

**EVOSTC FY17-FY21 INVITATION FOR PROPOSALS  
FY21 (YEAR 10) CONTINUING PROGRAM PROPOSAL SUMMARY PAGE**

**Program Number and Title**

21120114 - Gulf Watch Alaska Program: Long-term Monitoring of Marine Conditions and Injured Resources

**Primary Investigator(s) and Affiliation(s)**

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**Date Proposal Submitted**

August 28, 2020

**Program Abstract**

The Gulf Watch Alaska (GWA) program directly addresses the *Exxon Valdez* Oil Spill (EVOS) Trustee Council's (EVOSTC's) focus area, integrated long-term monitoring of marine conditions and injured resources services. The overarching goal of GWA is to provide sound scientific data and products that inform management agencies and the public of changes in the environment and the impacts of these changes on injured resources. GWA has a consortium of 12 projects organized in the following functional groups: three monitoring components (environmental drivers, pelagic, and nearshore), a program management team, a science review panel, a science coordinating committee, and an outreach steering committee.

The program has five primary objectives: 1) sustain and build upon existing time series in the EVOS-affected regions of the Gulf of Alaska, 2) provide scientific data, data products and outreach to management agencies and a wide variety of users, 3) develop science synthesis products to assist management actions, inform the public and guide monitoring priorities for the next 15 years, 4) continue to build on collaborations between the GWA and Herring Research and Monitoring programs, as well as other EVOSTC program focus areas including the data management program, lingering oil and potential cross-program publishing groups, and 5) leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.

Sampling and outreach activities during FY20 have been disrupted by the novel coronavirus pandemic. However, some GWA projects have found ways to continue collecting data and maintain their long-term legacy datasets. In FY21, the program management team will continue to work with EVOSTC staff to revise and finalize the science synthesis report after a successful workshop with the Science Review Panel. Work on syntheses, peer reviewed publications, ecosystem indicators, and final reports will be a focus for the program as the end of the 5-year funding cycle approaches. Overall, there are no changes to GWA program management. Due to COVID-19 impacts, several projects have requested moving funds between categories for the remainder of FY20 and during FY21.

**EVOSTC Funding Requested\* (must include 9% GA)**

FY17	FY18	FY19	FY20	FY21	TOTAL
\$2,278,750	\$2,574,860	\$2,540,070	\$2,784,980	\$2,579,490	\$12,758,160

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

FY17	FY18	FY19	FY20	FY21	TOTAL
\$3,205,100	\$3,260,300	\$3,027,500	\$3,629,600	\$3,718,300	\$16,840,800

## 1. PROGRAM EXECUTIVE SUMMARY

This proposal requests continuation of the Gulf Watch Alaska (GWA) long-term monitoring (LTM) program for FY21, year 10 of the program. We are submitting a package of FY21 Work Plans to the *Exxon Valdez* Oil Spill (EVOS) Trustee Council (EVOSTC) containing a program proposal (this document), a program management (PM) proposal (combined for the PM I and PM II projects) and 12 monitoring project proposals. Individual project proposals and budget plans are provided, as requested, in the program's Research Workspace for EVOSTC staff members.

### Background

The EVOSTC initiated 5-year funding for the GWA LTM program beginning in 2012 (McCammon et al. 2011) and in 2016 recommended continuation for the next 5-year increment, years 6-10 (Lindeberg et al. 2016). As requested by the EVOSTC, this program is designed to monitor key components that play important roles in the Gulf of Alaska (GOA) marine ecosystem. These components include environmental drivers such as temperature and nutrient availability; pelagic populations of predators and prey; and the nearshore ecosystem. Through this effort, scientists and resource managers will be able to continue to monitor injured resources from the EVOS and have a better understanding of potential impacts to these resources from natural and anthropogenic changes in the environment.

GWA is a consortium of 12 projects, ten of which started before 2012 and several with long-term data sets extending over 30 years and prior to the EVOS. A wide array of information and tools have been effectively coordinated and synthesized by the GWA program to date (e.g., two Science Synthesis Reports, each prepared during the 3<sup>rd</sup> year of the 5-year funding cycles, 2015 and 2020; GWA first 5-year final reports; special issue publication of *Deep-Sea Research II – Topical Studies in Oceanography*; additional cross-project and cross-component scientific papers; and contributions to ecosystem status reports used in fisheries management). The program has fostered partnerships that include professional administrative support, advanced data housing, scientific collaboration and synthesis across projects and disciplines, and a significant outreach capacity through agency partners.

Collectively, this group of 28 PIs represents unsurpassed expertise and knowledge of the GOA ecosystem and spill-affected region. The overarching goals of the program are to:

- A. *Collect long-term ecological monitoring information from the GOA EVOS-affected region*
- B. *Make monitoring data publicly available for use by stakeholders, managers, and facilitate synthesis efforts*
- C. *Assess monitoring data holistically across projects, components, and programs (i.e., HRM) to better understand the range of factors affecting individual species and the ecosystem*

### COVID-19 Related Impacts

The novel coronavirus (COVID-19) pandemic has affected the GWA program and projects to varying degrees. State health mandates restricting travel, group interactions, and services coupled with agency-specific restrictions on facilities and vessels created an unprecedented challenge for researchers depending on their agency or organization. Every effort is being made by the GWA management team and principal investigators (PIs) to mitigate disruptions to program datasets. Project field work, laboratory analyses, and outreach have experienced delays or cancellations. In particular, the US Fish and Wildlife Service's (USFWS's) Prince William Sound (PWS) summer marine birds survey (project 21120114-M) and the National Oceanic and Atmospheric

Administration's (NOAA's) PWS Lingering oil survey (project 21120114-P) have both postponed sampling planned for FY20 to FY21. The PM II project (project 21120114-B) has also delayed traditional ecological knowledge roundtable discussions in PWS villages until FY21 for the health and safety of remote communities. The US Geological Survey's (USGS's) PWS forage fish project (projects 21120114-C) and the Nearshore Ecosystems component (project 21120114-H) have had major portions of their fieldwork cancelled. In general, most projects will have delays in data analyses due to facility lockdowns and the inability to access laboratories.

However, on the positive side of things, there have been successes in data collection due to the program's diverse partnerships and motivated PIs developing creative solutions. The continuous plankton recorder (CPR) tows (project 21120114-D) have not been interrupted. The May 2020 Seward Line/GAK-1 survey (projects 21120114-L and 21120114-I) was executed using a skeleton science team of only 3 PIs and the summer survey proceeded with half the normal science compliment. PWS oceanographic surveys (project 21120114-G) were completed and remote sensing instrumentation by Environmental Drivers component projects continued to log data despite the pandemic. PIs for various projects and between programs (GWA & Herring Research and Monitoring [HRM]) worked together to collect data for each other that otherwise may have been lost (e.g., PWS Science Center [PWSSC] staff collecting samples for the forage fish project). Some PIs were able to do small boat work (e.g., University of Alaska Fairbanks [UAF] in Kachemak Bay), overnight with tents on land (e.g., National Park Service [NPS] in PWS), and capitalize on spousal/professional relationships in the field (e.g., Middleton Island). It is worth noting that a great deal of effort by program PIs went into developing agency and organizational plans for safe practices in the field during this coronavirus pandemic. These successes demonstrate the value of the GWA program and its ability to conduct annual sampling, something other programs and researchers have not been able to achieve.

Please see Sections 2B and 6B of this program Work Plan and the specific project Work Plans for descriptions of COVID-19 impacts and other minor modifications to the projects in FY21 funding requests.

#### *Project Summaries from FY20*

The following sections provide brief summaries of each project under the GWA program with recent findings. These are not meant to be comprehensive but provide a quick means for reviewing key aspects of all projects (e.g., interim findings and highlighted time series datasets where appropriate). For more details, please see individual project Work Plans. Fig. 1 shows the GWA "footprint" for the various monitoring projects and the expanded footprint of the National Science Foundation (NSF)-funded Northern Gulf of Alaska (NGA) Long-term Ecological Research (LTER) program (see Seward Line, project 21120114-L).

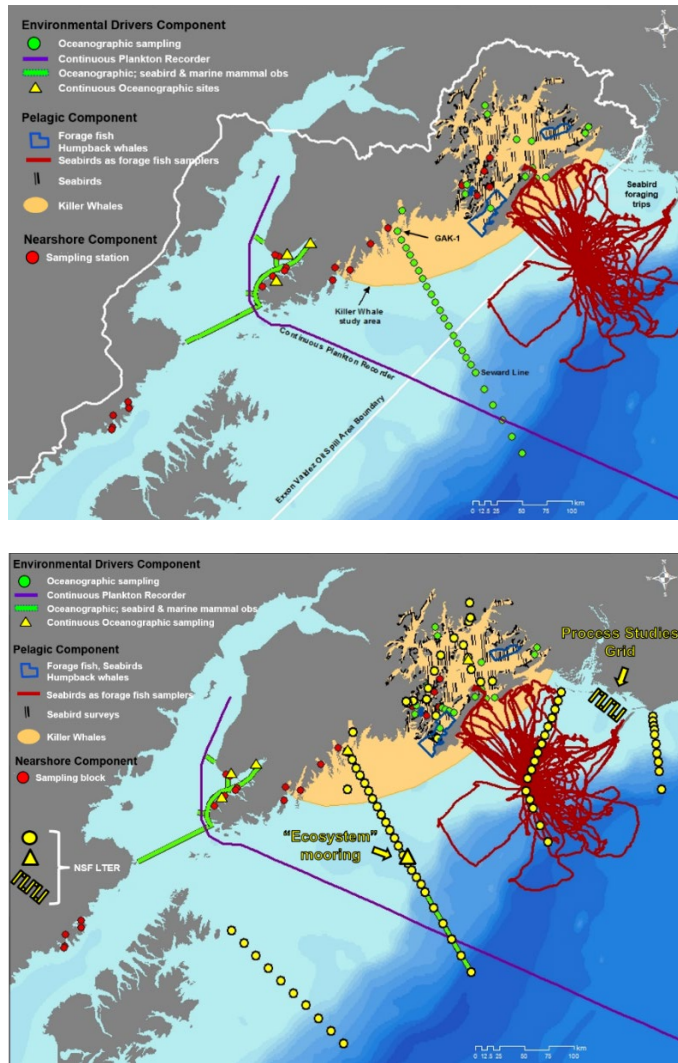


Figure 1. Gulf Watch Alaska monitoring “footprint” by ecosystem component and project focus (upper panel). Gulf Watch Alaska with the National Science Foundation-funded Northern Gulf of Alaska Long-term Ecological Research sampling footprint (lower panel).

*Integrated Program Management and Administration*

**Project 21120114-A (PM I) and 21120114-B (PM II)**

*Program Management I - Program coordination and science synthesis – Mandy Lindeberg and Rob Suryan, NOAA Auke Bay Laboratories and Donna Aderhold, Prince William Sound Science Center (PWSSC)*

*Program Management II - Program administration, logistics, and outreach – Katrina Hoffman, PWSSC*

The Program Management I (PM I) project provides program coordination and science synthesis of data for the EVOSTC’s integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services program, referred to as GWA. The Program Management II (PM II) project is the administrative and outreach component of GWA. PWSSC serves as the fiscal agent for non-Trustee Agency recipients of GWA funds. The Work Plans for these two projects are combined because together they represent all management of the GWA program.

The program management team (PMT, collectively PM I and PM II) oversees a group of 28 PIs, collaborators, and science reviewers to produce and integrate a wealth of scientific information on the northern GOA ecosystem and spill-affected area and share that information with others. Program coordination and science synthesis (PM I) improves linkages between monitoring efforts spanning large regional areas (PWS, GOA shelf, and lower Cook Inlet). Program coordination includes facilitating program planning and sharing of information between PIs, other Trustee-funded programs, and non-Trustee organizations. High quality products and science synthesis efforts help communicate monitoring results by delivering reports, publishing data, developing scientific papers, supporting outreach, and integrating information across the entire program. Program administration, science review panel (SRP), logistics, and outreach and community involvement (PM II) complements work under the PM I project in many ways. The administrative portion of the PM II project oversees funds for non-Trustee Agencies, while also providing travel and logistics for GWA in-person meetings, teleconferences, maintaining GWA's website, and managing community outreach and engagement.

During FY21, the PMT will complete science synthesis tasks with GWA and HRM that were initiated in FY19, including publication of the four chapters of the science synthesis report (with one of these publications led by the PMT). GWA postdoctoral scholars will continue to conduct cross-component synthesis efforts largely focusing on assessing physical drivers and spatial variability of biological change in the GOA. We will also complete final external reviews of the 27 proposed manuscripts for the GWA-led Gulf of Alaska *Deep-Sea Research II* special issue titled "Understanding Ecosystem Processes in the Gulf of Alaska: Volume 3". We will continue developing project-level ecosystem indicators to inform GOA resource management and will expand indicators beyond the current suite. FY21 marks the end of the EVOSTC's current 5-year funding cycle (monitoring years 6-10) and GWA final reports will be drafted and submitted for review. We also will complete strategic planning of long-term priorities for the EVOSTC's next funding cycle (FY22-31).

On an administrative level, the program will continue to engage and be responsive to the Public Advisory Committee members and Trustees. PWSSC will facilitate all logistics for relevant program meetings, including participation by SRP members. The PMT will involve the SRP in constructive oversight of the program. Further, PWSSC will amend all non-Trustee Agency subaward contracts, monitor their performance, submit timely SF-425 reports and semi-annual program reports to NOAA, complete an annual federal single audit, and monitor spending. If COVID-19 conditions permit in FY21, we will conduct a local and traditional ecological knowledge roundtable-type symposium in one or more villages on PWS (either Chenega Bay, Tatitlek, or both, depending on community receptivity).

#### *Environmental Drivers Component*

The Environmental Drivers component of the GWA program provides the spatial and temporal context for understanding change in the physical and chemical environment. This observation network consists of five interconnected projects distributed across the spill-affected GOA and are key to improving our understanding of the intersection of the Alaska Coastal Current (ACC) with PWS, Resurrection Bay, and Lower Cook Inlet:

#### *Project 21120114-D (CPR)*

*CPR monitoring of plankton populations on the Alaskan Shelf – Clare Ostle, Marine Biological Association (MBA), and Sonia Batten, MBA*

The CPR transect samples the Alaskan shelf from lower Cook Inlet across the slope into the open GOA, providing a now 20-year record of taxonomically resolved, seasonal, near-surface zooplankton and large phytoplankton abundance over a wide spatial scale. Sampling takes place approximately monthly, six times per year, usually

between April and September. Outputs from the project include indices of plankton abundance (e.g., large diatom abundances, estimated zooplankton biomass), seasonal cycles (phenology of key groups) and community composition (e.g., appearance of warm water species, change in dominance by some groups). Variability in any, or all, of these indices might be expected to flow-through to higher trophic levels such as herring, salmon, birds, and mammals that forage across the region, some of which have been impacted by EVOS.

The unusually warm conditions in this region from 2014-2016, known as the Pacific marine heatwave, induced noticeable changes in the plankton. Continued sampling of the CPR transect in 2017-2018 can now be used to determine whether a return to less extreme (although still warm conditions) also saw a return to more typical sub-arctic plankton communities (Fig. 2). The results in Fig. 2 show that the heatwave years had low diatom abundance which changed dramatically in 2017 and 2018 to high abundances. Furthermore, the small copepods were very abundant during the heatwave and this abundance continued into 2017 but declined back to average levels in 2018. In 2019 we see that it is another warm year, with low abundance of diatoms and high abundance of small copepods. It is possible that the low diatoms were the result of increased grazing pressure by the copepods during these years, rather than reduced productivity; however, since in 2017 we recorded high diatoms AND high numbers of small copepods it is more likely that primary productivity was reduced during the heatwave.

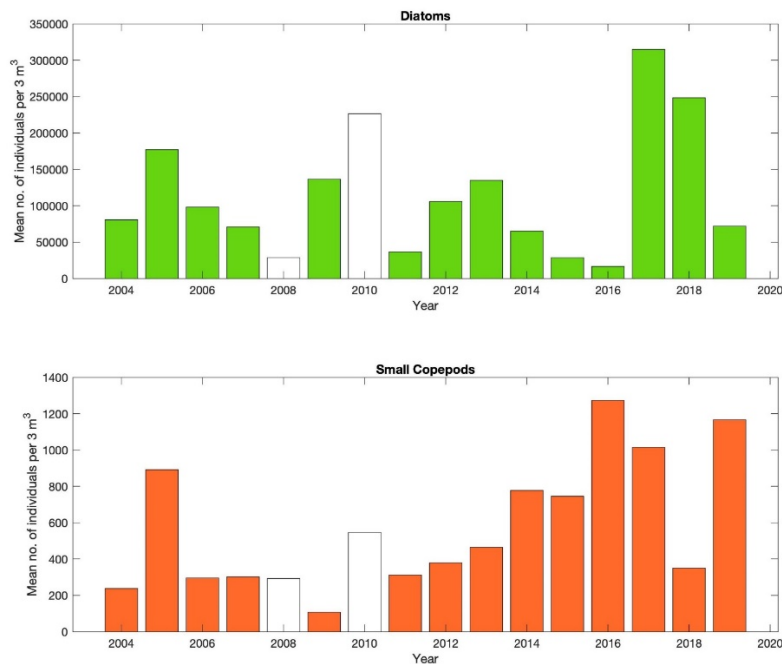


Figure 2. Mean annual abundance of diatoms (green bars) and small copepods (<2mm total length, orange bars) from shelf samples. Unfilled bars are years when less than four months were sampled, and data are not as robust. Please note that 2019 CPR samples have been analyzed but are not yet finalized.

**Project 21120114-G (PWS Oceanography)**

*Oceanographic conditions in PWS – Rob Campbell, PWSSC*

The goal of this project is to continue the time series of oceanographic observations in PWS that began in 2009 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). These data are used to

observe and describe how the region changed in response to the 2014-2016 marine heatwave and to begin to address the many hypotheses for the mechanisms that are driving productivity in the region. In addition, a state-of-the-art autonomous profiling mooring is used to observe the annual cycle of physical, biogeochemical, and biological metrics in central PWS at very high frequency.

Temperature anomalies show a warming trend over the last 45 years at most depths (Fig. 3). The temperature trend at the surface has the weakest trend, presumably due to enhanced inputs of cold meltwater at the surface along the margin of the GOA (Campbell 2018). In late 2013, temperature anomalies shifted to primarily positive (Fig. 3), like those observed throughout the GOA (Bond et al. 2015). Anomalies within PWS in 2015 were as much as 2°C above average (4°C 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 seastars; and larger than average blooms of toxin producing phytoplankton (e.g., Zador et al. 2019). 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. 3). Temperature anomalies in 2019 were the highest observed over the 46-year CTD time series and 2019 has been designated as a second marine heatwave distinct from 2013-2016 heat wave (aka “The Blob”; Amaya et al. 2020). Amaya et al. (2020) suggests that the genesis of the 2019 heatwave was a summertime weakening of the North Pacific high pressure system, while the 2013-2016 heat wave was due to a weakening of the Aleutian Low in winter (Bond et al. 2015).

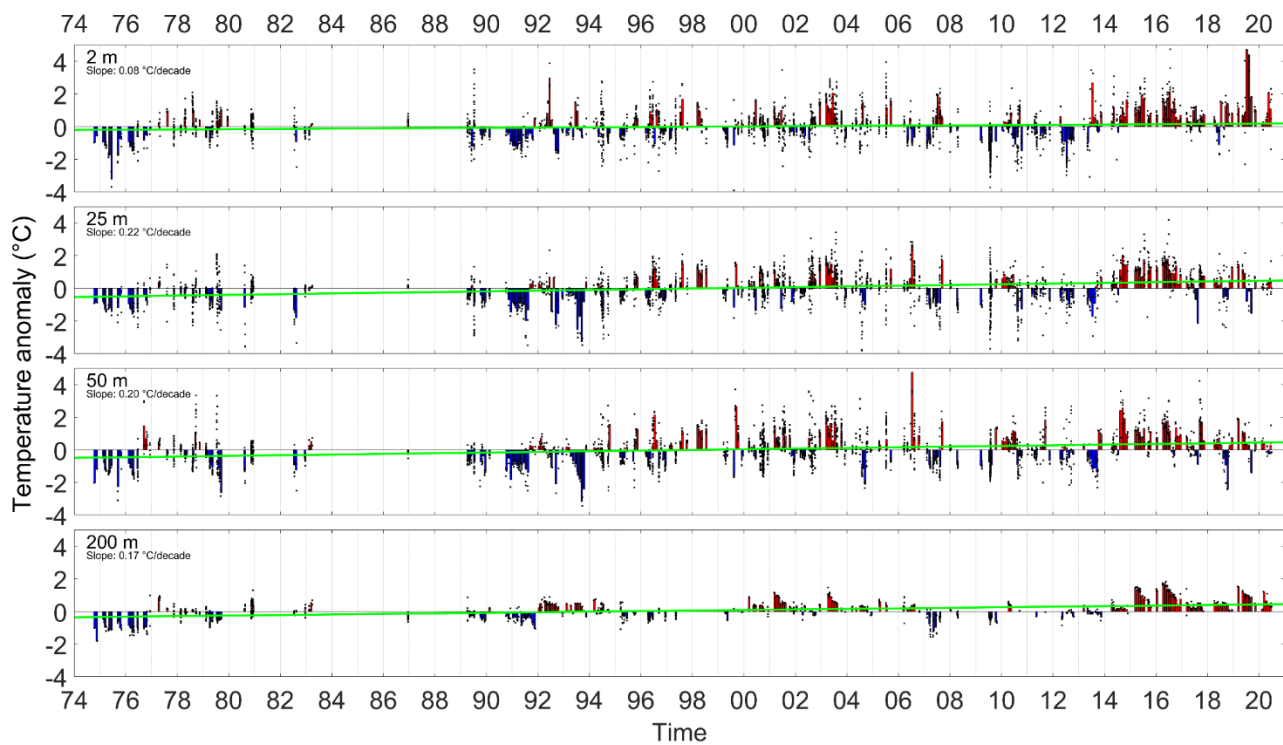


Figure 3. Temperature anomalies at four selected depths in central Prince William Sound. Anomalies were calculated as the residual to a second order cosine curve fit to all years data (to remove seasonality: Campbell 2018). Black points are observations, bars are monthly averages, and the green line indicates the linear trend. All slopes were significantly different from zero ( $p < 0.05$ ).

**Project 21120114-I (GAK-1)**

*Gulf of Alaska mooring (GAK-1) – Seth Danielson and Tom Weingartner, UAF*

The goal of the GAK-1 project is to provide a long-term high-quality reference dataset for the coastal northern GOA that enables scientists, students, commercial and subsistence fishers, and resource managers to better understand climatic and ecological conditions, their changes, and ramifications of change (Fig. 4). Recent water temperatures remain warmer than the long-term average throughout the water column, while near-surface waters have freshened over time and near-bottom waters have salinized. An increase of stratification that carries important and far-reaching implications for ecosystem dynamics.

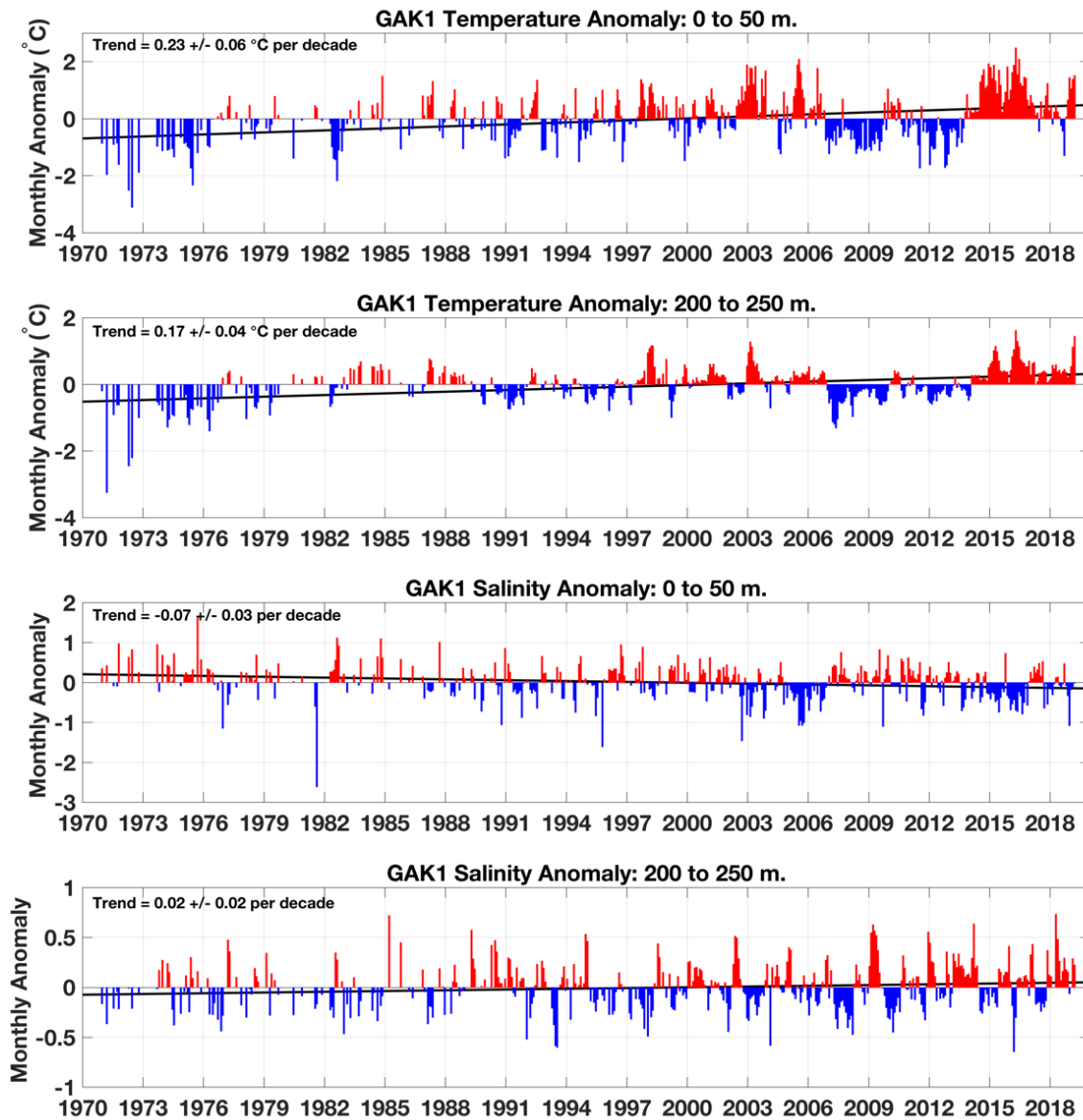


Figure 4. GAK-1 monthly anomaly time series for the 1970-2019 period of record. Temperature (upper two panels) and salinity (lower two panels) anomalies represent averages over the uppermost and lowermost 50 m of the water column. The data exhibit a long-term trend in warming punctuated by signals associated with the cycles of El Niño and other phenomena. Black lines show the least squares best fit trend over the period of record. Text provides trend statistics (best fit least squares linear) over the record length.



**Project 21120114-J (Lower Cook Inlet Oceanography)**

*Oceanographic conditions in Lower Cook Inlet/Kachemak Bay – Kris Holderied, NOAA Kasitsna Bay Laboratory, and Steve Baird, University of Alaska Anchorage (UAA) Kachemak Bay National Estuarine Research Reserve (KBNERR)*

The Cook Inlet/Kachemak Bay Environmental Drivers monitoring project conducts year-round, high temporal resolution oceanographic and plankton sampling to assess the effects of seasonal and inter-annual oceanographic variability on nearshore and pelagic species injured by EVOS. Our overall project goal is to continue to enhance time-series of oceanographic and plankton data in lower Cook Inlet and Kachemak Bay to help understand what drives variations in nearshore and pelagic food webs.

Zooplankton sample identification and data processing have been completed for the 2018 Kachemak Bay and Cook Inlet samples and analysis of 2019 samples are ongoing. 2018 zooplankton data were incorporated into a time series of zooplankton abundance anomalies calculated by combining all zooplankton samples in the study area (Fig. 5), with results indicating that warm water copepod species increased during the heatwave year of 2016, but also in the latter part of 2017, under more average oceanographic conditions. Warm water copepod species declined and cool water species increased in 2018, which had near normal marine temperatures for most of the year. In addition, there were temporal shifts in seasonal transitions in zooplankton communities during warmer years. Temporal patterns in overall zooplankton abundance did not show a clear relationship with the marine heatwave or warmer years through 2018 (Fig. 5).

