



Exxon Valdez Oil Spill Trustee Council
Long-Term Research and Monitoring, Mariculture, Education and Outreach
Annual Project Reporting Form

**For Instructions for each section below, see Reporting Policy, II (B); the Reporting Policy can be found on the website, <https://evostc.state.ak.us/policies-procedures/reporting-procedures/>*

Project Number: 22210128

Project Title: Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay

Principal Investigator(s):

Kenai Peninsula Coast Component

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Marc Romano, Co-PI, US Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge

Erik Osnas, Co-PI, US Fish and Wildlife Service, Migratory Bird Management, Alaska Region

Kachemak Bay Component

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Kathy Kuletz, Co-PI, US Fish and Wildlife Service, Migratory Bird Management, Alaska Region

Erik Osnas, Co-PI, US Fish and Wildlife Service, Migratory Bird Management, Alaska Region

Reporting Period: Feb 1, 2021 – January 31, 2022

Submission Date: Mar 31, 2022

Project Website: N/A

Please check all the boxes that apply to the current reporting period.

Project progress is on schedule.

Project progress is delayed

Kenai Peninsula Coast Component

Due to COVID-19 pandemic, the Kenai Fjords coast wide surveys intended for 2021-2023 were scheduled for 2022-2024 with approval by the EVOSTC Executive Director.



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Kachemak Bay Component

The first year of this study focused on the July surveys and aimed to derive a robust population estimate for injured marine bird species that have not recovered following the *Exxon Valdez* oil spill, including *Brachyramphus murrelets*, in Kachemak Bay, Alaska. We observed low murrelet numbers in the study area limiting the power to detect trends in the murrelet population in Kachemak Bay. We have determined in order to provide a robust population estimate for murrelets we need to increase our sample size by adding additional systematic transects in our study area. As such, we propose to modify our study design to increase the number of transect in Kachemak Bay from 12 to 24 for the July population estimate surveys in order to increase our sample size and reduce the coefficient of variation of population estimates. The addition of these transects will require ~7 days of additional survey time. Because of the need to increase sampling effort for the July population survey we propose to drop the August juvenile murrelet survey. We concluded given limited resources, the cost benefit of using funds to address non-recovered marine bird species' population estimates, and trends is our primary objective in this study. By increasing sampling effort during the July survey, we will obtain more precise estimates of each species population during July and better resolution to obtain estimates of how density change over the surveyed area. More precise population estimates in July will also allow us to better estimate the inter-annual component of variation in populations of murrelets that has been shown in past studies and will improve our ability to detect changes in populations as compared to past surveys (Kuletz et al. 2008).

Budget reallocation request.

Kachemak Bay Component

The COVID-19 pandemic impacted the FY21 field season. We were unable to conduct a full field season due to COVID-19 mitigation efforts. In addition, our project's spending was altered due to several factors detailed in the budget section. We request carrying over unspent funds to FY22. We are also requesting to shift funds to increase our sampling effort in Kachemak Bay during the July population estimate surveys. Detailed justification provided in the section above.

Personnel changes.



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1. Summary of Work Performed:

Kenai Peninsula Coast Component

For the Kenai Peninsula component, work conducted during the reporting period contributed to project objectives 3-Estimate current population size, trends in distribution, and trends in relative abundance of pigeon guillemot in Resurrection Bay and 4-Estimate juvenile densities and age ratios as an index of productivity for marbled murrelet and pigeon guillemot in Resurrection Bay. Ongoing surveys in Resurrection Bay were continued to estimate trends in distribution and relative abundance of pigeon guillemots over a 15-year period, building on data collected since 2011 (Objective 3). In July -September 2021, we conducted marbled murrelet and pigeon guillemot juvenile surveys in upper and outer Resurrection Bay (Objective 4; Figure 1). Surveys were conducted at approximately weekly intervals from July 27- September 22. Line transect surveys covered approximately 72 km of coastline and were conducted from a vessel traveling 100 m from the shore, with an observer, data recorder, and vessel operator aboard. Bird observations were recorded in 25 m bins within 100 m from each side of the vessel. A total of 9353 bird observations were recorded, representing 37 species. A total of 733 marbled murrelets and 159 pigeon guillemots were observed (Table 1). Of the total number of murrelets, 101 (14%) were juveniles and 12 (2%) were of unknown age. Of the pigeon guillemots, 32 (20%) were juveniles. The juvenile counts for marbled murrelets and pigeon guillemots peaked from mid-August to early September (Figure 2). These findings provide the first year of data to estimate juvenile densities through years in Resurrection Bay.



