

**EVOSTC FY17-FY21 INVITATION FOR PROPOSALS
FY19 (YEAR 8) CONTINUING PROJECT PROPOSAL SUMMARY PAGE**

Project Number and Title

Gulf Watch Alaska: Pelagic Component Project

19120114-E—Long-term Monitoring of Marine Bird Abundance and Habitat Associations during Fall and Winter in Prince William Sound

Primary Investigator(s) and Affiliation(s)

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Date Proposal Submitted

August 17, 2018

Project Abstract

The fall-winter marine bird surveys in Prince William Sound (PWS) will continue to build upon an 11-year time series (2007-2018) of marine bird abundance and habitat associations. Marine bird surveys occur onboard research vessels conducting oceanographic, fisheries, or marine mammal surveys, thereby increasing opportunities for cross-project collaboration and reducing project costs. Our September marine bird surveys are integrated with Gulf Watch Alaska forage fish assessments of prey availability and humpback whale prey consumption and population monitoring with all three projects sharing logistics, timing, and location of sampling. These integrated surveys allow us to estimate forage biomass at the same locations in which marine birds and humpback whales are feeding, thereby providing comparable information on both predator density and prey availability. We use established protocols employed by all other Gulf Watch Alaska marine bird survey efforts (Kachemak Bay/Cook Inlet, Seward Line/Gulf of Alaska, PWS summer).

Of the marine birds that overwinter in PWS, nine species were initially injured by the *Exxon Valdez* oil spill, including three species that have not yet recovered or their recovery status is unknown (pigeon guillemot, marbled murrelet, and Kittlitz’s murrelet). Fall through winter are critical periods for survival as food tends to be relatively scarce or inaccessible, the climate more extreme, light levels and day length reduced, and water temperatures colder. By monitoring marine birds during fall and winter we will improve our predictive models of species abundance and distribution across PWS in relation to biological and physical environmental factors. Our long-term monitoring has shown that the nonbreeding season cannot be characterized as a single time period when describing marine bird distribution and suggests that multiple surveys are required to quantify wintering populations and understand changes in marine bird distribution.

The only change to the FY19 work plan is a request for charter vessel funding for November and March surveys. These surveys had relied on fishery survey vessels of opportunity that are no longer funded. The November and March surveys were originally conducted in collaboration with the Herring Research and Monitoring program, then NOAA chartered vessels in FY17-18. New dedicated survey funding would allow us to continue identifying shifts in the winter marine bird community of PWS as well as their potential impact on juvenile herring.

EVOSTC Funding Requested* (must include 9% GA)

FY17	FY18	FY19	FY20	FY21	TOTAL
\$90,100	\$92,700	\$121.9 *	\$124.8*	\$127.9*	\$557.3*

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

FY17	FY18	FY19	FY20	FY21	TOTAL
\$53,000	\$53,000	\$53,000	\$53,000	\$53,000	\$265,000

* Totals in FY19-21 include additional annual request of \$24,000 to conduct November & March surveys in bays of PWS. Please see Sections 2C and 6B for details.

1. PROJECT EXECUTIVE SUMMARY

Pelagic Component

The pelagic component research team proposed for FY17-21 to continue monitoring key pelagic species groups in Prince William Sound (PWS) using the same five projects focused on killer whales (19120114-N), humpback whales (19120114-O), forage fish (19120114-C), and marine birds (19120114-E, 19120114-M). Thus, the two over-arching questions for the pelagic component to answer during this 5-year period are:

1. What are the population trends of key upper trophic level pelagic species groups in PWS – killer whales, humpback whales, marine birds, and forage fish?
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?

Fall-Winter Marine Bird Monitoring

During the current, 5-year period (2017-2021), our project will: a) continue to conduct systematic surveys to document the fall-winter abundance and distribution of marine birds in PWS using regularly-scheduled vessels of opportunity, with 4 surveys identified for FY19; and, b) investigate the trophic linkages in areas with high marine bird concentrations by expanding and integrating our efforts with two other projects in the pelagic component - the forage fish and humpback whale projects. Predator-prey surveys that combine the marine bird, humpback whale, and forage fish (including euphausiids) projects will be conducted each fall (September). Using the same vessel platforms in time and space (two vessels: one for acoustic-trawl forage fish and marine birds and a second for humpback whale sampling), concurrent surveys will provide quantitative measures of the density and distribution of marine bird and humpback whale predators relative to forage fish availability and will facilitate an integrated analysis of how predator communities respond to changes in prey availability (quantity, distribution, and quality).

Furthermore, our marine bird study will gather data to improve our ability to monitor status and trends of marine bird populations during fall and winter. Additionally, this research will address the following hypotheses:

1. Marine bird distribution and abundance varies with physical and biological habitat characteristics within the fall/winter season.
2. Marine bird distribution and abundance varies with prey availability (quantity and/or quality).
 - a. Marine bird forage flocks signal the presence of prey aggregation to humpback whales.