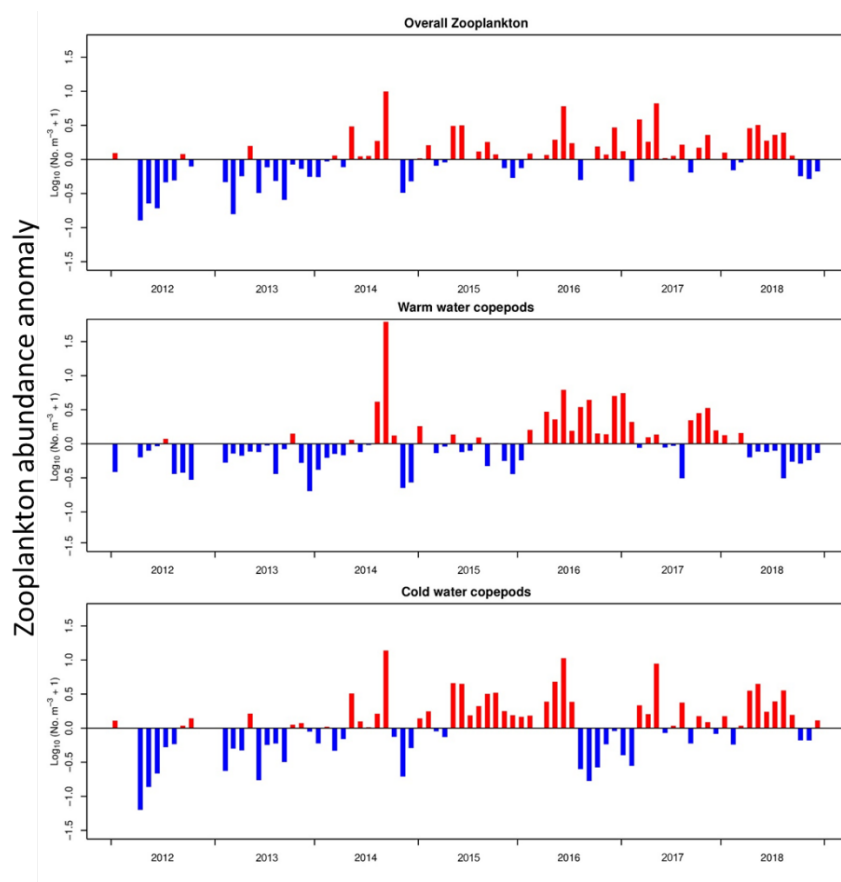


Figure 5. Abundance anomalies of all zooplankton (top panel), warm water copepod species (middle panel) and cool water copepod species (bottom) panel from all Kachemak Bay and Cook

Inlet stations, 2012–2018. Observations were log<sub>10</sub>+1 transformed, averaged by month, and subtracted from the monthly average to produce an anomaly (without detrending).

### Project 21120114-L (Seward Line)

*Seward Line – Russ Hopcroft, UAF*

We are continuing multi-disciplinary oceanographic observations begun in fall 1997 in the northern GOA. We determine the physical-chemical structure, the distribution and abundance of phytoplankton, microzooplankton, and mesozooplankton, and survey seabirds and marine mammals. These observations enable descriptions of the seasonal and inter-annual variations of this ecosystem. Our goal is to characterize and understand how different climatic conditions influence the biological conditions across these domains within each year, and what may be anticipated under future climate scenarios.

Warmer years result in reduced body size and typically lower lipid storage by the large-bodied spring copepods (i.e., *Neocalanus* spp.). In contrast to spring, temperature is much less variable during late summer, although biological communities continue to show high variability, including increased prevalence of southern species during warmer years such as those during the marine heatwave (Fig. 6). Thus, while lipid accumulation during 2019 appeared low, it was relatively normal during 2020. Several southern species rebounded during fall 2019, preliminary observations for 2020 suggests low abundances during summer.

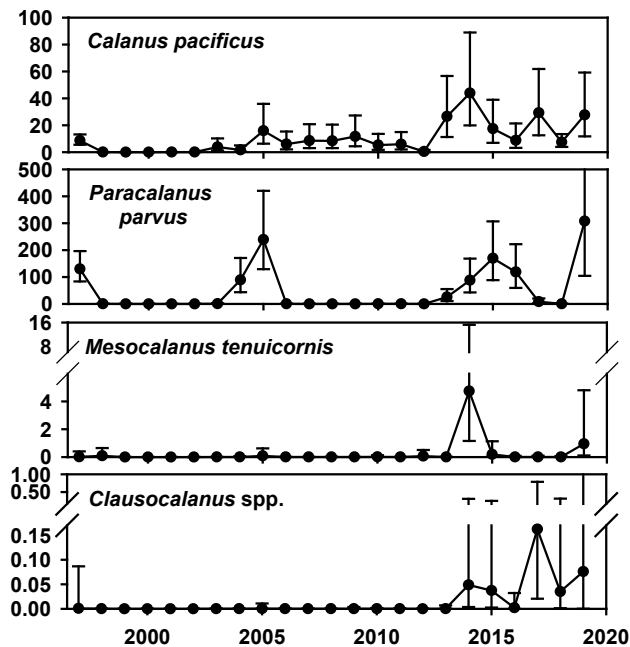


Figure 6. Abundance of the four most prevalent California Current copepods along the Seward Line during late summer. Several species rebounded during 2019, and in one case to record numbers.

### Pelagic Component

The Pelagic Component research team monitors key pelagic species groups using five projects focused on killer whales, humpback whales, forage fish, and marine birds (two projects: summer and fall/winter). The two overarching questions for the Pelagic Component to answer in the current five year funding cycle are: 1) what are the population trends of key upper trophic level pelagic species groups in PWS – killer whales, humpback

whales, and marine birds? and 2) how do predator-prey interactions, including interannual changes in prey availability, contribute to underlying changes in the populations of pelagic predators in PWS and Middleton Island?

**Project 21120114-C (PWS Forage Fish)**

*Forage fish distribution and relative abundance – Mayumi Arimitsu and John Piatt, USGS Alaska Science Center*

Forage species are important in marine food webs because they are consumed by marine predators such as birds, mammals, and predatory fish. Forage species typically produce many offspring and have short life spans, and these traits predispose populations towards large fluctuations in abundance, with subsequent consequences for their predators. Examples of important forage taxa in PWS include capelin, Pacific sand lance, Pacific herring, juvenile walleye pollock, and krill. The primary objectives of the forage fish monitoring project are to: 1) monitor the status and trends of forage fish in areas with known persistent aggregations of predators and prey during fall, and 2) support annual field and laboratory efforts to continue the Middleton Island long-term seabird diet index in spring/summer, 3) assess changes in forage fish abundance indices on acoustic-trawl surveys during summer, and 4) support HRM program aerial survey validation efforts in summer.

Many patterns we observed during forage fish sampling in PWS in the first five years of GWA monitoring were consistent with patterns of recruitment, abundance and/or body condition of forage fish in the larger northern GOA region. For example, young of the year walleye pollock were extremely abundant in trawls during our surveys in 2012 and least abundant in 2015 (Arimitsu et al. 2018), which is consistent with changes in Gulf-wide recruitment and biomass (Dorn et al. 2016). We found capelin had highest body condition in 2013 (Arimitsu et al. 2018), which was a year when capelin were widespread and abundant on GOA Integrated Ecosystem Research Program hydroacoustic – trawl surveys (McGowan et al. 2016, 2020). On the other hand, age-1 capelin were increasingly scarce throughout PWS and other areas of the GOA, including seabird diets in 2014-2016 (Arimitsu et al. 2020). Time series data from Middleton Island, the longest available from any location in Alaska, show that after several years of high frequency of occurrence in seabird diets in 2008-2013, capelin virtually disappeared from diets in 2014-2019 (Fig. 7).

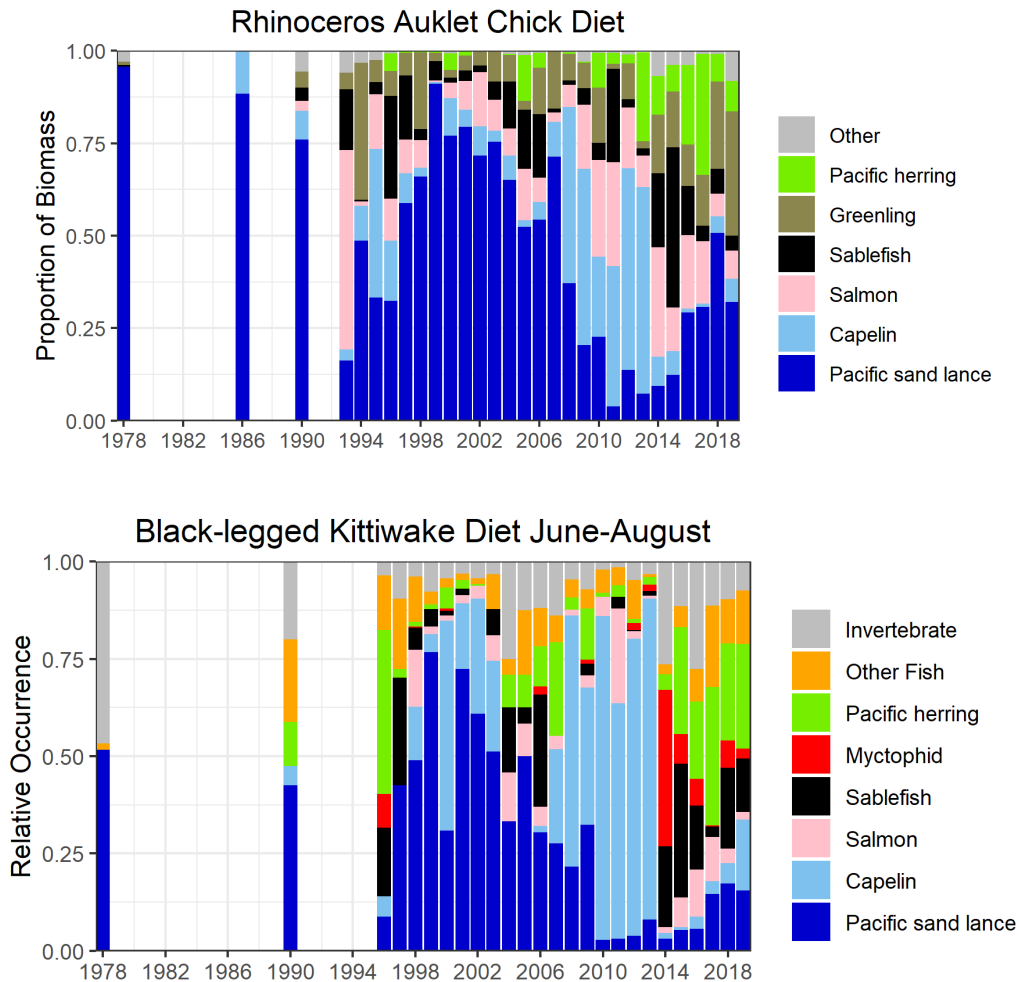


Figure 7. Interannual variation in diet composition of chick-rearing rhinoceros auklets (top) and black-legged kittiwakes (bottom) on Middleton Island, 1978 to 2019.

**Project 21120114-E (PWS Fall/Winter Seabirds)**

*Fall and winter habitat use and distribution of seabirds in PWS – Mary Anne Bishop (PWSSC)*

Of the marine birds that overwinter in PWS, nine species were initially injured by EVOS. As of 2014, two species that overwinter in PWS have not yet recovered (marbled murrelet and pigeon guillemot) and a third species, Kittlitz’s murrelet, has an unknown recovery status (EVOSTC 2014). Most of the marine bird monitoring in areas affected by EVOS has occurred around breeding colonies during the reproductive season when food is generally at its most plentiful; however, in winter prey availability and the marine bird community changes markedly compared to summer. We use long-term monitoring surveys of marine birds in PWS during fall and winter to understand post-spill ecosystem recovery and how changing ocean conditions are affecting marine bird populations.

We recently examined the use of ecosystem indicators to understand the influence of environmental variability on marine bird populations in PWS. We identified anomalies in monthly densities of murres as a useful indicator because, as piscivorous seabirds, murres are particularly sensitive to changes in the marine ecosystem. Murre densities appear to be highly variable within months and across winters (Fig. 8). For murres, our surveys

detected changes in densities and distribution in PWS during the months leading up to a prolonged die-off event occurring along the GOA beginning during the winter of 2014-2015 and ending in the spring of 2016. Our surveys recorded unusually high densities in February 2015 (immediately preceding the onset of the die-off in March 2015) and fall 2015 (immediately prior to the peak of the die-off in December 2015) (Fig. 8). The increased use of PWS by murres during winter coincided with persistently high ocean temperatures in the North Pacific Ocean beginning during the winter of 2013-14 and persisting through 2016 in the northeast Pacific (with regional variability) (Di Lorenzo and Mantua 2016), with positive temperature anomalies continuing through 2017 and 2018 in PWS (PI Campbell 20120114-G). Since the die-off and dissipation of the heatwave, murre densities have been lower than the long-term monthly average, except for September 2019, when murre densities were approximately equal to the long-term mean. Total bird density is also highly variable within and across years (Fig. 8). Similar to murres, the total marine bird density has been anomalously low since the heatwave. However, densities increased during fall 2019, which is potentially a sign of ecosystem recovery.

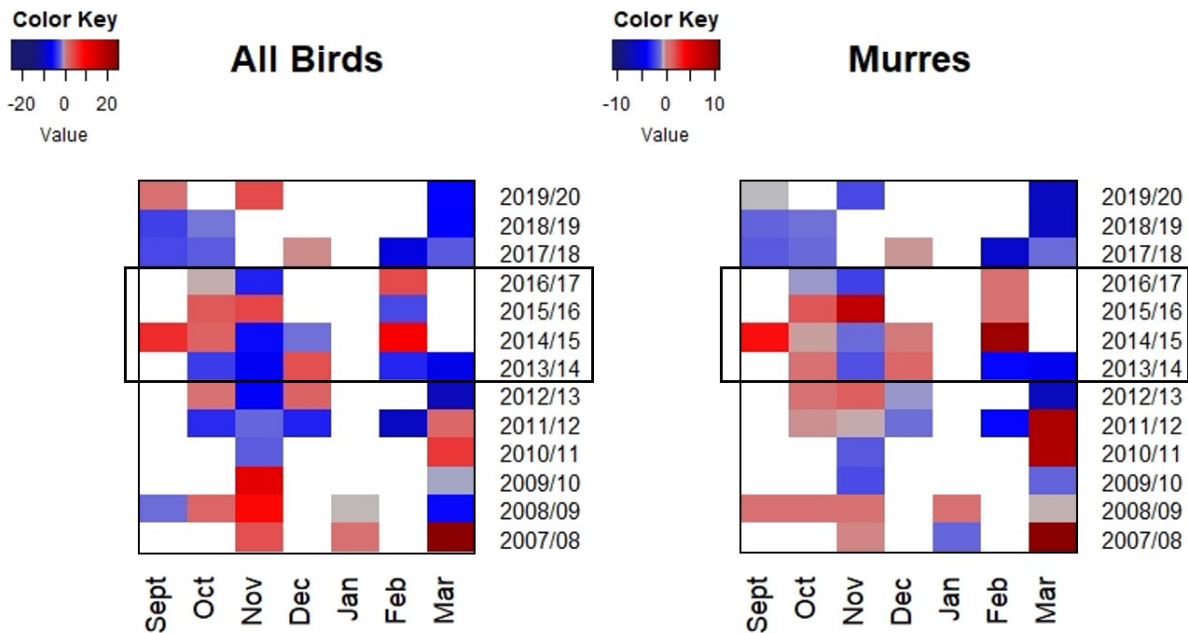


Figure 8. Monthly total marine bird and murre density anomalies observed during fall and winter bird surveys in Prince William Sound, 2007 – 2020. A marine heatwave event occurred throughout the Northeast Pacific Ocean beginning in the winter of 2013/14 and was strongest (with regional variability) through 2017 (indicated by black box). However, positive temperature anomalies persisted through 2018 in the Gulf of Alaska, including coastal regions (PI Danielson, project 20120114-I) and Prince William Sound (PI Campbell, project 20120111-G).

**Project 21120114-M (PWS Summer Marine Birds)**

*PWS summer marine bird surveys – Kathy Kuletz and Robert Kaler, USFWS*

Boat-based marine bird surveys have been conducted in PWS for more than 30-years following the EVOS in 1989. Surveys are conducted every two years and therefore occur during July 2018 and 2020 (see below) during the current GWA funding cycle (FY17-21) In order to better understand the dynamics of a marine bird community that has experienced the simultaneous effects of a major oil spill and climate variability, this project collects additional information to monitor the distribution and abundance of marine birds in PWS.

Using data collected during small boat surveys (1989-2012), Cushing et al. (2018) found that abundance estimates for both marbled murrelets and Kittlitz’s murrelets decreased by more than two-thirds over the study period. Density of marbled and Kittlitz’s murrelets continued a long-term pattern of decline in 2018 (Fig. 9). Additionally, densities of pigeon guillemots continued to decrease PWS-wide (Fig. 8). Also notable was complete or nearly complete breeding failures of black-legged kittiwakes in PWS 2016-2018 while density of kittiwakes throughout PWS trended downward during the same period (Fig. 9).

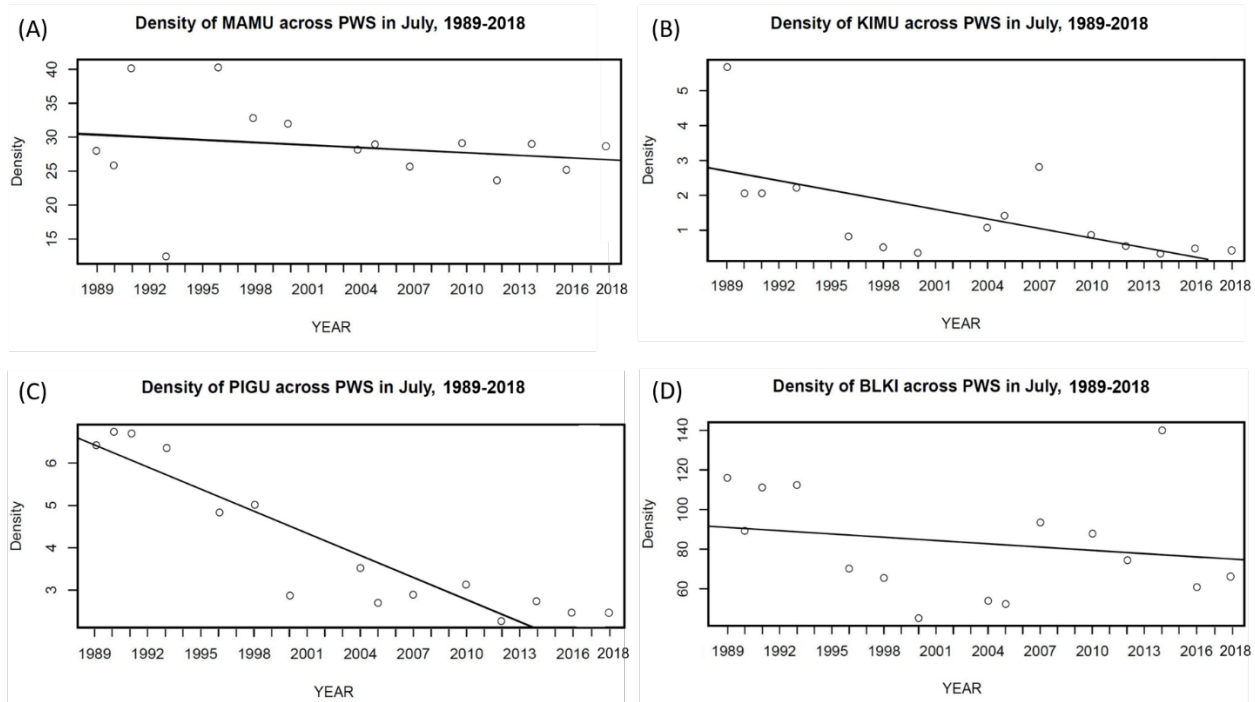


Figure 9. Density (birds/km<sup>2</sup>) estimated for (A) marbled murrelet [MAMU], (B) Kittlitz’s murrelet [KIMU], (C) pigeon guillemot [PIGU], and (D) black-legged kittiwake [BLKI] across Prince William Sound (PWS), Alaska, 1989-2018.

**Project 20120114-N (Killer Whales)**

*Long-term killer whale surveys – Craig Matkin, North Gulf Oceanic Society*

Both resident ecotype (AB pod) and transient ecotype (AT1 population) killer whales suffered significant mortalities following EVOS in 1989. AB pod is recovering after 26 years but has still not reached pre-spill numbers. The AT1 population is not recovering and may be headed toward extinction (Matkin et al. 2008) (Fig. 10). This project has determined that killer whales are sensitive to perturbations such as oil spills but has not yet determined the long-term consequence (which may include extinction) or the recovery period required. As an apex predator, this species (both fish and mammal eating types) has an important role in the ecosystem. Additionally, they are a primary focus of viewing by a vibrant tour boat industry in the region. Data from this project are used by tour boats to enhance viewers experience and understanding of the local environment and fauna.

During 2020 fieldwork we have collected 45 scale or flesh samples during predation events by resident killer whales and collected 38 scat samples. This is the most productive sampling in the early season that we have

ever recorded. Most exciting was the number of samples of both scales/flesh and of scat that were obtained in PWS where our success has been limited in the past. This will be a boost to our long-term study of resident killer whale feeding ecology. Our most recent results from previous scat analyses indicate the primary importance of Chinook and chum salmon in the diet, with minor contributions from other species (including sockeye salmon, halibut, and arrowtooth flounder). The data support the accuracy of scale and flesh (predation) analysis. In particular, the at times ubiquitous pink salmon have not been found in the predation samples (scales and flesh collected at predation sites) or in the scat.

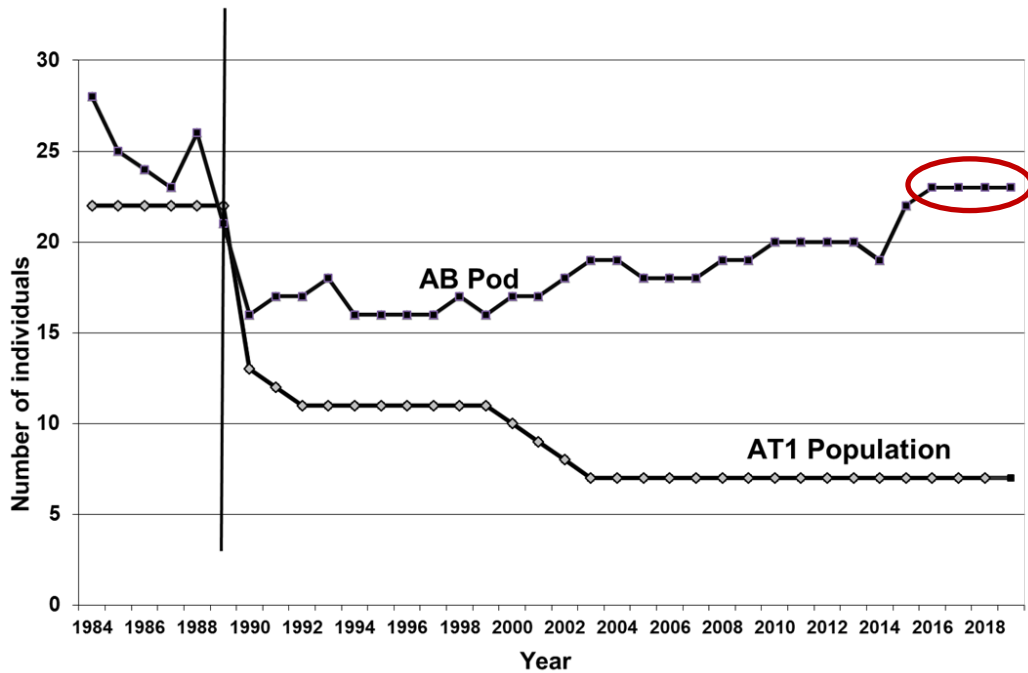


Figure 10. Number of whales in AB pod and AT1 population by year. Note: past four years total for AB pod (circled) does not take into account three missing matriline (AB17, AB22, and AB14).

**Project 21120114-O (PWS Humpback Whales)**

*Humpback whale predation on herring – John Moran and Jan Straley, NOAA National Marine Fisheries Service (NMFS) Auke Bay Laboratory and University of Alaska Southeast (UAS)*

Monitoring humpback whales and their diets is important to understanding predator prey interactions in the pelagic waters of PWS. Because humpback whales are significant predators in the ecosystem, they may have the potential to control the distribution and abundance of forage fish. The humpback whale population in the North Pacific has rebounded from near extinction in the late 1960s to over 22,000 individuals (Barlow et al. 2011), and parallel increases in whale abundance have been documented in PWS. Over much of the same period the abundance of the dominant forage fish, Pacific herring, shifted from an abundant to a diminished state. Pacific herring were identified as an injured species following the EVOS. Understanding the mechanisms behind their failed recovery requires a comprehensive understanding of both top-down and bottom-up processes in the context of a changing ecosystem.

PWS has had the smallest biomass of herring but the most whales relative to Southeast Alaska (Moran et al. 2018). This makes the impact of predation potentially more severe in PWS, suggesting that top-down forcing

may be limiting the recovery of herring in PWS. However, since 2013, major natural perturbations in the marine ecosystem (e.g., regime shift, El Niño, PDO, and marine heatwaves) have occurred (Straley and Moran 2018). Warmer water temperatures over the past two years combined with seabird and marine mammal die-offs, emphasize that the GOA is still undergoing major perturbations that impact species at the population level. Counts of humpback whales have dropped in our recent surveys (Fig. 11). This is likely the result of reduced prey availability. Although we saw a slight increase in September of 2019, humpback whale numbers within PWS have yet to return to their pre-heatwave abundance.

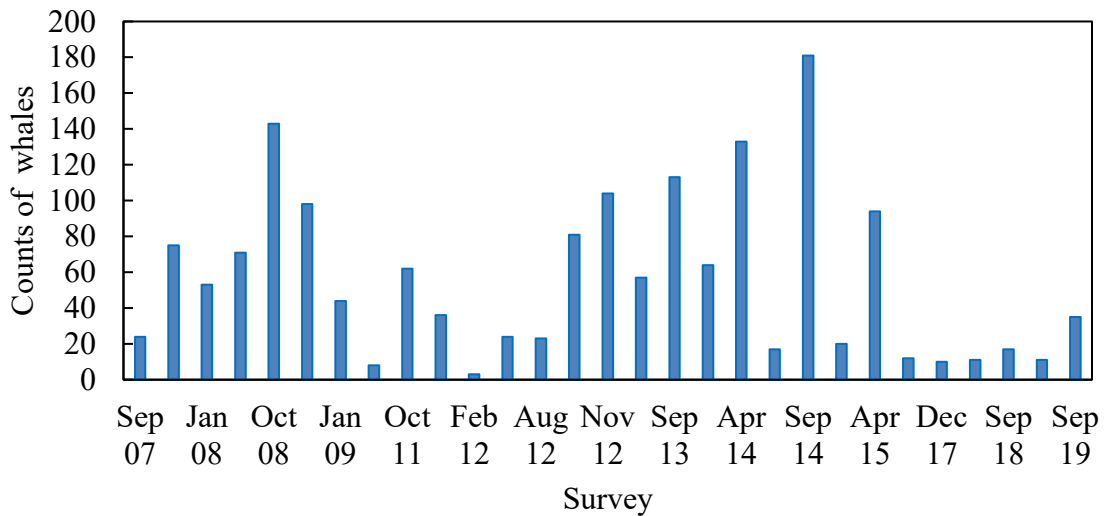


Figure 11. Counts of humpback whales in Prince William Sound provide an index of whale abundance, recent declines in whale numbers correspond to declines in herring biomass.

Nearshore Monitoring Component

**Project 21120114-H (Nearshore Ecosystem)**

*Nearshore systems in the GOA – Heather Coletti, NPS, Daniel Esler, Kim Kloecker, Dan Monson, and Ben Weitzman, USGS Alaska Science Center, and Brenda Konar and Katrin Iken, UAF*

The Nearshore component of the GWA long-term monitoring program investigates and monitors the nearshore environment of the greater EVOS area, with a focus on selected elements of the nearshore food web. Our overarching goal is to understand drivers of variation in the GOA nearshore ecosystem. The foundational questions of the Nearshore project include: (1) What are the spatial and temporal scales over which change in nearshore ecosystems is observed? (2) Are observed changes related to broad-scale environmental variation, local perturbations, or underlying ecological processes? (3) Does the magnitude and timing of changes in nearshore ecosystems correspond to those measured in pelagic ecosystems? The study design allows us to evaluate potential impacts from more localized sources, especially those resulting from human activities, including lingering effects of EVOS, and identifying potential mechanisms of change. We monitor more than 200 species dependent on nearshore habitats, many with well-recognized ecological roles in the nearshore food web.



The time series of marine bird and mammal data is starting to reveal important patterns within individual species. For example, sea otters can dramatically affect the structure and complexity of their nearshore ecological community. They cause well described top-down cascading effects on community structure by altering abundance of prey (e.g., sea urchins), which can in turn alter abundance of lower trophic levels (e.g., kelps; Estes and Palmisano 1974, Estes and Duggins 1995, Konar and Estes 2003, Estes 2015). As a keystone species (Estes and Duggins 1995), sea otters have been monitored by the Southwest Alaska NPS Inventory and Monitoring and GWA Nearshore programs since 2006 (Dean et al. 2014). Sea otter metrics include 1) carcass recovery to evaluate mortality, 2) aerial surveys to estimate abundance, and 3) foraging behavior and spraint observations, which provide insight into the diet of sea otters. Here we present preliminary analysis of prey composition for foraging observations collected on sea otters across all four regions beginning in 2003 (western PWS [WPWS]) through 2018 (all regions). To provide context as to possible drivers of prey composition differences across space and time, the Nearshore component independently measures prey resources of the sea otter in the intertidal, including sampling of clams, mussels, and other invertebrates. Patterns in prey composition and clam density and biomass are presented here.

