

EVOSTC **FY22** CONTINUING INDIVIDUAL PROJECT PROPOSAL

Project Number and Title

22210128 Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay

Primary Investigator(s) and Affiliation(s)

Kenai Peninsula Coast component

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Project Abstract

We propose an integrated study of status and trends of Kittlitz's murrelet (*Brachyramphus brevirostris*), marbled murrelet (*B. marmoratus*), and pigeon guillemot (*Cephus columba*) in two regions impacted by the Exxon Valdez Oil Spill (EVOS): Kenai Peninsula Coast and Kachemak Bay. Our overall goal is to provide information about trends in abundance and productivity of these three injured seabird species that are not recovering from EVOS or whose recovery status is unknown, thus supporting the EVOSTC in assessment of their recovery status. Kittlitz's murrelet and marbled murrelet two seabird species that were impacted by EVOS, with an estimated 5-10% and 6-12% of the spill zone population killed by acute oiling, respectively. Recovery status of Kittlitz's murrelets following the EVOS remains unknown, while marbled murrelets have not recovered to their pre-Spill numbers. Kittlitz's murrelet became a candidate species for listing under the Endangered Species Act in 2004 and was found not warranted for listing in 2013 due to insufficient or inconclusive knowledge, but remains a species of conservation concern for the US Fish and Wildlife Service. The marbled murrelet is more abundant and widespread in Alaska but remains a species of conservation concern due to evidence of population declines and is listed as a Threatened species from British Columbia to California. Pigeon guillemot populations in Prince William Sound have declined by an estimated 67% since the 1970s, and an estimated 10-15% of the spill area population died from acute oiling. Pigeon guillemots will be monitored in the Kenai Peninsula coast study area.

Our objectives for murrelets are to 1) Estimate current population sizes and decadal trends in abundance, 2) Characterize abundance patterns and identify factors influencing patterns, and 3) Estimate productivity trends. Knowledge gained about population levels and trends in productivity will provide information to assess recovery status of these species. Our objectives for pigeon guillemot are to estimate current population size, trends in distribution, and trends in relative abundance in the Kenai Peninsula coast study area.

This would be the first proposed effort to bring together data on both murrelet species, in conjunction with oceanographic data, from all sub regions of the spill zone. Available historical data provide a cost-efficient opportunity to examine decadal trends, patterns of distribution over time, and habitat use. Furthermore, historical and on-going oceanographic and zooplankton studies in the region will enable us to examine potential influences of environmental conditions on murrelet and guillemot population trends. Our project builds a team of expertise and partnerships among multiple state and federal agencies, private non-profit entities and the university to accomplish scientific, management, and education objectives outlined in the proposal.

Kenai Peninsula Coast Component

EVOSTC Funding Requested* (must include 9% GA)					
FY21	FY22	FY23	FY24	FY25	TOTAL
160,708	160,245	156,145	117,230	121,708	716,036

Non-EVOSTC Funds to be used, please include source and amount per source:					
FY21	FY22	FY23	FY24	FY25	TOTAL
52,190	37,813	41,102	TBD	TBD	131,105

**If the amount requested here does not match the amount on the budget form, the request on the budget form will be considered to be correct.*

Kachemak Bay Component

EVOSTC Funding Requested* (must include 9% GA)					
FY21	FY22	FY23	FY24	FY25	TOTAL
\$117,938	\$129,566	\$138,748	\$135,366	\$55,565	\$577,184

Non-EVOSTC Funds to be used, please include source and amount per source:					
FY21	FY22	FY23	FY24	FY25	TOTAL
\$48,144	\$49,408	\$50,711	\$52,052	\$47,433	\$247,748

**If the amount requested here does not match the amount on the budget form, the request on the budget form will be considered to be correct.*

1. PROJECT EXECUTIVE SUMMARY

This study will focus on status and trends of marbled murrelet (*Brachyramphus marmoratus*), Kittlitz's murrelet (*Brachyramphus brevirostris*), and pigeon guillemot (*Cephus columba*) which were impacted by direct mortality following the spill. Our overall goal is to provide information about trends in abundance and productivity of injured seabird species that are not recovering from EVOS or whose recovery status is unknown, thus supporting the EVOS Trustee Council (EVOSTC) in assessment of their recovery status.

An estimated 6-12% and 10-15% of marbled murrelet and pigeon guillemot populations in the area, respectively, were killed from acute oiling and both are not recovering from the effects of the spill (EVOSTC 2014). An estimated 5-10% of the world population of Kittlitz's murrelets died because of the spill, and their current recovery status remains unknown (EVOSTC 2014). Factors considered in lack of recovery include decrease in habitat availability, shifts in forage fish prey populations (herring, sand lance), and climatic factors.

In Alaska, recent surveys have indicated population declines (75-90%) of Kittlitz's murrelet at several locations since the 1980s and recent analyses indicate murrelets continue to decline in Prince William Sound (U.S. Fish and Wildlife Service 2009, Cushing et al. 2018). The species' habitat appears to be restricted to tidewater glaciers, glaciated fjords, outflows of glacial streams, and recently deglaciated areas during the breeding season (Day and Nigro 1999, Day et al. 2003, Kuletz et al. 2003). In Alaska, glaciers have experienced a rapid and increased rate of retreat during the 20th century (Arendt et al. 2002) and recent estimates predict that Alaska's glaciers will lose 30-60% of their total volume by 2100 (Huss and Hock 2015). The observed population declines, dependence on glacially-influenced habitats, and rapid retreat of glaciers have raised increasing concerns about the status of the Kittlitz's murrelet in Alaska (Kissling et al. 2007). The proposed study will provide data to assess the status of the species in the spill area. The study also will contribute to US Fish and Wildlife Service (USFWS) data to evaluate the conservation status of the species, which was a candidate for listing under the US Endangered Species Act (ESA) in 2004 and found not warranted for listing in 2013 due to lack of sufficient population trend data. Kittlitz's murrelet remains a species of concern for the USFWS, and for international professional and conservation groups (Pacific Seabird Group, International Union for Conservation of Nature).

