species occurred in 2018.

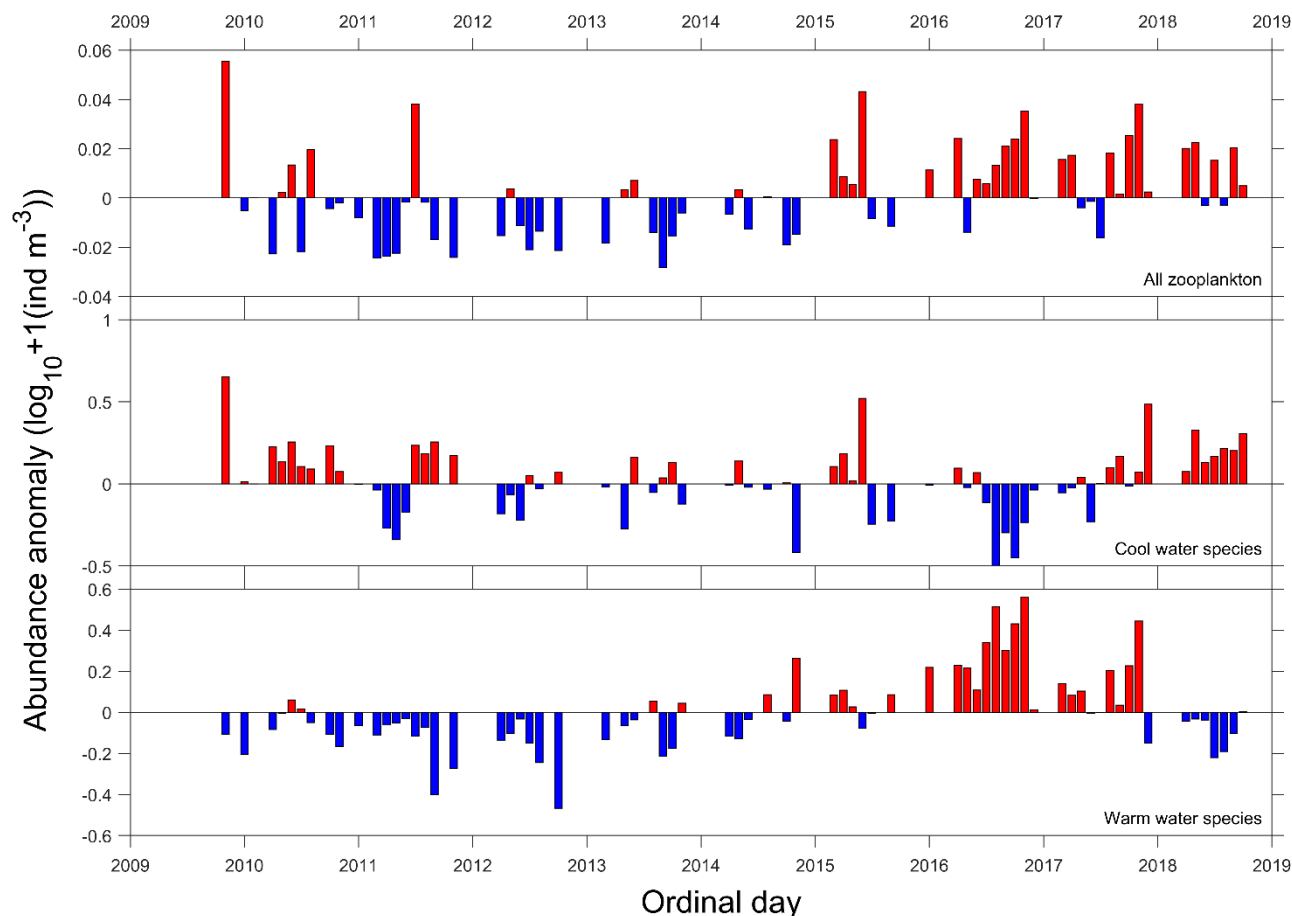


Figure 5. Time series of zooplankton anomalies in PWS, 2010-2018. Zooplankton were divided into “warm” and “cool” water copepod species per Peterson et al. (2017) and average anomalies calculated across groups per Fisher et al. (2015). Warm water species were *Calanus pacificus*, *Clausocalanus* sp., *Corycaeus anglicus*, *Ctenocalanus vanus*, *Mesocalanus tenuicornis* and *Paracalanus parvus*. Cool water species were *Acartia longiremis*, *Calanus marshallae*, *Oithona similis*, and *Pseudocalanus* sp. Abundances were $\log_{10}+1$ transformed prior to calculating anomalies. Note that the scaling of the ordinate varies among panels.

The PWS Profiling mooring is an early variant of the WETLabs Thetis profiler (<https://www.seabird.com/asset-get.download.jsa?code=251257>) that was purchased in 2013. It consists of a large frame, onboard electronics and winch. Syntactic foam buoyancy is attached to the top of the frame, and it is ballasted to have approximately 20 lbs of positive buoyancy. The profile spends most of its time at a specified park depth (60 m), and at specified intervals (usually twice per day at the solar minima/maxima) the profiler comes out of a low power sleep state, powers up the instruments, and begins paying out line to allow the frame to ascend to the

surface. After piercing the surface, data and instructions are telemetered through a cellular data connection, after which the profiler returns to the park depth and re-enters the low power mode (fig. 6). The instrument suite on the profiler includes a CTD recorder, chlorophyll-a fluorometer, turbidometer, oxygen sensor and nitrate sensor. Power is provided by a 1.5kW lithium-ion battery, which carries enough charge for ~90 60m to surface profiles.

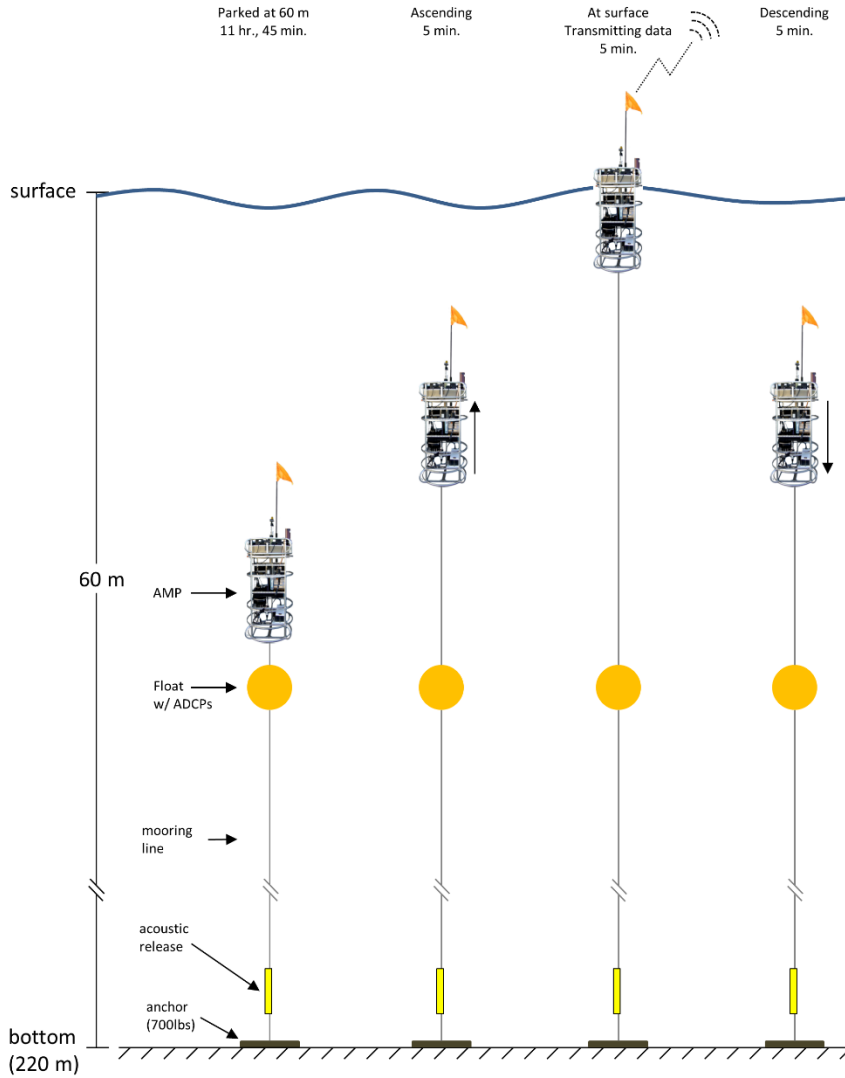


Figure 6. Schematic of the profiling mooring during a profiling cycle.