Variation by region is evident in the proportion of prey types in the diet of sea otters (Fig. 12). The sea otter diet at Kenai Fjords National Park (KEFJ) continues to be dominated by mussels, while in contrast, Katmai National Park and Preserve (KATM) continues to be dominated by clams with a diversity of other prey. WPWS appears to have shifted recently from a diet primarily of clams to one higher in mussels in 2018. Kachemak Bay (KBAY) foraging observations were initiated in 2017 and suggest a relatively high proportion of mussel consumption. Coinciding with increases in mussel consumption, we have documented an increase in large ( $\geq 20$  mm) mussels across the study areas (Coletti et al. 2019). Sea otter foraging data have been analyzed through 2018, 2019 is pending analysis.

Clam densities and biomass varied by regions over time, with KATM and KBAY tending to have higher clam densities and biomass than KEFJ or WPWS (Fig. 13). To account for the higher biomass but similar density, data suggest that clams at KBAY are larger relative to KATM and the other regions (all clams were measured at the time of collection; these data are being processed and will confirm any differences among regional sizes of clams). From 2017 to 2019 there was an increase in the density and biomass of clams at all regions, though especially so in KATM. A student project is relating annual clam recruitment in cores to the subsequent standing stock of clams at those same beaches. Preliminary results suggest that recruitment cores may predict adult standing stock (Zhang et al. 2020 poster presentation). By 2021, we will have 5 years of complementary quadrat and core data allowing us to evaluate potential relations between recruitment of juveniles and adult clam populations.

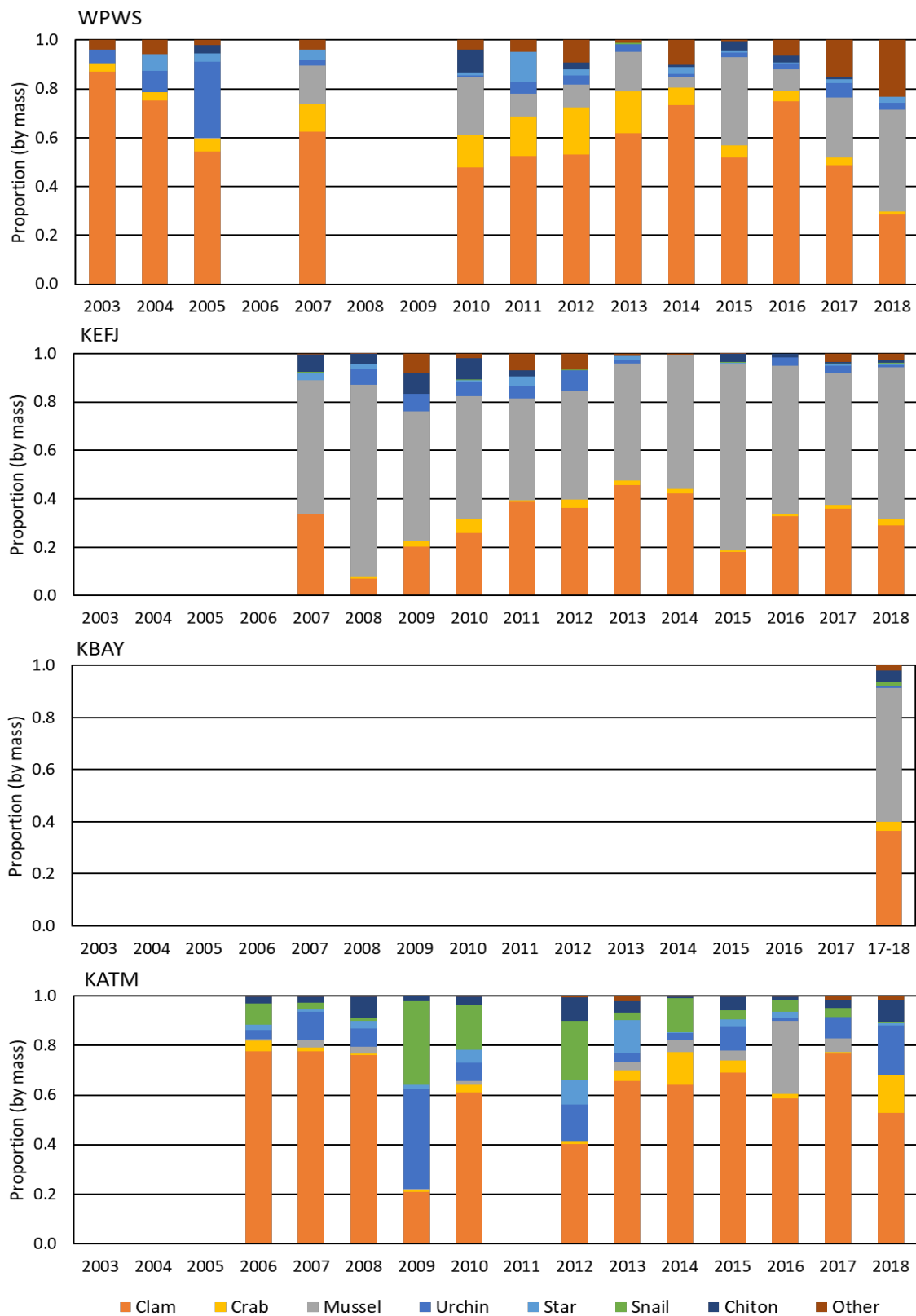


Figure 12. Sea otter prey proportions by region: western Prince William Sound (WPWS), Kenai Fjords National Park (KEFJ), Kachemak Bay (KBAY; 2017-2018 – combined due to low sample size in 2017), and Katmai National Park and Preserve (KATM).

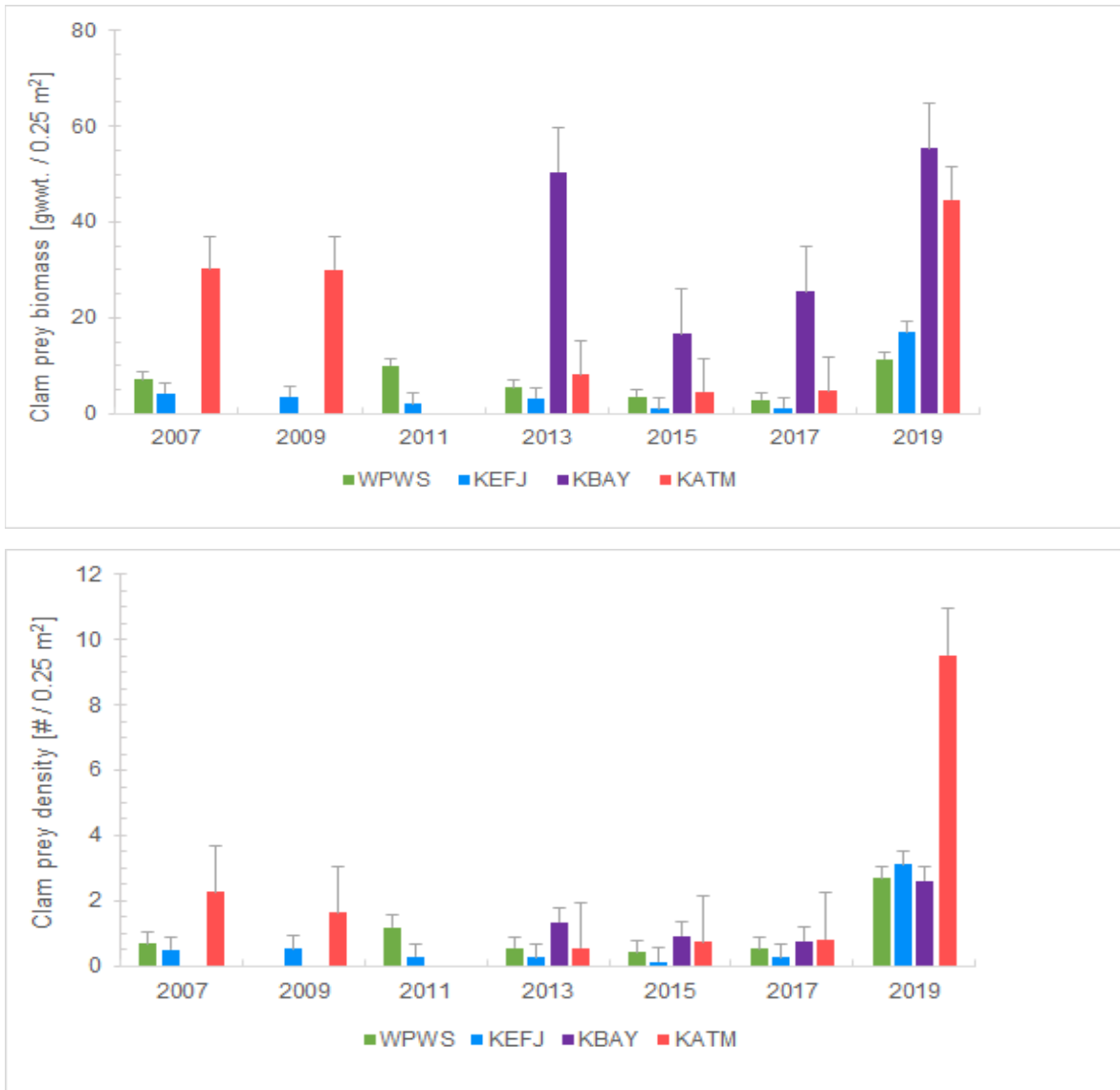


Figure 13. Mean  $\pm$  1 SE clam biomass (grams of wet weight per quarter  $m^2$  of edible tissue; upper panel) and density (number of individuals per quarter  $m^2$ ; lower panel) by region: western Prince William Sound (WPWS), Kenai Fjords National Park (KEFJ), Kachemak Bay (KBAY), and Katmai National Park and Preserve (KATM).

Lingering Oil Component

**Project 21120114-P (PWS Lingering Oil Survey)**

*Long-term monitoring of lingering oil in PWS – Mandy Lindeberg, NOAA, and Ron Heintz, Sitka Sound Science Center*

We proposed in FY20 to examine established lingering oil beaches in PWS for the presence of oil spilled by the *Exxon Valdez* as recommended by the last lingering oil project, 16120114-S (Lindeberg et al. 2017). Due to COVID-19 the field season for this project has been delayed until summer 2021. This project was developed in coordination with EVOSTC staff to provide a sensible monitoring program that continues past efforts. Past monitoring projects began with an initial assessment in 2001 where over 9,000 pits were excavated to estimate how much oil remained on beaches in Prince William Sound. Results from this survey showed oil was lingering in

the environment longer than expected and not changing in its chemical composition or “weathering”. Additional surveys were conducted from 2003-2015 to determine the oil’s extent and to refine model estimates. Recommendations from these surveys were to continue monitoring these known sites periodically on a 5-year cycle to maintain the oil chemistry time series and evaluate any change. This project proposes a low-cost presence/absence approach to monitoring that can be combined with previous EVOSTC-funded modeling efforts.

**2. PROGRAM STATUS OF SCHEDULED ACCOMPLISHMENTS**

**A. Program 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 Work Plan. C = completed, X = planned or not completed, V = cancelled due to COVID-19, P = partially completed, due to constraints of COVID-19. 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
<b>Field sampling</b>																				
Environmental drivers	C	C	C	C	C	C	C	C	C	C	C	C	P	P	P	X	X	X	X	X
Pelagic	C		C	C	C		C	C	C		C	C	P		X	X	X		X	X
Nearshore	C	C			C	C			C	C			V	P			X	X		
<b>Data</b>																				
Data to workspace				C				C				C				X				X
Prior year data to public					C				C				C				X			
<b>Meetings</b>																				
PI meetings	C	C	C	C	C	C	C	C	C	C	C	C	C	C	X	X	X	X	X	X
Trustee Council/PAC			C				C				C				X				X	
AMSS				C				C				C				X				X
Community engagement			C			C				C					V				X	
Year 3 joint workshop													C							
<b>Reporting</b>																				
Annual reports					C				C				C				X			
FY work plan (DPD)			C				C				C				C					
Year 3 synthesis report												C								
FY12-21 final report																				X

In addition to the primary program deliverables in Table 1, during the past year the program contributed to at least 18 ecosystem indicators from all GWA components for the NOAA Fisheries Gulf of Alaska Ecosystems Status Report to the North Pacific Fisheries Management Council and participated in two agency workshops promoting the use of GWA datasets. Program PIs and team members produced 18 peer reviewed publications, 10 manuscripts in preparation or review, and three theses and dissertations. The GWA program has over 25 leveraged partnerships with outside agencies and groups to integrate data from

broader efforts. Outreach included 74 scientific and public presentations, five articles, four editions of GWA Quarterly Currents, and two EVOS 30th anniversary events. GWA PIs also mentored 25 students ranging from PhDs, post docs, masters, undergraduates, and interns from a variety of universities.

## **B. Explanation for not completing any planned milestones and tasks**

Some GWA project milestones and tasks have been impacted by COVID-19 and the subsequent restrictions mandated by federal, state, and local community governments. As a result, some field sampling, laboratory analyses, and outreach activities have been cancelled, partially completed, or postponed until 2021. Below is a brief summary of COVID-19 impacts for each project affected. Additional details are provided in each project Work Plan. In summary, while adhering to health safety concerns and travel restrictions, numerous GWA projects were quite successful in maintaining partial or full data collection efforts. These GWA data will be especially valuable to resource managers and other stakeholders given the cancellation of other research programs in the GOA.

### 21200114-B (PM II)

Due to COVID-19 restrictions, we did not hold an in-person community engagement experience in the form of a local and traditional ecological knowledge roundtable in one of the PWS villages (Tatitlek, Chenega, or both) in FY20. Rather, we will postpone this exchange until FY21, if at all possible. Public health and safety is paramount and we will adjust our plans accordingly.

### 21200114-C (PWS Forage Fish)

Due to COVID-19 restrictions, the fall 2020 forage fish acoustic-trawl survey was cancelled, but some June aerial forage fish validation work did occur in collaboration with HRM.

### 21200114-D (CPR)

Results from CPR sampling in the first half of FY19 have been finalized; however, because of restricted laboratory access due to COVID-19, there has been a delay in finalizing the samples collected in the 3<sup>rd</sup> and 4<sup>th</sup> quarter of FY19. Although there will be some delay in finalizing the 2019 CPR data due to COVID-19 restrictions to lab access, the FY20 CPR tows have not been impacted and we are expecting all tows to be completed successfully.

### 21200114-E (Winter Marine Bird Surveys)

There were no impacts due to COVID-19, all surveys were completed.

### 21200114-G (PWS Oceanography)

Due to COVID-19 restrictions, one cruise was delayed and sample analyses are delayed. Sample analyses delays are because of restrictions on accessing the laboratory.

### 21200114-H (Nearshore Ecosystem)

Due to COVID-19 restrictions, our scheduled nearshore field work was drastically reduced and, in many cases, cancelled. All summer sampling and winter (March) marine bird and mammal surveys slated to be completed in KATM in 2020 were cancelled. WPWS spring beach walks used to collect sea otter carcasses for age-at-death estimates were cancelled. In KBAY, we were able to conduct most intertidal surveys, black oystercatcher surveys, and some sea otter observations. At two sites in KEFJ and across all WPWS sites, intertidal temperature loggers were swapped out, site photos were taken, sea star surveys were completed,

and black oystercatcher surveys were conducted. We were also able to photo document all mussel sites in WPWS.

#### 21200114-I (GAK-1)

Due to COVID-19 restrictions, we were unable to undertake the GAK-1 mooring turn-around in March and GAK-1 CTD profiles in March and April. We were able to do the turnaround in May from R/V Sikuliaq as part of a specially-permitted cruise to keep the 22-year May Seward Line time series intact. We got the GAK-1 CTD in June from on board R/V Nanuq. The July CTD profile was done from R/V Sikuliaq as part of the summer Seward Line sampling, and August 2020 is scheduled again for R/V Nanuq. Looking forward, we anticipate being able to make our regularly scheduled monthly CTD profiles. Other disruptions from COVID-19 have come in the form of delayed data processing, a full update of the GAK-1 time series is not presently available. We anticipate being on track by November 2020 prior to the fall PI meeting.

#### 21200114-J (Lower Cook Inlet Oceanography)

Due to COVID-19 restrictions, we were unable to complete some small boat surveys in FY20 (Quarters 1 and 2) (no ship-based surveys April and May 2020 and CTD-only survey in June 2020). System-Wide Monitoring Program nutrient samples were not collected and water quality sondes were not switched out from March through June at Seldovia, and April through May at Homer due to COVID-19 restrictions. The water quality and meteorological instruments continued to collect data, and any data quality impacts from the longer than normal deployments (2 months at Homer sites, 3 months at Seldovia sites) will be examined during the QA/QC process.

Non-COVID-19 related - due to prolonged cold and stormy weather and marine icing conditions, small boat oceanographic sampling could not be conducted at Cook Inlet stations outside Kachemak Bay (along Transects 3, 6, and 7) in February 2020 (Quarter 1); however, we were able to sample all oceanographic and plankton stations in Kachemak Bay that month (on Transects 9, 4, and the along-bay transect).

#### 21200114-L (Seward Line)

Despite COVID-19 restrictions, The May 2020 Seward Line survey was executed using a skeleton science team of only 3 PIs, and the summer survey with half the normal science compliment. With support from NSF, we successfully transferred our September cruise to the R/V Sikuliaq when the USFWS cancelled the R/V Tiglax's 2020 field season.

#### 21200114-M (PWS Summer Marine Birds)

Due to COVID-19 restrictions, we postponed the July 2020 marine bird survey. Seward Line and NGA LTER survey obligations were achieved, but instead of the spring cruise, an observer participated in the summer cruise.

#### 21200114-N (Killer Whales)

There were no disruptions to the primary goals of the killer whale project due to COVID-19. Two exceptions were optional aspects of the project that were not pursued: 1) morphometrics and body condition, and 2) an outreach opportunity.

### 21200114-O (PWS Humpback Whales)

Due to COVID-19 restrictions, the spring humpback whale survey was postponed to fall. Chemical analysis of samples collected in September 2019 were not completed prior to Auke Bay Laboratories campus being locked down. Lab work is scheduled to resume in mid-August 2020.

### 21200114-P (PWS Lingering Oil Survey)

Due to COVID-19 restrictions, the majority of lingering oil tasks have been deferred to FY21. The project PIs believe it will be a tight timeline in FY21, but all objectives and tasks will be completed as outlined. Delivery of the final report may be delayed.

#### **C. Justification for new milestones/tasks**

The GWA program is not requesting new milestones or tasks for FY21. However, the nearshore project (21200114-H) requests applying funds not used when FY20 field sampling was reduced to incorporate an MSc student at UAF to analyze stable isotope samples already collected.

### **3. PROGRAM COORDINATION AND COLLABORATION**

#### **A. Within an EVOSTC-funded Program**

Please see individual project Work Plans for coordination and collaborations being carried out at the PI level. The increased coordination and collaboration among the projects and PIs became evident as health restrictions from the novel coronavirus went into place. Projects coordinated to collect data for each other when possible and projects developed new ways to collect data where possible.

#### Gulf Watch Alaska

The following outlines how the GWA leadership personnel continue to achieve coordination and collaboration activities within the GWA program (see also organizational chart, Fig. 14):

*Program Lead* - oversees coordination of individual program components, science synthesis and integration, and ensuring a coordinated monitoring program that meets project milestones and deliverables. These duties include:

- Oversight of project synthesis efforts and coordinate preparation of scientific reports/papers for the EVOSTC and the public
- Coordinating efforts of the GWA program with the Data Management program, the HRM program, external programs, and resource agencies
- Working with Outreach Coordinator and PIs to support outreach efforts

*Science Coordinator* - provides program technical writing, review, and science coordination, including:

- Author and lead production of program synthesis products and promote integration of GWA projects
- Lead development of ecosystem indicators from GWA datasets
- Review and collation of reports and Work Plans
- Integrate GWA data and platforms with external programs such as HRM, NOAA's GOA survey, UAF and NSF's NGA LTER site.
- Editorial review, website development/updates, and assistance with coordination of outreach events for each project

- Attendance and presentation of program information at scientific meetings and public events.

*Program Coordinator* - facilitates meetings, reporting, outreach, sharing, and publication of information from the various monitoring projects, including:

- Planning and documenting all quarterly teleconferences and meetings
- Tracking and assisting with data and metadata publication in the Gulf of Alaska Data Portal
- Tracking progress towards deadlines and program products
- Assisting with maintenance and updates for program website for purposes of conveying important program goals and information to the group
- Participate on Outreach Steering Committee and assist with outreach events

*Administrative Lead* - works closely with all other members of the PMT on a regular basis to ensure within-program coordination and collaboration, including:

- Providing logistics for teleconferences and in-person meetings
- Acting as the fiscal agent for non-Trustee Agencies and organizations
- Coordinating outreach activities and the Outreach Steering Committee; overseeing the Outreach Coordinator
- Facilitating and funding participation by the SRP
- Completing annual audits to demonstrate compliance with federal grants management standards
- Ensuring collaboration, where appropriate, with HRM and Data Management programs
- Submitting all required narrative (semi-annual) and fiscal (quarterly) reports to NOAA, through which GWA funding flows to all non-Trustee Agencies via PWSSC

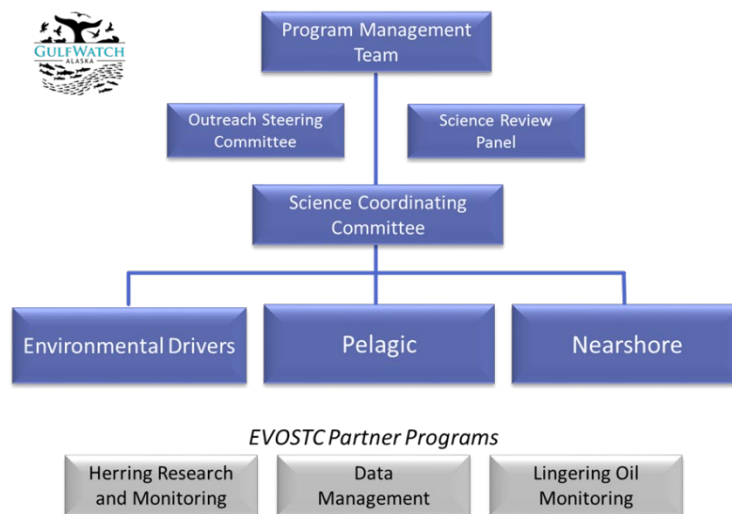


Figure 14. Organizational chart for Gulf Watch Alaska and other *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) programs. The Program Management Team consists of Program Lead, Administration and Outreach Lead, Science Coordinator, and Program Coordinator who are responsible for coordination and collaborations across EVOSTC programs and with outside agencies and non-governmental organizations. The Science Coordinating Committee consists of the Science Coordinator and the three Component Leads.



### Herring Research and Monitoring Program

The following outlines how the GWA leadership personnel will achieve coordination and collaboration activities between the GWA and HRM programs:

- Data from GWA projects are provided to the HRM program for their use and analysis.
- The GWA team regularly engages the HRM program lead, Scott Pegau by phone, email, and in person.
- The HRM program lead is included on all GWA PI general correspondence. Likewise, the GWA PMT is included in all HRM general correspondence.
- The HRM program lead is invited to all PI teleconferences and meetings and given an opportunity to hear GWA PI updates and provide HRM updates to PIs.
- The GWA and HRM programs collaborate on the 3-year synthesis workshop and report.

### Data Management Program

The GWA and Data Management programs are fully integrated and dependent on each other. The Program Lead and Science and Program Coordinators will work closely with the Alaska Ocean Observing System (AOOS) and Axiom data management staff to maintain data access tools, providing data and feedback in the Gulf of Alaska Data Portal, and metadata generation tools. The Science and Program Coordinators will continue to work with all project PIs within the program to ensure new data are loaded to the Gulf of Alaska Data Portal, have undergone QA/QC measures, and have appropriate metadata available for public access. In addition, PWSSC acts as the fiscal agent between AOOS and NOAA for the Data Management grant.

#### **B. With Other EVOSTC-funded Projects**

The GWA program does not have specific goals or objectives to support EVOSTC-funded projects that are not part of a program. However, data, reports, and publications from GWA projects are available and the Science and Program Coordinators are available to work with EVOSTC-funded projects where appropriate and applicable.

#### **C. With Trustee or Management Agencies**

The GWA program integrates ecosystem monitoring activities with NOAA, USFWS, USGS, Bureau of Ocean Energy Management, and NPS. We also coordinate with Alaska Department of Fish and Game researchers and managers through coordination and synthesis activities involving the HRM program.

GWA continues to work with NOAA to develop and include GWA time series as indicators in ecosystem assessments and reports to the North Pacific Fisheries Management Council.

PMT members attend annual NOAA workshops at the Alaska Fisheries Science Center, both with the intent to use ecosystem indicator time series to inform fisheries management: 1) Preview of Ecosystem and Economic Conditions, NOAA Integrated Ecosystem Assessment and 2) Ecosystem and Socioeconomic Profile Modeling Workshop. GWA's annual sampling greatly complements NOAA's biennial sampling effort in contributing to ecosystem-based fisheries management efforts in the GOA. GWA's sampling in 2020 was an even larger contribution to this effort because NOAA cancelled all large vessel cruises in Alaskan waters because of safety concerns related to the COVID-19 pandemic.

GWA PIs continue to contribute to reporting and sampling of marine mammal carcasses for NOAA Alaska Region Protected Resources Division (Kate Savage and Sadie Wright). GWA PIs have also been trained and are prepared to administer Coastal Observation and Seabird Survey Team die-off alert protocols if a marine bird mortality event is encountered when GWA PIs are in the field.

#### **4. PROGRAM DESIGN**

##### **A. Overall Program Objectives**

At the program-level, GWA has the following annual objectives:

1. Sustain and build upon existing time series in the EVOS-affected regions of GOA.
2. Provide scientific data, data products, and outreach to management agencies and a wide variety of users.
3. Develop science synthesis products to assist management actions, inform the public, and guide monitoring priorities for the next 15 years.
4. Enhance connections between GWA and HRM programs.
5. Leverage partnerships with outside agencies and groups to integrate data from broader efforts.

##### **B. Changes to Program Design and Objectives**

There are no changes to the GWA Program overall design or objectives.

#### **5. PROGRAM PERSONNEL – CHANGES AND UPDATES**

The GWA Science Coordinator (Suryan) is now a permanent NOAA employee. He continues to support the GWA program, but at a reduced level. GWA PMT and PIs all agreed to recruit a new postdoc to assist with science synthesis efforts, funded by using salary savings from the Science Coordinator budget. A cooperative agreement between NOAA and UAF for the postdoc is in place and the recruitment process is underway. Sarah Traiger (see CV in 2100114-A) the new USGS employee for the nearshore component (21200114-J) and replacing Ben Weitzman (who now works for NOAA in Kachemak Bay and GWA project 21200114-J) officially began work for GWA on June 22, 2020.

#### **6. PROGRAM BUDGET**

##### **A. Budget Forms (See GWA FY20 Budget Workbook)**

Please see completed program workbook for program summaries and for each project's five-year budget. No costs are associated with international travel or outreach events unrelated to the program. Table 2 provides an overall program budget summarized by category rather than project.

Table 2. Proposed GWA program budget summary by category across all projects for FY 2017-2021. Numbers are presented in thousands of dollars.

<b>Budget Category</b>	<b>FY 17</b>	<b>FY 18</b>	<b>FY 19</b>	<b>FY 20</b>	<b>FY 21</b>	<b>Total</b>
Personnel	1,105.2	1,212.9	1,301.2	1,451.2	1,380.6	6,451.1
Travel	100.7	111.2	92.8	70.8	60.1	435.6
Contractual	610.7	696.8	651.8	723.8	624.6	3,307.8
Commodities	115.9	154.8	133.2	157.5	168.1	729.5
Equipment	56.6	83.9	49.1	48.7	29.4	267.7
Indirect Costs	101.5	102.6	102.3	103.0	103.8	513.2
<b>Subtotal</b>	<b>2,090.6</b>	<b>2,362.3</b>	<b>2,330.3</b>	<b>2,555.0</b>	<b>2,366.5</b>	<b>11,704.7</b>
General Admin. (9% of subtotal)	188.2	212.6	209.7	230.0	213.0	1,053.4
<b>Program Total</b>	<b>2,278.8</b>	<b>2,574.9</b>	<b>2,540.1</b>	<b>2,785.0</b>	<b>2,579.5</b>	<b>12,758.2</b>
Other Resources (cost share funds)*	3,205.1	3,260.3	3,027.5	3,629.6	3,718.3	16,840.8

\* The last row (Other Resources) includes the compiled project funding that comes from sources other than the Exxon Valdez Oil Spill Trustee Council, including grant funding, partnerships with other organizations, and direct agency funding support.

## **B. Changes from Original Program Proposal**

Our FY21 budget does not include additional funding requests. However, numerous projects are requesting to transfer funds between budget categories and years because of staffing changes and disruptions due to the COVID-19 pandemic. These requests are described below, and further details are provided in the individual project Work Plans.