The marbled murrelet is also of conservation concern, due to declining populations in core nesting areas (Piatt et al. 2007, Kuletz et al. 2008, Kuletz et al. 2011). The proposed study will assess current status to address the question of recovery. The marbled murrelet is a species of conservation concern for the USFWS in Alaska and is federally listed as Threatened under the ESA in Washington, Oregon, and California, State-listed as Endangered in California, State-listed as Threatened in Oregon and Washington, and a species of concern in British Columbia.

Pigeon guillemot populations in Prince William Sound (PWS) have declined by an estimated 67% since the 1970s (Aglar et al. 1994, Golet et al. 2002). The reason for the decline is not well understood, but changes in marine ecosystems could affect food availability and regional population trends. The proposed study will provide information about the current status and trends of pigeon guillemot in the spill area on the Kenai Peninsula coast.

The Gulf of Alaska (GOA) has undergone periods of ocean warming and most recently, massive and persistent heatwaves, resulting in cascading trophic effects affecting fish abundance and distribution (Zador and Yasumiishi 2018). In 2014-2016, other fish-eating seabirds, primarily common murre, had wide-spread mass mortality events and breeding failures in the GOA (Piatt et al. 2020). Long-term trends in PWS indicate that pelagic feeding marine birds (such as murrelets) have not recovered as well as benthic-feeding coastal birds (Cushing et al.

2018). The impact of these changes on *Brachyramphus* murrelets and pigeon guillemot is unknown, although there is evidence from the GOA Seward Line off-shore surveys that murrelets respond to warmer oceans by moving closer to coastal and fjord habitats (Kuletz et al. 2018). By examining murrelet trends across the broader EVOS affected area, in conjunction with oceanographic conditions, we seek to determine if there are differences in murrelet trends among regions that may coincide with environmental conditions, thereby identifying factors potentially inhibiting murrelet recovery. Improved understanding of environmental influences on murrelet trends and distribution patterns across the area may also inform the fisheries management process in the GOA. Available historical data for murrelets and pigeon guillemot in our study area provide a cost-efficient opportunity to examine decadal trends, patterns of distribution over time, and habitat use for all these species.

In summary, we will create long-term data sets on abundance and productivity for these species, and explore hypotheses related to population response to environmental variability in the spill area. Replication of robust survey protocols provides high power to detect trends and understand spatial patterns of change. The study will provide new data for integrated analyses of seabird status and recovery in the spill area.

Kenai Peninsula Coast Component

Our study area in Kenai Fjords contains glacially-influenced fjords used by both Kittlitz's and marbled murrelets, although many of the tidewater glaciers are currently on the cusp of receding above sea level. Murrelet surveys in the Kenai Fjords date back to 1970s, but surveys have not been conducted in the area since 2006-2008 (Van Pelt and Piatt 2003, Arimitsu et al. 2011). Marine surveys conducted year-round in Resurrection Bay since 2011 indicate changes in seasonal abundance of marbled murrelet, suggesting a decline during the summer seasons of 2017-2019. These observed declines coincide with reproductive failure of other seabird species in the area that have been linked to the warming anomaly of 2015-2016.

Pigeon guillemot occupy the waters in Resurrection Bay during spring and summer seasons, and nest in small colonies throughout the bay. Since 2011, seasonal distribution and abundance of guillemots has been monitored in year-round surveys of the bay.

This component will study the status and trends of marbled murrelet, Kittlitz's murrelet, and pigeon guillemot along the southeast coast of the Kenai Peninsula, a region impacted by EVOS. For Kittlitz's murrelet, we will provide an assessment of population size and trends in the Kenai Fjords, and information to understand abundance patterns in glacially-influenced fjord habitats. For marbled murrelet and pigeon guillemot, we will provide an assessment of population size and trends in the Kenai Fjords and Resurrection Bay, and information about productivity. For marbled murrelet, we will also provide information to understand their abundance patterns in the fjords area.

Building on data from fjord surveys conducted in 2006-2008 and the only year-round marine bird survey ongoing in Alaska since 2011, our study offers a unique opportunity to assess status of three seabird species at a comparison site in Kenai Fjords, with a study design that lends itself to seamless comparison with other survey efforts being conducted in the spill region.

Year-round bird surveys in the Resurrection Bay are ongoing and seasonal juvenile surveys are underway. Additional information is provided under Section 2B on COVID-19 related logistics.

Kachemak Bay Component

This study component will provide current population estimates for Kittlitz's and marbled murrelet species, along with distribution and habitat use in Kachemak Bay. Kachemak Bay and the greater Lower Cook Inlet (LCI) region are critically important areas for Kittlitz's murrelets, with an estimated 9% of the total world population

(U.S. Fish and Wildlife Service 2013). The goal of this component is to provide an updated population estimate for *Brachyramphus* murrelets in Kachemak Bay and to conduct integrated analyses with collaborators to identify high density areas and provide trend information for the species across the spill zone.