To address the first hypothesis, our project is proposing to conduct marine bird surveys in selected bays of PWS during November and March using a dedicated charter vessel. Furthermore, we will conduct two to three additional surveys in collaboration with other marine research cruises, including the Pelagic Component's Integrated Predator-Prey Surveys, Alaska Department of Fish and Game (ADF&G) spot shrimp survey, and the PWS Science Center Ocean Tracking Network maintenance cruise. The second hypothesis will be addressed during marine bird surveys conducted as part of the Pelagic Component's Integrated Predator-Prey Surveys. Marine bird surveys will occur aboard the acoustic-trawl vessel and observations will include fish schools when bird and mammal predators are both present and absent. A vessel used for synoptic humpback whale surveys will ensure an adequate sampling of fish schools when humpback whales are present.

Background and FY 2018 Update

Of the marine birds that overwinter in PWS, nine species were initially injured by the *Exxon Valdez* oil spill (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). The vast majority of marine bird monitoring in areas affected by EVOS has taken place around breeding colonies during the reproductive season, a time when food is generally at its most plentiful. Long-term monitoring of marine birds in PWS during fall and winter is needed to understand how post-spill ecosystem recovery and changing physical and biological factors are affecting marine bird abundance and species composition, as well as marine bird distribution and habitat use.

Systematic fall and winter marine bird surveys began in 2007 under the direction of co-principal investigators (PI) Bishop and Kuletz. In 2012 this research project became part of the Gulf Watch Alaska (GWA) Pelagic Component under the direction of PI Bishop. Over the past eleven winters (2007/08 - 2017/18) a total of 44 marine bird surveys, typically 6-9 days in duration, have been conducted across PWS following established U.S. Fish and Wildlife Service (USFWS) survey protocols adapted for GPS-integrated data entry (USFWS 2007). Observers are placed on "ships of opportunity" that include research vessels already conducting oceanographic, fisheries, or marine mammal surveys, thereby enabling integration of data across projects. Collaborators have included the EVOS funded GWA Pelagic- Humpback Whale Project and the Herring and Research Monitoring-Juvenile Herring Hydroacoustic Surveys (2007-2016), as well as ADF&G spot shrimp surveys, and the PWS Science Center Ocean Tracking Network maintenance cruises.

We have documented consistent temporal patterns in density and distribution from fall through winter for the most abundant marine bird species, including common murre, marbled murrelet, black-legged kittiwake, and large gulls (primarily glaucous-winged gull) (Zuur et al. 2012, Dawson et al. 2015, Stocking et al. 2018). Our surveys have also identified patterns in the spatial distribution of marine birds in the Sound. When we modeled the relationship between spatial covariates and bird distributions over nine seasons, seasonal differences were important for seven of nine species groups, illustrating movement patterns into and out of PWS. We found that piscivorous birds have an overwhelming preference for shallower, warmer, and increasingly protected waters closer to shorelines. This supports the assertion that birds are seeking refuge during winter, which could render PWS superior winter habitat relative to the harsher Gulf of Alaska (GOA; Stocking et al. 2018). Furthermore, we have identified areas of persistent, high marine bird concentrations including northeast PWS, Montague Strait, and the southwest passages. These are also areas in which humpback whales concentrate. Similarly, Montague Strait is a known hotspot for killer whales. This suggests that in these areas environmental drivers such as currents and nutrients are creating dependable, favorable foraging conditions for marine birds and marine mammals.

We also developed a bioenergetics model for marine birds in winter. Our model results highlight the importance of herring to marine birds in PWS during winter and suggest that predation by marine birds may have an important top-down effect on the PWS herring population. Our model shows that in winters with relatively high numbers of marine birds or with relatively low adult herring biomass, as much as 10% (1,864 t) of the adult biomass can be removed by avian predators (Bishop et al. 2015). This relationship is especially important in light of the recent historically low estimates of the Pacific herring population in PWS (P. Rand, PWSSC, unpubl. data).

In FY17, we performed 4 surveys over a total of 1,241 km survey effort- the February 2017 Ocean Tracking Network maintenance cruise (3114 birds of 18 species), the September 2017 Integrated Predator-Prey survey

Table 1: Fall and winter marine bird surveys in Prince William Sound, AK during FY17 & FY18. OTN = Ocean Tracking Network.

Fiscal Year	Cruise	Km surveyed	Observer	FY17 Cruise Dates
FY17	PWSSC OTN Maintenance	483	A. Schaefer	Feb 7-10 & 17-20, 2017
FY17	NOAA, USGS, PWSSC EVOS Gulf Watch IMPP	346	A. Schaefer	Sep 17-23, 2017
FY17	ADF&G Shrimp	331	A. Schaefer	Oct 12-23, 2017
FY17	NOAA Pollock	81*	A. Schaefer	Dec 1-6 2017
FY18	PWSSC OTN Maintenance	301	A. Schaefer	Feb 7-12, 2018
FY18	NOAA Pollock	320	A. Schaefer	Mar 10-15, 2018
FY18	NOAA, USGS, PWSSC EVOS Gulf Watch IMPP		A. Schaefer	To be completed: Sep 2018
FY18	ADF&G Shrimp		A. Schaefer	To be completed: Oct 2018

*Inclement weather throughout this cruise limited the survey effort.