### 21200114-A (PM I)

The EVOSTC supports GWA's Science Coordinator position, Rob Suryan, at \$130K for FY21. However, the Science Coordinator is now a permanent NOAA employee and we are proposing a portion of his salary (\$110K) go towards a full-time postdoc. This change was vetted with the EVOSTC science director.

Additional changes are needed due to travel restrictions associated with the COVID-19 pandemic. We anticipate travel by the GWA management team will be reduced in FY21. We are therefore requesting \$6.7K in travel be moved to commodities to help with peer reviewed publication fees for GWA PIs.

### 21200114-B (PM II)

In FY21, PM II requests permission to transfer \$19.8K from travel and split it between Personnel (\$7.7K), Contractual (\$6K) and Commodities (\$6.1K). Since not all SRP members have traveled to every meeting, and some SRP members live in the location where some meetings have been held, the anticipated travel demands have not met the original budget estimate, so there are carryover funds. However, PWSSC has incurred increased costs in other areas such as insurance and maintenance, and also has additional costs due to the transition of Program Coordinator Donna Aderhold from NOAA contract employment to PWSSC employment. Travel is still anticipated to be lower in FY21 due to COVID-19, which is expected to impact travel in both FY20 and FY21. Carryover funds can accommodate travel needs in FY21 and the reallocated funds can support outreach, interpretive, and community engagement activities.

21200114-C (PWS Forage Fish)

The forage fish project canceled field work in 2020 due to the COVID-19 pandemic and this changed the amounts spent in some categories in this year, e.g., we spent \$33K less in salary and overtime, \$3K less in travel for field work, and \$32K less in vessel charter costs. We propose to redirect FY20 spending that would have occurred for field work to 1) maintenance and update of trawl gear for \$13.5K, and 2) funding to support a student or post-doc with training in acoustic data analysis to help accomplish GWA forage fish project goals and synthesis for \$54.5K. If approved, these expenditures in FY20 would balance out such that there are no changes to our originally proposed project total budget.

21200114-G (PWS Oceanography)

PWS oceanography has changes from original proposal. Some planned work was not done during the COVID-19 shutdown period and was therefore not billed to this project at that time. This has left some unspent funds that we will work to draw down as we catch up on our work.

21200114-H (Nearshore Ecosystem)

For FY20 and FY21, nearshore project funds have been shifted among budget categories; for example, personnel costs have increased while contractual costs have decreased, reflecting the transition from contracted PIs to agency staff.

In FY21 we propose redirecting funding that was unused for field operations in FY20 (due to COVID-19 restrictions) to UAF to support a MSc student to conduct a project evaluating stable isotope variation in nearshore food webs and associated effects on productivity of nearshore flora and fauna. These changes are reflected in the FY21 budget. We are making a 2-year commitment to a student, which goes beyond the currently funded GWA 5-year cycle, but we are confident we can acquire the necessary funds for FY22. We will be requesting the reallocation of some FY21 funds to support the student, which will be captured in the FY21 nearshore Work Plan.

21200114-J (Lower Cook Inlet Oceanography)

There are no proposed changes to the total budget amount for the lower Cook Inlet/Kachemak Bay oceanography project or major budget changes for FY21 from our original proposal. We propose to move a small amount of funds (\$3K difference from approved FY20 Work Plan) from the KBNERR budget to the NOAA Kasitsna Bay Laboratory budget in FY21 to cover additional small boat field work and data analysis efforts by Kasitsna Bay Laboratory contract staff. As planned in FY20 (and approved in our FY20 Work Plan), due to changes in project personnel and expiration of a labor services contract, we deobligated EVOSTC funds that were obligated to the labor services contract task order and plan to re-obligate the funds to a new NOAA contract task order at the beginning of Federal FY21. By re-obligating prior year funds, we will be able to expand our data analysis efforts in both project years 9 and 10 beyond what was originally proposed, without needing additional funding from EVOSTC. Specifically, this will allow us to conduct additional cross-disciplinary data syntheses in Cook Inlet and cross-GWA region data syntheses of oceanographic and plankton data, in collaboration with Rob Suryan, other GWA investigators and other state and federal agency researchers.

21200114-M (PWS Summer Marine Birds)

While no changes of been made to the PWS marine bird survey project budget, due to the COVID-19 pandemic, the July marine bird survey was postponed until July 2021, with FY20 funds carried over to FY21.

21200114-N (Killer Whales)

The overall cost of the killer whale project for FY19-21 has not changed. We seek to reallocate funds between categories in FY21. In this budget we request movement of \$3.5K from Travel and \$3.0K from Commodities to Contractual in FY21 to cover increased acoustic and other analytical costs. We are asking to discontinue funds going to Northwest Fisheries Science Center (\$2K) which will be used for other analysis under Contractual. Personnel amount remains unchanged from the original proposal; however, the allocation within the category has changed.

21200114-O (PWS Humpback Whales)

At this time, the humpback whale project does not request funding changes; we are hoping to complete the September IPP survey and reschedule the postponed spring survey for later in the year.

21200114-P (PWS Lingering Oil Surveys)

Since COVID-19 mandates prohibited the lingering oil project from conducting field sampling during summer 2020, funds for this project will be rolled over into FY21 and the lingering oil survey will occur during the summer of 2021. FY20 funds for the NOAA PI to travel (\$1.4K) were cancelled so we are requesting those funds to be reallocated to supplies.

**C. Sources of Additional Program Funding**

Because of the diversity of agencies and organizations represented by the GWA program, we are able to leverage more than \$16 million in cost-share, in-kind, direct funds, and other support funding for the 5-year funding cycle (Table 2).

A significant highlight of acquiring additional funding has been within the Environmental Drivers Component for projects GAK-1 (18120114-I) and the Seward Line (18120114-L). The NSF-funded NGA LTER program (\$1,127K/year, plus ship-time) that began sampling in 2018 leverages, complements, and enhances GWA program activities. The LTER program will provide many years of additional significant research activities that will naturally blend and add value to the GWA program.

Table 3. Summary of Gulf Watch Alaska projects awarded additional funding from external sources for FY21 based on provided documentation. This does not include direct agency funding support (e.g., salaries and agency provided equipment and resources).

Project	Principal Investigator	Source of Funding	Amount	Comments
21200114-D	Ostle	North Pacific Research Board (NPRB), Canadian Department of Fisheries and Oceans, Marine Biological Association	\$127,100	Continuous Plankton Recorder extended surveys
21200114-E	Bishop	Prince William Sound Regional Citizens' Advisory Council	\$39,000	Complementary seabird survey
21200114-G	Campbell	NPRB	\$186,300	Mooring; paralytic shellfish poisoning analyses
21200114-J	Holderied/Baird	Alaska Ocean Observing System	\$25,000	Ocean acidification, harmful algal bloom studies
21200114-L	Hopcroft	National Science Foundation	\$1,427,000	Oceanographic extended surveys
21200114-N	Matkin	Northwest Fisheries Science Center	\$22,000	Genetic analyses
<i>Total</i>			<u>\$1,826,400</u>	

See the consolidated budget matrix at the beginning of each project Work Plan for more detail about additional funds (also see project budget workbook forms).

## 7. FY17-20 PROGRAM PUBLICATIONS AND PRODUCTS

For convenience, Table 4 summarizes GWA publications and products followed by a complete listing of references.

Table 4. Summary of Gulf Watch Alaska information and data transfer, FY17-20.

Information and Data Transfer	Summary Number
Peer reviewed publications (includes manuscripts in press)	63
Manuscripts in review	3
Manuscripts in preparation	9
Reports (includes theses and dissertations)	81
Published datasets (includes datasets with a digital object identifier)	67
Conference and workshop presentations	215
Popular articles	23
Public presentations	39
Presentations and knowledge exchange with remote spill-affected communities	7
Other outreach (includes website updates, Quarterly Currents newsletters, project social media, agency website features, online interviews, and other types of outreach not captured above)	36

Peer Reviewed Publications

- Aderhold, D.G.R, Lindeberg, M.R., Holderied, K., Pegau, S.W., 2018. Introduction: Spatial and temporal ecological variability in the northern Gulf of Alaska: What have we learned since the *Exxon Valdez* oil spill? Deep-Sea Research Part II. [DOI:10.1016/j.dsr2.2017.11.015](https://doi.org/10.1016/j.dsr2.2017.11.015)
- Aguilar-Islas, A., M.J. Seguret, R. Rember, K.N. Buck, P. Proctor, C.W. Mordy, and N.B. Kachel. 2016. Temporal variability of reactive iron over the Gulf of Alaska shelf. Deep-Sea Research II 132 90-106.
- Arimitsu, M.L., K.A. Hobson, D.N. Webber, J.F. Piatt, E.W. Hood, J.B. Fellman. 2018. Tracing biogeochemical subsidies from glacier runoff into Alaska coastal marine food webs. *Global Change Biology* 24:387-398
- Batten, S., Helaouet, P., Ostle, C. and A. Walne. In prep. Responses of Gulf of Alaska plankton communities during and after a marine heatwave.
- Batten, S.D., D.E. Raitsos, S.L. Danielson, R.R. Hopcroft, K.C. Coyle, and A. McQuatters-Gollop. 2018. Interannual variability in lower trophic levels on the Alaskan Shelf. *Deep Sea Research II* 147:58-68. <http://dx.doi.org/10.1016/j.dsr2.2017.04.023>.
- Batten, S.D, A. Walne, and P. Helaouet. In prep. Impact of the marine heat wave on Gulf of Alaska plankton communities. Has normal service now been resumed?
- Bodkin, J.L., H.A. Coletti, B.E. Ballachey, D. Monson, D. Esler, and T.A. Dean. 2017. Spatial and temporal variation in Pacific blue mussel, *Mytilus trossulus*, abundance in the northern Gulf of Alaska, 2006-2015. *Deep Sea Research Part II*: <https://doi.org/10.1016/j.dsr2.2017.04.008>
- Bowen, L., K. Counihan, B. Ballachey, H. Coletti, T. Hollmen, B. Pister and T. Wilson. 2020. Monitoring nearshore ecosystem health using Pacific razor clams (*Siliqua patula*) as an indicator species. *PeerJ* 8:e8761 DOI 10.7717/peerj.8761
- Bowen, L., A.K. Miles, B.E. Ballachey, S. Waters, J.L. Bodkin, M. Lindeberg, and D. Esler. 2017. Gene transcription patterns in response to low level petroleum contaminants in *Mytilus trossulus* from field sites and harbors in southcentral Alaska. *Deep Sea Research Part II*: <https://doi.org/10.1016/j.dsr2.2017.08.007>
- 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. In prep. The Annual Secondary Productivity cycle in Prince William Sound measured with the Prince William Sound plankton camera. *Manuscript ~75% complete*
- Campbell, R.W., P.L. Roberts, and J. Jaffe. 2020. The Prince William Sound Plankton Camera: a profiling in situ observatory of plankton and particulates. *ICES J. Mar. Sci.* doi:10.1093/icesjms/fsaa029.
- 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*.
- Chasco, B., I. Kaplan, A.C. Thomas, A. Acevedo-Gutierrez, D.P. Noren, M.J. Ford, M.B. Hanson, J.J. Scordino, S.J. Jeffries, K.N. Marshal, A.O. Shelton, C. Matkin, B.J. Burke, and E.J. Ward. 2017. Competing tradeoffs between increasing marine mammal predation and fisheries harvest of Chinook salmon. *Scientific Reports* 7:15439 DOI: 10.1038/s41598-017-14984-8

- Chenoweth, E.M., and K.R. Criddle. 2019. The Economic Impacts of Humpback Whale Depredation on Hatchery-Released Juvenile Pacific Salmon in Southeast Alaska. *Marine and Coastal Fisheries*, V11, 1, pp. 62-75, <https://doi.org/10.1002/mcf2.10061>
- Counihan, K., L. Bowen, B. Ballachey, H. Coletti, T. Hollmen, and B. Pister. 2019. Physiological and gene transcription assays in combinations: a new paradigm for marine intertidal assessment. *PeerJ* 7:e7800 <https://doi.org/10.7717/peerj.7800>
- Coyle, K.O., A.J. Hermann, and R.R. Hopcroft. 2019. Modeled spatial-temporal distribution of productivity, chlorophyll, iron and nitrate on the northern Gulf of Alaska shelf relative to field observations. *Deep Sea Research Part II: Topical Studies in Oceanography*, doi:10.1016/j.dsr2.2019.05.006.
- 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
- Cushing, D., D. Roby, and D. Irons. 2018. Patterns of distribution, abundance, and change over time in a subarctic marine bird community. *Deep Sea Research Part II* 147:148-163. <https://doi.org/10.1016/j.dsr2.2017.07.012>
- Danielson, S.L., D.F. Hill, K.S. Hedstrom, J. Beamer, and E. Curchitser. 2020. Coupled terrestrial hydrological and ocean circulation modeling across the Gulf of Alaska coastal interface. *WRR/JGR Oceans special issue on Coastal Hydrology and Oceanography* DOI:10.1029/2019JC015724
- Danisheskaya, A.V., O. Filatova, F.I.P. Samarra, P.J.O. Miller, J.K.B. Ford, H. Yurk, C.O. Matkin, and E. Hoyt. 2018. Crowd intelligence can discern between repertoires of killer whale ecotypes. *Bioacoustics*. DOI: 10.1080/09524622.2018.1538902
- Davis, R., J.L. Bodkin, H.A. Coletti, D.H. Monson, S.E. Larson, L.P. Carswell, and L.M. Nichol. 2019. Future direction in sea otter research and management. *Frontiers in Marine Science*. 5:510. doi:10.3389/fmars.2018.00510
- Doyle, M.J., S.S. Strom, K.O. Coyle, A.J. Hermann, C. Ladd, A.C. Matarese, S.K. Shotwell, and Hopcroft. 2019. Early life history phenology among Gulf of Alaska fish species: Strategies, synchronies, and sensitivities. *Deep Sea Research II* doi:10.1016/j.dsr2.2019.06.005.
- Doyle, M.J., Strom, S.S., Coyle, K.O., Hermann, A.J., Ladd, C., Matarese, A.C., Shotwell, S.K., and Hopcroft, R.R., 2019. Early life history phenology among Gulf of Alaska fish species: Strategies, synchronies, and sensitivities. *Deep Sea Research Part II: Topical Studies in Oceanography*, doi:10.1016/j.dsr2.2019.06.005.
- Esler, D., B.E. Ballachey, C.O. Matkin, D. Cushing, R. Kaler, J. Bodkin, D. Monson, G.G. Esslinger, and K. Kloecker. 2017. Timelines and mechanisms of wildlife population recovery following the *Exxon Valdez* oil spill. *Deep Sea Research Part II*: <https://doi.org/10.1016/j.dsr2.2017.04.007>
- Hauri, C., C. Schultz, K. Hedstrom, S. Danielson, B. Irving, S.C. Doney, R. Dussin, E.N. Curchitser, D.F. Hill, and C.A. Stock. In press. A regional hindcast model simulating ecosystem dynamics, inorganic carbon chemistry, and ocean acidification in the Gulf of Alaska, *Biogeosciences Discussions*, <https://doi.org/10.5194/bg-2020-70>



- Helser, T., C. Kastle, A. Crowell, T. Ushikubo, I.J. Orland, R. Kozdon, and J.W. Valley. 2017. A 200-year archaeozoological record of Pacific cod (*Gadus macrocephalus*) life history as revealed through ion microprobe oxygen isotope ratios in otoliths. *Journal of Archaeological Science: Reports* <http://dx.doi.org/10.1016/j.jasrep.2017.06.037>.
- Kobari, T., A. Sastri, L. Yebra, H. Liu, and R.R. Hopcroft. In press. Evaluation of trade-offs in traditional methodologies for measuring metazooplankton growth rates: assumptions, advantages and disadvantages for field applications. *Progress in Oceanography* <https://doi.org/10.1016/j.pocean.2019.102137>
- Konar, B., and K. Iken. 2018. The use of unmanned aerial vehicle imagery in intertidal monitoring. *Deep Sea Research Part II: Topical Studies in Oceanography*, 147:79-86. <https://doi.org/10.1016/j.dsr2.2017.04.010>
- Laurel, B.J., and L.A. Rogers. 2020. Loss of spawning habitat and prerecruits of Pacific cod during a Gulf of Alaska heatwave. *Canadian Journal of Fisheries and Aquatic Sciences* 77:644-650.
- Lindeberg, M.R., Maselko, J., Heintz, R.A., Fugate, C.J., Holland, L., 2017. Conditions of persistent oil on beaches in Prince William Sound 26 years after the *Exxon Valdez* spill. *Deep-Sea Research Part II*. [DOI:10.1016/j.dsr2.2017.07.011](https://doi.org/10.1016/j.dsr2.2017.07.011).
- Litzow, M.A., M.E. Hunsicker, E.J. Ward, S.C. Anderson, J. Gao, S. McClatchie, S. Zador, S. Batten, S. Dressel, J. Duffy-Anderson, E. Fergusson, R.R. Hopcroft, B.J. Laurel, and R. O'Malley. 2020. Evaluating ecosystem change as Gulf of Alaska temperature exceeds the limits of preindustrial variability. *Progress in Oceanography* 186: <https://doi.org/10.1016/j.pocean.2020.102393>.
- Litzow, M.A., M.J. Malick, N.A. Bond, C.J. Cunningham, J.L. Gosselin, and E.J. Ward. 2020. Quantifying a Novel Climate Through Changes in PDO-Climate and PDO-Salmon Relationships. *Geophysical Research Letters* p.e2020GL087972.
- Matkin, C.O., G.M. Ylitalo, P. M. Chittaro, M. B. Hanson, C. Emmons C., et al. in prep. Chemical tracer changes in tissues of two eastern North Pacific killer whale (*Orcinus orca*) populations: Ecosystem flux or changing diet?
- McGowan, D.W., E.D. Goldstein, M.L. Arimitsu, A.L. Dreary, O. Ormseth, A. De Robertis, J.K. Horne, L.A. Rogers, M.T. Wilson, K.O. Coyle, K. Holderied, J.F. Piatt, W.T. Stockhausen, and S. Zador. 2020. Spatial and temporal dynamics of Pacific capelin (*Mallotus catervarius*) in the Gulf of Alaska: implications for ecosystem-based fisheries management. *Marine Ecology Progress Series* 637:117-140. DOI: <https://doi.org/10.3354/meps13211>
- 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.
- McKinstry, C., R. Campbell, and K. Holderied. In prep. Influence of the 2013-2016 marine heatwave on seasonal zooplankton community structure and abundance in the lower Cook Inlet, Alaska. *Manuscript 90% complete*.
- Mitchell, T.J., B. Konar, K. Iken, H. Coletti, T. Dean, D. Esler, M. Lindeberg, B. Pister, and B. Weitzman. In Review. Wasting disease and environmental variables drive sea star assemblages in the northern Gulf of Alaska. *Journal of Experimental Marine Biology and Ecology*.

- Monson D., R. Taylor, G. Hilderbrand, J. Erlenbach, H. Coletti, and J. Bodkin. In Review. Brown Bears and sea otters along the Katmai coast: Terrestrial and nearshore communities linked by predation. *Journal of Mammology*.
- Moran, J.R., R.A. Heintz, J.M. Straley, and J.J. Vollenweider. 2018. Regional variation in the intensity of humpback whale predation on Pacific herring in the Gulf of Alaska. *Deep Sea Research Part II*. DOI: <http://dx.doi.org/10.1016/j.dsr2.2017.07.010>.
- Moran, J., M. O'Dell, M. Arimitsu, J. Straley, and D. Dickenson. 2018. Seasonal distribution of Dall's porpoise in Prince William Sound. *Deep Sea Research II* 147:164-172. DOI: <https://doi.org/10.1016/j.dsr2.2017.11.002>.
- Nielsen, J.M., L.A. Rogers, D.G. Kimmel, A.L. Deary, and J.T. Duffy-Anderson. 2019. Contribution of walleye pollock eggs to the Gulf of Alaska food web in spring. *Marine Ecology Progress Series* 632:1-12.
- Olsen, D. W., C.O. Matkin, R.D. Andrews, and S. Atkinson. 2018. Seasonal and pod-specific differences in core use areas by resident killer whales in the Northern Gulf of Alaska. *Deep-Sea Research Part II* 147:196-202. DOI:10.1016/j.dsr2.2017.10.009
- Olsen, D.W., C.O. Matkin, F.J. Mueter, and S. Atkinson. 2020. Social behavior increases in multipod aggregations of southern Alaska resident killer whales (*Orcinus orca*). *Marine Mammal Science*. DOI: 10.1111/mms.12715
- Olson, A.P., C.E. Siddon, and G.L. Eckert. 2018. Spatial variability in size at maturity of golden king crab (*Lithodes aequispinus*) and implications for fisheries management. *Royal Society Open Science*. 5. <http://doi.org/10.1098/rsos.171802>
- Ormseth, O.A., M.M. Baker, R.R. Hopcroft, C. Ladd, C.W. Mordy, J.H. Moss, F.J. Mueter, S.K. Shotwell, and S.L. Strom. In press. Introduction to understanding ecosystem processes in the Gulf of Alaska, volume 2. *Deep Sea Res. II*. <https://doi.org/10.1016/j.dsr2.2019.06.019>
- Piatt, J.F., M. Arimitsu, W. Sydeman, S.A. Thompson, H. Renner, S. Zador, D. Douglas, S. Hatch, A. Kettle, and J. Williams. 2018. Biogeography of Pelagic Food Webs: Forage Fish Distribution and Habitat Use in the North Pacific Revealed by Puffins. *Fisheries Oceanography*. 27:366-380.
- Piatt, J.F., J.K. Parrish, H.M. Renner, S.K. Schoen, T.T. Jones, M.L. Arimitsu, K.J. Kuletz, B. Bodenstein, M. García-Reyes, R.S. Duerr, R.M. Corcoran, R.S.A. Kaler, G.J. McChesney, R.T. Golightly, H.A. Coletti, R.M. Suryan, H.K. Burgess, J. Lindsey, K. Lindquist, P.M. Warzybok, J. Jahncke, J. Roletto, and W.J. Sydeman. 2020. Extreme mortality and reproductive failure of common murrelets resulting from the northeast Pacific marine heatwave of 2014-2016. *PLoS ONE* 15:e0226087.
- Robinson, B.H., H.A. Coletti, L.M. Phillips, and A.N. Powell. 2018. Are prey remains accurate indicators of chick diet? A comparison of diet quantification techniques for Black Oystercatchers. *Wader Study* 125: 20-32. doi:10.18194/ws.00105. <http://www.waderstudygroup.org/article/10823/>
- Robinson, B. H., L. M. Phillips and A. N. Powell. 2019. Energy intake rate influences survival of Black Oystercatcher *Haematopus bachmani* broods. *Marine Ornithology* 47:277-283
- Roncalli, V., M.C. Cieslak, M. Germano, R.R. Hopcroft, and P.H. Lenz. 2019. Regional heterogeneity impacts gene expression in the sub-arctic zooplankton *Neocalanus flemingeri* in the northern Gulf of Alaska. *Communications Biology* 2:324 <https://doi.org/10.1038/s42003-019-0565-5>

- Roncalli, V., M.C. Cieslak, R.R. Hopcroft, and P.H. Lenz. 2020. Capital breeding in a diapausing copepod: A transcriptomics analysis. *Frontiers in Marine Science* 7 [doi:10.3389/fmars.2020.00056](https://doi.org/10.3389/fmars.2020.00056)
- Roncalli, V., M.C. Cieslak, S.A. Sommer, R.R. Hopcroft, and P.H. Lenz. 2018. *De novo* transcriptome assembly of the calanoid copepod *Neocalanus flemingeri*: A new resource for emergence from diapause. *Marine Genomics* 37:114-119 doi: 10.1016/j.margen.2017.09.002.
- Roncalli, V., S.A. Sommer, M.C. Cieslak, C. Clarke, R.R. Hopcroft, and P.H. Lenz. 2018. Physiological characterization of the emergence from diapause: A transcriptomics approach. *Scientific Reports* 8:12577
- Sánchez-Montes, M.L., E.L. McClymont, J.M. Lloyd, J. Müller, E.A. Cowan, and C. Zorzi. 2020. Late Pliocene Cordilleran Ice Sheet development with warm northeast Pacific sea surface temperatures. *Climate of the Past* 16:299-313.
- Schaefer, A., M.A. Bishop, and R. Thorne. 2020. Marine bird response to forage fish during winter in subarctic bays. *Fisheries Oceanography*. <https://doi.org/10.1111/fog.12472>.
- 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.
- Stabeno P.J., S. Bell, W. Cheng, S.L. Danielson, N.B. Kachel, and C.W. Mordy. 2016. Long-term observations of Alaska Coastal Current in the northern Gulf of Alaska. *Deep-Sea Research*. <https://doi.org/10.1016/j.dsr2.2015.12.016> .
- Stephensen, S., D. Irons, W. Ostrand, and K. Kuletz. 2016. Habitat selection by Kittlitz's *Brachyramphus brevirostris* and Marbled Murrelets *B. marmoratus* in Harriman Fjord, Prince William Sound, Alaska. *Marine Ornithology* 44:31-42. <http://www.marineornithology.org/content/get.cgi?rn=1152>
- Stocking, J.S., M.A. Bishop, and A. Arab. 2018. Spatio-temporal distributions of piscivorous birds in a subarctic sound during the nonbreeding season. *Deep-Sea Research II* 147:138–147. doi: 10.1016/j.dsr2.2017.07.017.
- Straley, J.M., J.R. Moran, K.M. Boswell, R.A. Heintz, T. J. Quinn II, B. Witteveen, and S. D. Rice. 2017. Seasonal presence and potential influence of foraging humpback whales upon Pacific herring wintering in the Gulf of Alaska. *Deep Sea Research Part II*. DOI: <http://dx.doi.org/10.1016/j.dsr2.2017.08.008>.
- Straley, J.M., et al. in prep. Local collapse of a humpback whale population during a marine heatwave.
- Strom, S.L., K.A. Fredrickson, and K.J. Bright. 2019. Microzooplankton in the coastal Gulf of Alaska: regional, seasonal and interannual variations. *Deep-Sea Research Part II* 165:192-202 <https://doi.org/10.1016/j.dsr2.2018.07.012>
- Strom, S., A. Aguilar-Islas, S.L. Danielson, R.R. Hopcroft, and W.J. Burt. In prep. Consequences of the 2014-16 marine heat wave for planktonic communities in the northern Gulf of Alaska.
- Sydeman, W.J., J.F. Piatt, S. Thompson, M. Garcia-Reyes, S.A. Hatch, M.L. Arimitsu, L. Slater, J.C. Williams, N.A. Rojek, S. G Zador, and H.M. Renner. 2017. Puffins reveal contrasting relationships between forage fish and ocean climate in the N. Pacific. *Fisheries Oceanography*. DOI: 10.1111/fog.12204.

- Sydeman, W.J., S.A. Thompson, T. Anker-Nilssen, M.L. Arimitsu, et. al. 2017. Best practices for assessing forage fish fisheries – seabird resource competition. *Fisheries Research* 194: 209-221. doi 10.1016/j.fishres.2017.05.018.
- Thompson, S.A., M. Garcia-Reyes, W.J. Sydeman, M. Arimitsu, S. Hatch, and J. Piatt. In press. Effects of ocean climate on the size and condition of forage fish in the Gulf of Alaska: regional, species, and age-class comparisons. *Fisheries Oceanography*.
- Vandersea, M.W., S.R. Kibler, P.A. Tester, K. Holderied, D. E. Hondolero, K. Powell, S. Baird, A. Doroff, D. Dugan, and R.W. Litaker. 2018. Environmental factors influencing the distribution and abundance of *Alexandrium catenella* in Kachemak Bay and lower Cook Inlet, Alaska, *Harmful Algae*, 77:81-92, ISSN 1568-9883, <https://doi.org/10.1016/j.hal.2018.06.008>.
- Vandersea, M.W., S.R. Kibler, S.B. Van Sant, P.A. Tester, K. Sullivan, G. Eckert, C. Cammarata, K. Reece, G. Scott, A. Place, K. Holderied, D. Hondolero, and R.W. Litaker. 2017. qPCR assays for *Alexandrium fundyense* and *A. ostenfeldii* (Dinophyceae) identified from Alaskan waters and a review of species-specific *Alexandrium* molecular assays. *Phycologia* 56:303-320.
- Vandersea, M., P. Tester, K. Holderied, D. Hondolero, S. Kibler, K. Powell, S. Baird, A. Doroff, D. Dugan, A. Meredith, M. Tomlinson, R. W. Litaker. 2020. An extraordinary *Karenia mikimotoi* “beer tide” in Kachemak Bay Alaska. *Harmful Algae* 92. [doi.org/10.1016/j.hal.2019.101706](https://doi.org/10.1016/j.hal.2019.101706).
- Van Hemert, C., S.K. Schoen, R.W. Litaker, M.M. Smith, M.L. Arimitsu, J.F. Piatt, W.C. Holland, D.R. Hardison, and J.M. Pearce. 2020. Algal toxins in Alaskan seabirds: Evaluating the role of saxitoxin and domoic acid in a large-scale die-off of Common Murres. *Harmful Algae* 92:101730.
- von Biela, V.R., M.L. Arimitsu, J.F. Piatt, B. Heflin, S. Schoen, J. Trowbridge, and C. Clawson. 2019. Extreme reduction in nutritional value of a key forage fish during the Pacific marine heatwave of 2014-2016. *Marine Ecology Progress Series*. doi: 10.3354/meps12891
- Walsh, J.R., R. Thoman, U.S. Bhatt, P.A. Bieniek, B. Brettschneider, M. Brubaker, S. Danielson, R. Lader, F. Fetterer, K. Holderied, K. Iken, A. Mahoney, M. McCammon, and J. Partain. 2018. The high latitude marine heat wave of 2016 and its impacts on Alaska [in “Explaining Extreme Events of 2016 from a Climate Perspective”]. *Bulletin of the American Meteorological Society* 99 (1). S39-43. doi:10.1175/BAMS-D-17-0105.1
- Zador, S.G., K. K. Holsman, K. Y. Aydin, and S. K. Gaichas, 2017. Ecosystem considerations in Alaska: the value of qualitative assessments, *ICES Journal of Marine Science*, 74:421–430, <https://doi.org/10.1093/icesjms/fsw144>, ISSN 0967-0645.