The Kachemak Bay component of the project conducted the first field season in 2021. We successfully completed the July surveys to determine the population estimate of *Brachyramphus* murrelets and other seabird species in Kachemak Bay. Field operations were conducted in Kachemak Bay on 19-30 July 2021. We first completed observer training, tested survey methodology to improve distance sampling protocols, and then conducted five days of boat-based seabird surveys. In addition, extra time was allocated in July 2021 to prepare and repair the 25 ft Boston Whaler for field operations, given the vessel had been in storage and unmaintained for several years.

Field operations in 2021 were impacted by travel restrictions related to COVID-19. The USFWS required all projects to submit an internal COVID-19 risk assessment before any field work could be conducted in 2021. The Kachemak Bay project was approved by the USFWS Alaska Regional Directorate Team on the caveat that the field crew would isolate as a group while in Homer to mitigate potential COVID-19 exposure during the project. This additional logistic challenge meant that we could not utilize the in-kind contribution of lodging at the Alaska Maritime National Wildlife Refuge bunkhouse due to the shared housing situation at the bunkhouse during the survey period. We were able to secure housing for the field crew by renting a cabin in Homer where the crew could isolate and minimize potential exposure to COVID-19. The additional cost of the rental property was covered by supplementary in-kind contribution of \$4,077 by USFWS Migratory Bird Management.

The proposed August juvenile murrelet surveys was not completed in 2021 due to the associated uncertainty of COVID-19 logistics, inability to rotate survey crew, and associated costs. Additional information is provided under Section 2B Project Status of Scheduled Accomplishments.

Integration of Components

Data collection methods are coordinated between the two component areas, allowing for integrated data analysis to compare murrelet densities and population trends between the study areas. Coordination efforts will be continued throughout the project, including coordination of training of observers and regular meetings among the team of investigators. A workshop focusing on current research and techniques to investigate murrelet abundance, productivity, and habitat associations will be hosted by our research team, to further facilitate discussions and collaborations among study areas, trophic levels, and interested resource managers.

Preliminary Results

In 2021, we continued surveys in the upper Resurrection Bay and from April to date have detected 2974 birds on the water and 1474 birds in the air. Of those, 229 were marbled murrelets and 90 were pigeon guillemots. A total of 42 bird species have been detected since April.

In July of 2021 we surveyed 177 km of line transects in Kachemak Bay and detected 671 birds and marine mammals on the water and 526 in the air (Figure 1). Of the water observations, we recorded 210 sea otters, 127 marbled murrelets, 7 Kittlitz's murrelets, 24 unidentified *Brachyramphus* murrelets. The number of Kittlitz's murrelets observed this year was the lowest count of birds since surveys began in 2005. Other species recorded included common murre, pigeon guillemot, black-legged kittiwakes, short-tailed shearwaters, and 108 individuals of other species.

To adjust for detectability of each species, we fit a detection function to six common and focal seabird species (marbled murrelet, common murre, pigeon guillemot, *Brachyramphus* murrelet, Kittlitz's murrelet, ancient murrelet) and estimated a species scale parameter and density. We then overlaid the common detection function on a histogram of distance bins (Figure 2). Seabird detection was high out to the distance bin of 50 m and then dropped off quickly at 150m. Average detection out to 150 m was 0.64. Observations > 150 m from the survey line were not included in the analysis. Abundance estimates for all seabirds had a high coefficient of variation of 40-50%, similar to past survey estimates (Kuletz et al. 2008), which did not use line transect distance sampling estimation methods.

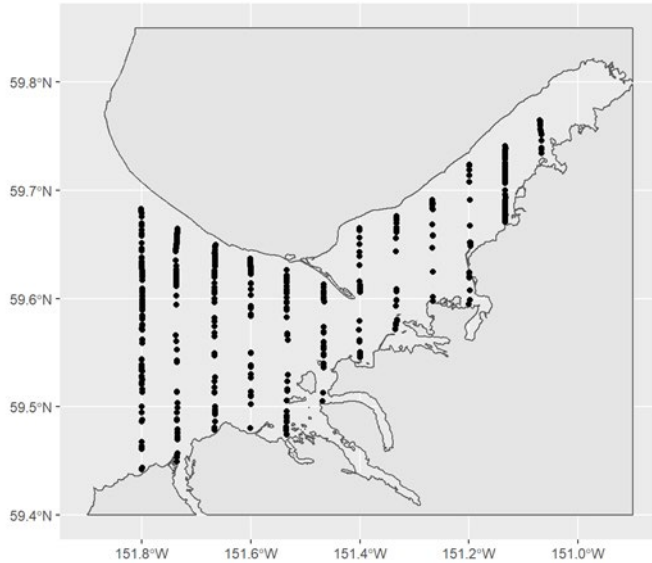


Figure 1. Preliminary overview of marine bird and mammal observations recorded on the water during surveys in Kachemak Bay, Alaska, 23-27 July, 2021. Each dot location represents a recorded sighting of individual or group of species.

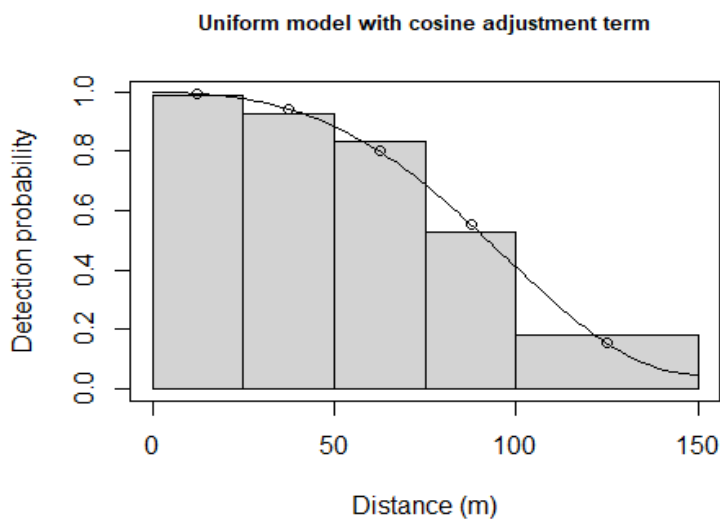


Figure 2. Histogram of observed distances for core seabird species with the estimated detection function during surveys in Kachemak Bay, Alaska, 23-27 July 2021. Detection function was estimated using a uniform key and

cosin adjustment terms. Other function forms fit the data nearly equivalently. Average detection rate out to 150 m was 0.64.