The winch used by the PWS profiling mooring was sent back to the manufacturer in late 2017 for service and new seals, it was not returned until late April, resulting in a later 2018 deployment than desired, missing some of the spring bloom (Fig. 7). In mid-August the profiler stopped checking in, and upon recovery it was found that the winch would only operate in one direction. The winch electronics were sent back to the factory where it was found that a trace on a circuit board had burned out. The electronics were repaired, but the service visit resulted in a large data gap in August-October. The 2018 time series from the profiler (Fig. 7) showed a return to warm temperature anomalies near-surface, and negative anomalies at depth for much of the summer months, which are likely a manifestation of the shallowing of the surface mixed layer over time. There was a bloom near-

surface in May that also occurred in the satellite record (Fig. 3), and primary productivity was centered near the nitricline for most of the summer months (Fig. 7).

An *in situ* plankton camera was developed for the profiler in 2016, in collaboration with Jules Jaffe and Paul Roberts at the Scripps Institution of Oceanography, with funding from the North Pacific Research Board. The camera system consists of a 12 MP camera and a 99.5 mm 0.114X telecentric lens, along with darkfield illumination produced by an in-line ring/condenser lens system. The system images a volume of ~450 ml, and, operating at 4Hz during the 30 cm s⁻¹ ascent of the profiler, images ~360 liters of water per profile. Just under 2.5 x 10⁶ images have been collected during the first three years of deployments. A subset of almost 2 x 10⁴ images was manually identified into 43 unique classes, and a hybrid convolutional neural network (CNN) classifier has been developed and trained to identify the images. The classifier was then used on the entire image set to examine the annual cycles in the more common plankton taxa in Prince William Sound at a much finer resolution than done previously (depths in terms of centimeters, time in terms of days), and showed previously unobserved annual cycles in abundance and depth distributions, that have been undescribed in several species. For instance, observations of large copepods (Fig. 8) shows that the large calanoids *Neocalanus* and *Calanus* were present near surface during spring as would be expected (Cooney et al. 2001b, Eslinger et al. 2001), while the depth range of *Metridia* changes over the course of the year. *Metridia* undergoes daily diel migrations (Hays et al. 2001), and the shift in depth range may be related to changes in solar illumination over the course of the year. A manuscript describing the camera system and CNN classifier has been completed and will be submitted following review by co-authors. A second manuscript on the results of the CNN on the image set is in preparation.

There are no major changes to sampling expected for this project in FY20.

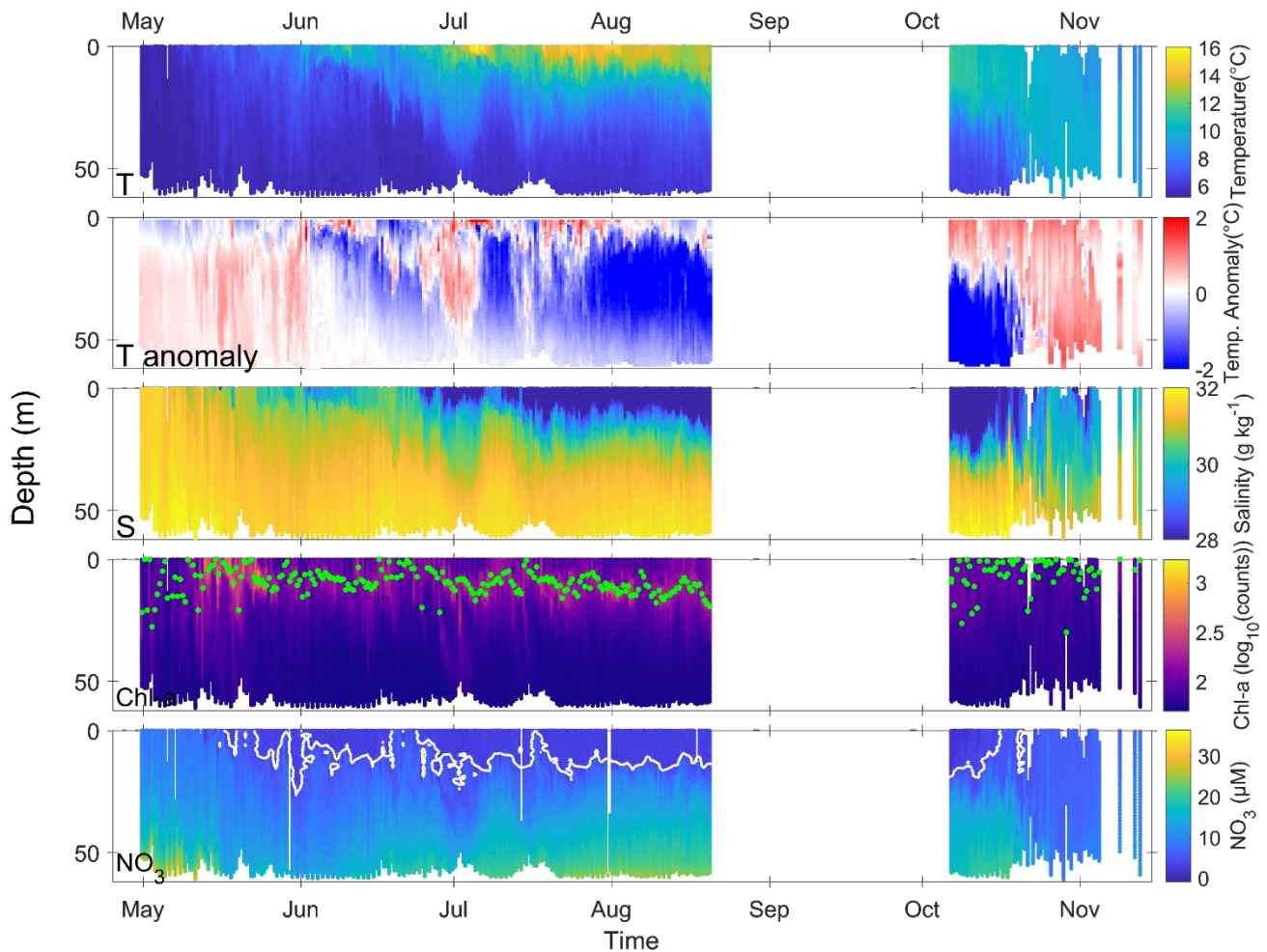


Figure 7. Time series of observations made by the PWS autonomous profiler in 2018. Temperature anomalies were calculated with the method of Campbell (2018). Chlorophyll is presented as \log_{10} transformed digital counts (counts are linearly proportional to chlorophyll-a concentration); green dots represent the depth of maximum chlorophyll-a concentrations in each profile. The white line of the nitrate panel indicates the depth of the $4 \mu\text{M}$ contour.