### Reports

- Arimitsu, M., J.F. Piatt, and S. Hatch. 2018. Monitoring long-term changes in forage fish distribution, abundance, and body conditions in PWS. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-C.
- Arimitsu, M., J.F. Piatt, and S. Hatch. 2019. Monitoring long-term changes in forage fish distribution, abundance, and body conditions in PWS. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-C.

- Arimitsu, M., J.F. Piatt, and S. Hatch. 2020. Monitoring long-term changes in forage fish distribution, abundance, and body conditions in PWS. FY20 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-C.
- Arimitsu, M.L., J.F. Piatt, B. Heflin, V. von Biela, and S.K. Schoen. 2018. Monitoring long-term changes in forage fish distribution, abundance and body condition in Prince William Sound. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-O), U. S. Geological Survey Alaska Science Center, Anchorage, AK. 64 pp.
- Arimitsu, M., J. Piatt, R. Suryan, S. Batten, M.A. Bishop, R. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Hatch, S. Haught, R. Hopcroft, K. Kuletz, C. Marsteller, C. McKinstry, D. McGowan, J. Moran, W.S. Pegau, A. Schaeffer, S. Schoen, J. Straley, and V. von Biela. 2020. Synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. *In: The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Long-Term Monitoring Program (Gulf Watch Alaska) Synthesis Report Exxon Valdez Oil Spill Trustee Council Program 19120114* (Eds: Suryan, R.M., M.R. Lindeberg, and D.R. Aderhold). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Batten, S.D. 2017. Continuous Plankton Recorder Data from the Northeast Pacific: Lower Trophic Levels in 2016. Contribution in the 2017 NOAA Ecosystems Considerations Report to the North Pacific Fisheries Management Council.
- 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>
- Batten, S.D., and Brown, R. 2018. Long-term Monitoring of plankton populations on the Alaskan Shelf and in the Gulf of Alaska using Continuous Plankton Recorders. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-A). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Batten, S., and R. Brown. 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.
- Bentz, S., M. Johnson, G. Gibson, S. Baird, and J. Schloemer. 2018. Ocean Circulation Mapping to Aid Monitoring Programs for Harmful Algal Blooms and Marine Invasive Transport in South-central, Alaska. State Wildlife Grant, Alaska Dept. of Fish and Game. Annual Report. 45pp.
- Bishop, M.A. 2018. Long-term monitoring of seabird abundance and habitat associations during late fall and winter in Prince William Sound. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 16120114-C), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Bishop, M.A., and A. Schaefer. 2018. Long term monitoring of marine bird abundance and habitat associations during fall and winter in Prince William Sound. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-M.
- Bishop, M.A., and A. Schaefer. 2019. Long term monitoring of marine bird abundance and habitat associations during fall and winter in Prince William Sound. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-E.

- Bishop, M. A., and A. Schaefer. 2020. Long term monitoring of marine bird abundance and habitat associations during fall and winter in Prince William Sound. FY19 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-E.
- Bowen L., A. Love, S. Waters, K. Counihan, B. Ballachey, and H. Coletti. 2019. Report: Port Valdez Mussel Transcriptomics. Prepared for Prince William Sound Regional Citizens' Advisory Council. Contract Number 951.20.06
- 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.
- Chenoweth, E.M. 2018. Bioenergetic and economic impacts of humpback whale depredation at salmon hatchery release sites, Ph.D. Dissertation, University of Alaska Fairbanks, Fairbanks, AK
- Coletti, H., J. Bodkin, T. Dean, D. Esler, K. Iken, B. Ballachey, K. Kloecker, B. Konar, M. Lindeberg, D. Monson, B. Robinson, R. Suryan and B. Weitzman. 2019. Intertidal ecosystem indicators in the Northern Gulf of Alaska. in Zador, S.G., and E.M. Yasumiishi. 2019. Ecosystem Status Report 2019: Gulf of Alaska. Report to the North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99301.
- Coletti, H., J. Bodkin, T. Dean, K. Iken, B. Konar, D. Monson, D. Esler, M. Lindeberg, R. Suryan. 2018. Intertidal Ecosystem Indicators in the Northern Gulf of Alaska 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>
- Coletti, H., D. Esler, B. Ballachey, J. Bodkin, G. Esslinger, K. Kloecker, D. Monson, B. Robinson, B. Weitzman, T. Dean, and M. Lindeberg. 2018. Gulf Watch Alaska: Nearshore Benthic Systems in the Gulf of Alaska. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-R), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Coletti, H., D. Esler, B. Konar, K. Iken, K. Kloecker, D. Monson, B. Weitzman, B. Ballachey, J. Bodkin, T. Dean, G. Esslinger, B. Robinson, and M. Lindeberg. 2018. Gulf Watch Alaska: Nearshore Ecosystems in the Gulf of Alaska. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 17120114-H), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Coletti, H., D. Esler, B. Konar, K. Iken, K. Kloecker, D. Monson, B. Weitzman, B. Ballachey, J. Bodkin, T. Dean, G. Esslinger, B. Robinson, and M. Lindeberg. 2019. Gulf Watch Alaska: Nearshore Ecosystems in the Gulf of Alaska. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 18120114-H), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

- Coletti, H.A., and T.L. Wilson. 2018. Nearshore marine bird surveys: Data synthesis, analysis and recommendations for sampling frequency and intensity to detect population trends. *Exxon Valdez Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Final Report (Exxon Valdez Oil Spill Trustee Council Project 12120114-F)*. Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Danielson, S.L. 2017. Gulf of Alaska Mooring GAK1 long-term monitoring. Contribution in the 2017 NOAA Ecosystems Considerations Report to the North Pacific Fisheries Management Council.
- Danielson, S.L. In review. Glacier Bay Oceanographic Monitoring Program Analysis of Observations, 1993-2016. Natural Resource Technical Report NPS/XXXX/NRTR—20XX/XXX. National Park Service, Fort Collins, Colorado.
- Danielson, S.L., T.D. Hennon, D.H. Monson, R.M. Suryan, R.W. Campbell, S.J. Baird, K. Holderied, and T.J. Weingartner. 2019. Chapter 1 A study of marine temperature variations in the northern Gulf of Alaska across years of marine heatwaves and cold spells. 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.
- Danielson, S.L., and R.R. Hopcroft. 2018. Seward line May temperatures *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>
- Danielson, S.L., and T.J. Weingartner. 2019. Long-term monitoring of oceanographic conditions in the Alaska Coastal Current from hydrographic station GAK1. FY18 annual report to the Exxon Valdez Oil Spill Trustee Council, project 18120114-I.
- Doroff, A., and K. Holderied. 2018. Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay to understand recovery and restoration of injured near-shore species. *Exxon Valdez Oil Spill Long-term Monitoring Program (Gulf Watch Alaska) Final Report (Exxon Valdez Oil Spill Trustee Council Project 16120114-G)*, Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Doroff, A., M. Johnson, and G. Gibson. 2017. Ocean Circulation Mapping to Aid Monitoring Programs for Harmful Algal Blooms and Marine Invasive Transport in South-central, Alaska. State Wildlife Grant, Alaska Dept. of Fish and Game. Annual Report. 41pp.
- Dragoo, D., H.M. Renner, and R.S.A. Kaler. 2017. Breeding status and population trends of seabirds in Alaska, 2017. U.S. Fish and Wildlife Service Report AMNWR 2018/02. Homer, Alaska.
- Dragoo, D., H.M. Renner, and R.S.A. Kaler. 2018. Breeding status and population trends of seabirds in Alaska, 2018. U.S. Fish and Wildlife Service Report AMNWR 2019/03. Homer, Alaska.
- Dragoo, D., H.M. Renner, and R.S. A.Kaler. 2020. Breeding status and population trends of seabirds in Alaska, 2019. U.S. Fish and Wildlife Service Report AMNWR 2020/01. Homer, Alaska.
- Garlich-Miller, J., G. Esslinger, and B. Weitzman. 2018. Aerial surveys of sea otters (*Enhydra lutris*) in lower Cook Inlet, Alaska, May 2017. USFWS Technical Report MMM 2018-01. U.S. Fish & Wildlife Service, Marine Mammals Management. Anchorage, AK

- Hatch, S.A., M. Arimitsu, J.F. Piatt. 2018. Seabird-derived forage fish indicators from Middleton Island 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>
- Hoffman, K.C., and M.E. McCammon. 2018. Long term monitoring: program coordination and logistics & outreach. *Exxon Valdez* Oil Spill Trustee Council Restoration Project Final Report (Restoration Project 16120014-B). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Holderied, K., and D. Aderhold. 2018. Science coordination and synthesis for the long-term monitoring program. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-H). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Holderied, K., and S. Baird. 2019. Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay to understand recovery and restoration of injured near-shore species. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-J.
- Holderied, K., and J. Shepherd. 2018. Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay to understand recovery and restoration of injured near-shore species. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-J.
- Hopcroft, R.R., S.L. Danielson, and K. Coyle. 2018. The Seward Line – Marine Ecosystem monitoring in the Northern Gulf of Alaska. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-L.
- Hopcroft, R.R., S.L. Danielson, and K. Coyle. 2019. The Seward Line – Marine Ecosystem monitoring in the Northern Gulf of Alaska. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-L.
- Hopcroft, R.R., S.L. Danielson, and S.L. Strom. 2018. The Seward Line: Marine ecosystem monitoring in the Northern Gulf of Alaska. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-J). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Jones, T., S. Saupe, K. Iken, B. Konar, S. Venator, M. Lindeberg, H. Coletti, B. Pister, J. Reynolds, and K. Haven. 2019. Evaluation of nearshore communities and habitats: Lower Cook Inlet nearshore ecosystem. Anchorage (AK): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2019-075. 219 p.
- Kaler, R., E. Labunski, and K. J. Kuletz. 2018. Prince William Sound marine bird surveys. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 16120114-K), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Konar B., K. Iken, and A. Doroff. 2018. Long-term monitoring: nearshore benthic ecosystems in Kachemak Bay. Long-term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project 16120114-L). *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Konar, B., T.J. Mitchell, K. Iken, H. Coletti, T. Dean, D. Esler, M. Lindeberg, B. Pister, and B. Weitzman. 2019. Wasting disease and environmental variables drive sea star assemblages in the northern Gulf of Alaska. *Journal of Experimental Marine Biology and Ecology*. <https://doi.org/10.1016/j.jembe.2019.151209>



- Kuletz, K., and R. Kaler. 2018. Continuing the legacy: Prince William Sound marine bird population trends. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-M.
- Kuletz, K., and R. Kaler. 2019. Continuing the legacy: Prince William Sound marine bird population trends. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-M.
- Mazur, C.M. 2020. Comparing the bioavailability of a natural and synthetic iron source: Do past experiments accurately model phytoplankton response to episodic iron addition. Western Washington University.
- Matkin, C.O., and D. Olsen. 2018. Long term killer whale monitoring in Prince William Sound / Kenai Fjords. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-N.
- Matkin, C.O., and D. Olsen. 2019. Long term killer whale monitoring in Prince William Sound / Kenai Fjords. FY18 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 18120114-N.
- Matkin, C., D. Olsen, G. Ellis, G. Ylitalo, R. Andrews. 2017. Long-term killer whale monitoring in Prince William Sound/ Kenai Fjords. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-M), North Gulf Oceanic Society Homer, Alaska.
- McCammon, M., K. Hoffman, K. Holderied, D. R. Aderhold, and T. H. Neher. 2018. Long-term monitoring of marine conditions and injured resources and services. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Mendoza-Islas, H.M. 2020. Abundance, composition and distribution of predatory gelatinous zooplankton in the Northern Gulf of Alaska. University of Alaska Fairbanks.
- Moran, J., and J. Straley. 2017. Data contributed to the NOAA Ecosystem Considerations Report 2017 for the Gulf of Alaska region. Full reports may be found at the following link: <https://access.afsc.noaa.gov/reem/ecoweb/Index.php>.
- Moran, J.R., and J.M. Straley. 2018. Long-term monitoring of humpback whale predation on Pacific herring in Prince William Sound. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Final Report (*Exxon Valdez* Oil Spill Trustee Council Project: 16120114-O), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Moran, J.R., and J.M. Straley. 2018. Long-term Monitoring of Humpback Whale Predation on Pacific Herring in Prince William Sound). *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Annual Report (*Exxon Valdez* Oil Spill Trustee Council Project: 17120114-O), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Moran, J.R., and J.M. Straley. 2019. Long-term Monitoring of Humpback Whale Predation on Pacific Herring in Prince William Sound. *Exxon Valdez* Oil Spill Long-Term Monitoring Program (Gulf Watch Alaska) Annual Report (*Exxon Valdez* Oil Spill Trustee Council Project: 18120114-O), *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.
- Moran, J., and J. Straley. 2019. Summer survey of population level indices for Southeast Alaska humpback whales and fall surveys of humpback whales in Prince William Sound *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>

- Moran, J., and J. Straley. 2019. Fall Surveys of Humpback Whales in Prince William Sound in Zador, S.G., and E.M. Yasumiishi. 2019. 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://access.afsc.noaa.gov/REFM/REEM/ecoweb/pdf/2019GOAecosys.pdf>
- Moran, J., and J. Straley. 2019. Provide data and input for: Draft Biological Report for the Proposed Designation of Critical Habitat for the Central America, Mexico, and Western North Pacific Distinct Population Segments of Humpback Whales (*Megaptera novaeangliae*). Prepared by: National Marine Fisheries Service U.S. Department of Commerce National Oceanic and Atmospheric Administration May. <https://www.fisheries.noaa.gov/action/proposed-rule-designate-critical-habitat-central-america-mexico-and-western-north-pacific>
- Moran, J., and J. Straley. 2019. Provide data for: Endangered and Threatened Wildlife and Plants: Proposed Rule to Designate Critical Habitat for the Central America, Mexico, and Western North Pacific Distinct Population Segments of Humpback Whales. 9 October. <https://www.govinfo.gov/content/pkg/FR-2019-10-09/pdf/2019-21186.pdf>
- Olsen D.W. and C.O. Matkin. 2017. Behavioral changes during multi-pod aggregations of southern Alaska resident killer whales (*Orcinus Orca*). 2017 Society for Marine Mammalogy Biennial Conference.
- Pretty, J.L. 2019. Particles in the Pacific: how productivity and zooplankton relate to particles in the deep sea. University of Alaska Fairbanks.
- Rider, M., D.A. Apeti, A. Jacob, K. Kimbrough, E. Davenport, M. Bower, H. Coletti, and D. Esler. 2020. A synthesis of ten Years of chemical contaminants monitoring in National Park Service - Southeast and Southwest Alaska Networks. A collaboration with the NOAA National Mussel Watch Program. NOAA Technical Memorandum NOS NCCOS xxx-xxx. Silver Spring, MD.
- Robinson, B., D. Esler, H. Coletti. 2019. Long-term monitoring of Black Oystercatchers in the Gulf of Alaska. Annual Summary Compilation: New or ongoing studies of Alaska shorebirds. Alaska Shorebird Group, Anchorage, Alaska.
- Starcevich, L.A.H., T. McDonald, A. Chung-MacCoubrey, A. Heard, J.C.B. Nesmith, H. Coletti, and T. Philippi. 2018. Methods for estimating trend in binary and count response variables from complex survey designs. Natural Resource Report NPS/KLMN/NRR—2018/1641. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/DataStore/Reference/Profile/2253180>
- Suryan, R., M. Arimitsu, H. Coletti, R. Hopcroft, M. 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, B. Laurel, J. Maniscalco, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, S. Pegau, J. Piatt, L. Rogers, A. Schaeffer, S. Straley, K. Sweeney, M. Szymkowiak, B. Weitzman, J. Bodkin, and S. Zador. 2019. Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska. *In: The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Long-Term Monitoring Program (Gulf Watch Alaska) Synthesis Report Exxon Valdez Oil Spill Trustee Council Program 19120114* (Eds: Suryan, R.M., M.R. Lindeberg, and D.R. Aderhold). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Suryan, R.M., M.R. Lindeberg, and D.R. Aderhold. 2020. The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Long-Term Monitoring Program (Gulf Watch Alaska) Synthesis

Report, (*Exxon Valdez Oil Spill Trustee Council Program 19120114*). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Tanedo, S. 2017. Using remote camera techniques to study Black-legged Kittiwake (*Rissa tridactyla*) productivity in Resurrection Bay in the northern Gulf of Alaska, M.S. Thesis, University of Alaska Fairbanks, Fairbanks, Alaska.

Ware, L., D. Green, D. Esler, B. Robinson, H. Coletti. 2019. Field report: Movement ecology of the Black Oystercatcher in Alaska. Prepared for the Bird Banding Laboratory, Laurel, MD.

Weingartner, T.J., and S.L. Danielson. 2017. Long-term monitoring of oceanographic conditions in the Alaska Coastal Current from hydrographic station GAK1 over 1970-2016. *Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 16120114-P)*, University of Alaska Fairbanks, AK.

Weingartner, T. J., and S. L. Danielson. 2018. Long-term monitoring of oceanographic conditions in the Alaska Coastal Current from hydrographic station GAK1 over 1970-2016. *Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 16120114-P)*. Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Weitzman, B.P., J.L. Bodkin, K.A. Kloecker, and H.A. Coletti. 2017. SOP for monitoring intertidal bivalves on mixed-sediment beaches — version 2.0: Southwest Alaska Inventory and Monitoring Network. Natural Resource Report NPS/SWAN/NRR—2017/1443. National Park Service, Fort Collins, Colorado.

Weitzman, B., B. Konar, K. Iken, H. Coletti, D. Monson, R.M. Suryan, T. Dean, D. Hondolero, and M.R. Lindeberg. 2019. Chapter 2 Changes in rocky intertidal community structure during a marine heatwave in the northern 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.

Zador, S., and Yasumiishi, E. (editors), and coauthors, 2018, Gulf of Alaska, North Pacific Fishery Management Council Ecosystem Status Report 2018, 194 p.

Zador, S., E. Yasumiishi, and G.A. Whitehouse (editors), and coauthors. 2019. Ecosystem Status Report 2019, 233 p.

#### Published and updated datasets

##### **DataONE Published Datasets**

Aguilar-Islas, A. 2020. Dissolved Aluminum and Manganese concentrations from sampling at select stations on seasonal cruises for the Northern Gulf of Alaska LTER site, 2018-2019. Dataset under review

Aguilar-Islas, A. 2020. Dissolved Inorganic Nutrient Data from seasonal cruises for the Northern Gulf of Alaska LTER site, 2018. Dataset under review.

Aguilar-Islas, A. 2020. Surface Dissolved Iron from seasonal cruises for the Northern Gulf of Alaska LTER site, 2018. Dataset under review.

Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Fish morph data in Prince William Sound, Alaska 2012-2015. *Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program*, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.

- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Marine bird and mammal surveys in Prince William Sound, Alaska 2012-2013 and 2015. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Oceanographic profile data from various regions in Prince William Sound, 2012-2015. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Zooplankton biomass data from 2012-2015 in Prince William Sound, Alaska. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Nutrients data from CTD sampling stations in Prince William Sound, Alaska 2012-2015. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Fish catch data in Prince William Sound, Alaska 2012-2015. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2017. Gulf Watch Alaska Forage Fish Component: Hydroacoustic surveys in Prince William Sound, Alaska 2014-2015. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.5066/F74J0C9Z>.
- Batten, S.D., K. Holderied, M. McCammon, and K. Hoffman. 2017. Continuous Plankton Recorder and Temperature Data, Gulf of Alaska, 2011-2016, 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/rw1k112>.
- Batten, S.D. 2018. Continuous Plankton Recorder Final 2016 Plankton Data, Gulf of Alaska, 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/rw1k112>.
- Bishop, M.A., A. Schaefer, K. Kuletz, M. McCammon, and K. Hoffman. 2017. Fall and Winter Seabird Abundance Data, Prince William Sound, 2007-2017, Gulf Watch Alaska Pelagic Component. Research Workspace. 10.24431/rw1k1w.
- 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>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Nearshore Component: Black oystercatcher nest density and chick diets from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2016 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7WH2N5Q>.

- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Nearshore Component: Monitoring Site Locations from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.5066/F78S4N3R>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Nearshore Component: Intertidal Mussel Site Data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2008-2015. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.5066/F7FN1498>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Nearshore Component: Intertidal Mussel Site Data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2016. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.5066/F7WS8RD4>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Limpet Size Data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2014. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7513WCB>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore *Nucella* and *Katharina* counts from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2014. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7513WCB>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Invertebrate and Algae from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2014. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7513WCB>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Seastar counts from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2014. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7513WCB>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Marine Bird and Mammal Survey Data from Katmai National Park and Preserve and Kenai Fjords National Park, 2006-2015. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://dx.doi.org/10.5066/F7416V6H>.

- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Benthic Component: Marine Water Quality, Water Temperature from Prince William Sound, Katmai National Park & Preserve, and Kenai Fjords National Park, 2006-2014. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7WH2N3T>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter Carcass Collection from Prince William Sound, Katmai National Park & Preserve, and Kenai Fjords National Park. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7WH2N3T>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter foraging observations from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2013. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7H993CZ>.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Sea Otter Aerial Surveys in Katmai National Park and Preserve 2008 and Kenai Fjords National Park 2007. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger. 2017. Gulf Watch Alaska Nearshore Component: Black oystercatcher nest density and chick diets from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2016 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <http://dx.doi.org/10.5066/F7CJ8BN7>.
- Danielson, S. 2020. Hydrographic, optical, and meteorological parameters measured by R/V Sikuliaq's underway systems during the Northern Gulf of Alaska LTER cruises, 2018 and 2019. <https://doi.org/10.24431/rw1k45a>.
- Danielson, S. 2020. Temperature and salinity time series measurements from the GAK1 Mooring in the Northern Gulf of Alaska near Seward, AK. <https://doi.org/10.24431/rw1k44x>.
- Danielson, S., and E. Dobbins. 2020. Water columns properties measured by CTD sensors during seasonal cruises in the Gulf of Alaska for the Northern Gulf of Alaska LTER project, 2018 and 2019. <https://doi.org/10.24431/rw1k459>.
- Danielson, S., and E. Dobbins. 2020. Ocean currents measured by R/V Sikuliaq's Shipboard Acoustic Doppler Current Profiler (SADCP) during the Northern Gulf of Alaska LTER Spring 2018 cruise. <https://doi.org/10.24431/rw1k43u>.
- Danielson, S.L., and T.J. Weingartner. 2017. GAK1 Mooring Timeseries data, Seward, AK, from the GAK1 project, 2012-2016, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.24431/rw1k18>.

- Danielson, S.L., and T.J. Weingartner. 2017. CTD profile time series data from the GAK1 project, 2012-2016, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.24431/rw1k1b>.
- Doroff, A., and K. Holderied. 2018. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Water Quality, Meteorological, and Nutrient Data collected by the National Estuarine Research Reserve System's System-wide Monitoring Program (NERRS SWMP), 2012-2016, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k21f>.
- Hauri, C. 2020. Gulf of Alaska ROMS-COBALT Hindcast Simulation 1980 - 2013. <https://doi.org/10.24431/rw1k43t>.
- Hauri, C., and B. Irving. 2020. Inorganic Carbon data from water samples collected during CTD casts at stations during the Northern Gulf of Alaska LTER seasonal cruises, 2018. <https://doi.org/10.24431/rw1k45g>.
- Holderied, K., K. Powell, and A. Doroff. 2017. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, CTD Data, 2012-2016, Gulf Watch Alaska Environmental Drivers Component *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1d>.
- Holderied, K., and A. Doroff. 2018. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Zooplankton Data, 2012-2016, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k21g>.
- Hopcroft, R.R. 2017. Seward Line Conductivity, Temperature, and Depth (CTD) Data, 2012 to 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/rw1k1l>.
- Hopcroft, R.R. 2017. Seward Line Zooplankton Data, 2012 to 2015, 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/rw1k1k>.
- Hopcroft, R.R. 2017. Seward Line Chlorophyll-A and Nutrient Data, 2012 to 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/rw1k1j>.
- Hopcroft, R.R. 2018. Seward Line Zooplankton Data, final 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/rw1k1k>.
- Hopcroft, R., and C. Clarke-Hopcroft. 2020. Gelatinous zooplankton abundance and biomass observations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018. Dataset under review.
- Hopcroft, R., and C. Clarke-Hopcroft. 2020. Zooplankton abundance and biomass observations obtained from a 0.5 mm MultiNet, as analyzed by traditional microscopy, during research cruises in the Northern Gulf of Alaska (NGA) LTER Program, 2018. Dataset under review.

- Hopcroft, R., and C. Clarke-Hopcroft. 2020. Zooplankton abundance observations collected from 150 um Quad-Nets, as analyzed by Zooscan, from research cruises in the Northern Gulf of Alaska (NGA) LTER Program, 2018. Dataset under review.
- Hopcroft, R., and C. Clarke-Hopcroft. 2020. Zooplankton abundance observations collected from 505 um Bongo Net, as analyzed by Zooscan, from research cruises in the Northern Gulf of Alaska (NGA) LTER Program, 2018. Dataset under review.
- Hopcroft, R., S. Danielson, and E. Dobbins. 2020. Temperature and Salinity measured by a flow-through thermosalinograph (TSG) during research cruises aboard the R/V Tiglax and R/V Wolstad for the Northern Gulf of Alaska (NGA) LTER site, 2018 and 2019. <https://doi.org/10.24431/rw1k45o>.
- Hopcroft, R., C. Smoot, and C. Clarke-Hopcroft. 2020. Zooplankton abundance and biomass observations obtained from 150 um Quad-Nets, as analyzed by traditional microscopy, during research cruises in the Northern Gulf of Alaska (NGA) LTER Program, 2018. Dataset under review.
- Iken, K., and B. Konar. 2017. Long-term Monitoring of Ecological Communities in Kachemak Bay, 2012-2016, Gulf Watch Alaska Nearshore Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program. Research Workspace. <https://doi.org/10.24431/rw1k1o>.
- Kaler, R., and K. Kuletz. 2017. Prince William Sound Marine Bird Data, Alaska, 2012-2016, Gulf Watch Alaska Pelagic Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k113>
- Kuletz, K.J. 2017. Seward Line and Lower Cook Inlet Marine Bird Survey Data, 2006-2016, Gulf Watch Alaska Nearshore Component. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1m>.
- Kuletz, K., D. Cushing, and E. Labunski. 2020. Marine bird survey observation and density data from Northern Gulf of Alaska LTER cruises, 2018. Dataset under review.
- Matkin, C.O. 2017. Acoustic Recordings of Killer Whales in Prince William Sound and Kenai Fjords, 2012 to 2016, Gulf Watch Alaska Pelagic Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1f>.
- Matkin, C.O. 2017. Acoustic Kenai Fjords and Prince William Sound Long-Term Photographic Monitoring of Killer Whales, 2012-2016, Gulf Watch Alaska Pelagic Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1s>.
- Matkin, C.O. 2017 Prince William Sound Killer Whale Satellite Telemetry Data, 2004 to 2016, Gulf Watch Alaska Pelagic Component. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1g>.
- Matkin, C.O. 2017. Behavior and Feeding Summaries for Killer Whales in Alaska, 2012-2016. Dataset. Exxon Valdez Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1r>.
- McDonnell, A. 2020. Zooplankton abundance and volume size distributions from an Underwater Vision Profiler 5 aboard seasonal cruises for the Northern Gulf of Alaska LTER site 2018. Dataset under review.