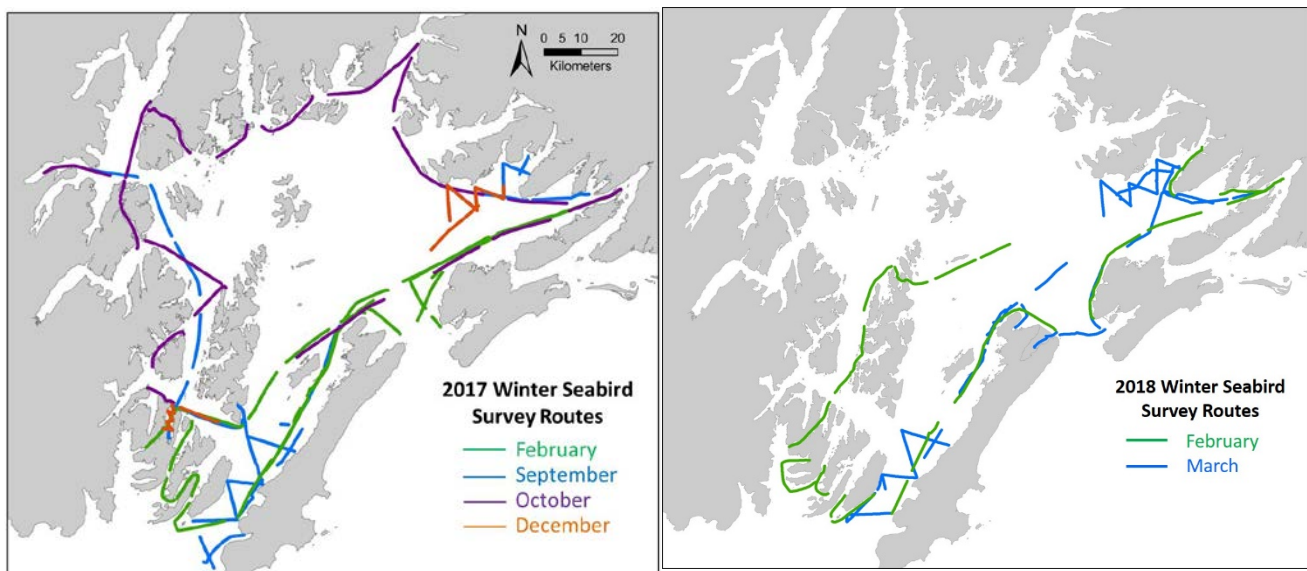


Figure 1. Spatial coverage of the two marine bird surveys completed during FY18 and four marine bird surveys completed during FY17 in Prince William Sound, AK. From 2007-2016 our surveys included a series of PWS bays in collaboration with the EVOSTC Herring Research and Monitoring juvenile herring nursery bay project (16120111-F). However, since the termination of the juvenile herring nursery bay project, most marine bird survey efforts have occurred in open water and passages of PWS, with the exception of transects within Port Gravina during the September and December surveys.

(1125 birds of 19 species), the October 2017 ADF&G Shrimp survey (650 birds of 22 species), and the December 2017 NOAA Pollock Survey (256 birds of 12 species; Table 1, Fig. 1). Interestingly, **the October survey encounter rate has been decreasing over the past three years**, from 3.89 birds/km in 2015 to 1.96 birds/km in 2017. This survey samples fixed stations during the same dates each year, so it is our most consistent dataset spatially and temporally.

So far, in FY18, we have conducted two surveys over a total of 601 km of survey effort (Table 1, Fig. 1). We completed the Ocean Tracking Network maintenance cruise in February 2018 during which we counted 712 birds of 20 species while on effort. We also completed the NOAA Pollock Survey in March 2018 during which we counted 1690 birds of 16 species while on effort. Density analyses for these surveys are forthcoming. Still to be completed in FY18 are the Integrated Predator-Prey survey in September 2018 and the ADF&G spot shrimp survey in October 2018.

We have also recently examined the use of ecosystem indicators to understand the influence of environmental variability on marine bird populations in PWS. Our previous modeling efforts found that murre and murrelets demonstrate relatively consistent temporal patterns in PWS within winter; murrelets tend to be present in low densities during fall and high densities during spring, whereas murrelets tend to occur in low densities in early fall increasing to higher densities in late fall, and then occur in low densities during spring (Dawson et al. 2015, Stocking et al. 2018).