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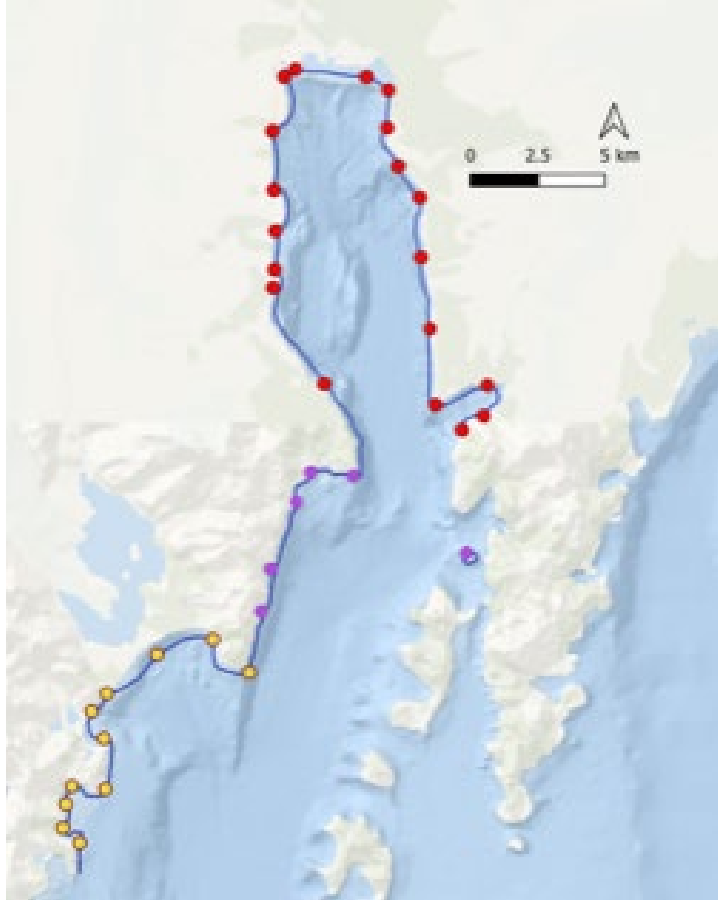


Figure 1. Survey route for marbled murrelet and pigeon guillemot in Resurrection Bay. In 2021, surveys were conducted at approximately weekly intervals from July 27 to September 22.

Table 1. Total counts of adult, juvenile, and unknown age marbled murrelets and pigeon guillemots observed in Resurrection Bay surveys from July 27 – September 22, 2021.

Species	Age	Total Count
Marbled Murrelet (MAMU)	Adult	620
Pigeon Guillemot (PIGU)	Adult	127
Marbled Murrelet (MAMU)	Juvenile	101
Pigeon Guillemot (PIGU)	Juvenile	32
Marbled Murrelet (MAMU)	Unknown Age	12