- McDonnell, A., B. Irving, J. Pretty, and S. O'Daly. 2020. Particle abundance and volume size distributions from an Underwater Vision Profiler 5 aboard seasonal cruises for the Northern Gulf of Alaska LTER site 2018. <https://doi.org/10.24431/rw1k45h>.
- Moran, J.R., and J.M. Straley. 2017. Lipid Analyses for Pacific Herring, Invertebrates and Humpback Whales in the Gulf of Alaska, 2012-2015, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1q>.
- Moran, J.R., and J.M. Straley. 2017. Significance of Whale Predation On Natural Mortality Rate of Pacific Herring in Prince William Sound, Alaska: 2006 - 2009, 2011-2015, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1n>.
- Moran, J.R., and J.M. Straley. 2017. Dall's and Harbor Porpoise Survey Data, Prince William Sound, Alaska: 2007 - 2008, 2011-2015, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1p>.
- Strom, S. 2020. Microzooplankton abundance and biomass from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018. <https://doi.org/10.24431/rw1k45e>.
- Strom, S. 2020. Primary production estimates from research cruises for the Northern Gulf of Alaska LTER site, 2018. <https://doi.org/10.24431/rw1k45b>.
- Strom, S., and K. Fredrickson. 2020. Chlorophyll-a concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018. <https://doi.org/10.24431/rw1k45f>.
- Strom, S., and K. Fredrickson, K. 2020. Dissolved organic carbon concentrations from NGA-LTER research cruises in the Gulf of Alaska, 2018-present. <https://doi.org/10.24431/rw1k45c>.
- Strom, S., and K. Fredrickson. 2020. HPLC-derived pigment data from research cruises for the Northern Gulf of Alaska LTER site, 2018. Dataset under review.
- Strom, S., and K. Fredrickson. 2020. Particulate carbon concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-present. <https://doi.org/10.24431/rw1k45d>.

### **Gulf of Alaska Data Portal Datasets**

(updated and available to the public through AOOS)

- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Fish morph data in Prince William Sound, Alaska 2017-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Oceanographic profile data from various regions in Prince William Sound, 2017-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Zooplankton biomass data from 2017 in Prince William Sound, Alaska. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.

- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Nutrients data from CTD sampling stations in Prince William Sound, Alaska 2017-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Fish catch data in Prince William Sound, Alaska 2017-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Hydroacoustic surveys in Prince William Sound, Alaska 2017-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Arimitsu, M.L., J.F. Piatt, and B. Heflin. 2019. Gulf Watch Alaska Forage Fish Component: Seabird diet data, Middleton Island, Alaska 1978-2018. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Batten, S.D. 2019. Gulf Watch Alaska Continuous Plankton Recorder 2017 physical data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Bishop, M. A., and A. Schaefer. 2019. Fall and Winter Seabird Abundance: PWS fall and winter 2018-2019 seabird observations. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Bishop, M.A., and A. Schaefer. 2018. Fall and Winter Seabird Abundance: PWS fall and winter 2017-2018 seabird observations. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- 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.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Nearshore Component: Black oystercatcher data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Nearshore Component: Black oystercatcher data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Nearshore Component: Black oystercatcher data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2017-2021. Gulf Watch Alaska Nearshore Component: Monitoring Site

Locations from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Nearshore Component: Intertidal Mussel Site Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Nearshore Component: Intertidal Mussel Site Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Nearshore Component: Intertidal Mussel Site Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Limpet Size Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Limpet Size Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Limpet Size Data from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Nucella and Katharina counts from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Nucella and Katharina counts from Prince William Sound, Katmai National Park and Preserve, Kachemak

Bay, and Kenai Fjords National Park. 2018 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore *Nucella* and *Katharina* counts from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Invertebrate and Algae from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Invertebrate and Algae from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

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Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Seastar counts from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Intertidal Rocky Shore Seastar counts from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

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- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Marine Bird and Mammal Survey Data from Kachemak Bay, Katmai National Park and Preserve and Kenai Fjords National Park. 2018 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Benthic Component: Marine Bird and Mammal Survey Data from Kachemak Bay, Katmai National Park and Preserve and Kenai Fjords National Park. 2019 Data. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska Benthic Component: Marine Water Quality, Water Temperature from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska Benthic Component: Marine Water Quality, Water Temperature from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2018 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska Benthic Component: Marine Water Quality, Water Temperature from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter Carcass Collection from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter foraging observations from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park, 2017. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter foraging observations from Prince William Sound, Katmai National Park and Preserve, Kachemak Bay, and Kenai Fjords National Park, 2018. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.

- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter Spraint observations from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2019. Gulf Watch Alaska, Benthic Monitoring Component: Sea otter Spraint observations from Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. Through 2019 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2018. Gulf Watch Alaska, Benthic Monitoring Component: Soft sediment sampling in Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2017 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Coletti, H., J. Bodkin, B. Ballachey, D. Monson, D. Esler, M. Lindeberg, T. Dean, B. Weitzman, K. Kloecker, G. Esslinger, K. Iken, and B. Konar. 2020. Gulf Watch Alaska, Benthic Monitoring Component: Soft sediment sampling in Prince William Sound, Katmai National Park & Preserve, Kachemak Bay, and Kenai Fjords National Park. 2019 Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Danielson, S.L., and T.J. Weingartner. 2018. CTD profile time series data from the GAK1 project 1970-2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Danielson, S.L., and T.J. Weingartner. 2018. GAK1 Mooring Timeseries data, Seward, AK, from the GAK1 project, 2016-2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Danielson, S.L., and T.J. Weingartner. 2019. GAK1 Mooring Timeseries data, Seward, AK, from the GAK1 project, 2017-2018, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Danielson, S.L., and T.J. Weingartner. 2019. GAK1 Mooring Timeseries data, Seward, AK, from the GAK1 project, 2018-2019, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program. Gulf of Alaska Data Portal.
- Holderied, K., S. Baird, J. Schloemer, and K. Schuster. 2019. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Meteorological and Nutrient Data, 2017, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Holderied, K. Baird, S., Schloemer, J., Schuster, K. 2019. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Water Quality Data, 2017, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.

- Holderied, K., S. Baird, J. Schloemer, and K. Schuster. 2019 Oceanographic Monitoring in Cook Inlet and Kachemak Bay, CTD Data, 2017, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Holderied, K., S. Baird, J. Schloemer, and K. Schuster. 2019. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Zooplankton Data, 2017, Gulf Watch Alaska Environmental Drivers Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Hopcroft, R.R. 2019. Seward Line Conductivity, Temperature, and Depth (CTD) Data, 2012 to 2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Hopcroft, R.R. 2019. Seward Line zooplankton biomass and abundance data from Spring and Summer cruises aboard the Tiglax, 2012 to 2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez Oil Spill* Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Hopcroft, R.R. 2019. Seward Line Chlorophyll-A and Nutrient Data, 2012 to 2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Kuletz, K.J. 2019. Seward Line and Lower Cook Inlet Marine Bird Survey Data, 2006-2017, Gulf Watch Alaska Nearshore Component. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Gulf of Alaska Data Portal.
- Olsen, D.W. 2017. Acoustic Recordings of Killer Whales in Prince William Sound and Kenai Fjords, 2012 to 2016, Gulf Watch Alaska Pelagic Component
- Olsen, D.W. 2017. Kenai Fjords and Prince William Sound Long-Term Photographic Monitoring of Killer Whales, 2012-2016, Gulf Watch Alaska Pelagic Component
- Olsen, D.W. 2017. Killer Whale Biopsy Genetic and Chemical Data from Southern Alaska, 1994 to 2016, Gulf Watch Alaska Pelagic Component
- Olsen, D.W. 2017 Database of Southern Alaska Killer Whale Surveys and Encounters, 2001 to 2016, Gulf Watch Alaska Pelagic Component.
- Moran, J.R., and J.M. Straley. 2019. Dall's and Harbor Porpoise Survey Data, Prince William Sound, Alaska: 2007-2008, 2011-2015, and 2017-2018, Gulf Watch Alaska Pelagic Component. Gulf of Alaska Data Portal. [https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder\\_metadata/2660559](https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2660559)
- Moran, J.R., and J.M. Straley. 2019. Lipid Analysis for Pacific Herring, Invertebrates and Humpback Whales in the Gulf of Alaska, 2012-2018, Gulf Watch Alaska Pelagic Component. Gulf of Alaska Data Portal. [https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder\\_metadata/4992914](https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/4992914)
- Moran, J.R., and J.M. Straley. 2019. Whale survey and prey data, 2008-2018, Gulf Watch Alaska Pelagic Component. Gulf of Alaska Data Portal. [https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder\\_metadata/2660555](https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2660555)

Moran, J.R. and J.M. Straley, 2019. Castaway CTD Data, Prince William Sound, Alaska: 2017-2018, Gulf Watch Alaska Pelagic Component. Gulf of Alaska Data Portal. [https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder\\_metadata/2852300](https://portal.aos.org/gulf-of-alaska#metadata/54adceab-74cb-4419-b02c-bacb6d2acb8b/project/folder_metadata/2852300)

### **North Pacific Pelagic Seabird Database**

Drew, G., and J. Piatt. 2020. Fall and Winter Seabird Abundance: PWS fall and winter 2007-2016 seabird observations. Bishop, M.A., and A. Schaefer contribution to North Pacific Pelagic Seabird Database v. 3.0 (NPPSD): U.S. Geological Survey data release.

### **Presentations**

Aguilar-Islas, A.M. 2020. The Northern Gulf of Alaska Long Term Ecological Research Site: Nutrient dynamics across the shelf from Kayak to Kodiak islands. University of South Florida, Invited talk. Tampa, FL.

Aguilar-Islas, A.M., M. Kaufman, and S. Strom. 2020. Nutrient dynamics and their influence in the Northern Gulf of Alaska. Ocean Sciences Meeting. San Diego, CA.

Arimitsu, M. 2019. Northern Gulf of Alaska forage fish sampling in 2018, connectivity between LTER and GWA Ecosystem Monitoring Programs. 2020. Oral Presentation. NGOA LTER PI meeting. Fairbanks, AK. 21 January.

Arimitsu, M.L. 2018. Monitoring forage fish in Alaska: Detecting change in non-commercial prey populations. Oral Presentation. Department of Fisheries and Oceans Canada Forage Fish Workshop. Pacific Biological Station, Nanaimo, BC. 13-15 March. [Invited, travel paid by DFO]

Arimitsu, M., M.A. Bishop, D. Cushing, S. Hatch, R. Kaler, K. Kuletz, C. Matkin, J. Moran, D. Olsen, W.S. Pegau, J. Piatt, A. Schaefer, and J. Straley. 2020. Changes in Marine Predator and Prey Populations in the Northern Gulf of Alaska: Gulf Watch Alaska Pelagic Update 2019. Poster Presentation. Alaska Marine Science Symposium, January 2020, Anchorage, AK.

Arimitsu, M.L., Bishop, M.A., Hatch, S., Kaler, R., Kuletz, K., Matkin, C., Moran, J., Olsen, D., Piatt, J.F., Schaeffer, A., Straley, J. 2018. Changes in marine predator and prey populations in the aftermath of the North Pacific heat wave: Gulf Watch Alaska Pelagic update 2017. Alaska Marine Science Symposium, Anchorage, AK, January.

Arimitsu, M.L., S. Pegau, J. Piatt, B. Heflin, and S. Schoen. 2017. Spatial and temporal variability of forage fish in coastal waters of Prince William Sound, Alaska, Alaska Marine Science Symposium, Anchorage, AK. January.

Arimitsu, M.L., J. Piatt, B. Heflin, and S. Schoen. 2017. Jellyfish blooms in warm water may signal trouble for forage fish in a warming climate. ICES/PICES Symposium on Drivers of Dynamics of Small Pelagic Fish Resources, Victoria, BC Canada, March.

Arimitsu, M.L., J.F. Piatt, B.M. Heflin, S.K. Schoen, V.R. von Biela. 2018. Ripples of the North Pacific heatwave: signals from seabirds and their forage base in the Gulf of Alaska. Poster Presentation. Ocean Sciences Meeting, Portland, OR. 11-16 February.

Arimitsu, M.L., Piatt, J.F., Schoen, S.S., Heflin, B.H., von Biela, V.R., Hatch, S. 2018. Changes in forage fish during the winter 2015-16 seabird die-off and the North Pacific marine heat wave. Alaska Marine Science Symposium, Anchorage, AK, January.



- Barbeau, K., R.R. Hopcroft, O. Schofield, and H. Sosik. 2018. Pelagic LTER site: site overviews, inter-comparisons and synthesis planning. Workshop. LTER All Scientists Meeting, Pacific Grove, CA, October.
- 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, A. Walne, and P. Helaouet. 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, Anchorage, Alaska.
- Bodkin, J.L., B.E. Ballachey, G.E. Esslinger, B.P. Weitzman, A.M. Burdin, L. Nichol and H.A. Coletti. 2017. A century of sea otter science and conservation in National Parks. X Sea Otter Conservation Workshop, 17-19 March, Seattle Aquarium. Oral Presentation. Seattle WA.
- Bodkin, J., H. Coletti, B. Ballachey, D. Monson, T. Dean, D. Esler, G. Esslinger, K. Iken, K. Kloecker, B. Konar, M. Lindeberg, and B. Weitzman. 2018. Detecting and inferring cause of change in Alaska nearshore marine ecosystem: An approach using sea otters as a component of the nearshore benthic food web. Oral Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Boswell, K., R. Heintz, J. Vollenweider, J. Moran, and S. LaBua. 2020. The decline of acoustic backscatter associated with overwintering Pacific herring (*Clupea pallasii*) in Lynn Canal, Alaska. Poster Presentation. Alaska Marine Science Symposium, Anchorage, AK. 27-31 January.
- Bowen, L., H.A. Coletti, B. Ballachey, T. Hollmen, S. Waters, and K. Counihan. 2018. Transcription as a Tool for Assessing Bivalve Responses to Changing Ocean Conditions. Oral Presentation. Ocean Sciences Meeting. February 11-16.
- Brydie, A., and S.L. Danielson. 2019. Copper River Plume, LTER REU Mini-Symposium, August.
- Brydie, A., and S.L. Danielson. 2020. Copper River discharges in the Northern Gulf of Alaska: freshwater distribution and evolution during the July 2019 freshet. Ocean Sciences Meeting, San Diego, CA, February.
- Burt, W., R.R. Hopcroft, S.L. Strom, and S.L. Danielson. 2020. Quantifying Phytoplankton Biomass and Productivity at Unprecedented Spatial Scales in the Northern Gulf of Alaska LTER Program Using Ship-Board Optical Measurements. Alaska Marine Science Symposium. Anchorage, AK.
- Burt, W., R.R. Hopcroft, S.L. Strom, and S.L. Danielson. 2020. Use of ship-board optical measurements to quantify plankton biomass and productivity across multiple trophic levels in the Northern Gulf of Alaska LTER program. Ocean Sciences Meeting. San Diego, CA.
- Busse, H., S. Strom, J. Fiechter. 2020. Grazing by mixotrophic nano- and dinoflagellates in the Northern Gulf of Alaska in response to gradients in light, inorganic nutrients, and prey availability. Ocean Sciences Meeting. San Diego, CA.
- 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.
- Campbell, R.W., P.L. Roberts, and J. Jaffe. 2020. The annual secondary productivity cycle in Prince William Sound measured with the Prince William Sound Plankton Camera. ASLO Ocean Sciences Meeting, San Diego. Oral presentation
- Campbell, R.W., P.L. Roberts, and J. Jaffe. 2020. The annual secondary productivity cycle in Prince William Sound measured with the Prince William Sound Plankton Camera. Alaska Marine Science Symposium, Anchorage. Poster presentation
- Coletti, H.A. 2019. Gulf Watch Alaska overview and updates. Oral Presentation. MARINE and BOEM joint meeting. September.
- Coletti, H., D. Esler, B. Ballachey, J. Bodkin, T. Dean, G. Esslinger, K. Iken, K. Kloecker, B. Konar, M. Lindeberg, D. Monson, B. Robinson, and B. Weitzman. 2018. A decade's worth of data: Key metrics from a large-scale, trophic web based long term monitoring program in the northern Gulf of Alaska. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Coletti, H.A., G. Hilderbrand, D. Monson, J. Erlenbach, B. Ballachey, B. Pister and B. Mangipane. 2019. Where carnivores clash: Evidence of competition - Prey-shifting by brown bears during a period of sea otter recovery. Oral Presentation. Sea Otter Conservation Workshop 2019. March.
- Coletti, H.A., P. Martyn, D.H. Monson, D. Esler and A.E. Miller. 2018. Using Small Unmanned Aircraft Systems (sUAS) to map intertidal topography in Katmai National Park and Preserve, Alaska. Poster Presentation. Ocean Sciences Meeting. February 11-16.
- Coletti, H.A., R. Suryan, D. Esler, R. Kaler, T. Hollmen, M. Arimitsu, J. Bodkin, T. Dean, K. Kloecker, K. Kuletz, J. Piatt, B. Robinson, and B. Weitzman. 2019. Birds of a feather flock together... or do they? Regional and temporal patterns of community composition and abundance in nearshore marine birds across the Gulf of Alaska. Oral Presentation. Alaska Bird Conference. March.
- Coletti, H.A., G. Hilderbrand, D. Monson, J. Erlenbach, B. Ballachey, B. Pister and B. Mangipane. 2019. Where carnivores clash: Evidence of competition - Prey-shifting by brown bears during a period of sea otter recovery. Oral Presentation. Sea Otter Conservation Workshop 2019. March 2019.
- Collins, R.E. 2018. Microbial community structure in Prince William Sound. Poster Presentation, Alaska Marine Science Symposium, January.
- Counihan, K., L. Bowen, B. Ballachey, H. Coletti, T. Hollmen, and B. Pister. 2019. Physiological and gene transcription assays in combinations: a new paradigm for marine intertidal assessment. Oral Presentation. Alaska Marine Science Symposium. January 28 – February 1.
- Coyle, K.O., A.J. Hermann, and R.R. Hopcroft. 2018. Modeled spatial-temporal distribution of production and biomass relative to field observations in the northern Gulf of Alaska. Oral Presentation Ocean Sciences Meeting – Portland, OR, February.

- 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.
- Cushing, D., K. Kuletz, R.R. Hopcroft, S.L. Danielson, and E. Labunski. 2017. Shifts in cross-shelf distribution of seabirds in the northern Gulf of Alaska under different temperature regimes, 2007-2015. Poster Presentation. Pacific Seabird Group, Tacoma, WA, February.
- Cushing, D., K. Kuletz, E. Labunski, and R.R. Hopcroft. 2019. Seabird Studies During the Northern Gulf of Alaska Long Term Ecological Research Program. Poster Presentation. Alaska Marine Science Symposium, January.
- Danielson, S. L., 2017. UAF Site Review: Northern Gulf of Alaska Marine Ecosystem Monitoring, M.J. Murdock Charitable Trust, 10 August 2017. Oral Presentation.
- Danielson, S. 2017. Marine heatwaves in the North Pacific & Pacific Arctic 2013-2017, UAF-CFOS Fisheries and Oceanography Seminar Series. Oral Presentation.
- Danielson, S.L. 2018. The short and the long of it: the importance of high-resolution Alaskan marine process studies and monitoring. Oral Presentation. UAF-CFOS FOS Seminar, September. Fairbanks, AK.
- Danielson, S.L., 2019. Changing stratification over Alaska region continental shelves suggests altered diapycnal mixing and nutrient fluxes, 3rd International Symposium: Ocean Mixing Processes: Impact on Biogeochemistry, Climate and Ecosystem. University of Tokyo, 23 May 2019. Oral Presentation.
- Danielson, S. 2019. 21<sup>st</sup> Century Oceanography in the Last Frontier, Invited Keynote Presentation, RVTEC, Fairbanks, AK, October.
- Danielson, S. 2019. Presentation to the Alaska Ocean Observing System Board, Anchorage, AK, December.
- Danielson, S. 2020. Presentation to the Northern Gulf of Alaska Long Term Ecological Research Program PI meeting, January.
- Danielson, S.L., A. Aguilar-Islas, J. Fiechter, R.R. Hopcroft, K. Kuletz, H. Statscewich, and S.L. Strom. 2018. Acrobat Observations along the Gulf of Alaska Hydrographic Tightrope. Poster Presentation. LTER All Scientists Meeting, Pacific Grove, CA, October.
- Dorsaz, T., and B. Konar. 2019. Clam predation patterns as a way of understanding sea star wasting disease's impacts in Kachemak Bay. Poster Presentation. Alaska Marine Science Symposium. January 28 – February 1, 2019.
- Du, X., R. Campbell, S. Kibler, K. Holderied, D. Hondolero, R. Robinson, C. Guo, C. Walker, M. Arimitsu, and J. Piatt. 2020. Prevalence of paralytic shellfish toxins in the marine food web of southcentral and southwest Alaska NPRB #1801: project update. Poster Presentation. Alaska Marine Science Symposium. Anchorage, AK. 27-31 January.
- Du, X., R. Campbell, S. Kibler, K. Holderied, D. Hondolero, K. Shuster, R. Robinson, M. Arimitsu, J. Piatt. 2019. Prevalence of paralytic shellfish toxins in the marine food webs of Prince William Sound and Kachemak Bay, Alaska. Poster Presentation. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January.
- Esler, D. 2017. Sea ducks as indicators of nearshore marine conditions. Oral Presentation. 6th International Sea Duck Conference, San Francisco.

- Esler, D. 2017. Sea Duck Traits: Their Influence on Oil Spill Vulnerability and Restoration Potential. Oral Presentation. 6th International Sea Duck Conference, San Francisco.
- Esler, D., B. Ballachey, C. Matkin, D. Cushing, R. Kaler, J. Bodkin, D. Monson, G. Esslinger, and K. Kloecker. 2016. Long-term data provide perspective on ecosystem recovery following the *Exxon Valdez* oil spill. Oral presentation. Gulf of Mexico Oil Spill and Ecosystem Science Conference, Tampa, Florida.
- Esslinger, G.G., H.A. Coletti, J.L. Bodkin, D.H. Monson, B.E. Ballachey, T.A. Dean, and D. Esler. 2017. Contrasting demography and behavior among sea otter populations in the northern Gulf of Alaska. Oral Presentation. Alaska Chapter of The Wildlife Society Annual Meeting, Fairbanks.
- Esslinger, G.G., H.A. Coletti, J.L. Bodkin, D.H. Monson, B.E. Ballachey, T.A. Dean, and D. Esler. 2017. Trends and equilibrium density vary among sea otter populations in the northern Gulf of Alaska. Oral Presentation. Sea Otter Conservation Workshop, Seattle.
- Fredrickson, K., H. Busse, D. Walker-Phelan, C. Mazur, and S. Strom. 2020. Unexpected importance of the smallest phytoplankton in the Northern Gulf of Alaska ecosystem. Alaska Marine Science Symposium. Anchorage.
- Griffin, K., and H. Coletti. 2020. Seabird colonies on the Katmai coast. Poster Presentation. Alaska Marine Science Symposium. January 27-30.
- Hauri, C., K Hedstrom, C. Schultz, S.L. Danielson, J. Beamer, S. Dony, D.F. Hill, and C. Stock. 2019. Influence of Ocean Acidification and Climate Change on the Biogeochemistry in the Gulf of Alaska: A Regional Modeling Study. Presentation. Alaska Marine Science Symposium, January.
- Heflin, B., M. Arimitsu, J. Piatt, S. Schoen, and E. Madison. 2016. Seabird and forage fish response to contrasting cold and warm years in Prince William Sound, Alaska. Pacific Seabird Group meeting, Honolulu, HI, February.
- Hernandez, A., and R.R. Hopcroft. 2020. The Effects of Environmental Changes in the Northern Gulf of Alaska on the Synthesis of Lipid in *N.flemingeri* and *N.plumchrus* from 2018 to 2019. Ocean Sciences Meeting. San Diego, CA.
- Holderied, K. 2018. Alaska Coastal Science and Management Examples. Oral presentation at Joint Polar Satellite System Arctic Summit, Anchorage, AK. May.
- Holderied, K. 2019. Gulf Watch Alaska: Ecosystem Monitoring (and data for you?) in the northern Gulf of Alaska. Oral presentation. NMFS/Alaska Fisheries Science Center Groundfish Seminar Series. October.
- Holderied, K., and E. Ammann. 2017. Improving shellfish restoration and habitat assessment in coastal Alaska: Kachemak Bay Habitat Focus Area. Oral presentation at Coastal and Estuarine Research Federation conference. Providence, RI. November.
- Holderied, K., S. Baird, J. Schloemer, and D. Hondolero. 2020. Impact of the warm, dry 2019 summer of nearshore waters in Kachemak Bay Alaska – rain vs. glacial melt? Oral presentation at Alaska Marine Science Symposium, Anchorage, AK. January.
- Holderied, K., D. Hondolero, S. Kibler, M. Vandersea, A. Doroff, J. Schloemer, and S. Buckelew. 2017. Using coastal Alaska marine responses to the 2014-2016 Pacific Warm Anomaly to improve risk assessment for climate-driven increases in paralytic shellfish poisoning events. Oral presentation at Climate Predictions Applications Science Workshop. Anchorage AK. May.

- Holderied, K., K. Powell, S. Baird, and J. Schloemer. 2018. Variability in estuarine salinity and stratification in Kachemak Bay, Alaska from 2012-2017. Poster presentation at Alaska Marine Science Symposium, Anchorage AK. January.
- Holderied, K., K. Powell, J. Schloemer, S. Baird, and D. Hondolero. 2018. Heating up and cooling off in Kachemak Bay Alaska – what does it mean for the marine ecosystem? Oral presentation at the Kachemak Bay Science Conference, Homer, AK. March.
- Holderied, K., K. Powell, J. Schloemer, and D. Hondolero. 2018. Variability in nearshore and estuarine oceanography in the northern Gulf of Alaska: 2004-2017. Poster presentation at 2018 Ocean Sciences Meeting, Portland, OR. February.
- Holderied, K., J. Schloemer, K. Powell Schuster, S. Baird, and D. Hondolero. 2019. Seasonal and spatial variability in ocean acidification conditions in Kachemak Bay and Cook Inlet Alaska. Poster presentation at Alaska Marine Science Symposium, Anchorage AK. January.
- Hondolero, D., T. Bell, B. Weitzman, and K. Holderied. 2020. Kelp forest mapping in Kachemak Bay, Alaska using a drone. Poster Presentation. Alaska Marine Science Symposium. January 26-31.
- Hondolero, D., M. Vandersea, K. Holderied, S. Kibler, K. Powell, S. Baird, A. Doroff, and W. Litaker. 2018. Environmental factors affecting toxic phytoplankton plankton in Kachemak Bay. Oral presentation at the Kachemak Bay Science Conference, Homer, AK. March.
- Hopcroft, R.R., A. Aguilar-Islas, S.L. Danielson, J. Feichter, S. Strom. 2018. NGA-LTER Overview. LTER PI Meeting, October, Asilomar, CA.
- Hopcroft, R.R., K.O. Coyle, and S.L. Danielson. 2018. The Seward Line - 2017. Poster Presentation. Alaska Marine Science Symposium, January.
- Hopcroft, R.R., K.O. Coyle, S.L. Danielson, and S.L. Strom. 2017. Twenty Years of Observations Along the Gulf of Alaska's Seward Line: Impact of Continued Warm Conditions. Oral Presentation. Kodiak Marine Science Symposium, Kodiak, April.
- Hopcroft, R.R., K.O. Coyle, S.L. Danielson, and S.L. Strom. 2017. Oceanography in the Northern Gulf of Alaska: the Seward Line. Public Presentation for Osher Lifelong Learning Institute, Fairbanks, December.
- Hopcroft, R.R., and D. J. Lindsay. 2018. Gelatinous zooplankton in Alaskan waters: from nets to ROVs. Invited PICES Annual Meeting, Yokohama, Japan, October.
- Hopcroft, R.R, S.L. Strom, A. Aguilar-Islas, S.L. Danielson, and J. Fiechter. 2018. The Northern Gulf of Alaska Long-term Ecological Research Program. Poster Presentation. Alaska Marine Science Symposium, January.
- Hopcroft, R.R., S.L. Strom, A. Aguilar-Islas, S.L. Danielson, and J. Fiechter. 2018. The Northern Gulf of Alaska Long-term Ecological Research program: coming to an ocean near you in 2018. Poster Presentation. Ocean Sciences Meeting – Portland, OR, February.
- Hopcroft, R.R., S.L. Strom, A. Aguilar-Islas, S.L. Danielson, and J. Fiechter. 2018. A new Long-term Ecological Research (LTER) site in the Northern Gulf of Alaska. Poster PICES Annual Meeting, Yokohama, Japan, October.