2. PROJECT STATUS OF SCHEDULED ACCOMPLISHMENTS

A. Project Milestones and Tasks

Kenai Peninsula Coast Component

Project milestone and task progress by fiscal year and quarter, beginning February 1, 2021. C = completed, X = planned or not completed. 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	FY21				FY22				FY23				FY24				FY25			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Kenai Fjords surveys																				
Annual planning and preparation	C	C			X	X			X	X										
Surveys						X	X			X	X			X	X					
Annual data summary and submission				X				X				X								
Resurrection Bay surveys																				
Annual planning and preparation	C	C			X	X			X	X			X	X			X	X		
Surveys	C	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Annual data summary and submission				X				X				X				X				X
Data analysis and synthesis																				
Current population size and trends													X	X	X	X	X	X	X	X
Spatial analysis													X	X	X	X	X	X	X	X
Productivity indices																	X	X	X	X
Reporting																				
Annual reports					X				X				X				X			
FY work plan			C				X				X				X				X	
Final report*																				
Deliverables																				
Peer reviewed paper 1 – Current population size and trends																				X
Peer reviewed paper 2 – Density patterns																				X
Peer reviewed paper 3 - Productivity																				X

Data posted online						X					X					X				X
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Kachemak Bay Component

Milestone/Task	FY21				FY22				FY23				FY24				FY25			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Milestone: Logistics																				
Field Work Preparations	C				X				X				X							
Conduct July Survey		C				X				X				X						
Conduct August Survey			X				X				X				X					
Milestone 2 Data Management																				
Data QAQC & Metadata			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Analysis & Summary					X				X				X				X			
Reporting																				
Annual reports					X				X				X				X			
FY work plan			C				X				X									
Final report																				
Annual PI meeting				X				X				X				X				X
Deliverables																				
Peer reviewed paper 1																				X
Data posted online						X				X				X			X			

*Final Report will be submitted by March 1, 2025 according to the EVOSTC reporting policy.

B. Explanation for not completing any planned milestones and tasks

Due to the COVID-19 pandemic situation and logistical challenges with field operations, the Kenai Fjords -wide replicate surveys for the Kenai Peninsula Coast Component that were originally planned to begin in FY21 were postponed to begin in FY22, to allow us to maintain the study design for seasonal replicate surveys as described in the original study plan (ie., to conduct an early, mid, and late season multi-day survey within each year for three years). We plan to conduct these seasonal fjord-wide surveys in FY22-FY24. All other surveys for the Kenai Peninsula component have been conducted as planned.

In 2021 we were unable to conduct the August juvenile murrelet surveys in Kachemak Bay due to logistics associated with COVID-19 field operations. The August surveys require three complete surveys of the bay at weekly intervals, to determine peak juvenile abundance and variability across the fledging period (Kuletz and Kendall 1998). USFWS policy required all projects submit an internal COVID-19 risk assessment plan for field projects to evaluate COVID-19 conditions while the project was underway. Given the potential risk of the project being cancelled due to increased COVID-19 risk, we concluded that it would not be prudent to attempt August surveys, since we could not ensure that the entire survey sequence could be successfully conducted. In addition, USFWS policy required the survey crew to mitigate potential risk of COVID-19 exposure by creating a safe lodging “bubble” environment for the survey crew. The additional costs associated with renting housing for three weeks while based in Homer made August surveys cost prohibitive.

We are completing the remaining milestones for FY21, including: (i) Data QA/QC and creating associated project metadata, and (ii) attending the annual PI meeting.

C. Justification for new milestones/tasks

No new milestones or tasks are currently being proposed. As described in section 2B, we are planning to conduct seasonal fjord-wide surveys in Kenai Fjords during FY22-24, due to COVID-19 pandemic related logistical limitations in our ability to conduct and complete all replicate surveys in 2021. The replicate survey milestones in Kenai Fjords are included in the current work plan for FY22-24. In Kachemak Bay we are in the process of assessing our field data from recently completed surveys to determine if any additional milestones or tasks are necessary.

3. PROJECT COORDINATION AND COLLABORATION

We have coordinated collaboration efforts with other programs for the integrated project. We outline the collaboration efforts for both components in this section.

Kenai Peninsula Coast Component

A. Within an EVOSTC Funded Program

Gulf Watch Alaska

We will closely coordinate and collaborate with several related Gulf Watch Alaska (GWA) programs. Our study area overlaps with the GWA study area, which provides opportunities to coordinate directly on field logistics, data collection, and data sharing. Principal Investigators of the Nearshore Benthic Systems in the Gulf of Alaska project (Esler, Coletti, Weitzman), in collaboration with NPS, are conducting research documenting variation in nearshore physical oceanography in relation to tidewater glacial input and quantifying biological responses to that variation across trophic levels in nearshore areas of the Kenai Fjords National Park. This work, focusing on nearshore marine processes, and the proposed project are very complementary and offer strong synergy opportunities on data sharing. Information about forage fish status and trends is available from the GWA Forage Fish project monitoring efforts in Prince William Sound and the Middleton Island research site in the Gulf of Alaska. In addition, we will collaborate with the Oceanographic Conditions in Lower Cook Inlet and Kachemak Bay project conducting oceanographic and plankton monitoring in Kachemak Bay. Investigators of our study will participate in annual GWA PI meetings, facilitating coordination and interactions with the GWA program investigators.