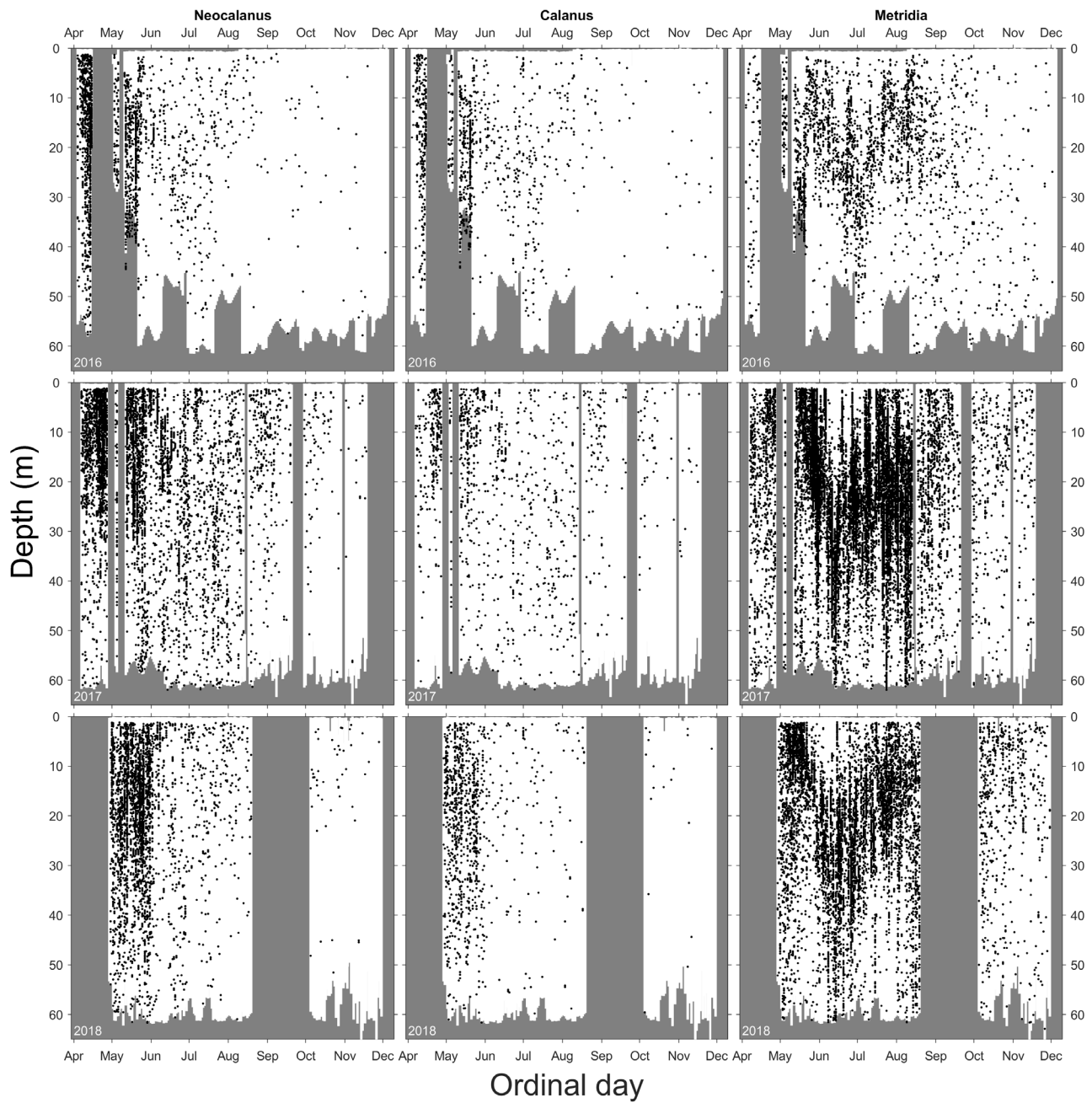


Figure 8. Depth and time distribution of images collected by the plankton camera system that were identified as large copepod species by the CNN classifier, including *Neocalanus* (left column), *Calanus* (center column) and *Metridia* (right column). Each year of deployment is presented row-wise. Grey regions indicate times/depths with no data.

2. PROJECT STATUS OF SCHEDULED ACCOMPLISHMENTS

A. Project Milestones and Tasks

Table 1. This table breaks down project deliverables and their status into milestones and tasks by fiscal year and quarter, beginning February 1, 2017. Yellow highlight indicates proposed fiscal year workplan. C = completed, X = not completed or planned. Fiscal year quarters: 1 = Feb 1 – April 30; 2 = May 1 – July 31; 3 = Aug. 1 – Oct. 31; 4 = Nov. 1 – Jan. 31.

Milestone/Task	FY17				FY18				FY19				FY20				FY21			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone1: Surveys																				
Vessel surveys	C	C	C	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X
Sample analysis	C	C	C	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X
Data available online					C				C				X				X			
Milestone 2: Profiling mooring																				
Mooring deployed	C	C	C	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X
Service/calibration				C	C			C	C			X	X			X	X			
Milestone 3: Reporting																				
Annual Reports					C				C				X				X			
Annual PI meeting				C				C				X				X				X
FY Work Plan (DPD)			C				C				C				X					

In addition to the primary project deliverables in Table 2, during the past year we led or contributed to three presentations and contributed four outreach articles. Two manuscripts are also in preparation (see Section 7). We anticipate completing FY19 and FY20 milestones and tasks as planned.

B. Explanation for not completing any planned milestones and tasks

All sampling, milestones, and tasks for 2018 and first two quarters of 2019 were completed in accordance with our proposal and with sampling protocols available on the GWA Research Workspace.

C. Justification for new milestones/tasks

No new milestones/tasks proposed.

3. PROJECT COORDINATION AND COLLABORATION

A. Within an EVOSTC-funded Program

Gulf Watch Alaska

This project links with the Lower Cook Inlet/Kachemak Bay long term monitoring effort: plankton samples collected in Lower Cook Inlet/Kachemak Bay (project 20120114-J) are analyzed at the Prince William Sound Science Center under this project. We have also collaborated with Holderied group on poster presentations and the beginnings of a manuscript. The data collected will also be of use to projects under the Nearshore (particularly in areas of overlap, such as Whale Bay) and Pelagic components by providing climatic context to their studies. Campbell is collaborating with Rob Suryan (project 20120114-A), Dan Monson (project 20120114-H), and Mayumi Arimitsu (project 20120114-C) and contributing data and analyses to the

synthesis manuscripts. This project has provided platforms of opportunity for other GWA investigators: A hydrophone has been deployed on the profiling mooring since 2016 to listen for marine mammal vocalizations for the GWA long-term killer whale monitoring project (Project 20120114-N). A joint cruise with a bird observer from the seabird abundance in fall and winter project (20120114-E) was done in March 2019, a second is planned for November, and joint cruises are expected to continue each year going forward.

Herring Research and Monitoring

This project links directly with the Herring Research and Monitoring (HRM) program by providing a bottom up context for the work on herring in PWS. Plankton samples have been collected and sent to Dr. Paul Hershberger for herring disease studies (project 20120111-E). Campbell is currently collaborating with Dr. David McGowan, a post-doctoral researcher working under the HRM program looking into interannual variability in herring spawning in PWS (project 20120111-C). Deployment of an acoustic receiver on the profiling mooring for the Annual herring migration cycle project (project 20120111-B) began in 2019.

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. With Other EVOSTC-funded Projects

This project will coordinate with other *Exxon Valdez* Oil Spill Trustee Council (EVOSTC)-funded projects as appropriate by providing data, discussing the relevance and interpretation of data, and collaborating on reports and publications.

C. With Trustee or Management Agencies

Plankton samples have been regularly sent to Paul Hershberger of the U.S. Geological Survey (USGS) Marrowstone Marine Field Station to test for the presence of *Ichthyophonus* life stages. A proposal to add a discrete water sampler to the profiler is in preparation with John Crusius (USGS, University of Washington) and Amy Mueller (Northeastern). A proposal to leverage Gulf Watch observations in the vicinity of tidewater glaciers is also being developed with Shad O'Neel (USGS, Alaska Science Center) and Ellen Enderlin (Boise State). Campbell is a co-investigator on a project funded by the North Pacific Research Board (NPRB) in 2018 to add phytoplankton, fish and shellfish sampling to this Gulf Watch project. Samples are being sent to Xiuning Du (Oregon State University, Hatfield Marine Science Center) and Steve Kibler (NOAA Beaufort Laboratory).