- Hopcroft, R.R., S.L. Strom, K.O. Coyle, and S.L. Danielson. 2017. Three in a row: continued warm conditions along the Gulf of Alaska's Seward Line. Oral Presentation. Association for the Sciences of Limnology and Oceanography, Honolulu, March.
- Iken, K., and B. Konar. 2018. Nearshore Gulf Watch Alaska monitoring in Kachemak Bay. Oral Presentation. Kachemak Bay Science Conference, Homer, AK. 8-9 March.
- Iken, K., and B. Konar. 2018. Freezing in a warming climate? Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Iken, K., and B. Konar. 2018. Nearshore Gulf Watch Alaska monitoring in Kachemak Bay. Poster Presentation. Kachemak Bay Science Conference. March 7-10.
- Jones, J., et al. 2018. Climate Change at LTER sites. Workshop. LTER All Scientists Meeting, Pacific Grove, CA, October.
- Kaler, R. 2019. Population estimates and trends for Marbled and Kittlitz's Murrelets in Prince William Sound, Alaska. Oral presentation. Marine Stewardship Council meeting, Anchorage, Alaska, 12 December.
- Kaler, R. 2019. Sentinels of the seas: Seabirds, die-offs, and ecosystem changes in the Gulf of Alaska. Invited presentation to undergraduate environmental studies course at the University of Alaska, Anchorage, 18 November.
- Kaler, R. 2020. Alaska seabird update in Gulf of Alaska. Invited presentation at the Kodiak Regional Management Meeting of the Alaska Migratory Bird Co-management Council, 24 March.
- Kaler, R. 2020. Prince William Sound loon population trends. Invited presentation at the Loons in Northern Alaska information exchange and coordination meeting, Anchorage, Alaska, 25 February.
- Kaler, R. 2020. Alaska's ocean sentinels seabirds as ecosystem indicators, Part I and II. Invited presentation for the Opportunities for Lifelong Education, Anchorage, Alaska, 23 & 30 January.
- Kaler, R. 2020. Pacific Seabird Group Seabird Monitoring Committee, 2019 summary. Oral presentation. Portland, Oregon, 12 February.
- Kaler, R. 2020. Alaska's ocean sentinels seabirds as ecosystem indicators in Prince William Sound. Invited presentation at the Prince William Sound Natural History Symposium, 18 May.
- Kibler, S., X. Du, R.W. Campbell, K. Holderied, D. Hondolero, K. Powell Schuster, R. Robinson, M. Arimitsu, 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.
- Kibler, S., B. Wright, X. Du, R.W. Campbell, K. Holderied, D. Hondolero, R. Masui, C. Guo, and C. Walker. 2020. NPRB 1801 – Prevalence of paralytic shellfish toxins in the marine food web of Southcentral and Southwest Alaska: Year 1 Update. Alaska Marine Science Symposium, Anchorage. Poster presentation
- Kloecker, K.A., D.H. Monson, B. Robinson, H.A. Coletti, B.E. Ballachey, and D. Esler. 2017. Correlates between sea otter diet and prey energetics in a mussel-specialist population. Oral Presentation. Sea Otter Conservation Workshop, Seattle.

- Konar, B., K. Iken, H. Coletti, T. Dean, D. Esler, K. Kloecker, M. Lindeberg, B. Pister, and B. Weitzman. 2018. Trends in intertidal sea star abundance and diversity across the Gulf of Alaska: effects of sea star wasting. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Konar, B., K. Iken, H. Coletti, T. Dean, D. Esler, K. Kloecker, M. Lindeberg, B. Pister, and B. Weitzman. 2018. Trends in intertidal sea star abundance and diversity across the Gulf of Alaska: effects of sea star wasting. Oral Presentation. Ocean Sciences Meeting. February 11-16, 2018.
- Konar, B., K. Iken, H. Coletti, T. Dean, D. Esler, K. Kloecker, M. Lindeberg, B. Pister, and B. Weitzman. 2018. Trends in intertidal sea star abundance and diversity across the Gulf of Alaska: effects of sea star wasting. Oral Presentation. Kachemak Bay Science Conference. March 7-10, 2018.
- Kuletz, K., D. Cushing, R.R. Hopcroft, S.L. Danielson, and E. Labunski. 2017. Running Hot and Cold: Shifts in Seabird Distribution in the Northern Gulf of Alaska under Different Temperature Regimes, Based on Seward Line Surveys, 2007-2015. Poster Presentation. Alaska Marine Science Symposium, January.
- Kuletz, K., B. Hoover, D. Cushing, J. Santora, W. Sydeman, R. Hopcroft, S. Danielson, and E. Labunski. 2019. Seabird distribution relative to biophysical oceanographic properties in North Pacific Ecosystems. Annual meeting of the Pacific Seabird Group. Lihue, HI.
- Kuletz, K., R.R. Hopcroft, S.L. Danielson, J. Santora, W. Sydeman, B. Hoover, and D. Cushing. 2018. Seabird distribution relative to biophysical oceanographic properties in North Pacific ecosystems. Poster LTER All Scientists Meeting, Pacific Grove, CA, October.
- Kuletz, K., and R. Kaler. 2019. Data from GWA-funded marine bird surveys and LTER surveys were presented at the Marbled Murrelet Technical Committee, Kittlitz's Murrelet Technical Committee, Tufted Puffin Technical Committee, Seabird Monitoring Committee, and Short-tailed Albatross Recovery Team meeting. Pacific Seabird Group annual conference, Kauai, Hawaii, 27 February-2 March.
- Kuletz, K., and R. Kaler. 2020. Data from GWA-funded marine bird surveys and LTER surveys were presented at the Marbled Murrelet Technical Committee, Kittlitz's Murrelet Technical Committee, Tufted Puffin Technical Committee, Seabird Monitoring Committee, and Short-tailed Albatross Recovery Team meeting. Pacific Seabird Group annual conference, Portland, Oregon, 12-15 February.
- Kurtz, D., D. Esler, T. Jones, B. Weitzman, and B. Robinson. 2019. Spatial and temporal patterns in nearshore physical oceanography in tidewater glacial fjords. Poster Presentation. Alaska Marine Science Symposium. January 28 – February 1, 2019.
- Lenz, P.H., V. Roncalli, Hartline, M. Germano, M.C. Cieslak, S.L. Strom, and R.R. Hopcroft. 2018. The physiological ecology of the calanid copepod, *Neocalanus flemingeri* in the northern Gulf of Alaska. Oral Presentation. Alaska Marine Science Symposium, January.
- Lindeberg, M. 2017. The Long-Term Monitoring Program of the *Exxon Valdez* Trustee Council. Briefing to the EVOSTC Trustees, Nov. 14.
- Lindeberg, M. 2017. We are Watching – the long-term monitoring program of the *Exxon Valdez* Oil Spill Trustee Council. PWS RCAC Science Night. December.
- Lindeberg, M. 2018. The Long-term Monitoring Program of the *Exxon Valdez* Trustee Council. Briefing to the EVOSTC Trustees, Nov. 14.

- Lindeberg, M. 2018. Science without borders – is it possible? Keynote presentation. 2018 Kachemak Bay Science Conference, Homer, AK, March 7-10.
- Lindeberg, M. 2018. Gulf Watch Alaska Long-term Monitoring Program. Speed talk. 2018 Ocean Sciences Conference, Portland, OR, February 11-16.
- Lindeberg, M. 2018. Nearshore Ecosystem Component of the Gulf Watch Alaska Long-term Monitoring Program. Speed talk. 2018 Ocean Sciences Conference, Portland, OR, February 11-16.
- Lindeberg, M.R. 2019. Long-term Programs of the *Exxon Valdez* Oil Spill Trustee Council. Presentation. Alaska Forum on the Environment, Feb. 11-15, Anchorage, Alaska.
- Lindeberg, M., K. Holderied, D. Aderhold, K. Hoffman, M. Arimitsu, H. Coletti, and R. Hopcroft. 2017. Gulf Watch Alaska: Results from five years of ecosystem monitoring in the northern Gulf of Alaska. Presentation. 2017 Alaska Marine Science Symposium, Anchorage.
- Lindeberg, M., K. Holderied, D. Aderhold, K. Hoffman, M. Arimitsu, H. Coletti, and R. Hopcroft. 2017. Gulf Watch Alaska: Results from five years of ecosystem monitoring in the northern Gulf of Alaska. Presentation. 2017 NMFS Alaska Fisheries Science Center mini symposium.
- Lindeberg, M., M. McCammon, K. Holderied, K. Hoffman, D. Aderhold, R. Hopcroft, M. Arimitsu, and H. Coletti. 2017. Five years of ecosystem monitoring in the Northern Gulf of Alaska. Alaska Marine Science Symposium. January.
- Lindeberg, M., R. Suryan, D. Aderhold, K. Hoffman, R. Hopcroft, H. Coletti, and M. Arimitsu. 2018. Gulf Watch Alaska Report: Residual effects of the marine heatwave persist in the Gulf of Alaska. Alaska Marine Science Symposium, Anchorage, AK, January.
- Lindeberg, M., R. Suryan, D. Aderhold, and K. Hoffman. 2020. Gulf Watch Alaska Program Overview and Highlights (FY2012-2019). Presentation. EVOSTC Science Synthesis Workshop. Anchorage, Alaska, February.
- Lyman, E., R. Finn, J. Moran, K. Savage, C. Gabriele, J. Straley, N. Davis, F. Sharpe, J. Neilson, A. Jensen, D. Schofield, S. Wright, P. Cottrell, T. Rowles, S. Wilkin, M. Lammers, E. Zang. 2019. Are recent population level changes in the central North Pacific humpback whales, *Megaptera novaeangliae*, affecting entanglement threat and reporting rate? Poster Presentation. World Marine Mammal Conference, Barcelona, Spain. 9-12 December.
- Martyn, P., D. Monson, H. Coletti, A. Miller, and D. Esler. 2018. Using Small Unmanned Aircraft Systems (sUAS) to map intertidal topography in Katmai National Park and Preserve, Alaska. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Matkin, C.O. 2017. Tracking whales with hydrophones. Delta Sound Connections, PWS Science Center. March.
- Matkin C.O. 2018. Life History and Social Structure of Alaskan Killer Whales, 2018. Oral Presentation to Kenai Peninsula College, October.
- Matkin C.O., D.W. Olsen, and G. Ellis. 2018. Southern Alaska resident killer whales may be dependent on more than Alaska salmon: some initial stream of origin genetic data from prey samples. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January.



- Matkin, C.O., Olsen D.W. and Ellis, G. 2019. An unfortunate legacy: Continuing effects of the *Exxon Valdez* oil spill on killer whales. Alaska Marine Science Symposium, Anchorage Alaska. Poster Presentation.
- Mayer, K., C. Clarke-Hopcroft, and R.R. Hopcroft. 2020. Spatial and Temporal Patterns of Zooplankton Species in the Gulf of Alaska as Revealed by Image Analysis. Ocean Sciences Meeting. San Diego, CA.
- Mazur, C., S. Strom, and A. Aguilar-Islas. 2020. Comparing the Bioavailability of a Natural and Synthetic Iron Source: Do past experiments adequately model diatom growth in response to episodic iron addition. Ocean Sciences Meeting. San Diego, CA.
- McGowan, D.W., M.L. Arimitsu, K. Coyle, A.L. Dreary, A. De Robertis, E.D. Golstein, K. Holderied, J.K. Horne, O. Ormseth, J.F. Piatt, L.A. Rogers, M.T. Wilson, S. Zador. 2019. Spatial and temporal dynamics of capelin (*Mallotus villosus*) in the Gulf of Alaska: implications for fisheries and ecosystem-based management. Oral Presentation. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January.
- 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.
- McKinstry, C., R. Campbell, and K. Holderied. 2020. Influence of the 2013-2016 marine heatwave on zooplankton community structure in lower Cook Inlet, Alaska. Poster presentation at the Ocean Sciences Meeting, San Diego, CA. February.
- 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.
- Mendoza-Islas, H.M., and R.R. Hopcroft. 2019. First year pollock and their zooplankton predators in the Gulf of Alaska. Poster Presentation. Alaska Marine Science Symposium, January.
- Mendoza-Islas, H.M., and R.R. Hopcroft. 2020. Abundance and Distributions of Gelatinous Zooplankton in the Northern Gulf of Alaska. Ocean Sciences Meeting. San Diego, CA.
- Mendoza-Islas, H., and R.R. Hopcroft. 2020. Abundance and Distributions of Gelatinous Zooplankton in the Northern Gulf of Alaska. *Alaska Marine Science Symposium*. Anchorage, AK.
- Monacci, N.M., J. Cross, and J. Mathis. 2019. Ocean acidification observations along the Seward Line: 2008-2017. Poster Presentation. Alaska Marine Science Symposium, January.
- 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.
- Monson, D., R. Taylor, G. Hilderbrand, J. Erlenbach, and H. Coletti. 2019. Top-Level Carnivores Linked Across the Marine / Terrestrial Interface: Sea Otter Haulouts Offer a Unique Foraging Opportunity to Brown Bears. Oral Presentation. Alaska Marine Science Symposium. January 28 – February 1.

- Monson, D.H., B.P. Weitzman, K.A. Kloecker, D. Esler, L.A. Sztukowski, S.A. Sethi, H.A. Coletti, and T. Hollmen. 2017. Understanding Trophic Relationships of Sea Otters and Their Effects on Demographic Attributes. Oral Presentation. Sea Otter Conservation Workshop, Seattle.
- Moran, J. 2018. A whale of an update. Auke Bay Laboratory Mini Seminar. Juneau, AK. 4 April.
- Moran, J. 2018. What do predators tell us about prey? Juneau Marine Naturalist Symposium. Juneau, AK. 10 May.
- Moran, J. 2019. Upper Trophic Conditions: Humpback whales. Spring PEEC 2019[Preview of Ecosystem and Economic Conditions] An Alaska IEA activity AFSC/PMEL, Seattle, WA. 6-7 June.
- Moran, J. 2020. What happens in Alaska doesn't stay in Alaska. 14<sup>th</sup> Annual Whale Tales. Kapalua HI. 14-16 February.
- Moran, J., K. Boswell, and J. M. Straley. 2017. Humpback whales ruin a perfectly good overwintering strategy for Pacific herring in Alaska. Presentation. PICES - Drivers of Dynamics of Small Pelagic Fish Resources, Victoria, British Columbia, CA, 6-11 March.
- Moran, J., C. Gabriele, J. Neilson, K. Savage, and J. Straley. 2018. Recent observations of humpback whales in the Gulf of Alaska: carrying capacity or a cause for concern? Poster Presentation. Ocean Science Meeting, Portland OR. 11-16 February.
- Moran, J., M. O'Dell, D. Dickson, J. Straley, and M.L. Arimitsu. 2017. Seasonal distribution of Dall's Porpoise in Prince William Sound, Alaska. Alaska Marine Science Symposium. January.
- Moran, J.R., and J.M. Straley. 2018. Recent observations of humpback whales in the Gulf of Alaska: carrying capacity or a cause for concern? 2018 Ocean Science Meeting. Portland, OR, 11-16 February.
- Moran, J., and J. Straley. 2019 Trends in humpback whale (*Megaptera novaenagliae*) abundance, distribution, and health in Hawaii and Alaska Meeting Report. Workshop. NOAA Fisheries Pacific Islands Regional Office, Honolulu, Hawaii. 27-28 November.
- Moran, J., and J. Straley. 2020. Humpback whale numbers have not recovered in Prince William Sound following the 2014 – 2016 marine heatwave. Poster Presentation. Alaska Marine Science Symposium, Anchorage, AK. 27-31 January.
- Myers, H., D. Olsen, C. Matkin, and B. Konar. 2020. Killer whale spatial use in the Gulf of Alaska. Alaska Marine Science Symposium, Anchorage Alaska. Poster Presentation
- O'Daly, S., S. Strom, and A. McDonnell. 2020. Particulate carbon flux, flux attenuation, and export efficiency in the summer of 2019 across the northern Gulf of Alaska shelf. Alaska Marine Science Symposium. Anchorage.
- Olsen et al. 2017. Behavioral Changes During Multi-pod Aggregations of Southern Alaska Resident Killer Whales (*Orcinus orca*). Oral Presentation. Society of Marine Mammalogy Conference, Halifax, Nova Scotia, November 2017.
- Olsen, D.W. 2018. Mom knows best: Killer whale culture in Prince William Sound. Oral Presentation to Kenai Peninsula College. November 2018.
- Olsen, D. 2019. Killer whales of Kenai Fjords. Seward naturalists and boat operators, Seward, Alaska. Oral Presentation. May.

- Olsen, D.W. 2019. Marine Mammal Acoustics. Oral Presentation to Kenai Peninsula College. November.
- Olsen, D., C. Matkin, and K. Parsons. 2020. Characterization of killer whale (*Orcinus orca*) diet in the Northern Gulf of Alaska through genetic analysis of fecal samples. Alaska Marine Science Symposium, Anchorage Alaska. Poster Presentation
- Parrish, J.K., H. Burgess, T. Jones, J. Lindsey, A. Lestenkof, B. Bodenstein, B. Mangipane, E. Labunski, E. Lujan, H. Coletti, H. Renner, J. Christensen, J. Piatt, K. Hilwig, K. Lewandowski, K. Plentnikoff, K. Lefebvre, K. Kuletz, K. Griffin, L. Divine, L. Wilson, M. Romano, M. Cady, M. Good, M. Brubaker, N. Graff, N. Stellrecht, P. Lestenkof, P. Fitzmorris, P. Melovidov, R. Kaler, R. Corcoran, S. Schoen, S. Backensto, S. Knowles, S. Thomas, T. Mullet, C. Wright, A. Will and T. Lewis. 2020. Unabated Mass Mortality of Marine Birds in the Northeast Pacific. Oral Presentation. Alaska Marine Science Symposium. January 27-30.
- Piatt, J., and M. Arimitsu. 2019. The ectothermic vise: regulation of seabirds by forage fish in hot water. Oral Presentation. Pacific Seabird Group meeting, Kauai, HI. 28 February – 2 March.
- Piatt, J., M. Arimitsu, S. Schoen, V. von Biela, J. Parrish, H. Renner. 2019. Mass mortality and breeding failure of seabirds during and after the 2014-2016 marine heatwave. Oral Presentation. Joint American Fisheries Society-The Wildlife Society Meeting. Reno, NV. 1-4 October.
- Piatt, J., T. Jones, K. Kuletz, H. Renner, J. Parish, R. Corcoran, S. Schoen, B. Bodenstein, R. Kaler, M. Garcia-Reyes, H. Coletti, M. Arimitsu, R. Duerr, K. Lindquist, J. Lindsey, and W. Sydeman. 2018. Unprecedented Scale of Seabird Mortality in the NE Pacific During the 2015-2016 Marine Heatwave. Oral Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Piatt, J., J.K. Parrish, H.M. Renner, S.K. Schoen, T.T. Jones, M.L. Arimitsu, K.J. Kuletz, B. Bodenstein, M. García-Reyes, R.S. Duerr, R.M. Corcoran, R.S.A. Kaler, G.J. McChesney, R.T. Golightly, H.A. Coletti, R.M. Suryan, H.K. Burgess, J. Lindsey, K. Lindquist, P.M. Warzybok, J. Jahncke, J. Roletto, and W.J. Sydeman. 2019. Was an “ectothermic vise” responsible for the mass mortality and breeding failure of seabirds in Alaska following the NE Pacific marine heat wave of 2014-2016? Oral Presentation. PICES annual meeting. Victoria, BC, Canada. 16-27 October.
- Powell, K., J. Schloemer, K. Holderied and A. Doroff. 2018. Oceanographic characteristics associated with spring zooplankton community structure in Kachemak Bay, Alaska from 2012 to 2016. Poster presentation at Alaska Marine Science Symposium, Anchorage AK. Jan 2018.
- Powell Schuster, K., K. Holderied, J. Schloemer, and D. Hondolero. 2019. Variability of zooplankton abundance and community structure in Kachemak Bay and lower Cook Inlet Alaska: 2012-2017. Poster presentation at Alaska Marine Science Symposium, Anchorage AK. Jan 2019.
- Renner, M., K. Holderied, K. Powell, D. Hondolero, J. Schloemer, A. Doroff, and K. Kuletz. 2018. Ecosystem variability in Lower Cook Inlet across trophic levels, space, seasons, and climate regimes. Oral presentation at Alaska Marine Science Symposium, Anchorage, AK. Jan 2018.
- Rogers, M., J. Moran, J. Straley, C. Weiss, and A. Masterman. 2020. Hot tub time machine: Stable isotopes in baleen reconstruct humpback whale nutritional ecology. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January.
- Roncalli, V. 2018. Physiological ecology of the calanoid *Neocalanus flemingeri* in the Gulf of Alaska. Invited presentation presented at the Pacific Biosciences Research Center, University Hawaii Manoa, Honolulu, HI, February.

- Roncalli, V., M. Cieslak, R.R. Hopcroft, and P.H. Lenz. 2019. Environmental heterogeneity in the northern Gulf of Alaska impacts physiological status in the copepod *Neocalanus flemingeri*. Poster Presentation. Alaska Marine Science Symposium, January.
- Roncalli, V., M.C. Cieslak, P.H. Lenz, and R.R. Hopcroft. 2020. Energy allocation in a diapausing copepod: a transcriptomics analysis. Ocean Sciences Meeting. San Diego, CA.
- Roncalli, V., M.C. Cieslak, S. Mathews, C. Clarke-Hopcroft, R.R. Hopcroft, and P.H. Lenz. 2017. Physiological changes in *Neocalanus flemingeri* females during the transition from diapause to reproduction. Oral Presentation. Association for the Sciences of Limnology and Oceanography, February.
- Roncalli, V., D.K. Hartline, M. Germano, M.C. Cieslak, S.L. Strom, R.R. Hopcroft, and P.H. Lenz. 2018. Consequences of regional heterogeneity on the physiology of a calanid copepod, *Neocalanus flemingeri*, in the northern Gulf of Alaska. Oral Presentation Ocean Sciences Meeting – Portland, OR, February.
- Schaefer, A.L., M.A. Bishop, and R. Thorne. 2018. Non-breeding marine bird response to forage fish schools in Prince William Sound, Alaska. Poster Presentation. Alaska Marine Science Symposium, January, Anchorage, AK.
- Schloemer, J., S. Baird, S. Bentz, M. Johnson, and R. Masui. 2019. Using circulation mapping and long-term water quality data to aid community monitoring programs in Kachemak Bay, Alaska. Poster presentation at Alaska Marine Science Symposium, Anchorage AK. January.
- Sethi, S., K. Iken, B. Konar, and H. Coletti. 2018. Regional and local drivers combine to structure mussel growth and mortality. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Siegert, D., K. Iken, B. Konar, S. Saupe, and M. Lindeberg. 2018. Nearshore food web structure in two contrasting regions of Cook Inlet. Poster Presentation. Alaska Marine Science Symposium, Anchorage Alaska. January 21-25.
- Siegert, D., K. Iken, S. Saupe, and M. Lindeberg. 2019. Comparison of intertidal food web structure between two regions of lower Cook Inlet. Poster Presentation. Alaska Marine Science Symposium. January 28 – February 1.
- Siegert, D., K. Iken, S. Saupe, and M. Lindeberg. 2019. Comparing intertidal food web and community structure across two regions of lower Cook Inlet. Oral Presentation. CMI Annual Review, Anchorage, AK. 1 February.
- Siegert, D., K. Iken, S. Saupe, and M. Lindeberg. 2018. Nearshore food web structure in two contrasting regions of Cook Inlet. Oral Presentation. CMI Annual Review, Anchorage, AK. 26 January.
- Siegert, D., K. Iken, S. Saupe, and M. Lindeberg. 2018. Nearshore food web structure in two contrasting regions of Cook Inlet. Poster Presentation. Kachemak Bay Science Conference, Homer, AK. 8-9 March 2018.
- Smoot, C., K.O. Coyle, and R.R. Hopcroft. 2020. Warm-water zooplankton in the Northern Gulf of Alaska: Observations from the Seward Line. Alaska Marine Science Symposium. Anchorage, AK.
- Straley, J. 2019. Observations of humpback whales in Alaska. Trends in humpback whales meeting, Honolulu HI. 27-28 November.

- Straley, J. 2019. Ecosystem implications for the decline in reproductive success in humpback whales in the Gulf of Alaska. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January.
- Straley, J.M., and J.R. Moran. 2018. Have Gulf of Alaska Humpback Whales Reached Carrying Capacity or Has the Blob Made the Food Web Screwed. Alaska Marine Science Symposium. Anchorage, Alaska. 21-28 January.
- Straley, J.M., and J.R. Moran. 2018. Have Gulf of Alaska Humpback Whales Reached Carrying Capacity or Has the Blob Made the Food Web Screwed? 2018 Ocean Science Meeting. Portland, OR, 11-16 February.
- Straley, J., and J. Moran. 2019. Observations of humpback whales in Alaska. Trends in humpback whales meeting, Honolulu HI. 27-28 November.
- Straley, J., J. Moran, B. Witteveen, O. Titova, O. Filatova, C. Gabriele, J. Neilson, C. Matkin, O. von Ziegesar, and T. Cheeseman. 2020. Local collapse of a humpback whale population during the 2014-2016 marine heatwave: Where have all the whales gone? Poster Presentation. Alaska Marine Science Symposium, Anchorage, AK. 27-31 January.
- Strom, S.L, K. J. Bright, and K.A. Fredrickson. 2019. Mixotrophy in the Gulf of Alaska: Abundant plant-animal cells have major implications for ecology and biogeochemistry. Presentation AMSS (January)
- Strom, S.L., and R.R. Hopcroft. 2019. Planktonic Communities in the Coastal Gulf of Alaska: Strong Dichotomies in Structure and Function. Oral Presentation Ocean Sciences Meeting – Portland, OR (February)
- Strom, S., R.R. Hopcroft, A. Aguilar-Islas, S.L. Danielson, J. Feichter. 2019. Resilience Amidst a Sea of Change: The Northern Gulf of Alaska LTER Program, Keynote Presentation, Alaska Marine Science Symposium, January 2019, Anchorage, AK.
- Suryan, R.M. 2019. Gulf of Alaska ecosystem status for 2018 and early indicators for 2019. Alaska Groundfish and Halibut Seabird Working Group, NOAA Alaska regional office, Juneau.
- Suryan, R.M. 2019. Mixed Signals of “Recovery” From the Gulf of Alaska Marine Heatwave: Perspectives from Gulf Watch Alaska. University of Alaska Southeast, Juneau, Alaska.
- Suryan, R.M. 2019. Changing Climate, Changing Ecosystems, Sitka WhaleFest public presentation, Sitka, Alaska.
- Suryan, R.M. 2019. Biological response to a marine heatwave in the Gulf of Alaska. Evening public lecture series. Kachemak Bay Campus, Kenai Peninsula College, University of Alaska Anchorage. October.
- Suryan, R.M., M. Arimitsu, H. Coletti, M.A. Bishop, D. Cushing, D. Esler, S. Hatch, D. Irons, R. Kaler, K. Kuletz, J. Piatt, A. Schaefer. 2020. Response of seabirds on colony and at sea to a prolonged marine heatwave in the Gulf of Alaska. 6th World Seabird Twitter Conference.
- Suryan, R., M. Arimitsu, H. Coletti, R. Hopcroft, M. Lindeberg, S. Batten, J. Bodkin, M. Bishop, R. Campbell, D.I. Cushing, S. Danielson, D. Esler, S. Hatch, S. Haught, K. Holderied, K. Iken, D. Irons, R. Kaler, B. Konar, K. Kuletz, C. Matkin, C. McKinstry, D. Monson, J. Moran, D. Olsen, S. Pegau, J. Piatt, A. Schaefer, J. Straley, and B. Weitzman. 2019. Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska: Seabirds are the tip of the iceberg. Oral Presentation. The Wildlife Society and American Fisheries Society Conference, Reno, Nevada. 28 September - 3 October.
- Suryan, R.M. Lindeberg, D. Aderhold, and K. Hoffman. 2020. Gulf Watch Alaska Program Science Synthesis Overview. Presentation. EVOSTC Science Synthesis Workshop. Anchorage, Alaska, February.