We identified anomalies in murre and murrelet densities over time as potential indicators because, as piscivorous seabirds, murre and murrelets are particularly sensitive to changes in the marine ecosystem. Both murre and murrelet densities appear to be highly variable within months and across winters (Figs. 2, 3). For murre, our surveys detected changes in densities and distribution in PWS during the months leading up to a prolonged die-off event occurring along the Gulf of Alaska. Our surveys recorded anomalously 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. 2).

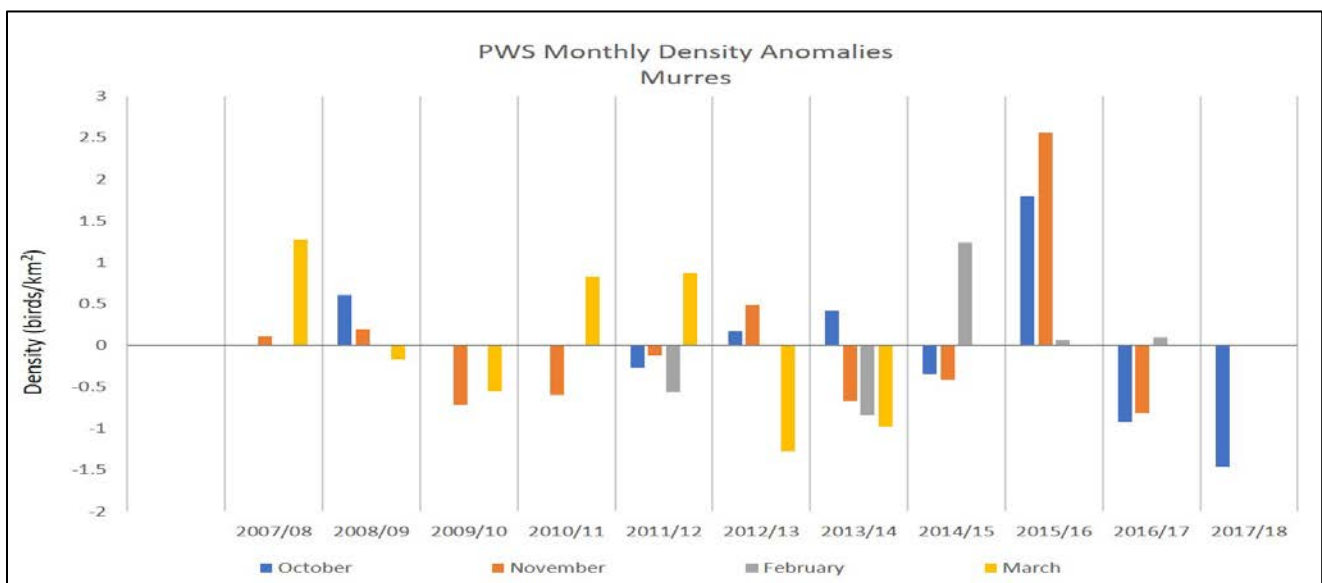


Figure 2. Monthly density anomalies for murre during fall and winter marine bird surveys in Prince William Sound, Alaska, 2007-2017.