Herring Research and Monitoring

We will coordinate with the Herring Research and Monitoring (HRM) program on opportunities to collaborate and coordinate field plans, data collection, and data sharing efforts to build research and logistical synergies. *Brachyramphus* murrelets rely on herring and other small forage fish during the summer breeding season and may therefore be impacted by low herring numbers. Data provided by the HRM program would offer insight into prey availability in southcentral Alaska. We will coordinate collaboration and data sharing opportunities with the program lead.

Data Management

We are working with Axiom Data Science to ensure data management milestones and requirements are met. We have created a shared data management plan to organize and archive data in a shared research workspace.

The project will submit data to the EVOSTC-funded Data Management program and produce compliant metadata in accordance with data management requirements. Data will be archived at the AOOS-Gulf Watch Alaska Workspace and the North Pacific Pelagic Seabird Database.

B. With Other EVOSTC-funded Projects

Prince William Sound Marine Bird Population Trends (EVOSTC Project 21120114-M)

Marine bird surveys in Prince William Sound will be conducted in July using similar survey methods as we will use. We will coordinate data sharing and analysis to determine murrelet population estimates and trends among the areas and examine environmental conditions and habitats with respect to those trends. These comparisons will only address adult populations, as the PWS surveys do not include August juvenile surveys.

Pigeon Guillemot Restoration Project (EVOSTC Project 21110853)

The proposed project will collaborate with the Pigeon Guillemot Restoration Project for comparisons on available data on pigeon guillemot abundance and trends.

The Seward Line Project (EVOSTC Project 21120114-L)

Ongoing research by University of Alaska Fairbanks (Seward Line and Long-Term Ecological Research site) will provide substantial collaborations and opportunities for data sharing on environmental conditions in the study area. The data maps from Ecosystem Observatory buoys will provide a real-time data source for oceanographic conditions in the Gulf of Alaska. Collaboration will be coordinated with PI S. Danielson.

C. With Trustee or Management Agencies

We partner and collaborate with several EVOSTC agencies on the project, including the U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), the U.S. Geological Survey (USGS), and the Alaska Department of Fish and Game (ADFG).

Both marbled and Kittlitz's murrelet are species of concern for the USFWS. We will collaborate and coordinate surveys and data sharing with the USFWS and particularly with the Alaska Maritime National Wildlife Refuge (AMNWR), with whom we will partner on both research and public outreach components of the project. Our surveys that include all species of seabirds will provide added value to AMNWR by providing at-sea data of a variety of USFWS trust species, including tufted puffin, a species undergoing a Species Status Assessment.

The USFWS Alaska Region Migratory Bird Management Office (USFWS-MBM) supports this project, and will commit personnel time of the co-investigators for the Kachemak Bay component, ensuring close coordination with other MBM projects in terms of methods, data collection, and data sharing. The project addresses several goals prioritized in the Kittlitz's Murrelet Conservation Action Plan published by the USFWS-MBM Office in 2009 (<https://www.fws.gov/migratorybirds/pdf/management/focal-species/KittlitzsMurrelet.pdf>).

Kenai Fjords National Park (KEFJ) has an interest in seabird status and trends in the area. The majority of the proposed study area is within or adjacent to the Park. Kittlitz's murrelet breeds in glacial habitats that are changing, and the NPS has a long-term interest in understanding impacts of glacial habitat change on the species. The NPS has committed funding to seabird survey projects that are complementary with the proposed project. In addition to updated data about population status and trends, our project will provide information about murrelet distribution, habitat "hot spots", and potential nursery areas within KEFJ to Park resource managers.

The NPS Southwest Alaska Inventory and Monitoring Program (SWAN) consists of five parks National Parks in Southwest Alaska, including the KEFJ. This project will collaborate with SWAN to coordinate field work and data sharing. In addition, long-term survey data from SWAN will be made available to incorporate into the analytical framework of the proposed project. Efforts are coordinated with H. Coletti (NPS).

The USGS and the NPS are co-leading a research program in Kenai Fjords (Nearshore Ecosystem Response to Deglaciation), offering logistical and research synergies between our proposed project and the ongoing field program. The project is collecting oceanographic data along mid-fjord transects in all the fjords, and we are coordinating collaborations on data collection and sharing with PIs D. Esler (USGS) and D. Kurtz (NPS).

The USGS is conducting research on status of forage fish in Lower Cook Inlet. We will collaborate with PIs M. Arimitsu and J. Piatt.

The ADFG supports our research goals and we will collaborate with the State biologists on data collection and data sharing. The project will open opportunities to develop collaborative research with state biologists on the ecology and status of three seabird species listed as Species of Greatest Conservation Need in Alaska. We are coordinating collaborations with ADFG Biologist K. Christie. We are collaborating with Michelle Kissling and results from her PhD research will inform interpretation of data from our surveys.

The National Oceanic and Atmospheric Administration (NOAA) conduct regular fish surveys in the Gulf of Alaska, providing a source for regional data on trends, abundance, and distribution of forage fish important to murrelets and pigeon guillemots.