- Suryan, R., M. Lindeberg, D. Aderhold, M. Arimitsu, J. Piatt, J. Moran, J. Straley, H. Colletti, D. Monson, S. Hatch, T. Dean, R. Hopcroft, S. Batten, S. Danielson, B. Konar, K. Iken, B. Laurel, R. Campbell, and S. Pegau. 2018. Ecosystem variability and connectivity in the Gulf of Alaska following another major ecosystem perturbation. North Pacific Marine Science Organization (PICES) annual meeting, Yokohama, Japan. 25 October - 4 November.
- Suryan, R.M., M. Lindeberg, M. Arimitsu, H. Coletti, R. Hopcroft, D. Aderhold, K. Hoffman. 2020. Ecosystem response to a prolonged marine heatwave in the Gulf of Alaska: Perspectives from Gulf Watch Alaska. Alaska Marine Science Symposium, Anchorage, Alaska
- Suryan, R., S. Zador, M. Lindeberg, D. Aderhold, J. Moran, B. Laurel, H. Coletti, M. Arimitsu, J. Piatt, D. Monson, S. Hatch, J. Straley, R. Campbell, S. Pegau, R.R. Hopcroft, S.L. Danielson, B. Konar, K. Iken, S. Batten, and T. Dean. 2018. Ecosystem variability and connectivity in the Gulf of Alaska. Oral Presentation. PICES Annual Meeting, Yokohama, Japan, October.
- Suryan, R., S. Zador, M. Lindeberg, M. Arimitsu, J. Piatt, J. Moran, J. Straley, H. Coletti, D. Monson, S. Hatch, T. Dean, R. Hopcroft, S. Batten, S. Danielson, B. Konar, K. Iken, B. Laurel, R. Campbell, M. Bishop, S. Schaeffer, S. Pegau, K. Kuletz, and R. Kaler. 2019. Ecosystem response to a marine heatwave in the Gulf of Alaska: seabirds are the tip of the iceberg. Oral Presentation. Pacific Seabird Group meeting, Kauai, HI. 28 February – 2 March.
- Sydeman, W.J., S.A. Thompson, M. Garcia-Reyes, M. Arimitsu, J. Piatt, H. Renner, and S. Hatch. 2018. Puffins as samplers of forage fish in Alaska: variation in length and condition relative to ocean climate in the Gulf of Alaska. Alaska Marine Science Symposium, Anchorage, AK, January.
- Suryan, R., S. Zador, M. Lindeberg, M. Arimitsu, J. Piatt, J. Moran, J. Straley, H. Coletti, D. Monson, S. Hatch, T. Dean, R. Hopcroft, S. Batten, S. Danielson, B. Konar, K. Iken, B. Laurel, R. Campbell, M. Bishop, A. Shaefer, S. Pegau, K. Kuletz, R. Kaler, and D. Irons. 2019. Ecosystem response to a marine heat wave in the Gulf of Alaska: seabirds are the tip of the iceberg. 2019 Oral Presentation. Pacific Seabird Group 46th Annual Meeting Kaua'i Beach Resort Lihue, Kaua'i, Hawai'i. 27 February – 3 March.
- Sydeman, W.J., S.A. Thompson, M. Garcia-Reyes, M. Arimitsu, J. Piatt, H. Renner, and S. Hatch. 2018. Puffins as samplers of forage fish in Alaska: variation in length and condition relative to ocean climate in the Gulf of Alaska. Alaska Marine Science Symposium, Anchorage, AK, January.
- Sydeman, W., S.A. Thompson, S. Zador, K. Shotwell, M. Arimitsu, H. Renner, J. Piatt, S. Hatch, and Y. Watanuki. 2019. Potential application of seabird data on groundfish stock assessments. Oral Presentation. PICES annual meeting. Victoria, BC, Canada. 16-27 October.
- Thompson, S.A., M. García-Reyes, W.J. Sydeman, M.L. Arimitsu, S.A. Hatch, and J.F. Piatt. 2019. Effects of ocean climate on the length and condition of forage fish in the Gulf of Alaska. Poster Presentation. PICES annual meeting. Victoria, BC, Canada. 16-27 October.
- Vandersea, M., P. Tester, K. Holderied, D. Hondolero, S. Kibler, K. Powell, S. Baird, A. Doroff and W. Litaker. 2018. Distribution and abundance of *Alexandrium catenella* in Kachemak Bay and Lower Cook Inlet, Alaska. Poster presentation at Alaska Marine Science Symposium, Anchorage, AK. January.
- Van Hemert, C., M. Smith, R. Dusek, S. Schoen, M. Arimitsu, R. Kaler, J. Piatt, K. Kuletz, J. Pearce, G. Sheffield, G. Baluss, L. Divine, D. Hardison, and R.W. Litaker. 2020. Harmful algal blooms and Alaskan seabirds: An

- emerging issue in northern waters? Harmful algal blooms and Alaskan seabirds: An emerging issue in northern waters? Oral Presentation. Alaska Marine Science Symposium. Anchorage, AK. 27-31 January.
- Van Hemert, C., M. Smith, S. Schoen, R. Dusek, J. Piatt, M. Arimitsu, W. Litaker, and J. Pearse. 2019. Harmful algal blooms in northern waters: an emerging issue for Alaskan seabirds? Oral Presentation. International Conference of the Wildlife Disease Association, Tahoe City, CA. 4-9 August.
- von Biela, V, J. Piatt, M. Arimitsu, and L. Ball. 2019. Fish and wildlife responses to prolonged heatwaves: A window to the future? Symposium Organizers. Joint American Fisheries Society-The Wildlife Society Meeting. Reno, NV. 1-4 October.
- von Biela, V.R., M.L. Arimitsu, S.K. Schoen, B.M. Heflin, J.F. Piatt. 2018. Declining condition of a key forage fish in the Gulf of Alaska during the North Pacific marine heatwave. Oral Presentation. American Fisheries Society, Anchorage, AK. 21-25 May.
- Weiss, C., J.R. Moran, and T. Miller. 2018. Fine-scale trophic ecology and bioenergetics of euphausiids in Prince William Sound, Alaska. Alaska Marine Science Symposium. Anchorage, Alaska. 21-28 January.
- Weitzman, B. 2019. Can you dig it? Patterns of variability in clam assemblages across the Gulf of Alaska. Oral presentation. UAF College of Fisheries & Ocean Sciences Special Seminar, Fairbanks, AK. February 27.
- Weitzman, B., D. Esler, H. Coletti, B. Konar, and K. Iken. 2018. Can you dig it? Patterns of variability in clam assemblages within mixed-sediment habitats across the Gulf of Alaska. Oral Presentation. Kachemak Bay Science Conference. March 7-10.
- Williamson, E., B. Konar, K. Iken, and M.K. McCabe. 2020. Size frequency distribution of *Mytilus trossulus* in Kachemak Bay. Poster Presentation. Alaska Marine Science Symposium. January 27-30.
- Zhang, B., B. Konar, B. Weitzman, H. Coletti, and D. Esler. 2020. Associating clam recruitment with adult standing stock in the Northern Gulf of Alaska. Poster Presentation. Alaska Marine Science Symposium. January 27-30.

### Outreach

- Aderhold, D. 2017. Gulf Watch Alaska monitors ecosystem health. Delta Sound Connections 2017-18. 16 pp. <http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf>
- Aderhold, D. 2018. An overview of GWA. Presentation to Cook Inlet Regional Citizens' Advisory Council Board of Directors.
- Aderhold, D. 2020. Scientists integrate studies of predators and prey in Prince William Sound. Delta Sound Connections 2020-21. 16 pp. <https://pwssc.org/wp-content/uploads/2020/07/DSC-2020-web.pdf>
- Aderhold, D., S. Buckelew, M. Groner, K. Holderied, K. Iken, B. Konar, H. Coletti, and B. Weitzman. 2018. GWA and HRM information exchange event in Port Graham, AK, May 15.
- Aderhold, D., Holderied, K., Hondolero, D., Konar, B., Siegert, D., Weitzman, B., and Kloecker, K. 2019. Gulf Watch Alaska monitoring program overview: Drivers, HABs, Foods webs, nearshore changes, and sea otters. Gulf Watch Alaska Community Outreach Event. Seldovia Community Center, Seldovia, AK. May 17.
- Arimitsu, M.L., 2016. "Virtual Field Trip: Forage fish studies". [http://www.alaskasealife.org/gw\\_Pelagic](http://www.alaskasealife.org/gw_Pelagic).

- Arimitsu, M.L. 2018. Monitoring forage fish in Alaska: Detecting change in non-commercial prey populations. Department of Fisheries and Oceans Canada forage fish workshop. Pacific Biological Station, Nanaimo, BC, Mar. 2018.
- Arimitsu, M. 2019. Forage fish, jellyfish, and other touchable marine creatures in Prince William Sound. Outreach presentation at Chenega School. 20 September.
- Arimitsu, M., 2019. Forage fish in changing seas. Invited Speaker. Sitka Whalefest, Sitka, AK. 31 October – 2 November.
- Arimitsu, M. 2020. Last Chance Endeavors podcast about research on changes in forage fish populations that were first signaled by large die-offs of seabirds during the 2014-2016 North Pacific marine heatwave – aka “The Blob.” Last Chance Endeavors mission is to connect students to the environment. Listen to the podcast at: <https://www.lastchanceendeavors.com/podcast/episode/2507d869/mayumi-arimitsu-research-ecologist-at-whalefest-2019-or-why-are-the-birds-dead-or-episode-028>.
- Arimitsu, M., J. Piatt, and S. Hatch. 2020. Forage fish in the Northern Gulf of Alaska: on the road to recovery at last? Delta Sounds Connections 2020-2021. <https://pwssc.org/wp-content/uploads/2020/07/DSC-2020-web.pdf>
- Arimitsu, M., J. Piatt, S. Schoen, and B Heflin. 2017. Forage fish in hot water contribute to seabird die-off. Delta Sounds Connections 2017-18. <http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf>.
- Backensto, S., and H. Coletti. 2019. Another Year of Seabird Die-Offs. High Latitude Highlights, the NPS Alaska Region Resource Newsletter. Fall Issue: pg 2- 3.
- Ballachey, B. 2019. The *Exxon Valdez* Oil Spill: Perspectives & Lessons, 30 years later. University of Calgary Continuing Education class; Course BMC153 Environmental Site Assessment. Calgary, CA. March 2019.
- Buckelew, S. 2018. Gulf Watch Alaska website updates.
- Buckelew, S. 2019. Gulf Watch Alaska website updates.
- 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](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.
- 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](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)).
- Campbell, R. 2019. Computers to identify plankton images from Prince William Sound. Delta Sound Connections 2018-2019. Prince William Sound Science Center ([https://pwssc.org/wp-content/uploads/2019/05/DSC-2019\\_WEB.pdf](https://pwssc.org/wp-content/uploads/2019/05/DSC-2019_WEB.pdf))
- Campbell, R.W., J. Jaffe, and P.L. Roberts. 2018. Photographing plankton. PWSSC Delta Sound Connections ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf))
- Coletti, H., D. Esler, B. Robinson, and B. Weitzman. 2018. Ocean Alaska Science and Learning Center Teacher Workshop. Kenai Fjords National Park, AK, June.



- Coletti, H., D. Esler, B. Robinson, and B. Weitzman. 2019. Ocean Alaska Science and Learning Center Teacher Workshop. Kenai Fjords National Park, AK, June.
- Danielson, S.L. 2017. "Gulf Watch Alaska, Mystery of the Blob." Interview. Available at [http://www.alaskasealife.org/gulfwatchblobvft\\_investigation](http://www.alaskasealife.org/gulfwatchblobvft_investigation).
- Danielson, S.L., 2017. GAK-1 internet home page updates. Available at <http://research.cfos.uaf.edu/gak1/>
- Danielson, S.L., 2018. GAK-1 internet home page updates. Available at <http://research.cfos.uaf.edu/gak1/>
- Danielson, S.L., 2019. GAK-1 internet home page updates. Available at <http://research.cfos.uaf.edu/gak1/>
- Danielson, S., Hopcroft, R., Holderied, K. and R. Campbell. 2019. Tracking water layers in the ocean. Delta Sound Connections 2019-2020. Prince William Sound Science Center ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)).
- Esler, D. 2019. Sea Ducks in Nearshore Marine Systems: Contrasting Responses to Oil Spill and Heat Wave Perturbations. Oral Presentation. Prince William Sound Regional Citizens' Advisory Council Science Night.
- Grobelyny, C., and J. Pfeiffenberger. 2020. Exploring the Fjords: A Hands-On Teacher Workshop. NPS OASLC YouTube video <https://www.youtube.com/watch?v=N14pfHOoNOU&feature=youtu.be>
- GWA PMT and Pls. 2018. Listening session with Chugachmiut elders. Hosted by Chugachmiut Heritage Preservation Program and attended by GWA, HRM, Kachemak Bay National Estuarine Reserve, and State of Alaska Salmon and People program participants. Alaska Islands and Ocean Visitors Center, March.
- Holderied, K. 2017. What's up with the Blob? Public evening talk. Alaska Islands and Ocean Visitor Center. Homer AK. Feb 2017.
- Holderied, K. 2017. Solving Alaska Ocean Mysteries – connections matter. Keynote address. Northwest Aquatic and Marine Educators Annual Conference. Homer AK. Aug 2017.
- Holderied, K. 2019. Kachemak Bay Oceanography. Alaska Department of Fish and Game Razor Clam Summit (Alaska, Oregon, and Washington state shellfish managers). Homer, AK. April.
- Holderied, K., and S. Baird. 2020. Presentations of Gulf Watch Alaska Kachemak Bay/Cook Inlet Oceanography and KBNERR SWMP programs. Kachemak Bay Virtual Master Naturalist Training. Homer AK. June.
- Holderied, K., S. Baird, B. Konar and K. Iken. 2019. Homer AK. Kachemak Bay Ecosystem Monitoring. Gulf Watch Alaska program public evening science talk. October.
- Holderied, K., D. Hondolero, K. Konar, B. Weitzman, and K. Kloecker. 2019. Gulf Watch Alaska evening science talks for community. Seldovia, AK. May.
- Hopcroft, R., and S. Danielson. 2018. Website: Seward Line. <http://research.cfos.uaf.edu/sewardline/>. The Seward Line website has been overhauled to accommodate the new LTER dimension. The website provides context for results via summaries of the program's history, hypotheses, methods and publications.
- Kaler, R. 2019. Naked Island Seabird Restoration, Youth Marine Expedition, Organized by Lisa Matlock, Prince William Sound Regional Citizen's Advisory Council. The youth on this trip were a mix of grades 6-8 and included both diverse urban Anchorage kids (some of whom had never been on a hike or on a boat before this trip) and kids from the EVOS region (this year included Cooper Landing, Seward, Girdwood,

and Whittier). The EVOS funded seabird restoration effort at the Naked Islands group provided the youth a chance to learn about field biology, social attraction efforts to expedite the recovery of extirpated seabirds, and learn about what seabirds feed their young. Special thanks to Sam Stark and Alexa Piggot (Oregon State University) for making time to connect kids with nature.

- Kaler, R., K. Kuletz, D. Dragoo, and H. Renner. 2017. Unusual observations of seabirds in the Gulf of Alaska following the 2015-2016 mass die-off. Delta Sound Connections. <http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf>
- Konar, B., and K. Iken. 2018. Wasting sea stars in the Gulf of Alaska. Delta Sound Connections 2018-2019. Prince William Sound Science Center.
- Konar, B., and K. Iken. 2018. Wasting sea stars in the Gulf of Alaska. Delta Sound Connections 2018-2019. Prince William Sound Science Center.
- Lindeberg, M. 2018. Alaska Fisheries Science Center Feature web story. A Wealth of Scientific Information, Decades in the Making a recent special issue journal highlights the status of an Alaska marine ecosystem more than a quarter century after the *Exxon Valdez* oil spill. February 26, 2018. <https://www.fisheries.noaa.gov/feature-story/wealth-scientific-information-decades-making>
- Lindeberg, M. 2018. Alaska Fisheries Science Center Feature web story. Dall's Porpoise Expands Territory in a Changing Prince William Sound. Territory increases as killer whale population dwindles. February 26, 2018. <https://www.fisheries.noaa.gov/feature-story/dalls-porpoise-expands-territory-changing-prince-william-sound>
- Lindeberg, M., and R. Heintz. 2019. 30 years since the *Exxon Valdez* oil spill: An era of scientific research and monitoring that has changed our understanding of oil spill impacts. Delta Sound Connections 2019-20. 16 pp. [http://pwssc.org/wp-content/uploads/2019/05/DSC-2019\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2019/05/DSC-2019_WEB.pdf)
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 1.1: spring quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 1.2: summer quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter. Volume 1.3: fall quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2017. GWA Quarterly Currents. Newsletter. Volume 1.4: winter quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2018. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Panel members, and others as approved by the EVOSTC Executive Director. Volume 2.1: spring quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2018. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Panel members, and others as approved by the EVOSTC Executive Director. Volume 2.2: summer quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2019. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 3.1-2: spring/summer quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).

- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2019. GWA Quarterly Currents. Newsletter. Volume 3.3: fall quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2019. GWA Quarterly Currents. Newsletter. Volume 3.4: winter quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 4.1: spring quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Lindeberg, M., K. Hoffman, R. Suryan, and D. Aderhold. 2020. GWA Quarterly Currents. Newsletter to EVOSTC staff, Science Review Panel members, and others as approved by the EVOSTC Executive Director. Volume 4.2: summer quarter. Link on [gulfwatchalaska.org](http://gulfwatchalaska.org).
- Matkin, C. O. 2017. Tracking whales with hydrophones. Delta Sound Connections, PWS Science Center. March 10, 2017.
- Matkin, C. 2018. A Sense of What Is. Interview in: Pillsbury, R.A. Guided by Whales. Duende Press.
- Matkin, C. 2018. Beyond Delta-Sound Connections. Delta Sound Connections. Prince William Sound Science Center. [http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf) Olsen, D. 2019. Killer whales of the world. Zegrahm Expeditions, Antarctica. Oral presentation. January, 2019.
- McKinstry, C. 2018. Microscopic tourists. PWSSC Delta Sound Connections ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf))
- McKinstry, C. 2019. How is a copepod like a bear? Delta Sound Connections 2019-2020. Prince William Sound Science Center ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)).
- Moran, J. R. 2018. Dall's Porpoise: Life in the fast lane. Delta Sound Connections. Prince William Sound Science Center. [http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)
- Moran, J. R. 2018. What do predators tell us about prey? 11th annual Juneau Naturalist Symposium. Juneau, AK, 10 May.
- Moran, J. R. 2018. Humpback whales in Alaska. Auke Bay Lab. Mini seminar series. Juneau, AK, 13 April.
- Moran, J.R. 2020. What Happened to the Humpback Whales of Prince William Sound? Delta Sound Connections. Prince William Sound Science Center. <https://pwssc.org/wp-content/uploads/2020/07/DSC-2020-web.pdf>
- NOAA. 2018. Dall's Porpoise Expands Territory in a Changing Prince William Sound. February 26. Feature Story. <https://www.fisheries.noaa.gov/feature-story/dalls-porpoise-expands-territory-changing-prince-william-sound>.
- NOAA. 2018. Dall's Porpoise Research in Alaska. NOAA Fisheries website. <https://www.fisheries.noaa.gov/alaska/marine-mammal-protection/dalls-porpoise-research-alaska>.
- NOAA. 2018. Science and Stewardship: Keys to Restoring Kachemak Bay (video). NOAA National Marine Fisheries Service. <https://coastalscience.noaa.gov/news/kachemak-bay-hfa-video/>.
- North Gulf Oceanic Society. 2017 Updates to Facebook page during field season with descriptions of field activities. <https://www.facebook.com/NorthGulfOceanicSociety/>

North Gulf Oceanic Society. 2018. Updates to Facebook page during field season with descriptions of field activities. <https://www.facebook.com/NorthGulfOceanicSociety/>

North Gulf Oceanic Society. 2019. Updates to Facebook page during field season with descriptions of field activities. <https://www.facebook.com/NorthGulfOceanicSociety/>

North Gulf Oceanic Society. 2020. Updates to Facebook page during field season with descriptions of field activities. <https://www.facebook.com/NorthGulfOceanicSociety/>

Olsen, D.W. 2017. Kenai Fjords National Park Interpretive guide training. Oral Presentation. May 5, 2017.

Olsen, D.W. 2017. Killer whales. Oral Presentation. Seward public science night, Resurrect Art Coffee House. May 16, 2017.

Olsen, D.W. 2017. Killer Whales. Oral presentation to Kenai Fjords National Park Interpretive guide training. May 2017.

Olsen, D.W. 2019. Killer whales of Prince William Sound. Oral Presentation to Chenega Village School. September.

Olsen, D.W. 2018. Zegrahm Expeditions, Killer whales of the world. Oral Presentation to Zegrahm Expeditions May 2018.

Olsen, DW. 2018. Mom knows best: Killer whale culture in Prince William Sound. Oral Presentation. Kenai Fjords National Park naturalist training May 2018.

Olsen, D.W. 2018. Mom knows best: Killer whale culture in Prince William Sound. Oral Presentation. Prince William Sound Science Center Brown Bag May 2018.

Olsen, D.W. 2018. Mom knows best: Killer whale culture in Southern Alaska. Oral Presentation to Public / naturalists / Captains, Seward, May 2018.

Olsen, D.W. 2018. Mom knows best: Killer whale culture in Southern Alaska. Oral Presentation. Kayak Adventures guide training, May 2018.

Olsen, D. 2018. Killer whales of Alaska. Kenai Fjords National Park interpretive guide training. Oral Presentation. May 2018.

Olsen, D. 2018. Mother knows best: Killer whale culture in Alaska. Annual Kenai Fjord Tourboat Operators and Boaters meeting. Oral Presentation. May 2018.

Olsen, D. 2018. Killer whales of the world. Zegrahm Expeditions, Antarctica. Oral Presentation. January 2018

Olsen, D. 2018. Killer whales of Prince William Sound. Prince William Sound Science Center Brown Bag presentation. Oral Presentation. May 2018.

Olsen, D.W. 2018. Killer whales of the world. Oral Presentation to Zegrahm Expeditions July 2018.

Olsen, D.W. 2018. Life of the Killer Whale. Oral Presentation to Seabourne Sojourn August 2018.

Olsen, D. 2019. Killer whales of Kenai Fjords. Kayak Adventures Worldwide guide training, Seward, Alaska. Oral Presentation. May.

Olsen, D. 2019. Killer whales of Kenai Fjords. Kenai Fjords National Park interpretive staff training, Seward, Alaska. Oral Presentation. May.

- Olsen, D. 2019. Killer Whale Acoustic Identification. Kenai Fjords National Park staff and general Seward naturalists. Seward, Alaska. Oral Presentation. June.
- Olsen, D. 2019. Killer whales of Alaska. Lindblad Expeditions, Southeast Alaska. Oral Presentation. July.
- Olsen, D.W. 2020. Killer whales of the world. Oral Presentation to Zegrahm Expeditions. February.
- Olsen, D.W. 2020. Killer whales of Kenai Fjords. Oral Presentation to Kayak Adventures naturalists. Online. May.
- Olsen, D.W. 2020. Killer whales of Prince William Sound. Online Oral Presentation to Whittier Naturalists, US Fish and Wildlife Service. Online. May.
- Olsen, D. 2020. Updates to Twitter feed for North Gulf Oceanic Society.
- Olsen, D. 2020. Regular informational killer whale emails to Seward naturalist email group.
- Robinson, B., H. Coletti, D. Green, L. Ware, D. Esler. 2019. The black oystercatcher: Migration, movement and monitoring. Oral Presentation. Gulf Watch Alaska Community Outreach Event. Kachemak Bay Campus, Homer, AK. October 8.
- Robinson, R., A. Rademacher, R. Kaler, and D. Aderhold 2018. COASST die off alert training in Seldovia, AK, May 18.
- Suryan, R., Batten, S., Campbell, R. and S. Danielson. 2019. What does the future hold for the Gulf of Alaska? Delta Sound Connections 2019-2020. Prince William Sound Science Center ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)).
- Schaefer, A. 2018. A winter refuge for seabirds. Delta Sound Connections. Prince William Sound Science Center ([http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)).
- Schaefer, A. 2017. Avian invasion. Delta Sound Connections. Prince William Sound Science Center <http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf>.
- Shepherd, J. 2018. Reading the landscape. 49 Writers Online Blog. April 2018.
- Suryan, R., S. Batten, R. Campbell, and S. Danielson. 2019. What does the future hold for the Gulf of Alaska? Delta Sound Connections 2019-20. 16 pp. [http://pwssc.org/wp-content/uploads/2019/05/DSC-2019\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2019/05/DSC-2019_WEB.pdf)
- Trotter, M.H. 2018. Our May 2018 cruise hosted a media group led by Michele Hoffman Trotter (Columbia College) who has prepared various video clips chronicling our research. She provided for outreach to K-12 teachers and students and to adult audiences in the Chicago area where she is based. Her K-12 audience also included homeschool students in California. Michele's outreach team included Carlee Belt, a media and education specialist, and Katherine Brennan, a cinematographer. The team provided 15 daily dispatches from the ship that included videos of ship operations and interviews with scientists and the crew deploying sampling equipment. They also collected footage for the on-going Microcosm film project that will feature the diversity and roles of microscopic life in the ocean.
- Weitzman, B. 2017. Unhappy as a clam? Delta Sound Connections. <http://pwssc.org/wp-content/uploads/2017/06/DSC-2017-web2.pdf>.
- Weitzman, B. 2019. Sea otter and clam population dynamics in Kachemak Bay. Kachemak Bay National Estuarine Research Reserve Lunch Lecture Series, Kachemak Bay Campus, Homer, AK. December 6.

Weitzman, B. 2019. Monitoring nearshore ecosystems in the Gulf of Alaska through sea otters. Fireweed Academy Community Outreach and Lecture Series, Homer, AK. December 13.

YouTube Video highlighting the common murre die-off. 2017. Cooperative efforts between NPS, USFWS, USGS and GWA. <https://www.youtube.com/watch?v=Nhji4H5u65M>

## 8. LITERATURE CITED

- Amaya, D.J., A.J. Miller, S-P. Xie, and Y. Kosaka. 2020. Physical drivers of the summer 2019 North Pacific marine heatwave. *Nature Communications* 11:1903. doi: 10.1038/s41467-020-15820-w
- Arimitsu, M.L., J. Piatt, S. Hatch, R. Suryan, S. Batten, M.A. Bishop, R. Campbell, H. Coletti, D. Cushing, K. Gorman, S. Haught, R. Hopcroft, K. Kuletz, C. Marsteller, C. McKinstry, D.W. McGowan, J. Moran, S. Pegau, A. Schaefer, S. Schoen, J. Straley, and V.R. von Biela. 2020. Reduced quality and synchronous collapse of forage species disrupts trophic transfer during a prolonged marine heatwave. In: *The Pacific Marine Heatwave: Monitoring During a Major Perturbation in the Gulf of Alaska. Long-Term Monitoring Program (Gulf Watch Alaska) Synthesis Report Exxon Valdez Oil Spill Trustee Council Program 19120114* (Eds: Suryan, R.M., M.R. Lindeberg, and D.R. Aderhold). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
- Arimitsu, M.L., J.F. Piatt, B. Heflin, V.R. von Biela, and S.K. Schoen. 2018. Monitoring long-term changes in forage fish distribution, abundance and body condition. *Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 16120114-O)*. U.S. Geological Survey Alaska Science Center.
- Barlow, J., J. Calambokidis, E.A. Falcone, C.S. Baker, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, T.J. Quinn, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., P. Wade, D. Weller, B.H. Witteveen, and M. Yamaguchi. 2011. Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. *Mar. Mammal. Sci.* 27:793-818.
- Bond, N.A., M.F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. *Geophysical Research Letters* 42:3414-3420, doi:10.1002/2015GL063306.
- Campbell, R.W. 2018. Hydrographic trends in Prince William Sound, Alaska, 1960-2016. *Deep Sea Research Part II* 147:43-57. doi:10.1016/j.dsr2.2017.08.014
- Cushing, D., D. Roby, and D. Irons. 2018. Patterns of distribution, abundance, and change over time in a subarctic marine bird community. *Deep Sea Research Part II* 147:148-163. <https://doi.org/10.1016/j.dsr2.2017.07.012>
- Dean, T.A., J.L. Bodkin, and H.A. Coletti. 2014. Protocol Narrative for Nearshore Marine Ecosystem Monitoring in the Gulf of Alaska: Version 1.1. *Natural Resource Report NPS/SWAN/NRR - 2014/756*. Fort Collins, Colorado.
- Di Lorenzo, E., and N. Mantua. 2016. Multi-year persistence of the 2014/15 North Pacific marine heatwave. *Nature Climate Change* 6:1042-1047.
- Dorn, M., K. Aydin, D. Jones, W. Palsson, and K. Spalinger. 2016. Assessment of the Walleye Pollock Stock in the Gulf of Alaska. *North Pacific Fisheries Management Council (Issue December)*.
- Estes, J.A. 2015. Natural history, ecology, and the conservation and management of sea otters. In: Larson, S.E., J.L. Bodkin, and G.R. VanBlaricom (eds), *Sea otter conservation*. Elsevier, London, UK, p. 19-41

- Estes, J.A., and D.O. Duggins. 1995. Sea otters and kelp forests in Alaska – generality and variation in a community ecological paradigm. *Ecological Monographs* 65:75–100.
- Estes, J.A., and J.F. Palmisano. 1974. Sea otters: their role in structuring nearshore communities. *Science* 185:1058-1060.
- Exxon Valdez* Oil Spill Trustee Council. 2014. 2014 Update, Injured Resources and Services List. Anchorage, Alaska.
- Konar, B., and J.A. Estes. 2003. The stability of boundary regions between kelp beds and deforested areas. *Ecology* 84:174-185.
- Lindeberg, M. 2016. Gulf Watch Alaska Program: Long-term Monitoring of Marine Conditions and Injured Resources. Five-year proposal to the *Exxon Valdez* Oil Spill Trustee Council. 57 p.
- Lindeberg, M.R., J. Maselko, R.A. Heintz, C.J. Fugate, and L. Holland. 2018. Conditions of persistent oil on beaches in Prince William Sound 26 years after the Exxon Valdez spill. *Deep-Sea Research Part II*. DOI:10.1016/j.dsr2.2017.07.011.
- Matkin, C.O., G.M. Ellis, E.L. Saulitis, P. Olesiuk, and S.D. Rice. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the Exxon Valdez oil spill in Prince William Sound, Alaska. *Marine Ecological Progress Series* 356:269-281.
- McCammon, M., K. Holderied, and N. Bird. 2011. Long-term monitoring of Marine Conditions and Injured Resources and Services. Five-year proposal to Exxon Valdez Oil Spill Trustee Council. 879 p.
- McGowan, D.W., E.D. Goldstein, M.L. Arimitsu, A.L. Deary, O. Ormseth, A. De Robertis, J.K. Horne, L.A. Rogers, M.T. Wilson, K.O. Coyle, K. Holderied, J.F. Piatt, W.T. Stockhausen, and S.G. Zador. 2020. Spatial and temporal dynamics of Pacific capelin (*Mallotus catervarius*) in the Gulf of Alaska: implications for ecosystem-based fishery management. *Marine Ecology Progress Series*.
- McGowan, D.W., J.K. Horne, and S.L. Parker-Stetter. 2016. Variability in species composition and distribution of forage fish in the Gulf of Alaska. *Deep Sea Research Part II*. <https://doi.org/10.1016/j.dsr2.2016.11.019>