4. PROJECT DESIGN

A. Overall Project Objectives

The goal of this project is to provide environmental driver data to assess temporal and spatial changes in the marine environment in PWS. The data will be depth-specific (water column stability is important to ecosystem productivity), will be of sufficient frequency to capture timing changes (weeks), and will give an idea of spatial variability in the region. Long term environmental monitoring data will be integrated with future herring studies as well as building upon ongoing work funded by the trustee council. We will maintain all sampling depicted in Fig. 1. Specific objectives include:

Objective 1

Conduct regular surveys in PWS and its entrances to continue the ongoing time series of physical, biogeochemical, and biological parameters while also supporting continued herring research by maintaining the existing time series (hydrography, plankton and nutrients) at the four Sound Ecosystem Assessment bays.

Objective 2

Install and maintain an autonomous profiling mooring in PWS that will conduct frequent (at least daily) profiles of the same physical, biogeochemical, and biological parameters as the surveys, plus in situ observations of zooplankton, large phytoplankton and other particles.

B. Changes to Project Design and Objectives

None.

5. PROJECT PERSONNEL – CHANGES AND UPDATES

No changes.

6. PROJECT BUDGET

A. Budget Forms (See GWA FY20 Budget Workbook)

Please see project budget forms compiled for the program.

B. Changes from Original Project Proposal

No changes from original proposal.

C. Sources of Additional Project Funding

A major refit of the profiling mooring (new communications and electronics, development of an *in situ* plankton camera) began in 2016 with support from the NPRB (\$445K from FY15-FY19). That project also supported higher than average frequency sampling and maintenance visits. NPRB is also supporting observations of phytoplankton with particular reference to the Paralytic Shellfish Poisoning dinoflagellate *Alexandrium* sp. in FY18-21 (\$389K) in PWS and Kachemak Bay. Copies of the subaward agreements are attached below as documentation.

The following in-kind contributions are used for this project:

- Instruments used on the vessel surveys (~\$100K)
- Mooring equipment used for the profiling mooring (releases, floats, acoustic Doppler current profilers, and conductivity-temperature recorders: ~\$100K)
- Laboratory equipment used for nutrient, extracted chlorophyll-a, and zooplankton analyses (nutrient autoanalyzer, fluorometer, and microscopes: ~\$75K)
- Storage facilities for project equipment at several sites in Cordova.
- The vessel used for the surveys is owned by the Prince William Sound Science Center (PWSSC), which allows the timing of the cruises to be very flexible, and to avoid the standby and mobilization/demobilization fees that are standard with a charter vessel. A custom heated enclosure for a bird observer on the flying bridge was fabricated in 2019, and a proposal for a more elaborate

enclosure was submitted to the Alaska Ocean Observing System in 2019. The replacement cost of the vessel is approximately \$400K.

7. FY17-19 PROJECT PUBLICATIONS AND PRODUCTS

Publications

- Campbell, R.W. 2018. Hydrographic trends in Prince William Sound, Alaska, 1960–2016. *Deep-Sea Res II*. doi:10.1016/j.dsr2.2017.08.014
- Campbell, R. W. 2018. Long term monitoring of oceanographic conditions in Prince William Sound. *Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 16120114-E)*. Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Campbell, R.W. 2018. Long term monitoring of oceanographic trends in Prince William Sound. FY17 annual report to the Exxon Valdez Oil Spill Trustee Council, project 17120114-G.
- Campbell, R.W. 2019. Long term monitoring of oceanographic trends in Prince William Sound. FY18 annual report to the Exxon Valdez Oil Spill Trustee Council, project 18120114-G.
- Campbell, R.W. and C.A. McKinstry. 2018. Temperature trends in the surface waters of Prince William Sound. pp. 57-58 in Zador, S. and E. Yasumiishi (eds) *Ecosystem Status Report 2018: Gulf of Alaska*. North Pacific Fishery Management Council.
- Campbell, R.W., P.L. Roberts, and J. Jaffe. In prep. The Prince William Sound Plankton Camera: a profiling in situ observatory of plankton and particulates. *ICES J. Mar. Sci.*
- Campbell, R.W., P.L. Roberts, and J. Jaffe. In prep. The annual secondary productivity cycle in central Prince William Sound measured with the Prince William Sound Plankton Camera. *Journal of Plankton Research*.
- Crusius, J., A.W. Schroth, J.A. Resing, J. Cullen, and R.W. Campbell. 2017. Seasonal and spatial variabilities in the northern Gulf of Alaska surface water iron concentrations driven by shelf sediment resuspension, glacial meltwater, a Yakutat eddy, and dust. *Global Biogeochemical Cycles*. doi:10.1002/2016GB005493
- McKinstry, C.A.E., and R.W. Campbell. 2018. Seasonal variation of zooplankton abundance and community structure in Prince William Sound, Alaska, 2009–2016. *Deep-Sea Res II*. doi:10.1016/j.dsr2.2017.08.016.
- Schroth, A.W., J. Crusius, S. Gassó, C.M. Moy, N.J. Buck, J.A. Resing, and R.W. Campbell. 2017. Aleutian Low position drives dramatic inter-annual variability in atmospheric transport of glacial iron to the Gulf of Alaska. *Geophys. Res. Lett.* 44. doi:10.1002/2017GL073565.

Published and updated datasets

DataONE Published Datasets

- Campbell, R. W., M. McCammon, K. Holderied, and K. Hoffman. 2017. Oceanographic Conditions in Prince William Sound, CTD, Chlorophyll-a, and Zooplankton Data: 2013-2016, Gulf Watch Alaska Environmental Drivers Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k19>.

Gulf of Alaska Data Portal Datasets

Campbell, R. 2019. Oceanographic Conditions in Prince William Sound: 2017 chlorophyll and CTD data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.

Research Workspace:

Campbell, R. 2019. Oceanographic Conditions in Prince William Sound: 2018 chlorophyll and CTD data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.

Presentations

- Campbell, R. 2018. A profiling observatory for high resolution oceanographic, biogeochemical, and plankton observations in Prince William Sound. Alaska Marine Science Symposium, Anchorage. **Oral presentation.**
- Campbell, R.W. 2018. A Profiling Observatory for High Resolution Oceanographic, Biogeochemical, and Plankton Observations in Prince William Sound. ASLO Ocean Sciences Meeting, Portland. **Poster presentation**
- Campbell, R.W. 2019. The PWS Plankton Cam: an underwater microscope to view the zooplankton ecosystem of Prince William Sound. PWSSC Lecture series, Cordova. **Oral presentation**
- Campbell, R.W., Jaffe, J., and P. Roberts. 2019. The PWS Plankton Cam: An In-situ Look Into the Zooplankton Ecosystem of Prince William Sound. Alaska Marine Science Symposium, Anchorage. **Poster presentation**
- Crusius, J., Schroth, A.W., Gasso, S, and R.W. Campbell. 2018. "Gap" winds through mountainous topography dominate offshore winds along the curved coastline of southern Alaska, influencing transport of dust-derived Fe as well as Fe from upwelling and eddies. ASLO Ocean Sciences Meeting, Portland.
- Kibler, S., Du, X., Campbell, R.W., Holderied, K., Hondolero, D., Powell Schuster, K., Robinson, R., Arimitsu, M. and J. Piatt. 2019. NPRB 1801: Prevalence of Paralytic Shellfish Toxins in the Marine Food Webs of Prince William Sound and Kachemak Bay, Alaska. Alaska Marine Science Symposium, Anchorage. **Poster presentation**
- McKinstry, C. and R.W. Campbell. 2018. Seasonal variation of zooplankton abundance and community structure in Prince William Sound, Alaska, 2009-2016. ASLO Ocean Sciences Meeting, Portland. **Poster presentation**
- McKinstry, C., and R. Campbell. 2018. Zooplankton community structure and seasonal abundance in Prince William Sound. Alaska Marine Science Symposium, Anchorage. **Poster presentation.**
- Mearns, A, D. Janka, P. Marloff, R. Campbell, S. Pegau, and D. Esler. 2018. Twenty-eight years of intertidal biological variability based on volunteer visits to photo sites in Western Prince William Sound. Alaska Marine Science Symposium, Anchorage. **Poster presentation.**
- Monson, D., K. Holderied, R. Campbell, S. Danielson, R. Hopcroft, B. Ballachey, J. Bodkin, H. Coletti, T. Dean, K. Iken, K. Kloecker, B. Konar, M. Lindeberg, B. Robinson, B. Weitzman, and R. Suryan. 2018. Congruence of intertidal and pelagic water and air temperatures during an anomalously warm period in the northern Gulf of Alaska; the "Blob" washes ashore. Alaska Marine Science Symposium, Anchorage. **Poster Presentation.**