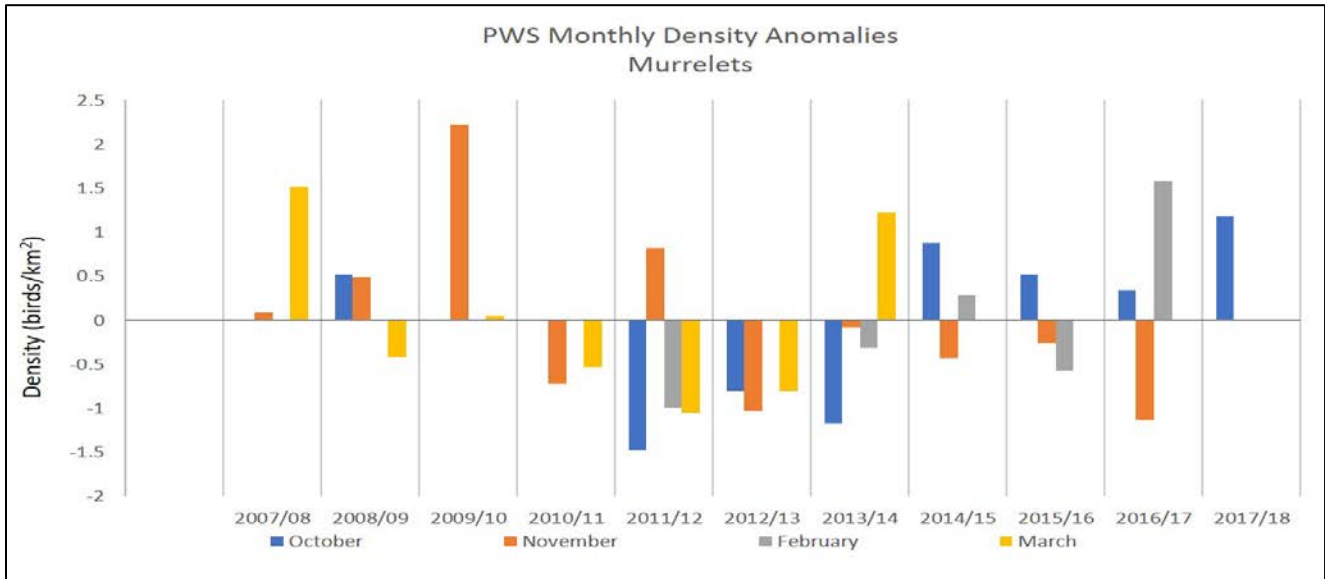


Figure 3. Monthly density anomalies for murrelets during fall and winter marine bird surveys in Prince William Sound, Alaska, 2007-2017.

This increased use of PWS by murrelets during winter coincided with persistently high ocean temperatures in the North Pacific Ocean (also known as “The Blob”) occurring from 2014 through 2016. Since the die-off, we have observed murre densities below the long-term monthly averages during fall 2016 and 2017 surveys, but slightly above average densities during February 2016 & 2017 surveys (Fig. 2).

Continued sampling in FY19 will allow us to assess how recovery from or persistence of the recent marine heat wave (the Blob and El Niño) is affecting marine bird abundance, prey associations, and habitat use.

2. PROJECT STATUS OF SCHEDULED ACCOMPLISHMENTS

A. Project Milestones and Tasks

Table 2. Project milestone and task progress by fiscal year and quarter, beginning February 1, 2017. The requested new task is indicated in red. C = completed, X = not completed or planned. Fiscal Year Quarters: 1= Feb. 1-April 30; 2= May 1-July 31; 3= Aug. 1-Oct. 31; 4= Nov. 1-Jan 31.

Milestone/Task	FY17				FY18				FY19				FY20				FY21				FY22
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
Milestone 1: Data Collection																					
Field cruises (Feb OTN, Sep Integrated predator prey, Oct ADF&G)	C		C		C		C		X		X		X		X		X		X		
Alternative Survey Schedule (NOAA funds lost after FY18)	C			C	C																

New task: Early spring survey (EVOSTC funding request)								X				X	X				X	X				X	X
Milestone 2: Data Processing/Mgmt																							
Data summary/analysis	C	C		C	C		X	X				X	X				X	X				X	
Upload data workspace	C				C			X				X					X						X
Metadata/data published	C				C			X				X					X						X
Milestone 3: Reporting																							
Annual Reports	C				C			X				X					X						
Annual PI meeting				C			X				X					X						X	
FY Work Plan (DPD)			C				C				X					X							
5-Year Final Report																							

B. Explanation for not completing any planned milestones and tasks

All milestones and tasks have been completed.

C. Justification for new milestones/tasks

Our November and March surveys in the bays of PWS have relied on EVOSTC Herring Research and Monitoring survey vessels of opportunity, which are no longer being funded as of FY17. NOAA vessels were leveraged for FY17 and FY18 but will no longer be available. To meet our EVOSTC FY17-21 funding period obligations to complete these surveys, we are requesting an additional \$24,000 per year during FY19-21 for two vessel charters annually. If funded, we will have dedicated marine bird surveys in November and March to extend our long-term dataset within bays of PWS. **Importantly, without these surveys we no longer have survey coverage within herring nursery bays of PWS** as the vessels of opportunity on which we currently place our marine observer conduct work almost exclusively in open waters (Fig. 1). Given that our long-term monitoring studies have shown that the nonbreeding season cannot be characterized as a single time period and marine birds aggregate in nursery bays during non-breeding seasons, it is particularly important to maintain the November and March surveys. The November and March surveys are shown in the Milestone/Task table above as alternative Survey Schedule with additional EVOSTC Funds. See section 4B for more details.

3. PROJECT COORDINATION AND COLLABORATION

A. Within an EVOSTC-funded Program

Gulf Watch Alaska

This project is a component of the integrated GWA-Long-term Monitoring of Marine Conditions and Injured Resources and Services. This long-term monitoring program is composed of three ecosystem components (Environmental Drivers, Pelagic, and Nearshore) with a series of projects in each component led by principal investigators from a number of institutions.

The fall and winter marine bird project is headed by Dr. Mary Anne Bishop, and is part of the Pelagic monitoring component. This project shares research vessels associated with the Integrated Predator-Prey Surveys. Marine bird observations from this project are integrated into the whale surveys (PIs Moran and Straley) and forage fish surveys (PIs Piatt and Arimitsu) through the Integrated Predator-Prey Surveys. This collaboration will afford efficiencies in field work, as well as facilitate greater understanding of predator-prey interactions in the Sound. Our annual winter sampling program in PWS also complements the Pelagic Component's PWS Marine Bird Summer surveys conducted every two years by U. S. Fish & Wildlife Service (USFWS, Kuletz & Kaler). Collectively, marine bird surveys cross all seasons and survey regions of GWA and allow for regional comparisons of marine bird densities and environmental drivers from PWS (PIs Bishop and Kaler) to Kachemak Bay/Lower Cook Inlet (PI Holderied), PWS, Kenai, and Katmai (PI Coletti), and Seward Line/Gulf of Alaska (PIs Hopcroft and Kuletz).