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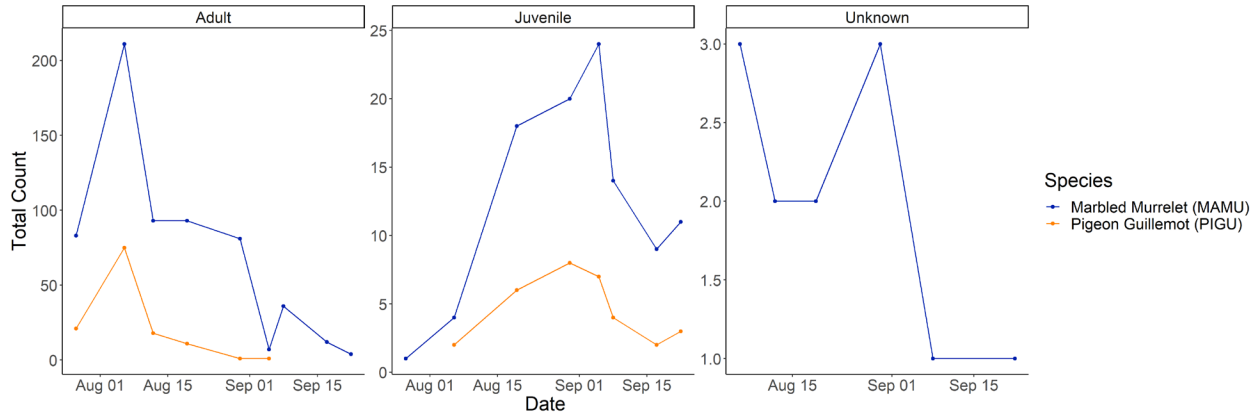
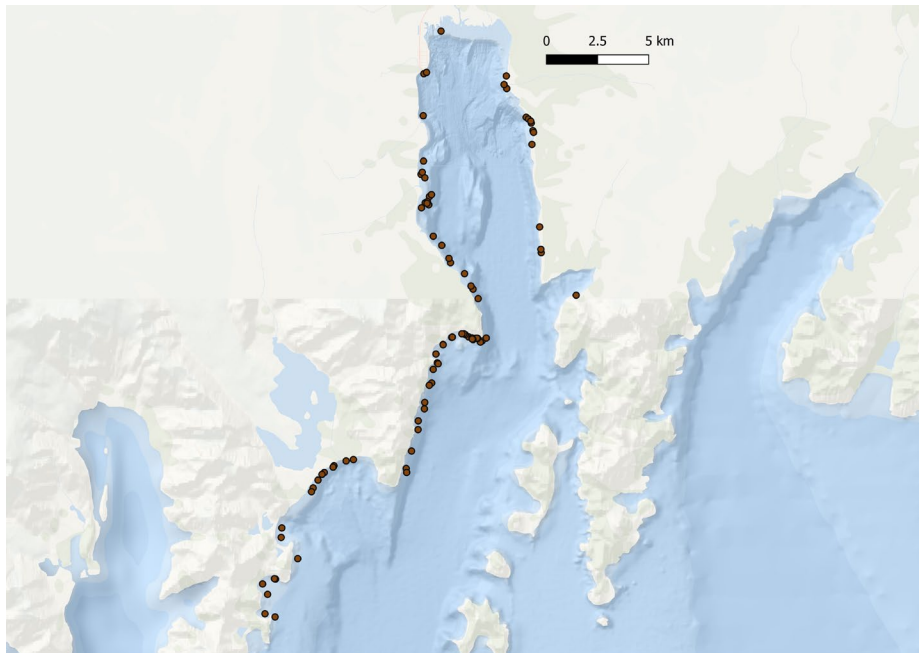


Figure 2. Timing of adult, juvenile, and unknown age marbled murrelet and pigeon guillemot observations in surveys conducted during July 27 – September 22, 2021 in Resurrection Bay, Alaska.

Preliminary data on distribution of juvenile marbled murrelets and pigeon guillemots are presented in Figures 3 and 4, respectively.





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Figure 3. Distribution of juvenile marbled murrelet sightings in Resurrection Bay, July 27 - September 22, 2021.



Figure 4. Distribution of juvenile pigeon guillemot sightings in Resurrection Bay, July 27 - September 22, 2021.

Kachemak Bay Component

The Kachemak Bay component conducted the first field season in 2021 in coordination with the Kenai Peninsula Coast component. Field operations in 2021 were impacted by travel restrictions related to COVID-19. The U.S. Fish and Wildlife Service (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



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the associated uncertainty of COVID-19 logistics, inability to rotate survey crew, and associated costs.

We successfully completed the July surveys to determine the population estimate of *Brachyramphus* murrelets and other marine birds in Kachemak Bay. Field operations were conducted in Kachemak Bay 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 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.