To facilitate integration of research, we will organize a workshop focusing on murrelets and their marine habitats and prey. We will invite researchers involved in investigation of murrelets and their prey, as well as resource managers to the workshop to discuss and facilitate integration of data collection and analyses.

D. With Native and Local Communities

The Alaska SeaLife Center, the AMNWR, and KEFJ, are partnering to engage the public and local communities through diverse outreach, education, and community science programs.

With the AMNWR, we will incorporate our seabird project into school lesson plans that the refuge educators are delivering in schools in Homer and Sitka. We will participate in Discovery Labs offered to students and other members of the community in Homer. We will present at local events, including the Kachemak Bay Shorebird Festival and the Seward Seabird Festival. We will distribute updates about our work and findings in the AMNWR monthly newsletter.

In the Kachemak Bay area, we will work with local communities of Homer, Port Graham, and Seldovia to inform them of our surveys, share results, and potentially integrate regional citizen science data when applicable. We will look to engage in local community outreach events including giving educational talks, informational flyers, coordinating with the Center for Alaska Coastal Studies.

Kenai Fjords National Park has the unique ability to provide high quality and engaging interpretation and education specific to this project. This is due in large part to the park's interpretive operations being delivered via ranger-led boat programming on tour boats within Resurrection Bay and the fjords that make up Kenai Fjords

National Park—the specific study areas for this project. Boat programming can reach thousands of visitors and provide an “in the resource” perspective of the project. This is a truly unique opportunity as visitors will learn about the project in the actual study area, have the opportunity to see the Kittlitz’s murrelet, marbled murrelet, and pigeon guillemot first-hand and have a National Park Service ranger explain the impacts of the *Exxon Valdez* Oil Spill, long-term study and recovery efforts as well as the positive impact people can have via this continued work. In addition, Kenai Fjords National Park features an award winning distance learning education program that can bring the fjords to life for students during the academic year, serving youth that might otherwise never learn about the *Exxon Valdez* Oil Spill, see the fjords or understand the value of these unique ecosystems. This element can reach an additional one thousand students. In total, Kenai Fjords National Park programming reached 321,596 visitors in 2018. Our contact with Kenai Fjords National Park is Shauna Potocky.

Researchers at the Alaska SeaLife Center are continuing a successful community science program with the Seward high school, engaging students as seabird observers to collect fine scale count data along Resurrection Bay shoreline. The student scientists will contribute weekly shore-based bird count data throughout the year, corresponding with marine survey transect adjacent to the Seward shoreline. The Alaska SeaLife Center education team also delivers classroom programs in area schools, including Native communities, and our project will provide materials for a seabird module. Video streaming will be available for broadcasting at the SeaLife Center exhibits.

Kachemak Bay Component

A. Within an EVOSTC Funded Program

Gulf Watch Alaska

This project will work closely with the Gulf Watch Alaska program, including attending the annual PI meetings. We will coordinate with Gulf Watch Alaska projects (PWS marine bird surveys, Project 21120114-M; Nearshore monitoring, Project 21120114-H) to collect comparable data on murrelets, permitting more comprehensive inferences on broader populations of Kittlitz’s and marbled murrelets in the spill affected area. In addition, Dr. Kathy Kuletz is the PI for the marine bird survey component of the LTER Project, and Robb Kaler is the PI for the proposed FY22-31 PWS Marine Bird Surveys and Associated Shelf Waters. Both projects will have field seasons in 2022 and 2024. We will compare data sets among regions to provide a broad perspective on conditions affecting marine birds in the northern Gulf of Alaska. Further, we will collaborate with the LCI oceanographic and plankton monitoring projects of the Kachemak Bay Research Reserve, the USGS forage fish study in LCI, and the Northern Gulf of Alaska Long Term Ecosystem Research project (funded by National Science Foundation and North Pacific Research Board).

Herring Research and Monitoring

Brachyramphus murrelets rely on herring and other small forage fish (Bishop et al. 2015, Day et al. 1999, Piatt et al. 2007) during the summer breeding season and may therefore be impacted by low herring numbers. Data provided by the HRM program would offer insight into prey availability in southcentral Alaska, which may also be reflected in murrelet densities and annual population estimates for Hatch Year birds. We are in contact with the program lead Dr. Scott Pegau to discuss the objectives of the proposed murrelet studies and will look to engage in future collaborative data sharing opportunities.

Data Management

We are working with Axiom Data Science to ensure data management milestones and requirements are met. We have created a shared data management plan to organize and archive data in a shared research workspace.

The project will submit data to the EVOSTC-funded Data Management program and produce compliant metadata in accordance with data management requirements. Data will be archived at the AOOS-Gulf Watch Alaska Workspace and the North Pacific Pelagic Seabird Database ([NPPSD](#)).

The USFWS has been in discussions with partners including, the Alaska SeaLife Center, USGS, and NPS on how to improve data sharing and archival in the NPPSD. We are currently working with ABR, Inc. to develop a shared standardize survey software package (named SeaLog) to conduct marine bird surveys. We received a beta version of the software from ABR, Inc. in May 2021 and are testing the software to refine the program. We plan on using the new software for marine bird surveys starting in 2022. The shared data entry platform will standardize the output files and the type of information that is collected during different surveys and components of the project. Additionally, we are assisting with development of a shared data processing software package that USFWS and other partners will use to conduct data QA/QC, generate densities, and expedite data archival and sharing among projects.