Herring Research and Monitoring

In the past, we placed observers onboard vessels associated with the PWS Herring Research and Monitoring Program. As designed for FY17-21, the fall/winter marine bird project is not working directly with the PWS Herring Research and Monitoring Program. However, our data will complement the suite of data collected by this program, including insertion of key predator data into the population modeling of herring. As part of the integrated predator-prey surveys we will collect forage fish for PI Kristen Gorman's Herring Age at Maturity project.

Data Management

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

B. With Other EVOSTC-funded Projects

This project will coordinate with other EVOSTC-funded projects as appropriate by providing data, discussing the relevance and interpretation of data, and collaborating on reports and publications. Of particular note, this project may share data and relevant information with the Pigeon Guillemot restoration project on the Naked Island Complex.

C. With Trustee or Management Agencies

This long-term marine bird monitoring project uses as observing platforms vessels associated with other agencies. From FY2008-2016 we had arrangements with the EVOSTC Herring Research and Monitoring Program to have an onboard observer during surveys of juvenile herring nursery bays in November (2007-2016) and March (2008-2012). Funding for the nursery project has been discontinued.

We have arrangements with the following agencies and organizations to place a marine bird observer onboard during these regularly scheduled annual surveys:

Alaska Department of Fish and Game: Jan Rumble. ADF&G provides a berth for a marine bird observer during the October shrimp surveys. This request is considered on a year to year basis.

Prince William Sound Science Center: Mary Anne Bishop. PWS Science Center provides a berth for a marine bird observer during the February cruise to upload data from and conduct maintenance on the Ocean Tracking Network arrays. Funding for this annual cruise is provided by the Alaska Ocean Observing System.

Finally, information from this project will feed into the *North Pacific Pelagic Seabird Database*, a database that is maintained by USFWS and U.S. Geological Survey (USGS).

4. PROJECT DESIGN

A. Overall Project Objectives

Our long-term monitoring has shown that the nonbreeding season cannot be characterized as a single time period when describing marine bird distribution and suggests that multiple surveys are required to quantify wintering populations and understand changes in marine bird distribution. For 2017-2021 this project will continue to conduct marine bird surveys in conjunction with marine research cruises, including the GWA Integrated Predator-Prey Surveys (Table 3), the ADF&G spot shrimp survey cruise, and the PWS Science Center Ocean Tracking Network maintenance cruise.

Objectives of this study are to:

1. Characterize the spatial and temporal distribution of marine birds in Prince William Sound during fall and winter.
2. Estimate marine bird abundance and distribution in areas with known seasonally predictable aggregations of predators and prey.
 - a. Relate marine bird presence to prey fields identified during concurrent hydroacoustic surveys.
 - b. Characterize marine bird-humpback whale foraging dynamics.
3. Model species abundance in relation to physical and biological variables across time and space.

Table 3. Integrated predator-prey collaborations by objective. Objectives related to this work plan are bolded.

Objective	Index	Task	PI
a. Estimate humpback whale abundance, diet, and distribution			
	Whale counts by sub-region	Integrated Surveys: whale counts, biopsies	Moran (NOAA)/ Straley (UAS)
	Whale Identification	Integrated Surveys: Photo ID	Moran (NOAA)/ Straley (UAS)
	Whale Diet	Integrated Surveys: scales, scat, biopsies, visual observations, hydroacoustics	Moran (NOAA)/ Straley (UAS)/ Arimitsu & Piatt (USGS)
b. Estimate marine bird abundance and distribution in seasonally predictable predator aggregation areas			
	Georeferenced marine bird counts, group size, behavior by species	Integrated Surveys: marine bird transects	Bishop (PWSSC)
b.i. Relate marine bird and humpback whale presence to prey fields identified during hydroacoustic surveys.			
	Spatial coherence of bird and whale presence/absence, acoustic estimates of forage fish and euphausiid biomass	Integrated Surveys: hydroacoustic and marine bird transects, whale focal follows	Arimitsu & Piatt (USGS)/ Bishop (PWSSC)/ Moran (NOAA)/ Straley (UAS)