Twelve line transects were surveyed in July totaling 180 km in Kachemak Bay. We detected 2472 marine birds and 474 marine mammals during surveys (Table 1). Murrelet observations were generally low in the study area (Figure 1). To adjust for detectability of each species, we fit three common detection functions (half-normal, cosine, and hazard rate) to six focal species (marbled murrelet, common murre, pigeon guillemot, *Brachyramphus* murrelet, Kittlitz's murrelet, ancient murrelet) pooled. All detection functions gave similar fit, so we used a hazard rate model to estimate species-specific scale (intercept) parameters, which allows for a common shape to the detection function across species but gives a species-specific density estimate. The common detection function was overlaid on a histogram of distance bins across all species is shown in (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 for the hazard rate model. 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% (Table 2). The coefficient of variation is to past survey estimates (Kuletz et al. 2008) that did not use line transect distance sampling estimation methods. Although we anticipated high coefficient of variation, we propose to double our transect effort in 2022 by adding 12 new transects equally spaced between the existing transects. The additional survey effort will reduce population estimate variance and thereby increase our ability to estimate population differences from past surveys and map densities across the bay. For sea otters we detected 181 groups and 464 individuals in the bay (Figure 1). We fit similar detection models as for seabirds and found all gave similar fit. We found detection to be 0.67 with a hazard rate detection function and estimated 5757 (SE = 1510) sea otter in Kachemak Bay (Table 2).



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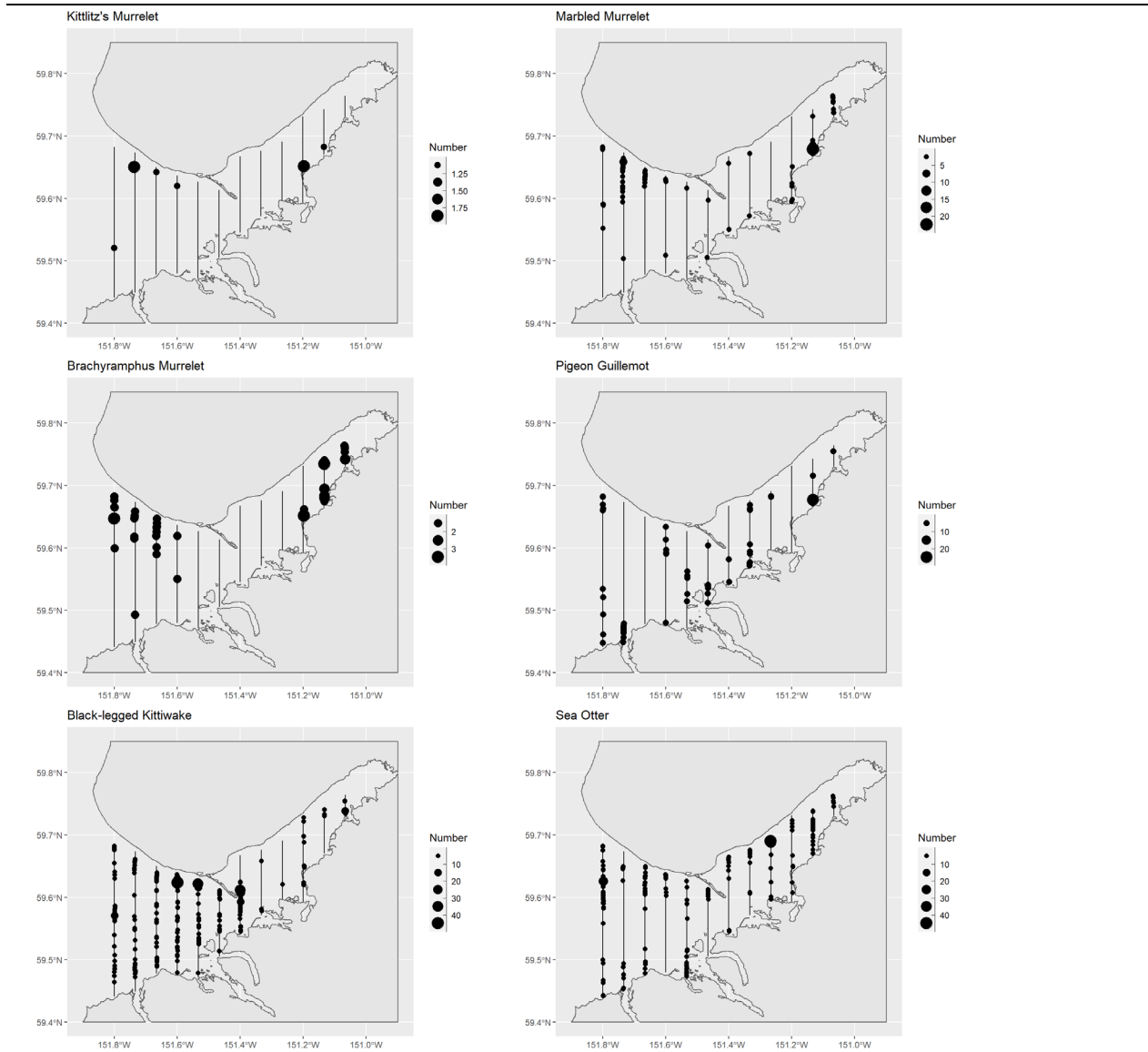