B. With Other EVOSTC-funded Projects

Prince William Sound Marine Bird Population Trends (EVOSTC Project 21120114-M)

Marine bird surveys in Prince William Sound will be conducted in July using survey methodology similar to our Kachemak Bay surveys. We will coordinate data sharing and analysis to determine murrelet population estimates and trends between PWS, Kachemak Bay, and Kenai Fjords/Resurrection Bay and examine environmental conditions and habitats with respect to those trends. These comparisons will only address adult populations, as the PWS surveys do not include August juvenile surveys. We will examine the potential to improve the PWS survey population estimates for Kittlitz's murrelets by adding additional systematic transects in fjords identified as key Kittlitz's murrelet habitat; these transects would be added in 3 to 5 fjords identified as having Kittlitz's murrelet aggregations (Allyn et al. 2012, Kuletz et al. 2003). The PWS Marine Bird Survey will overlap temporally with the Kachemak Bay project in 2022 and 2024 pending potential impacts of COVID-19 on field work.

Pigeon Guillemot Restoration Project (EVOSTC Project 21110853)

The proposed project will collaborate with the Pigeon Guillemot Restoration Project to share available data on pigeon guillemot abundance and trend data in Kachemak Bay with those obtained in PWS. USFWS-MBM will explore conducting pigeon guillemot colony counts in Kachemak Bay as part of our efforts with AMNWR to recensus seabird colony sites across Alaska. Pigeon guillemot colony counts would be coordinated with methods and standards used by AMNWR and the Kenai Peninsula Coast component.

C. With Trustee or Management Agencies

The proposed project supports the USFWS-MBM mission to advance the conservation of migratory birds. In addition to informing the EVOSTC regarding recovery of impacted resources, the project will inform other management agencies (ADFG, AMNWR, and NPS) with lands and waters adjacent to the proposed study area.

The project has also reached out to ADFG to identify potential opportunities to collaborate on analysis that had been previously conducted by Kelly Nesvacil before she left the agency. We have been informed that ADFG is working with Michelle Kissling to integrate the ADFG data into her current analysis at the University of Montana. We have already been working cooperatively with Michelle Kissling and have involved her in discussions focused on improving our study design based on her work in Glacier Bay. One component of Ms. Kissling's study may be development of a "detection availability" function, based on rate of movement in and out of a study area. If

successful, this would further improve our ability to detect population trends. We will continue to maintain this cooperative effort and identify further opportunities for collaboration.

The projects will also coordinate with Kris Holderied at the NOAA Kasitsna Bay Laboratory to identify supplemental sources of oceanographic data being collected in Kachemak Bay. In addition, the impact of tidal influence on murrelets will be quantified during the analysis by incorporating tidal information from the NOAA tide station located in Seldovia.

D. With Native and Local Communities

We will work with local communities of Homer, Port Graham, and Seldovia to inform them of our surveys, share results, and potentially integrate regional citizen science data when applicable. We would look to engage in local community outreach events including giving educational talks, informational flyers, and coordinating with the Center for Alaska Coastal Studies and AMNWR, based in Homer, to identify other cooperative outreach opportunities.

4. PROJECT DESIGN

A. Overall Project Objectives

Kenai Peninsula Coast Component

Objectives:

1. Estimate current population size for Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in the Kenai Fjords, and determine decadal trends in abundance for murrelets
2. Characterize current distribution of Kittlitz's and marbled murrelet in Kenai Fjords, investigate temporal changes in density patterns, and identify factors that influence density patterns
3. Estimate current population size, trends in distribution, and trends in relative abundance of pigeon guillemot in Resurrection Bay
4. Estimate juvenile densities and age ratios as an index of productivity for marbled murrelet and pigeon guillemot in Resurrection Bay
5. Develop recommendations for future monitoring of population size and abundance patterns for Kittlitz's murrelet and marbled murrelet in Kenai Fjords, and pigeon guillemot in Resurrection Bay

Distance sampling methods are used to estimate population size. In Resurrection Bay, distance sampling methods were not used during early years of the survey prior to the current study. Therefore, in any analysis that involves those previous years, we will apply detection functions developed in the current study to estimate abundance, or estimate trends in relative abundance. Objective 4 is focused on estimating juvenile densities, and we also will calculate age ratios as an index of productivity relative to the local population.

Kachemak Bay Component

Objectives:

1. Obtain current population estimates and long-term trends for Kittlitz's murrelets and marbled murrelets in Kachemak Bay.

2. Estimate annual abundance of adult and juvenile Kittlitz’s murrelets and marbled murrelets in Kachemak Bay during the fledgling period.
3. Describe the distribution of murrelets within Kachemak Bay, and identify marine habitats used by murrelets.
4. Synthesize results from Kachemak Bay with those from other regions in the spill zone, including Resurrection Bay and Prince William Sound.

B. Changes to Project Design and Objectives

No changes are proposed in project design and objectives for the Kenai Peninsula Coast Component.

For the Kachemak Bay Component, we are in the process of assessing our 2021 survey data to determine if any additional changes to the project will be required in subsequent years. We are currently evaluating the data to determine a detection function for *Brachyramphus* murrelets and other seabird species. We will apply the derived detection function to our historic data to facilitate comparison over the 2005 to 2021 time frame. We will also examine the data to determine if we need to increase sampling effort for the July population survey. It may be necessary to re-evaluate the budget or the value of August juvenile surveys if COVID-19 restrictions continue to impact survey logistics.

5. PROJECT PERSONNEL – CHANGES AND UPDATES

Jenna Schlener, seabird research coordinator at the Alaska SeaLife Center will support project coordination and participate in surveys.

6. PROJECT BUDGET

A. Budget Forms (Attach)

Budget Forms are attached.