Objective	Index	Task	PI
b.ii. Characterize marine bird-humpback whale foraging dynamics			
	Georeferenced marine bird and whale counts, group size, behavior by species	Integrated Surveys: marine bird transects; whale focal follows	Bishop (PWSSC)/ Moran (NOAA)/ Straley (UAS)/ Arimitsu & Piatt (USGS)
c. Estimate index of forage fish availability in seasonally predictable predator foraging areas			
	Species composition and biomass within persistent predator foraging areas	Integrated Surveys: hydroacoustic-trawl data	Arimitsu & Piatt (USGS)/Moran (NOAA) Bishop (PWSSC)
	Density and depth distribution	Integrated Surveys: hydroacoustic-trawl data	Arimitsu & Piatt (USGS)
	Diet, energy density	Sample Analysis: forage fish	Moran (NOAA)
d. Estimate an index of euphausiid availability in seasonally predictable predator foraging areas			
	Species composition and biomass within persistent predator foraging areas	Integrated Surveys: hydroacoustic-trawl data	Arimitsu & Piatt (USGS)
	Density and depth distribution	Integrated Surveys: hydroacoustic-trawl data	Arimitsu & Piatt (USGS)
e. Relate whale, marine bird and forage fish indices to marine habitat			
	Oceanographic metrics and zooplankton biomass	Integrated Surveys: CTD and zooplankton samples	Arimitsu & Piatt (USGS)/ Moran (NOAA)/ Straley (UAS)/ Bishop (PWSSC)

B. Changes to Project Design and Objectives

As part of our EVOSTC-funded marine bird surveys, we placed an observer onboard the EVOSTC Herring and Monitoring (HRM) Program’s juvenile herring surveys during November for 10 years (November 2007 – 2016) and in March for 5 years (March 2008 – 2012). HRM discontinued the March cruise starting FY13, and the HRM juvenile herring survey project (16120111-F), including the November cruise, was discontinued in FY17. We used NOAA funded vessels of opportunity in FY17-18, but these cruises were discontinued due to lack of funding.

The juvenile herring survey cruises represented our longest time series of PWS winter marine bird data and survey coverage within the bays of PWS. **Importantly, without these surveys we no longer have survey coverage within bays of PWS** as the vessels of opportunity on which we currently place our marine observer conduct work almost exclusively in open waters (with the exception of Port Gravina during September IMPP survey; Fig. 1). **Our research has shown that compared to the open waters, marine birds are more likely to be present and in larger aggregations in the protected bays of PWS during winter.**

To extend our long-term and most consistent dataset of marine bird abundance and distribution within bays of PWS, we are requesting supplemental funds to add a dedicated marine bird survey during November and March (Fig. 4) each winter during the remaining FY19-FY21 period. In conjunction with our other EVOSTC-funded marine bird surveys, November and March surveys will ensure consistent and broad spatial and temporal coverage of PWS while minimizing differences in effort across surveys. Reducing variation in effort, location, and timing of surveys will enhance comparison of results within and across

winters and enable us to more efficiently identify shifts in the marine bird community of PWS during winter as well as their potential impact on herring.

