Draft FY20 Work Plan excerpt
with reviews of the following proposal

Full FY20 Draft Work Plan available at:
www.evostc.state.ak.us

Project Number: **20200128**

Project Title: Status and Trends of Marbled Murrelet, Kittlitz's Murrelet, and Pigeon Guillemot in a Changing Northern Gulf of Alaska Ecosystem

Primary Investigator(s): Tuula Hollmen, John Maniscalco, Marc Romano, Erik Osnas

PI Affiliation: ASLC, USFWS **Project Manager:** USFWS

EVOSTC Funding Requested FY17-21: $320,900

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$160,700	$160,200

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $14,700

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$14,700	$0

Total Past EVOSTC Funding Authorized (FY17-19): $0

Total EVOSTC Funding Authorized (FY07-19) and Requested (FY20-21): $320,900

Total Non-EVOSTC Funding (FY17-21): $14,700

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 11/1/19, budget updated 11/1/19.*

We propose to study status and trends of marbled murrelet, Kittlitz's murrelet, and pigeon guillemot along the Kenai Peninsula Coast, an important concentration area for these species and a region impacted by EVOS. 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 in unknown, thus supporting the EVOSTC in assessment of their recovery status. Our study builds on data from surveys conducted in Kenai Fjords in 2006-2008 and from year-round surveys conducted in Resurrection Bay since 2011, and offers a unique opportunity to assess status of these three seabird species at a comparison site in Kenai Fjords. Our objectives 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 results will be comparable to surveys conducted in other regions, making the data usable in integrated modeling efforts in the EVOS area. Robust survey protocols provide high statistical power to detect trends, identify patterns of change, and understand determinants of habitat quality in the rapidly changing fjord environments. 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.

FY20 Funding Recommendations for Proposal Dated 11/1/19 (January 2020):

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Do Not Fund	Do Not Fund			

FY20 Funding Recommendations for Revised Proposal Dated 9/27/19 (October 2019):

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Not Reviewed	Defer to TC	Not Reviewed	Defer to TC	Deferred

FY20 Funding Recommendations for Revised Proposal Dated 8/16/19 (September 2019):

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Do Not Fund	Do Not Fund	Not Reviewed	Do Not Fund	Deferred

Science Panel Comments on Revised Proposal Dated 11/1/19 – FY20

Date: December 2019

The Panel appreciates the external and agency reviews. The external reviewers' assessments and recommendations are consistent with the recommendations that the Science Panel offered on the original proposals in September. The Panel recently reviewed the revised proposals, considered the external and agency reviewers' comments, and offers the following recommendations below. These include specific recommendations for further follow up in a FY21 proposal (see bold text below) coordinated with other murrelet researchers.

The Science Panel feels that this revision is improved over the original proposal. The Panel agrees with one of the reviewers that this project has excellent outreach and education potential with its strong linkages to the National Park Service ranger program and the Alaska SeaLife Center. The Panel reiterates the recommendation for more explicit coordination with proposal 20200130 in regard to scientific collaboration, data sharing and standardizing methods.

The Panel recommends that the proposers of this project and proposal 20200130 integrate their proposals into one proposal that addresses the concerns (see Table 1) for review for FY21. We believe that this will ensure standardization of methods and analyses, and facilitate data sharing and collaboration. Power analyses would be helpful in this regard. Considering that the same biometrician is a co-PI on both proposals, this should be fairly easy to do. The Panel also recommends that the proposers address the peer reviewers' thoughtful comments and concerns, some of these are included in Table 1.

Table 1. List of tasks that the Science Panel would like to see achieved in a consolidated revised proposal for proposals 20200128 and 20200130 to be submitted for review for FY21. This will ensure standardization of methods and analyses, ensure their adequacy for detecting trends, and facilitate data sharing and collaboration both among groups studying seabirds and between seabird groups and other EVOSTC funded projects.