Figure 1. Species distribution maps for marine bird and mammal surveys conducted in Kachemak Bay, Alaska, July 23 – July 27, 2021.



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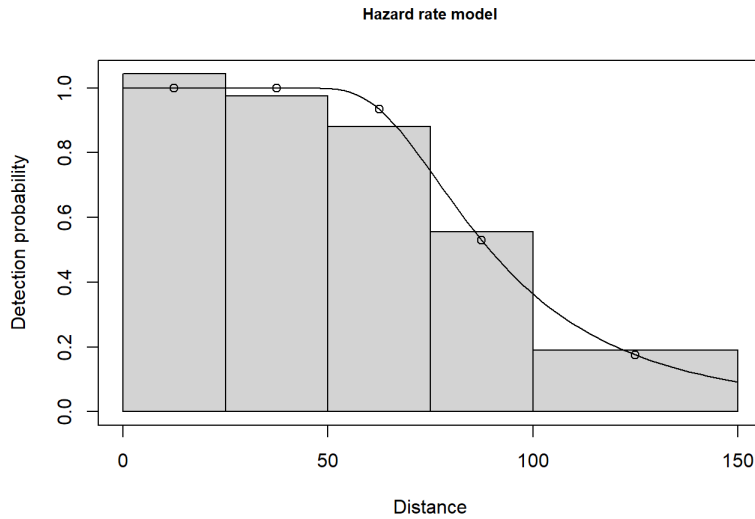


Figure 2. Histogram of observed distances for core seabird species with the estimated detection function during surveys in Kachemak Bay, Alaska, July 23 – July 27, 2021. Detection function was estimated using a hazard rate model, although other functional forms fit the data nearly equivalently. Average detection rate out to 150 m was 0.64.



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Table 1. Marine bird and mammal observation recorded on the water and in the air during surveys in Kachemak Bay, Alaska, July 23 – July 27, 2021

Common Name	Scientific Name	Number
Unidentified Bird	<i>Aves (Class)</i>	1
Unidentified Loon	<i>Gavia spp.</i>	1
Common Loon	<i>Gavia immer</i>	9
Red-necked Grebe	<i>Podiceps grisegena</i>	2
Sooty Shearwater	<i>Ardenna grisea</i>	102
Fork-tailed Storm-petrel	<i>Hydrobates furcatus</i>	30
Unidentified Cormorant	<i>Phalacrocorax spp</i>	1
Harlequin Duck	<i>Histrionicus histrionicus</i>	7
White-winged Scoter	<i>Melanitta deglandi</i>	9
Surf Scoter	<i>Melanitta perspicillata</i>	199
Bald Eagle	<i>Haliaeetus leucocephalus</i>	10
Unidentified Shorebird	<i>Charadrii (Suborder)</i>	18
Unidentified Phalarope	<i>Phalaropus spp.</i>	37
Red Phalarope	<i>Phalaropus fulicarius</i>	17
Red-necked Phalarope	<i>Phalaropus lobatus</i>	86
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	2
Unidentified Gull	<i>Larus spp.</i>	160
Glaucous-winged Gull	<i>Larus glaucescens</i>	76
Herring gull	<i>Larus argentatus</i>	8
Black-legged Kittiwake	<i>Rissa tridactyla</i>	613
Arctic Tern	<i>Sterna paradisaea</i>	102
Unidentified Alcid	<i>Alcidae (Family)</i>	10
Common Murre	<i>Uria aalge</i>	441
Pigeon Guillemot	<i>Cephus columba</i>	116
Brachyramphus Murrelet	<i>Brachyramphus spp.</i>	83
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	277
Kittlitz's Murrelet	<i>Brachyramphus brevirostris</i>	10
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	16
Unidentified Puffin	<i>Fratercula spp.</i>	2
Horned Puffin	<i>Fratercula corniculata</i>	9
Tufted Puffin	<i>Fratercula cirrhata</i>	18
Unidentified Whale	<i>Cetacea (Order)</i>	1
Killer Whale	<i>Orcinus orca</i>	4
Sea Otter	<i>Enhydra lutris</i>	464
Harbor Seal	<i>Phoca vitulina</i>	5