Outreach

- Campbell, R. 2018. Productive plankton in the world's richest waters: the role of nutrients in the annual plankton cycle. Delta Sound Connections 2019-2020. Prince William Sound Science Center (http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf).
- Campbell, R. 2018. Plankton monitoring. Web page and podcast (<http://pwssc.org/plankton-monitoring/>). The podcast has been used by the local radio station, KCHU.
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ATTACHMENTS

Executed NPRB subaward documents for section 6C:



NPRB Subaward
1502



NPRB Subaward
1801

**NORTH PACIFIC RESEARCH BOARD
SUBAWARD AGREEMENT**

1. Scope of Work

(a) The North Pacific Research Board (NPRB) and the Recipient listed below, jointly and severally agree to the provisions herein and to perform the work described in Appendix 1, which contains a statement of work, schedule, and budget for the following project recommended for approval by NPRB on May 7, 2015, and approved by the Secretary of Commerce on June 17, 2015:

Project Number:	1502C
Project Title:	High frequency observations of the secondary production cycle in Prince William Sound.
Recipient:	Prince William Sound Science Center P.O. Box 705 300 Breakwater Ave. Cordova, AK 99574
Recipient DUNS:	858569551
Principal Investigator:	Robert William Campbell Prince William Sound Science Center rcampbell@pwssc.org
Period:	February 1, 2018 - January 31, 2019
Current Funding Increment:	Year 4 in Appendix 1 (\$20,152)
Project TOTAL:	\$445,847

(b) This Agreement is a subaward of prime award number NA15NMF4720173, "North Pacific Research Board 2016-2020" (\$17,106,122) to NPRB from the U.S. Department of Commerce/National Oceanic and Atmospheric Administration, CFDA number 11.472 (Unallied Science Program). This award is not considered "Research and Development."

(c) The Recipient shall provide to NPRB the time and expertise of the Principal Investigator to perform the services and produce the products and reports described in Appendix 1. Material change to the Scope of Work requires prior approval by NPRB.

(d) The Recipient shall provide full and timely financial and programmatic reporting in compliance with all federal laws, regulations, and OMB Circulars appertaining to funds received by NPRB for the Scope of Work described herein.

(e) The Recipient acknowledges that the Scope of Work comprises professional scientific research services and agrees that all such work shall be performed by the named individual(s) and with intellectual integrity and scientific competence equal to or better than the professional community standards applicable to such work.

(f) The Recipient accepts full responsibility for performing the Scope of Work while managing and monitoring the project to a successful conclusion. The Recipient attests that he or she has read, understands, and while performing the Scope of Work, will comply with the North Pacific Research Board's March 2, 2009 Policy on Compliance with Subaward Agreements (Appendix 2).

2. Term

The Scope of Work shall be completed during the project period identified in Section 1. The NPRB acting through its staff, may in grant No-Cost Extensions (extensions of time) in writing if requested at least thirty days before the conclusion of this Agreement. Only one extension may be requested for a maximum of twelve (12) months from the original end date.

3. Payment

(a) For all services described in the Scope of Work, the Recipient shall be reimbursed in accordance with the budget detail in Appendix 1 and NPRB Financial Reporting Form set forth in Appendix 3, not to exceed the Total Recipient Amount identified in Section 1 above. Costs incurred in a currency other than U.S. dollars shall be reimbursed in U.S. dollars at the average exchange rate for the month of the expenditure.

(b) The NPRB, acting through its staff, may authorize in writing payment in advance for anticipated immediate expenditures to be incurred during the first thirty days of the Scope of Work, if the Recipient submits sufficient justification.

(c) The Recipient shall submit invoices and supporting documentation to NPRB quarterly for expenses incurred during calendar year quarters (invoices due January 31st, April 30th, July 31th and October 31st). All invoices must be accompanied by a properly completed NPRB Financial Reporting Form (Appendix 3), and shall itemize costs in compliance with law and NPRB reporting requirements.

Invoices shall be submitted electronically, with signature to Kristin Thoresen at kristint@alaskasealife.org or mailed to Alaska SeaLife Center; NPRB Fiscal Agent; P.O. Box 1329; Seward, AK 99664. Final invoices shall be marked "Final" and must be submitted no later than thirty days following the conclusion of the Agreement. Failure to submit the final invoice within such period shall constitute a complete waiver of all claims by the Recipient to any amounts not previously invoiced.

(d) Ninety (90) percent of all incurred costs authorized and properly reported by the Recipient shall be paid by NPRB within thirty (30) days following receipt of the same amounts by NPRB from the federal funding agency. Payments will be withheld while financial or programmatic reporting is delinquent. The remaining ten (10) percent shall be paid to the Recipient within thirty days following acceptance of the final programmatic report described in Section 5 below.

(e) Allowable direct costs shall be determined in accordance with the federal cost principles applicable to the Recipient (Uniform Guidance 2.C.F.R Part 200 applies). Allowable indirect costs shall be in accordance with the Negotiated Indirect Cost Agreement in effect on the date of signature of this Agreement. A copy of the NICRA must be provided during the application process.

(f) Reallocation of funds between or among the direct cost categories in the NPRB Financial Reporting Form in Appendix 3 must be approved in writing by NPRB prior to any such reallocated expenditure occurring, if that reallocation exceeds ten (10) percent of the total Recipient budget amount. Prior approval by NPRB is required to transfer funds from direct costs to indirect costs, or vice versa.

(g) All equipment and supplies (over \$5,000) purchased with funds pursuant to this Agreement that are not consumed in the Scope of Work and that have a useful life of more than one year from the date of purchase shall remain the property of Recipient. Equipment should be used for continued project work, after which it should be used for other federally funded programs, with the first preference being given to awards from the same funding agency. The Recipient will be responsible for tracking the equipment use after the award ends and will be required to seek disposition instructions when the equipment is no longer of use.

(h) The Recipient has no requirement for reporting any matching or in-kind contribution to this scope of work.

4. Key Personnel

The Recipient shall designate the person identified in Section 1 as the Principal Investigator for the work to be performed under this Agreement. This individual is essential to the project and shall not be removed or replaced without the prior written approval of NPRB.

5. Manuscripts, Reports, and Data Provisions

(a) In addition to programmatic reporting required by law, the Recipient shall submit semiannual progress reports and a final programmatic report in accordance with provided templates and guidelines. For projects with multiple partner organizations, only one report is required for the project in its entirety. Reports will be submitted via the Research Workspace account provided to the PI by the NPRB Program Manager. Reports must be in the current template provided in the Workspace account or as downloaded from the NPRB website.

Semi-annual progress reports are due every January 31 and July 31 until the Agreement is completed. Reports are not required for due dates that fall in the first or final six months of the project period.

(b) The Recipient shall strive to submit research results for publication by an appropriate scientific journal and present project results at appropriate scientific conference within one year following the completion date in Section 1. The Recipient shall deliver a reprint of any publications or presentations to NPRB within sixty days of publication or presentation.