Section	Task
Hypotheses	Provide more explicit hypotheses: The Panel would like to see stronger hypotheses; there are some opportunities to develop these. For example, data will be collected for other species in proposal 20200128 but there is no discussion on how these data will be used. Also, the Statistical Methods section in proposal 20200128 lists some data that will be collected on other potential covariates. This could be another opportunity for testing hypotheses.
Goals	The Panel recommends the proposers investigate the impact of gill netting on recovery to the extent possible, as suggested by external reviewer 2.
Survey methods	The survey description in proposal 20200130 cites previous published works but still requires more details for the reader who is not as familiar with these methods. The Panel agrees with the agency reviewers' questions regarding number of surveys and the lack of a power analysis.
Data analysis	Power analysis to determine the best approach to deal with the high variance of KIMU and MAMU abundance, refining sampling frequency. The Panel shares external reviewer 1's minor concern of the lack of power analysis and discussion that likely could easily be addressed.
Data analysis	Power analysis - or other statistical methodology - for trend data to determine how many surveys and how many years' data are needed to detect a trend: One of the objectives in this proposal and in proposal 20200130 is to detect population trends. Have the PIs determined if five years of data is enough to detect a trend? If this is not sufficient time to detect a trend, the Panel then wonders about the value of these data. Specifically, what are the biological implications if regional differences in trends are, or are not detected. The Panel agrees with external reviewer 1's concern of being able to compare data over space and time; this is extremely important.
Data analysis	Address and discuss other factors that can affect the interpretation of the HY: AHY ratio to estimate murrelet productivity. The Panel shares external reviewer 1's concerns about the use of the HY:AHY ratio to estimate productivity for all proposals. This ratio seems to be standard practice, but its validity depends on some key assumptions. For instance, it can be influenced by high adult mortality, making productivity seem higher than it really is. However, the Panel recognizes that this ratio could be a useful indicator particularly when used in combination with abundance trends, provided that statistical tests of trends have sufficient statistical power to detect trends.
Data integration	Explicit integration with other trophic levels (and respective projects), especially forage fish. The Panel feels that integration with other trophic levels was weak, especially with (forage) fish.
Data integration	Strengthen stated connections with the herring and GWA programs. The Panel felt that the stated connections with the herring and GWA programs were minimal.

Collaboration	Build upon mentioned collaborations with M. Kissling and work done by K. Nesvacil. As one of the reviewers mentioned, there is an opportunity to collaborate with other researchers studying murrelets (M. Kissling and K. Nevascil). The Panel would like to see these collaborations described in more detail.

Science Director Comments on Revised Proposal Dated 11/1/19 – FY20

Date: January 2020

I concur with the Science Panel's comments and recommendation. Combining this proposal with proposal 20200130 will facilitate standardization of methods and analyses as discussed to allow for meaningful analyses and comparisons between locations. The budgets for the two projects can remain segregated within a coordinated proposal. In summary, I recommend combining this project with 20200130 into one proposal which addresses the reviewers' and Science Panel's concerns for submission and review for FY21.

PAC Comments on Revised Proposal Dated 11/1/19 – FY20

Date: February 2020

The PAC will meet on February 25, any comments will be posted after the meeting.

Executive Director Comments on Revised Proposal Dated 11/1/19 – FY20

Date: February 2020

Science Director Comments on Revised Proposal Dated 9/27/19– FY20

Date: October 2019

The PIs have adequately addressed the Science Panel and Science Coordinator's concerns and submitted a revised the proposal as requested by individual Trustees. The PIs provided clarification on Objective 4, that the camera study for nesting birds is being treated as a "proof-of-concept" study to prove the utility of these monitoring methods for application in other remote regions of concern in Alaska. While the PIs provide justification for the camera study in their response and also have considerable experience in remote monitoring techniques of marine animals in Alaska, the nesting pigeon guillemot camera study was removed from the proposal as suggested. The PIs provide a sufficiently detailed description of the structure of the models in the revised proposal as requested. The revised proposal is strengthened and together with the existing long-term dataset, will allow this project to assess the status and trends of these three species that have not recovered from EVOS.