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Table 2: Population estimates from a hazard rate model with species-specific scale (intercept) parameters on the detection function. SE is standard error, CV is the coefficient of variation, Lower and Upper are the lower and upper 95% confidence intervals on the population estimate, respectively. Sea otter estimates were made separately from seabirds so that the detection function was not influenced by the detection function of seabirds.

Species	Population Estimate	SE	CV	Lower	Upper
Ancient Murrelet	435	378	0.87	90	2101
Brachyramphus Murrelet	470	203	0.43	191	1155
Kittlitz's Murrelet	156	73	0.47	62	395
Marbled Murrelet	4586	2024	0.44	1840	11430
Common Murre	3900	1365	0.35	1961	7757
Pigeon Guillemot	1670	771	0.46	689	4065
Sea Otter	5757	1510	0.26	3306	10026

Integration Component

Data collection methods were coordinated between the two component areas by joint training in distance sampling methods, coordination of survey data entry systems, coordination of field work plans, and holding regular meetings among the team of investigators. Data management was coordinated by development of a joint data management plan.

To support integration, the joint project organized a 1-day in person field trial workshop for the project PIs in Seward, Alaska on 8 July 2021. Our goal was to standardize survey methods and protocols to facilitate future integrated data analysis among the two regions. We conducted test surveys, distance sampling tests and coordinated the types of data we would collect during our respective surveys.

2. Products:

Peer-reviewed publications:

None at this time

Reports:



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None at this time.

Popular articles:

None at this time.

Conferences and workshops:

Hollmen, T., Maniscalco, J., Ulman, S., Tanedo, S., Schlener, J.. Demographic response of seabirds along the Kenai Fjords coast in the Northern Gulf of Alaska to a 2015-2016 marine heatwave. World Seabird Conference, October 2021.

Labunski, E., Hollmen, T., Osnas, E., Kaler, R., Kuletz, K., Maniscalco, J., Romano, M., Schlener, J., Assessing status and trends of *Exxon Valdez* oil spill injured seabirds in the Kenai Peninsula Coast and Kachemak Bay. Alaska Marine Science Symposium, January 2022.

Labunski, E., Kaler, R., Kuletz, K. A project overview at the Pacific Seabird Group Kittlitz's and Marbled Murrelet Technical Committee meeting, February 2021.

Labunski, E., Kaler, R., Kuletz, K. A project update at the Fall Gulf Watch Alaska PI Meeting, October 2021.

Public presentations:

None at this time.

Data and/or information products developed during the reporting period:

Juvenile marbled murrelet and pigeon guillemot count and distribution data, Resurrection Bay.

Population estimates for six seabird species and sea otters based on July 2021 systematic surveys along with select species distribution maps, Kachemak Bay.

Data sets and associated metadata:

We are coordinating with Axiom Data Science to archive transect location information, survey data, analysis output, and associated metadata for the project. We have created a joint data management plan and a research workspace to archive subsequent data sets to ensure comprehensive data sharing between the two project components. In addition, all finalized



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survey data will be formatted and archived in the North Pacific Pelagic Seabird Database (NPPSD) and made publicly available by the U.S. Geological Survey Alaska Science Center.

Additional Products not listed above:

None at this time.

3. Coordination and Collaboration:

The Alaska SeaLife Center or Prince William Sound Science Center

PI Hollmen is affiliated with the Alaska SeaLife Center. Research and outreach aspects of our integrated project have been closely coordinated throughout the duration of our project. Project PIs from both components conducted a 1-day in-person field test in Seward, Alaska to coordinate survey methods between the two components of the project to ensure the standardization of data collection methods, and test distance sampling protocols. The team of investigators meets throughout the year to continue close coordination of integrated efforts.