Kenai Peninsula Coast Component Budget Summary

Budget Category:	Proposed FY 21	Proposed FY22	Proposed FY23	Proposed FY24	Proposed FY25	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	\$29,263.0	\$30,141.0	\$31,045.0	\$31,977.0	\$32,935.0	\$155,361.0	
Travel	\$1,585.0	\$1,008.0	\$1,027.0	\$0.0	\$670.0	\$4,290.0	
Contractual	\$72,300.0	\$80,469.0	\$76,702.0	\$49,500.0	\$50,985.0	\$329,956.0	
Commodities	\$5,000.0	\$0.0	\$0.0	\$0.0	\$0.0	\$5,000.0	
Equipment	\$5,000.0	\$0.0	\$0.0	\$0.0	\$0.0	\$5,000.0	
Indirect Costs (<i>will vary by proposer</i>)	\$34,291.0	\$35,395.0	\$34,479.0	\$26,073.0	\$27,069.0	\$157,307.0	
SUBTOTAL	\$147,439.0	\$147,013.0	\$143,253.0	\$107,550.0	\$111,659.0	\$656,914.0	
General Administration (9% of subtotal)	\$13,270	\$13,231	\$12,893	\$9,680	\$10,049	\$59,122	
PROJECT TOTAL	\$160,709	\$160,244	\$156,146	\$117,230	\$121,708	\$716,036	
Other Resources (Cost Share Funds)	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	N/A

Kachemak Bay Component Budget Summary

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROJECT BUDGET PROPOSAL AND REPORTING FORM**

Budget Category:	Proposed FY 20	Proposed FY21	Proposed FY22	Proposed FY23	Proposed FY24	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	\$42,500.0	\$62,933.0	\$64,821.4	\$66,765.4	\$37,704.9	\$274,724.7	
Travel	\$7,440.0	\$15,300.1	\$15,696.8	\$16,105.9	\$9,773.0	\$64,315.8	
Contractual	\$0.0	\$30,000.0	\$30,000.0	\$30,000.0	\$0.0	\$90,000.0	
Commodities	\$7,495.2	\$10,635.0	\$12,774.0	\$11,317.0	\$3,500.0	\$45,721.2	
Equipment	\$36,200.0	\$0.0	\$4,000.0	\$0.0	\$0.0	\$40,200.0	
Indirect Costs (<i>will vary by proposer</i>)	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	
SUBTOTAL	\$93,635.2	\$118,868.1	\$127,292.1	\$124,188.4	\$50,977.9	\$514,961.7	
General Administration (9% of subtotal)	\$8,427.2	\$10,698.1	\$11,456.3	\$11,177.0	\$4,588.0	\$46,346.6	
PROJECT TOTAL	\$102,062.3	\$129,566.2	\$138,748.4	\$135,365.3	\$55,565.9	\$561,308.2	
Other Resources (Cost Share Funds)	\$48,144.0	\$49,408.3	\$50,710.6	\$52,051.9	\$47,433.4	\$247,748.2	N/A

B. Changes from Original Project Proposal

Currently there are no new funding requests for the FY22 year.

C. Sources of Additional Project Funding

A grant from the NPS will support seasonal coastal surveys in Resurrection Bay during 2021-2023, contributing to year-round survey data and providing data from the outer Bay area. This project also will be supported via Kenai Fjords National Park by providing time for the Chief of Interpretation and Education to guide the development of the interpretive and educational outreach elements based on the research conducted during this study. Contribution is valued at \$5,105 (1 pay period of Chief of Interpretation and Education). The Chief of Interpretation will provide supervision to staff who will be responsible for the development and delivery of interpretive and educational programming and all associated resource teaching kits and tangibles. Teaching kit supplies will be purchased via the park's interpretive supply budget. Additional support will include featuring the project, programs and work via Kenai Fjords National Park website and social media. Additional in-kind contributions involve partner staff time to conduct surveys and data analysis.

The USFWS-MBM, will provide In-kind support of salaries, travel, equipment, lodging, and administrative support, beyond that requested in our budget. Total contributions for contributed salaries and survey support are estimated at \$247,748. Specific items of in-kind contribution include:

- Salaries and administrative support for Co-PIs
- Two ruggedized laptops with hand-held GPS (as backups; will require new purchases)
- Develop updated survey software to standardize data collection among partner agencies
- Use of USFWS truck for travel to Homer, AK and hauling boat as necessary
- Use of AMNWR vessel to conduct surveys in Kachemak Bay
- Lodging for field crew at AMNWR bunkhouse in Homer, AK (when available and viable due to COVID-19)
- Lodging for field crew provided by USFWS-MBM in 2021
- Safety gear for vessel use, misc. equipment as backup
- Historical and concurrent data already available and processed for the study area

7. PROJECT PUBLICATIONS AND PRODUCTS

Publications

None at this time.

Published and updated datasets

We have created a data management system with Axiom Data Science to organize data files created during this project. We are currently in the initial phase of data QA/QC and will upload relative data files to the shared research workspace

Presentations

We presented an overview of project 22210128 Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay at the Annual Gulf Watch Alaska PI Meeting, virtual, November 2020.

An overview was also presented at the Pacific Seabird Group Technical Committee meeting, February 2021.

Hollmen gave a project presentation to ASLC Board of Directors, April 2021.

Outreach

We have been in contact with the Center for Alaskan Coastal Studies based in Homer Alaska to inform the organization of our project in Kachemak Bay. We will work with the organization in the future to provide community outreach, including presentations at the Kachemak Bay Science Conference hosted by the Center for Alaskan Coastal Studies.

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