Science Panel Comments Proposal Dated 8/16/19 – FY20

Date: September 2019

The Science Panel viewed this as the strongest of the three murrelet proposals we reviewed. The Science Panel recognizes the value of assessing the status and trends of these three species but was concerned both about the details of the monitoring efforts in this proposal and the nesting observation. Objectives 1-3 on monitoring distribution and abundance seemed attainable. The methods were well described and likely to yield the desired information. The existence of prior data will allow this project to assess the status and trends quickly rather than waiting for a new long-term dataset to emerge. Though statistical methods for these objectives were generally well described, the

Science Panel did not fully understand the structure of the models that were to be compared by AICc and would request more explicit description to evaluate their utility.

PI Response (9.27.19)
We would like to thank the Science Panel and Science Coordinator for their thoughtful comments on our proposal. Our responses are inserted below, and revisions to address these comments are included in our revised proposal. We have revised the first paragraph in Section C (Data Analysis and Statistical Methods) to provide a more detailed description of the structure of the models.

The Science Panel had stronger concerns about Objective 4. We agree that the data would be valuable but are concerned about the methods used to obtain the data. For example, how feasible is it to climb trees to place cameras near nests and without disturbing birds?

PI Response (9.27.19)
In the past, most marbled murrelet nesting activity has been monitored through repeated (sometimes daily) site visits, including repeated tree climbing, by researchers whose studies have resulted in the acquisition of highly important data regarding murrelet nesting behavior, success and failure (e.g., Nelson and Hamer 1995; Nelson and Peck 1995). The use of modern technology in the form of HD trail cameras at marbled murrelet nest sites offers the opportunity to collect much more detailed (24/7) information with minimal disturbance because no repeat visits will be necessary after cameras have been placed. Cameras will only be retrieved after the fledging season. With only one site visit early in the season for camera placement, disturbance will be minimal and is not expected to result in any lasting effects on the murrelets. Although this technology is new, PIs on this proposal have several years of experience successfully collecting data on nesting seabirds and marine mammals in the proposed study area using a variety of remote still- and video-imagery.

How experienced are the investigators at doing this to ensure success?

PI Response (9.27.19)
Co-PI JM has extensive experience scaling old growth trees with tree spikes, harnesses, and other safety equipment. He is also very familiar with nesting habitat and related behavior of murrelets in forested areas. Movement in trees will be slow, methodical, and stealthy.

How often do batteries have to be replaced in cameras?

PI Response (9.27.19)
We use new Lithium Ion batteries in our cameras each season which last 3-5 months while recording >1000 images. Therefore, battery replacement will not be necessary during the entire nesting season.

The Science Panel suggests that this objective be removed from the proposal or more clearly justified (including assurance that sample sizes of observations will be sufficient to provide robust estimates).

PI Response (9.27.19)
While the research team has considerable experience in remote monitoring techniques of marine animals in Alaska, the application of these methods to nesting murrelets is new and being treated as a 'proof-of-concept'. Proving the utility of these monitoring methods will provide more detail on logistics to obtain sample sizes, ability to provide robust estimates of nesting activity, and their applicability in

other remote regions of concern in Alaska. We have removed the nest monitoring component from objective 4 of our revised proposal.

Science Coordinator Note (9.27.19): PIs provide details regarding the procedural and scientific Methods, data Analysis and statistical methods for Objective 4: Monitor nesting of marbled murrelet and pigeon guillemot in Kenai Fjords and Resurrection Bay that is not included in this work plan. Please contact the EVOSTC office for more information.

Objective 6 was viewed by the Science Panel as being too vague and were left with the feeling that the integration of these data would be left to others unnamed in the proposal. Who's doing the population modeling and how would that be accomplished?

PI Response (9.27.19)
We have removed Objective 6 from our revised proposal and clarified in the project narrative that our goal is to provide data that can be integrated in data analyses of broader scope. Robust sampling method used in this project provide data that enable integration of results to surveys conducted at other locations, however, such integrated modeling efforts are beyond the scope of this proposal.

The panel was pleased by the many proposed connections to other EVOSTC projects (including the herring program), agencies and tribes.

PI Response (9.27.19)
We appreciate the feedback and would like to thank the reviewers again for the thoughtful comments.

The panel felt that a single comprehensive monitoring-focused project across the region could be of value. The Trustees may want to consider requesting a single comprehensive monitoring-focused project across the regions in the three proposals that does not include the nest monitoring due to high costs, feasibility issues and limited sample sizes.