(c) All manuscripts and reports pertaining to the Scope of Work shall acknowledge that funds were provided by a subaward through the North Pacific Research Board. When manuscripts are accepted in peer-reviewed journals, the Recipient will contact NPRB to obtain an NPRB publication number that should then be included in the acknowledgements section of the publication.

(d) The Recipient is required to immediately notify NPRB of any development that may significantly impact the project supported by this Agreement; in particular, notification is necessary regarding problems, delays, or adverse conditions which may materially impair the ability to meet objectives and milestones. The Recipient should not wait until the next semiannual report to notify NPRB of these types of developments. The notification must describe the action(s) taken or planned as well as any assistance needed to resolve the situation.

(e) NPRB reserves the right to distribute any and all information pertaining to the data and analyses found in and deriving from Recipient reports. NPRB will give appropriate credit to the authors who hold the copyright.

(f) The Recipient shall submit a final programmatic report, a copy of the data and accompanying metadata via the Research Workspace within sixty days of the end of the project period indicated in Section 1. The Recipient will provide responses to all review comments within 30 days of receiving the review comments.

(g) All rights, title, and interests (including patents, copyrights, trademarks and any other intellectual property) created under this Agreement shall be held solely by the Recipient. The Recipient grants to NPRB a royalty-free, paid-up, non-exclusive, worldwide, and irrevocable license to any copyrightable works of authorship, data, databases, software, photographs, outreach materials, and other information first developed by the Recipient under this Agreement to use, distribute, create derivative works, display, reproduce, translate, and publish for purposes within the mission of NPRB. Such license does not include the right to sell copies of the copyrightable material. Recipient does not warrant or make any representations; NPRB assumes all risk related to the use, or the results of the use, of the work, output, derivative works or related documentation with respect to their accuracy, reliability, or otherwise.

(h) The Recipient and PI agree to transfer all data and metadata to NPRB at the completion of the project according to the following metadata and data transfer policy: i) For projects involving data

collection or generation, NPRB requires the transfer of all data and its associated metadata; ii) For any third-party datasets used in the NPRB-funded project, only the transfer of the metadata associated with the third-party data is required; iii) If third-party data is modified for use in the NPRB funded project, the metadata associated with the third-party data is required in addition to the modified dataset and the associated metadata; iv) For modeling projects, transfer of data inputs, modeling code, and modeling output is required.

6. Audit and Records Retention

(a) The Recipient shall maintain accurate records of all costs incurred in the performance of this Agreement and shall make such records available upon request to representatives of NPRB or the federal funding agency to verify the validity and eligibility of expenses reimbursed under this Agreement. Financial records, supporting documents, and other records pertaining to this Agreement shall be retained and kept available by the Recipient for a period of three years from the termination date of this Agreement or, if under audit, for as long as is required to resolve.

(b) The Recipient agrees to comply with the requirements of OMB Uniform Guidance: Cost Principles, Audit, and Administrative Requirements for Federal Awards, Subpart F – Audit Requirements and will provide NPRB with copies of all audit reports regardless of results. In case of noncompliance, the Recipient shall provide copies of responses to auditor's reports and a plan for corrective action.

7. Hold Harmless and Indemnification

Each party to this Agreement agrees to defend, indemnify and hold harmless the other party from and against any and all claims, liabilities, losses, expenses, fees including attorneys' fees, and damages arising from or pertaining to the performance of this Agreement, but only in proportion to and to the extent such claims, liabilities, losses, expenses, fees including attorneys' fees, and damages are caused by or result from the negligent or intentional acts or omission of the indemnifying party, its officers, agents or employees.

8. Subcontracting and Assignment

The parties agree that the Recipient is providing the unique services of individual, qualified professionals/scientists and their staff in performance of the research under this agreement. The Recipient shall not assign or subcontract any portion of the Agreement without the prior written consent of NPRB.

9. Project Suspension

If the Recipient fails to comply with the project objectives, the terms and conditions of this Agreement, or the reporting requirements, NPRB may temporarily suspend this Agreement in accordance with Appendix 2 and follow the procedures contained therein, pending either corrective action by the Recipient or a decision to terminate the Agreement. NPRB may immediately suspend this Agreement without prior notice when it is believed that such action is reasonable to protect the interests of NPRB

and the federal government. No costs incurred during a suspension period will be allowable, except those costs approved by NPRB in the suspension notice, or which NPRB deems necessary and not reasonably avoidable.

10. Termination for Cause or Default

NPRB may terminate this Agreement, in whole or in part, in accordance with Appendix 2 and follow the procedures contained therein in the event that the Recipient fails or refuses to perform tasks or deliver services specified in the Agreement within the time provided, fails to obtain appropriate permits, or otherwise violates any of the conditions of this Agreement, or if it becomes evident that the Recipient is not conducting the work in accordance with the specifications or with diligence so as to permit delivery on or before the specified delivery date. Delays in delivery beyond the time specified in this Agreement due to causes beyond the control and without the fault or negligence of the Recipient may be excused by NPRB if the Recipient notifies NPRB in writing of the cause of such delay within a reasonable time and requests an extension of the project term.

11. Compliance with Law

(a) The Recipient will comply with all federal, state and local laws and regulations in the performance of the Scope of Work and in the performance of the terms and conditions of this Agreement, including but not limited to Department of Commerce Financial Assistance Standard Terms and Conditions, and NOAA Administrative Standard Award Conditions. This award is subject to and the recipient must comply with the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (Uniform Guidance), which is codified at 2.C.F.R Part 200. In effect as of December 26, 2014, this final guidance is a streamlining of the Federal government's guidance on administrative requirements, cost principles, and audit requirements for Federal awards. It supersedes requirements contained in OMB Circulars, A-21, A-87, A-102, A-110, and A-133.

(b) The Recipient agrees to obtain and to accept full responsibility for the proper administration of all permits and approvals required by law for the performance of the Scope of Work, including vessel safety and inspection.

12. Independent Recipient

The Recipient represents and warrants that it is a Recipient independent of NPRB in the performance of the Scope of Work and that the Recipient assumes full and sole responsibility for all benefits and protections of its employees whose services are utilized in the execution of this Agreement. Nothing in this Agreement shall be construed as authorizing the Recipient or its employees, agents or assigns to act as an agent or assign of NPRB, and the Recipient shall exercise all diligence to ensure that no third party construes the Recipient as an actual, ostensible or apparent agent of NPRB.

13. Debarment and Suspension Certification

In accepting this Agreement, the Recipient certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from

participation in this transaction by any federal department or agency. Any change in the debarred or suspended status of the Recipient during the life of this Agreement must be reported immediately to NPRB. The Recipient agrees to incorporate a similar Debarment and Suspension Certification into any subaward that it may enter into as part of this Agreement.

14. Payment of Taxes

The Recipient shall be solely responsible to pay any and all taxes incurred by and through the performance or payments made pursuant to this Agreement.

15. Dispute Resolution

The Recipient agrees to follow the problem resolution procedures contained in Appendix 2, and to negotiate diligently in good faith before resorting to a court of law or equity for the resolution of any dispute arising from or pertaining to this Agreement.

16. Applicable Law, Jurisdiction, and Venue

This Agreement shall be governed by the laws of the State of Alaska except to the extent pre-empted by United States federal law. Jurisdiction for the resolution of any dispute between the parties shall be the state trial courts of Alaska. Venue for the trial of any case shall be Anchorage, Alaska.

17. Entire Agreement and Modifications

This Agreement, Appendix 1, Appendix 2, and Appendix 3 represent the entire agreement between the parties, and supersede all prior oral or written agreements, understandings and alleged causes for detrimental reliance regarding any of the terms, conditions or Scope of Work contained in this Agreement. This Agreement may be amended or modified only in writing and must be executed by both parties. No-cost extensions (as is Section 2. Term) and re-budget requests (as is Section 3. (f) Payment) may be approved in writing by the NPRB Program Manager.