EVOSTC Long-Term Research and Monitoring Projects

PI Labunski has participated in annual meetings of the EVOSTC LTRM program, presenting updates and facilitating coordination efforts between the projects. Future discussions will explore opportunities to share and integrate data for further region-wide analysis on trends and distribution of focal species, including sea otters. We attended the Fall 2021 Gulf Watch Alaska PI meeting and presented an update to the group highlighting our projects objects and sampling schedule to seek collaborative opportunities. Marine bird and mammal data collected in this study will be available to researchers on the Northern Gulf of Alaska Long Term Ecological Research (NGA-LTER) projects. Our project will provide marine bird and mammal distribution data and population estimates to the following projects to contribute to interpreting regionwide results: Project 21120114-M, Prince William Sound Marine Bird Population Trends and Offshore Surveys; Project 21110853, Pigeon Guillemot Restoration Research in Prince William Sound; Project 21120114-C, Long-term Changes in Forage Fish, Abundance, and Body Condition in PWS; and Project 21120114-H, Nearshore Ecosystem in the Gulf of Alaska.

EVOSTC Mariculture Projects

Data will be made available to the mariculture projects in the region to assist in the development process. Finalized datasets will be archived at the Project Workspace and the publicly available North Pacific Pelagic Seabird Database.



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EVOSTC Education and Outreach Projects

PI Hollmen is on the project team for the CORaL network, facilitating close collaborations and coordination of activities between our project and the network.

The Kachemak Bay component has been in contact with the Center for Alaskan Coastal Studies based in Homer Alaska to discuss community outreach. The Center holds a biannual Kachemak Bay Science Conference highlighting research and traditional ecological information of the region. The next conference will be held in 2023 where we plan present information on our research project.

Trustee or Management Agencies

Several investigators in our project team are from the US Fish and Wildlife Service, facilitating close coordination of efforts between our project and the agency. Marine bird data collected during the 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, BOEM, NPS, and USGS) with lands and waters in the Gulf of Alaska region. We also continue coordinating field and outreach efforts closely with our partners in the Kenai Fjords National Park.

Native and Local Communities

The Resurrection Bay survey is closely linked to a community science project established in Seward in 2018, engaging local high school students in marine bird observations throughout the school year and lead by PI Hollmen. The student science education program has continued throughout the school year of 2021-2022.

In Kachemak Bay, direct community outreach efforts in 2021 were limited primarily due to COVID-19 mitigation efforts. We look forward to coordinating future outreach opportunities in native and local communities in Kachemak Bay in 2022.

4. Response to EVOSTC Review, Recommendations and Comments:



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Previous review recommendations have been incorporated into our study plan.

5. Budget:

Kenai Peninsula Coast Component

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

COMMENTS:
This summary page provides an five-year overview of proposed funding and actual cumulative spending. The column titled 'Actual Cumulative' must be updated each fiscal year as part of the annual reporting requirements. Provide information on the total amount actually spent for all completed years of the project. On the Project Annual Report Form, if any line item exceeds a 10% deviation from the originally-proposed amount; provide detail regarding the reason for the deviation.