Science Director Comments Proposal Dated 8/16/19 – FY20
Date: September 2019

I concur with the Science Panel's comments.

PAC Comments Proposal Dated 8/16/19 – FY20
Date: October 2019

The current term PAC members are in the process of being seated and thus a PAC meeting was not held in 2019.

Executive Director Comments Proposal Dated 8/16/19 – FY20
Date: October 2019

I concur with the recommendations of the Science Panel and Science Director.

Science Director Comments on Revised Proposal Dated 9/27/19– FY20
Date: October 2019

The PIs have adequately addressed the Science Panel and Science Coordinator's concerns and submitted a revised the proposal as requested by individual Trustees. The PIs provided clarification on Objective 4, that the camera study for nesting birds is being treated as a "proof-of-concept" study

to prove the utility of these monitoring methods for application in other remote regions of concern in Alaska. While the PIs provide justification for the camera study in their response and also have considerable experience in remote monitoring techniques of marine animals in Alaska, the nesting pigeon guillemot camera study was removed from the proposal as suggested. The PIs provide a sufficiently detailed description of the structure of the models in the revised proposal as requested. The revised proposal is strengthened and together with the existing long-term dataset, will allow this project to assess the status and trends of these three species that have not recovered from EVOS.

FY20 EVOSTC NEW PROJECT PROPOSAL

Does this proposal contain confidential information? ☐Yes ☒No

Project Number and Title

20200128 Status and trends of Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem

Primary Investigator(s) and Affiliation(s)

Tuula Hollmen, PI, Alaska SeaLife Center and University of Alaska Fairbanks

John Maniscalco, Co-PI, Alaska SeaLife Center

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

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

Date Proposal Submitted

August 16, 2019 *Revised November 1, 2019*

Project Abstract

We propose to study status and trends of marbled murrelet, Kittlitz's murrelet, and pigeon guillemot along the Kenai Peninsula Coast, an important concentration area for these species and a region impacted by EVOS. 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 in unknown, thus supporting the EVOSTC in assessment of their recovery status. Our study builds on data from surveys conducted in Kenai Fjords in 2006-2008 and from year-round surveys conducted in Resurrection Bay since 2011, and offers a unique opportunity to assess status of these three seabird species at a comparison site in Kenai Fjords. Our objectives 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 results will be comparable to surveys conducted in other regions, making the data usable in integrated modeling efforts in the EVOS area. Robust survey protocols provide high statistical power to detect trends, identify patterns of change, and understand determinants of habitat quality in the rapidly changing fjord environments. 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.

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

FY20	FY21	FY22	FY23	FY24	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:

FY20	FY21	FY22	FY23	FY24	TOTAL
14,690					

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

1. PROJECT EXECUTIVE SUMMARY

This study will focus on status and trends of seabirds that are considered not recovering or have an unknown recovery status from the Exxon Valdez oil spill (EVOS). This study will address three injured resources: marbled murrelet (*Brachyramphus marmoratus*), Kittlitz's murrelet (*Brachyramphus brevirostris*), and pigeon guillemot (*Cepphus columba*). These species were impacted by direct mortality following the spill. 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 considered to be not recovering from the effects of the spill (EVOSTC 2014). An estimated 5-10% of the world population of Kittlitz's murrelets died as a result 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. Furthermore, recent warm water anomalies during 2015-2016 (the "Blob") have been linked to large scale mortality events and decreased productivity of seabirds in the Gulf of Alaska.

In Alaska, recent surveys have indicated population declines (75-90%) of Kittltz'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 marbled murrelet is also of conservation concern, due to declining populations in core nesting areas (Piatt et al. 2007, Kuletz et al. 2008).

Our proposed 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 populations in Prince William Sound have declined by an estimated 67% since the 1970s (Agler 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. 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.

We propose a study of 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. 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 in unknown, thus supporting the EVOSTC in assessment of their recovery status. 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.

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. We will create long-term data sets on abundance and productivity, 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 proposed study will provide new data for integrated analyses of seabird status and recovery in the spill area.