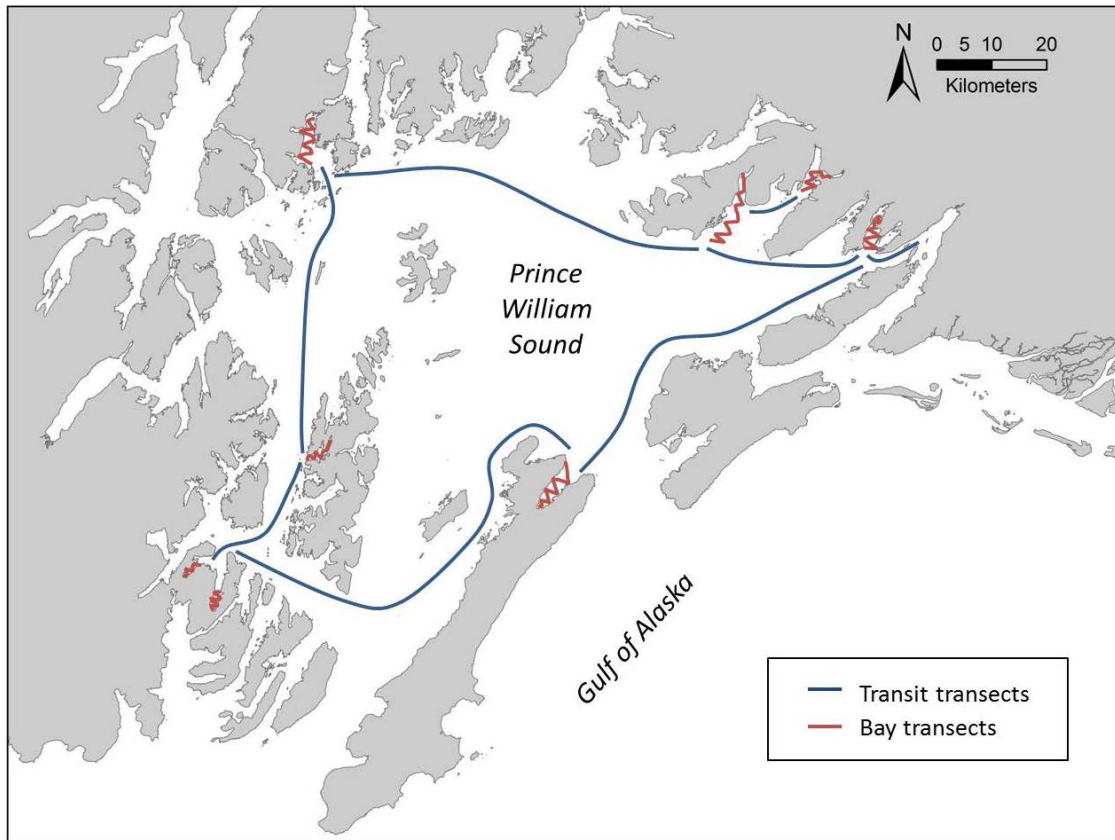


Figure 4. Proposed dedicated marine bird surveys to occur in November and March in Prince William Sound, AK. Surveys will replicate our longest time series (2007 - 2016) and most consistent data.

5. PROJECT PERSONNEL – CHANGES AND UPDATES

There are no personnel changes or updates.

6. PROJECT BUDGET FOR FY19

A. Budget Forms (See GWA FY19 Budget Workbook)

Please see project budget forms compiled for the program.

B. Changes from Original Project Proposal

In order to continue fulfilling project objectives, an additional \$24K in supplemental funds are requested annually for FY19-21. Supplemental funds would cover the cost of 12 days of dedicated vessel charter fees for marine bird surveys in November (7d) and March (5d) at \$2K/d including fuel. (See Table 4 below; 2C and 4B for more details).

Table 4. Request for additional funding (in thousands of dollars) by budget category including GA. Funds will support November and March surveys in PWS through FY21.

Budget Category	New Request FY19	New Request FY20	New Request FY21	Total New Request
Personnel	\$0.0	\$0.0	\$0.0	\$0.0
Travel	\$0.0	\$0.0	\$0.0	\$0.0
Contractual	\$24.0	\$24.0	\$24.0	\$72.0
Commodities	\$0.0	\$0.0	\$0.0	\$0.0
Equipment	\$0.0	\$0.0	\$0.0	\$0.0
Annual Subtotal	\$24.0	\$24.0	\$24.0	\$72.0
9% GA	\$2.2	\$2.2	\$2.2	\$6.5
Total with GA	\$26.2	\$26.2	\$26.2	\$78.5

C. Sources of Additional Project Funding

We are using vessels of opportunity funded by other programs for seabird observations during three of four surveys. In addition to the integrated forage fish/whale/seabird cruises scheduled for September (with vessel costs included in the GWA LTM Humpback whale project), observers will also be onboard the annual ADF&G PWS shrimp survey (\$35k) and the annual maintenance cruise for the Ocean Tracking Network (\$18k; funded by a grant from the Alaska Ocean Observing System).

7. FY18 PROJECT PUBLICATIONS AND PRODUCTS

Publications

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.

Schaefer, A., M.A. Bishop, and R. Thorne. *In prep.* Piscivorous seabird response to forage fish biomass in Prince William Sound, Alaska.

Datasets

Research Workspace: 2017 seabird survey data uploaded to Research Workspace and undergoing QC. Data will be added to Gulf of Alaska Data Portal on schedule. 2017 zooplankton data still being processed per schedule.

Presentations

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

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 presented at Alaska Marine Science Symposium, January 2018, Anchorage, AK.

Outreach

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

LITERATURE CITED

Bishop, M.A., J.T. Watson, K. Kuletz, and T. Morgan. 2015. Pacific herring (*Clupea pallasii*) consumption by marine birds during winter in Prince William Sound, Alaska. *Fisheries Oceanography* 24:1–13.

Dawson, N., M.A. Bishop, K. Kuletz and A. Zuur. 2015. Using ships of opportunity to assess winter habitat associations of seabirds in subarctic coastal Alaska. *Northwest Science* 89:111–128.

Stocking, J., M. A. Bishop, and A. Arab. 2018. Spatio-temporal distributions of piscivorous birds in a subarctic sound during the non-breeding season. *Deep-Sea Research Part II* 147:138-147.

USFWS. 2007. North Pacific pelagic seabird observer program observer's manual, inshore/small vessel version, November 2007. U.S. Fish and Wildlife Service, Migratory Bird Management Nongame Program, Anchorage, Alaska. Unpublished protocol manual, 25 pp.

Zuur, A.F., N. Dawson, M.A. Bishop, K. Kuletz, A.A. Saveliev and E.N. Ieno. 2012. Two-stage GAMM applied on zero inflated Common Murre density data. Pages 1550188 in A.F. Zuur, A.F., A.A. Saveliev, and E.N. Ieno. 2012. Zero inflated models and generalized linear mixed models with R. Highland Statics, Ltd.