18. Notices

All notices that in any way modify or alter this Agreement shall be sent to the following addresses:

NPRB:


Betsy Baker, Executive Director
North Pacific Research Board
1007 West 3rd Ave., Suite 100
Anchorage, AK 99501
Phone: (907) 644-6702, Fax: (907) 644-6780
betsy.baker@nprb.org

Authorized Signature/Recipient:
Linnea Ronnegard
Prince William Sound Science Center
PO Box 705
300 Breakwater Ave
Cordova, AK 99574
(907) 424-5800 x. 224


19. Authorizing Signatures

North Pacific Research Board

Recipient Institution



Betsy Baker
Executive Director



Principal Investigator

Date: 27 June 2018

Date: 6-27-18



Authorized Signer

Date: 6-27-18

**NORTH PACIFIC RESEARCH BOARD
SUBAWARD AGREEMENT**

1. Scope of Work

(a) The North Pacific Research Board (NPRB) and the Recipient listed below, jointly and severally agree to the provisions herein and to perform the work described in Appendix 1, which contains a statement of work, schedule, and budget for the following project recommended for approval by NPRB on May 9, 2018, and approved by the Secretary of Commerce on May 14, 2018:

Project Number:	1801
Project Title:	Prevalence of Paralytic Shellfish Toxins in the Marine Food Webs of Prince William Sound and Kachemak Bay, Alaska
Recipient:	Prince William Sound Science Center PO Box 705 Cordova, Alaska 99574
Recipient DUNS:	85869551
Principal Investigator:	Rob Campbell rcampbell@pwssc.org
Period:	September 1, 2018 – May 31, 2021
Total Recipient Amount:	\$114,031 (Uniform Guidance 2.C.F.R Part 200 applies)
1801	\$103,700 (NOAA NOS)
1801	\$171,624 (OSU)
Project TOTAL:	\$389,355

(b) This Agreement is a subaward of prime award number NA17NMF4720289, "North Pacific Research Board 10/01/2017-09/30/2022" (\$13,751,714) to NPRB from the U.S. Department of Commerce/National Oceanic and Atmospheric Administration, CFDA number 11.472 (Unallied Science Program). This award is not considered "Research and Development."

(c) The Recipient shall provide to NPRB the time and expertise of the Principal Investigator to perform the services and produce the products and reports described in Appendix 1. Material change to the Scope of Work requires prior approval by NPRB.

(d) The Recipient shall provide full and timely financial and programmatic reporting in compliance with all federal laws, regulations, and OMB Circulars appertaining to funds received by NPRB for the Scope of Work described herein.

(e) The Recipient acknowledges that the Scope of Work comprises professional scientific research services and agrees that all such work shall be performed by the named individual(s) and with intellectual integrity and scientific competence equal to or better than the professional community standards applicable to such work.

(f) The Recipient accepts full responsibility for performing the Scope of Work while managing and monitoring the project to a successful conclusion. The Recipient attests that he or she has read, understands, and while performing the Scope of Work, will comply with the North Pacific Research Board's March 2, 2009 Policy on Compliance with Subaward Agreements (Appendix 2).

2. Term

The Scope of Work shall be completed during the project period identified in Section 1. The NPRB acting through its staff, may in grant No-Cost Extensions (extensions of time) in writing if requested at least thirty days before the conclusion of this Agreement. Only one extension may be requested for a maximum of twelve (12) months from the original end date.

3. Payment

(a) For all services described in the Scope of Work, the Recipient shall be reimbursed in accordance with the budget detail in Appendix 1 and NPRB Financial Reporting Form set forth in Appendix 3, not to exceed the Total Recipient Amount identified in Section 1 above. Costs incurred in a currency other than U.S. dollars shall be reimbursed in U.S. dollars at the average exchange rate for the month of the expenditure.

(b) The NPRB, acting through its staff, may authorize in writing payment in advance for anticipated immediate expenditures to be incurred during the first thirty days of the Scope of Work, if the Recipient submits sufficient justification.

(c) The Recipient shall submit invoices and supporting documentation to NPRB quarterly for expenses incurred during calendar year quarters (invoices due January 31st, April 30th, July 31th and October 31st). All invoices must be accompanied by a properly completed NPRB Financial Reporting Form (Appendix 3), and shall itemize costs in compliance with law and NPRB reporting requirements.

Invoices shall be submitted electronically, with signature to grants-contracts@alaskasealife.org or mailed to Alaska Sealife Center, Grants and Contracts, NPRB Fiscal Agent, P.O. Box 1329, Seward, AK 99664. Final invoices shall be marked "Final" and must be submitted no later than thirty days following the conclusion of the Agreement. Failure to submit the final invoice within such period shall constitute a complete waiver of all claims by the Recipient to any amounts not previously invoiced.

(d) Ninety (90) percent of all incurred costs authorized and properly reported by the Recipient shall be paid by NPRB within thirty (30) days following receipt of the same amounts by NPRB from the federal funding agency. Payments will be withheld while financial or programmatic reporting is delinquent. The

remaining ten (10) percent shall be paid to the Recipient within thirty days following acceptance of the final programmatic report described in Section 5 below.

(e) Allowable direct costs shall be determined in accordance with the federal cost principles applicable to the Recipient (Uniform Guidance 2.C.F.R Part 200 applies). Allowable indirect costs shall be in accordance with the Negotiated Indirect Cost Agreement in effect on the date of signature of this Agreement. A copy of the NICRA must be provided during the application process.

(f) Reallocation of funds between or among the direct cost categories in the NPRB Financial Reporting Form in Appendix 3 must be approved in writing by NPRB prior to any such reallocated expenditure occurring, if that reallocation exceeds ten (10) percent of the total Recipient budget amount. Prior approval by NPRB is required to transfer funds from direct costs to indirect costs, or vice versa.

(g) All equipment and supplies (over \$5,000) purchased with funds pursuant to this Agreement that are not consumed in the Scope of Work and that have a useful life of more than one year from the date of purchase shall remain the property of Recipient. Equipment should be used for continued project work, after which it should be used for other federally funded programs, with the first preference being given to awards from the same funding agency. The Recipient will be responsible for tracking the equipment use after the award ends and will be required to seek disposition instructions when the equipment is no longer of use.

(h) The Recipient has no requirement for reporting any matching or in-kind contribution to this scope of work.

4. Key Personnel

The Recipient shall designate the person identified in Section 1 as the Principal Investigator for the work to be performed under this Agreement. This individual is essential to the project and shall not be removed or replaced without the prior written approval of NPRB.

5. Manuscripts, Reports, and Data Provisions

(a) In addition to programmatic reporting required by law, the Recipient shall submit semiannual progress reports and a final programmatic report in accordance with provided templates and guidelines. For projects with multiple partner organizations, only one report is required for the project in its entirety. Reports will be submitted via the Research Workspace account provided to the PI by the NPRB Program Manager. Reports must be in the current template provided in the Workspace account or as downloaded from the NPRB website.

Semi-annual progress reports are due every January 31 and July 31 until the Agreement is completed. Reports are not required for due dates that fall in the first or final six months of the project period.

(b) The Recipient shall strive to submit research results for publication by an appropriate scientific journal and present project results at appropriate scientific conference within one year following the completion date in Section 1. The Recipient shall deliver a reprint of any publications or presentations to NPRB within sixty days of publication or presentation.

(c) All manuscripts and reports pertaining to the Scope of Work shall acknowledge that funds were provided by a subaward through the North Pacific Research Board. When manuscripts are accepted in peer-reviewed journals, the Recipient will contact NPRB to obtain an NPRB publication number that should then be included in the acknowledgements section of the publication.

(d) The Recipient is required to immediately notify NPRB of any development that may significantly impact the project supported by this Agreement; in particular, notification is necessary regarding problems, delays, or adverse conditions which may materially impair the ability to meet objectives and milestones. The Recipient should not wait until the next semiannual report to notify NPRB of these types of developments. The notification must describe the action(s) taken or planned as well as any assistance needed to resolve the situation.

(e) NPRB reserves the right to distribute any and all information pertaining to the data and analyses found in and deriving from Recipient reports. NPRB will give appropriate credit to the authors who hold the copyright.