2. PROJECT HISTORY

This is a new project.

3. PROJECT DESIGN

A. Objectives

Our overall goal is to provide information about current population size and trends in abundance, distribution, and productivity of seabird species impacted by EVOS but not considered recovered to date: marbled murrelet, Kittlitz's murrelet, and pigeon guillemot. We propose to investigate decadal trends of the study species in dynamic tidewater glacier habitats by replicating Kenai Fords -wide murrelet surveys most recently conducted in 2006-2008; investigate patterns in seasonal abundance and distribution by building on the only year-round marine bird survey conducted in Alaska; and estimate trends in productivity. We will also provide recommendations for future monitoring of these seabird species in our study area, as a comparison site to other studies conducted in the region.

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 and trends in distribution and relative abundance for pigeon guillemot in the Resurrection Bay
4. Estimate productivity of marbled murrelet and pigeon guillemot in Kenai Fjords and Resurrection Bay
5. Develop recommendations for future monitoring of population size and abundance patterns in Kenai Fjords

Murrelet surveys in Kenai Fjords were most recently conducted in 2006-2008, using a robust survey method. Since then, the Gulf of Alaska has experienced a large scale warming event, unprecedented seabird die-offs, and changes in tidewater glaciers. Our ability to replicate the surveys conducted in 2006-2008 will provide a timely reassessment of status and trends in an important concentration area for these species. Replication of robust survey methods offers high power to detect trends, and spatial analysis of density patterns offers timely information about temporal change in distribution and insights into drivers of change. Additionally, we will generate new information about productivity and trends in productivity. Trends in productivity is considered an indicator of recovery status for murrelets and pigeon guillemot, and the Restoration Plan (2014) identifies needs for more information on productivity to support with assessments of recovery status. Finally, the robust

sampling methods employed (distance sampling and systematic, random design) will provide data that enable integration of results to surveys conducted at other locations and can be used in integrated analyses of status and recovery of the species in the spill area.

B. Procedural and Scientific Methods

1. Estimate current population size for Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in Kenai Fjords, and determine decadal trends in abundance for murrelets

   To estimate current population size and characterize current distribution of *Brachyramphus* murrelets in Kenai Fjords we propose to conduct coast-wide, small-boat surveys for Kittlitz's and marbled murrelets, and pigeon guillemot during their summer breeding season. Using a systematic survey design established by Arimitsu et al. (2011) we will conduct a coast-wide survey during the middle of the murrelet breeding season (late June to mid-July). Transects will cover an area from Nuka Bay in the west to Bear Glacier, Resurrection Bay in the east. By following the survey design established by Arimitsu et al. (2011) our results will be directly comparable with the result of their previous work.

   We will also survey a subset of the coast-wide transects located in areas of high Kittlitz's murrelet density (Aialik Bay and Northwestern Fjord/Harris Bay) during the early (late May to mid-June) and late (early to mid-August) portions of the breeding season (breeding phenology for Kittlitz's murrelet is based on Day 1996).

   Based on previous work in our study area showing that Kittlitz's murrelet density and distribution vary in relation to marine sills and distance to shorelines (Van Pelt and Piatt 2003, Arimitsu et al. 2011), we will separate our survey into four strata a priori based on the location of the transect. Transect will be classified as either coastal (<200 m from shore) or offshore (>200 m from shore) and either inner bay (north of marine sills in Aialik Bay and Northwestern Fjord) or outer bay (south of marine sills and in all other bays other than Aialik Bay and Northwestern Fjord).

   We will use the same transects utilized by Arimitsu et al. (2011), including coastal transects that were created by dividing the coastline into 4 km segments (from a random starting point) using GIS software, and offshore transects composed of parallel lines running from east to west, spaced every 0.93 km (30" of latitude), within each major bay along the Kenai Fjords coast. From the random starting point, one of every three coastal segments and one offshore line every 3.7 km (2' of latitude) were systematically selected for inclusion in the survey. Because historical surveys indicated that Kittlitz's murrelet distribution was generally restricted to the upper sections of Aialik Bay and to the Northwestern Lagoon (Van Pelt and Piatt 2003, Arimitsu et al. 2011), survey coverage will be increased by spacing offshore transects every 1.8 km (1' of latitude) in those two areas (the inner bay strata defined above).