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Kachemak Bay Component

Budget Category:	Proposed FY 21	Proposed FY22	Proposed FY23	Proposed FY24	Proposed FY25	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	\$42,500.0	\$62,933.0	\$64,821.4	\$66,765.4	\$37,704.9	\$274,724.7	\$5,384.0
Travel	\$7,440.0	\$15,300.1	\$15,696.8	\$16,105.9	\$9,773.0	\$64,315.8	\$1,342.0
Contractual	\$0.0	\$30,000.0	\$30,000.0	\$30,000.0	\$0.0	\$90,000.0	\$0.0
Commodities	\$7,495.2	\$10,635.0	\$12,774.0	\$11,317.0	\$3,500.0	\$45,721.2	\$5,474.0
Equipment	\$36,200.0	\$0.0	\$4,000.0	\$0.0	\$1,342.0	\$41,542.0	\$5,791.0
SUBTOTAL	\$93,635.2	\$118,868.1	\$127,292.1	\$124,188.4	\$52,319.9	\$516,303.7	\$17,991.0
General Administration (9% of subtotal)	\$8,427.2	\$10,698.1	\$11,456.3	\$11,177.0	\$4,708.8	\$46,467.3	N/A
PROJECT TOTAL	\$102,062.3	\$129,566.2	\$138,748.4	\$135,365.3	\$57,028.7	\$562,771.0	
Other Resources (Cost Share Funds) FWS in-kind support	\$48,144.0	\$49,408.3	\$50,710.6	\$52,051.9	\$47,433.4	\$247,748.2	
<p>COMMENTS: Actual cumulative amount summarizes the funds spend for FY21. Spending deviated more than 10% below projected amounts for FY21. Additional details provide for each spending category in the budget section of the annual report.</p> <p>This summary page provides an five-year overview of proposed project funding and actual cumulative spending. The column titled 'Actual Cumulative' must be updated each fiscal year as part of the annual reporting requirements. Provide information on the total amount actually spent for all completed years of the project. On the Project Annual Report Form, if any line item exceeds a 10% deviation from the originally-proposed amount; provide detail regarding the reason for the deviation.</p>							

Kachemak Bay component:

Personnel: Salary cost were lower than projected estimated in FY21. Some of the cost savings were associated with the shortened field season due to COVID-19. We were only able to conduct the July 2021 population estimate survey in FY21. One seasonal employee’s GS-7 salary was charged for the time that was allocated to prepare for the field and associated time conducting surveys in Kachemak Bay. Additional savings were incurred by the in-kind contribution of PWS PI salaries given the limited field season in FY21.

Travel: Travel costs were lower than projected given the shortened field season due to COVID-19. The original projected budget was allocated to support the July & August survey efforts but were only able to successfully conduct the July surveys. USFWS COVID-19 mitigation policy required any staff conducting field work to create an isolated “bubble environment” to prevent exposure to COVID-19. Therefore, we did not incur the additional projected cost to switch survey crewmember as originally planned. In addition, we were unable to send project PIs to the projected annual coordination meetings as anticipated given in-person meetings were cancelled in FY21 due to COVID-19.

Commodities: Commodities costs were lower than anticipated in FY21. The cost of upgrading the survey vessel’s electronics was lower than projected and we incurred a cost saving in this category.



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Equipment: Equipment costs were lower than projected in FY21. The primary costs savings were associated with the refurbishment of the 25' Boston Whaler survey vessel. The vessel underwent a mechanical inspection, and it was determined that only minor repairs and maintenance measures were required. Repair costs associated with the vessel's trailer were also lower given the trailer was in better condition than originally projected. Additional cost savings were associated with equipment that were unable to purchase in FY21. Some equipment that we planned to purchase was affected by supply chain issues associated with COVID-19. Our FY21 projected budget included the purchase of 2 survey laptops. We were unable to purchase these laptops in FY21 given USFWS policy requires all computer purchase be made a USFWS storefront inventory. Unfortunately, due to supply chain issues the USFWS laptop inventory has had no computers available for purchase since October 2020. We are currently on the waitlist to purchase 2 survey laptops and plan to purchase the laptops when inventory becomes available again. We have deferred purchasing some additional field equipment from FY21 to FY22 primarily to mitigate USFWS staff potential exposure to COVID-19 during the project staging phase. We were able to source the equipment for the Kachemak Bay survey from our current USFWS inventory of equipment. This equipment was made available due to the postponement of the PWS Marine Bird Survey (Project 20120114-M). We sourced equipment that would have been used on the PWS Marine Bird Survey and repurposed it for the FY21 Kachemak Bay survey. The equipment includes- salinity meter, safety equipment, a dingy for the survey vessel, vessel lines/buoys. We plan to purchase this additional equipment for the FY22 field season.

Literature Cited

Kuletz, K. J., Labunski, E. A. and S. G. Speckman. 2008. Abundance, distribution, and decadal trends of Kittlitz's and marbled murrelets and other marine species in Kachemak Bay, Alaska. Final Report (Project No. 14) by US Fish and Wildlife Service for Alaska Department of Fish and Game, State Nongame Wildlife Grant, Anchorage, Alaska.