(f) The Recipient shall submit a final programmatic report, a copy of the data and accompanying metadata via the Research Workspace within sixty days of the end of the project period indicated in Section 1. The Recipient will provide responses to all review comments within 30 days of receiving the review comments.

(g) All rights, title, and interests (including patents, copyrights, trademarks and any other intellectual property) created under this Agreement shall be held solely by the Recipient. The Recipient grants to NPRB a royalty-free, paid-up, non-exclusive, worldwide, and irrevocable license to any copyrightable works of authorship, data, databases, software, photographs, outreach materials, and other information first developed by the Recipient under this Agreement to use, distribute, create derivative works, display, reproduce, translate, and publish for purposes within the mission of NPRB. Such license does not include the right to sell copies of the copyrightable material. Recipient does not warrant or make any representations; NPRB assumes all risk related to the use, or the results of the use, of the work, output, derivative works or related documentation with respect to their accuracy, reliability, or otherwise.

(h) The Recipient and PI agree to transfer all data and metadata to NPRB at the completion of the project according to the following metadata and data transfer policy: i) For projects involving data collection or generation, NPRB requires the transfer of all data and its associated metadata; ii) For any third-party datasets used in the NPRB-funded project, only the transfer of the metadata associated with the third-party data is required; iii) If third-party data is modified for use in the NPRB funded project, the

metadata associated with the third-party data is required in addition to the modified dataset and the associated metadata; iv) For modeling projects, transfer of data inputs, modeling code, and modeling output is required.

6. Audit and Records Retention

(a) The Recipient shall maintain accurate records of all costs incurred in the performance of this Agreement and shall make such records available upon request to representatives of NPRB or the federal funding agency to verify the validity and eligibility of expenses reimbursed under this Agreement. Financial records, supporting documents, and other records pertaining to this Agreement shall be retained and kept available by the Recipient for a period of three years from the termination date of this Agreement or, if under audit, for as long as is required to resolve.

(b) The Recipient agrees to comply with the requirements of OMB Uniform Guidance: Cost Principles, Audit, and Administrative Requirements for Federal Awards, Subpart F – Audit Requirements and will provide NPRB with copies of all audit reports regardless of results. In case of noncompliance, the Recipient shall provide copies of responses to auditor's reports and a plan for corrective action.

7. Hold Harmless and Indemnification

Each party to this Agreement agrees to defend, indemnify and hold harmless the other party from and against any and all claims, liabilities, losses, expenses, fees including attorneys' fees, and damages arising from or pertaining to the performance of this Agreement, but only in proportion to and to the extent such claims, liabilities, losses, expenses, fees including attorneys' fees, and damages are caused by or result from the negligent or intentional acts or omission of the indemnifying party, its officers, agents or employees.

8. Subcontracting and Assignment

The parties agree that the Recipient is providing the unique services of individual, qualified professionals/scientists and their staff in performance of the research under this agreement. The Recipient shall not assign or subcontract any portion of the Agreement without the prior written consent of NPRB.

9. Project Suspension

If the Recipient fails to comply with the project objectives, the terms and conditions of this Agreement, or the reporting requirements, NPRB may temporarily suspend this Agreement in accordance with Appendix 2 and follow the procedures contained therein, pending either corrective action by the Recipient or a decision to terminate the Agreement. NPRB may immediately suspend this Agreement without prior notice when it is believed that such action is reasonable to protect the interests of NPRB and the federal government. No costs incurred during a suspension period will be allowable, except those costs approved by NPRB in the suspension notice, or which NPRB deems necessary and not reasonably avoidable.

10. Termination for Cause or Default

NPRB may terminate this Agreement, in whole or in part, in accordance with Appendix 2 and follow the procedures contained therein in the event that the Recipient fails or refuses to perform tasks or deliver services specified in the Agreement within the time provided, fails to obtain appropriate permits, or otherwise violates any of the conditions of this Agreement, or if it becomes evident that the Recipient is not conducting the work in accordance with the specifications or with diligence so as to permit delivery on or before the specified delivery date. Delays in delivery beyond the time specified in this Agreement due to causes beyond the control and without the fault or negligence of the Recipient may be excused by NPRB if the Recipient notifies NPRB in writing of the cause of such delay within a reasonable time and requests an extension of the project term.

11. Compliance with Law

(a) The Recipient will comply with all federal, state and local laws and regulations in the performance of the Scope of Work and in the performance of the terms and conditions of this Agreement, including but not limited to Department of Commerce Financial Assistance Standard Terms and Conditions, and NOAA Administrative Standard Award Conditions. This award is subject to and the recipient must comply with the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (Uniform Guidance), which is codified at 2.C.F.R Part 200. In effect as of December 26, 2014, this final guidance is a streamlining of the Federal government's guidance on administrative requirements, cost principles, and audit requirements for Federal awards. It supersedes requirements contained in OMB Circulars, A-21, A-87, A-102, A-110, and A-133.

(b) The Recipient agrees to obtain and to accept full responsibility for the proper administration of all permits and approvals required by law for the performance of the Scope of Work, including vessel safety and inspection.

12. Independent Recipient

The Recipient represents and warrants that it is a Recipient independent of NPRB in the performance of the Scope of Work and that the Recipient assumes full and sole responsibility for all benefits and protections of its employees whose services are utilized in the execution of this Agreement. Nothing in this Agreement shall be construed as authorizing the Recipient or its employees, agents or assigns to act as an agent or assign of NPRB, and the Recipient shall exercise all diligence to ensure that no third party construes the Recipient as an actual, ostensible or apparent agent of NPRB.

13. Debarment and Suspension Certification

In accepting this Agreement, the Recipient certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any federal department or agency. Any change in the debarred or suspended status of the Recipient during the life of this Agreement must be reported immediately

to NPRB. The Recipient agrees to incorporate a similar Debarment and Suspension Certification into any subaward that it may enter into as part of this Agreement.

14. Payment of Taxes

The Recipient shall be solely responsible to pay any and all taxes incurred by and through the performance or payments made pursuant to this Agreement.

15. Dispute Resolution

The Recipient agrees to follow the problem resolution procedures contained in Appendix 2, and to negotiate diligently in good faith before resorting to a court of law or equity for the resolution of any dispute arising from or pertaining to this Agreement.

16. Applicable Law, Jurisdiction, and Venue

This Agreement shall be governed by the laws of the State of Alaska except to the extent pre-empted by United States federal law. Jurisdiction for the resolution of any dispute between the parties shall be the state trial courts of Alaska. Venue for the trial of any case shall be Anchorage, Alaska.

17. Entire Agreement and Modifications

This Agreement, Appendix 1, Appendix 2, and Appendix 3 represent the entire agreement between the parties, and supersede all prior oral or written agreements, understandings and alleged causes for detrimental reliance regarding any of the terms, conditions or Scope of Work contained in this Agreement. This Agreement may be amended or modified only in writing and must be executed by both parties. No-cost extensions (as is Section 2. Term) and re-budget requests (as is Section 3. (f) Payment) may be approved in writing by the NPRB Program Manager.

18. Notices

All notices that in any way modify or alter this Agreement shall be sent to the following addresses:

NPRB:
Betsy Baker, Executive Director
North Pacific Research Board
1007 West 3rd Ave., Suite 100
Anchorage, AK 99501
Phone: (907) 644-6702, Fax: (907) 644-6780
betsy.baker@nprb.org

Authorized Signer:

Katrina Hoffman
Prince William Sound Science Center
Executive Director, Oil Spill Recovery Institute
PO Box 705
Cordova, AK 99574
907-424-5800 x2
khoffman@pwssc.org

19. Authorizing Signatures

North Pacific Research Board

Recipient Institution



Betsy Baker
Executive Director

Principal Investigator

Date: 13 August 2015

Date: 7.16.18



Authorized Signer **PRESIDENT CEO**

Date: 7.18.18