   Surveys will be conducted following methods outlined by Gould and Forsell (1989), with modifications for working in coastal nearshore waters from small boats (Agler et al. 1998) and for counting flying birds continuously (Raphael et al. 2007). We will use line transect sampling, estimating perpendicular distance to murrelets to the nearest meter within a maximum of 150 m forward and 300 m lateral to the transect line. Before each survey, observers will complete training in distance estimation that will include a combination of calibrating estimates with measurement of distances to fixed objects using rangefinders on fixed objects and estimation of distances to bird-sized buoys strung at known distances on a line towed behind the vessel.

Shoreline transects will be conducted approximately 100–150 m from shore or in the shallowest navigable waters, depending on the vessel size. Ground speed while conducting surveys will generally be held between 10 and 20 km/h, although survey crews will have the option to slow the vessel as needed to confirm the identification of murrelets.

We will count all murrelets and guillemots and identify them to species whenever possible. Identification of *Brachyramphus* murrelets can be challenging so experienced observers will be used, and training will be conducted prior to the surveys. All observed murrelets and guillemots will be assigned a behavior code depending on whether they are sighted on the water or flying within the transect. We will record juvenile murrelets when they can be positively identified. We will record all sightings using a real-time computer data-entry system that will log sightings, with their position coordinates, continuously. Weather and sea state will be constantly monitored and surveys will be ceased if wave height exceeds 0.5 m.

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

   Distribution of murrelets will be characterized based on survey data obtained for objective 1. We will estimate within-season densities using methods described in Kissling et al. (2007) and Arimitsu et al. (2011) and correcting for imperfect detection using spatial distance sampling (Miller et al. 2013). The spatial density estimates will be computed in program DISTANCE (Thomas et al. 2010) through the R package dsm (Miller et al. 2019). We will compare historical distribution within and among fjords to current distribution, separating within year spatial variation from long-term trends in habitat hotspots and hotspots of change (e.g., Kissling et al. 2007). We will incorporate a suite of spatially explicit covariates with spatial density analyses to explore factors influencing abundance patterns within and among fjords. The suite of covariates includes: fjord, year, season/Julian date, time of day, distance to glacier, distance to sill, depth, ice cover, tidal stage, tidal current velocity, sea conditions, turbidity, salinity, and temperature. Depth will be considered a surrogate for prey availability. Sill*tide stage interaction and tidal current velocity are considered as proxies of murrelet forage conditions (euphasiids and forage fish, respectively) (Kissling et al. 2007, Arimitsu et al. 2010). Marine habitat data will be collected in conjunction with seasonal fjord surveys, and in collaboration with other ongoing research projects. At start of surveys, we will record depth, sea conditions, ice cover, tidal conditions, and oceanographic measurements (turbidity, salinity, temperature).

3. Estimate current population size and trends in distribution and relative abundance of marbled murrelet and pigeon guillemot in Resurrection Bay

   Since 2011, nearshore surveys have been conducted monthly along a 44 km route in Resurrection Bay in the only year-round marine bird survey in Alaska. Surveys involve a driver and two observers. The vessel travels approximately 100 m from the shore at a speed of 7-14 km/hour, and all birds within a 200 m wide swath from the coast are counted. Surveys are conducted in sea conditions of 3 or less of Beaufort scale. Weather data is recorded at the start of each transect; seas (feet), wind (knots), cloud cover (%), and precipitation. For each bird sighting we record GPS coordinates (latitude/longitude), species, age, sex, location (inshore/offshore), distance from boat (0-50m or 50-100m), and behavior (on water, flying, on land, on floating object, or feeding). All data are collected using CyberTracker (v3.263) on a NAUTIZ X 7 handheld device (Handheld Group, Corvallis, OR).

Pigeon guillemot is a seasonal occupant in Resurrection Bay, with birds arriving in March-April and present until October. Marbled murrelet is a year-round occupant. Results since 2011 indicate changes in seasonal abundance of marbled murrelet, suggesting a decline during the summer seasons of 2017-2019 (Figure 1.).

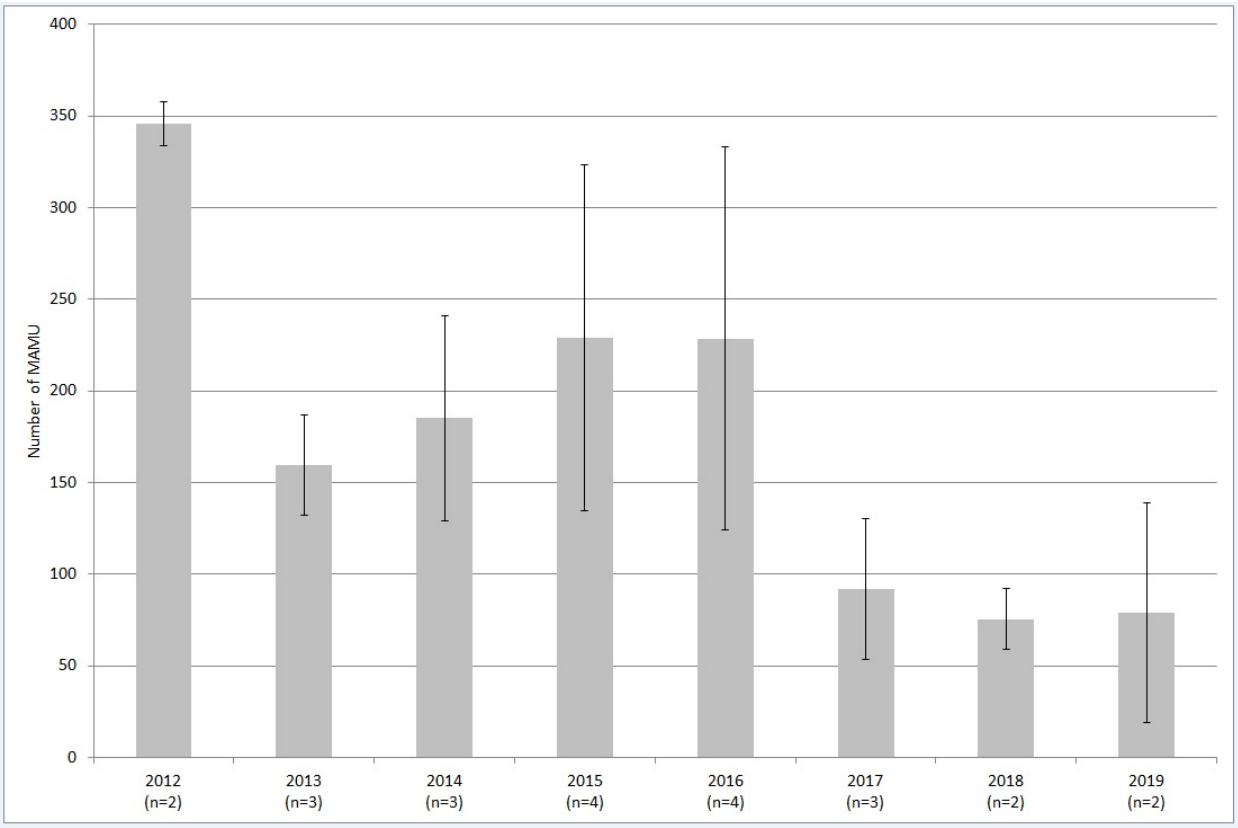

Figure 1. Marbled murrelet counts in Resurrection Bay 2011-2019.

Building on the existing survey data, we propose to generate a 14-year (2011-2024) data set on seasonal abundance and distribution of marbled murrelet and pigeon guillemot in Resurrection Bay. We will incorporate distance sampling to estimate current population size in the bay, and characterize seasonal patterns of distribution and relative abundance using the long-term data set. The survey period includes years of recent warm water anomaly in the Northern Gulf of Alaska, allowing us to explore potential influences of a warming event on murrelets and guillemots. As mentioned before, the lowest summer season count of marbled murrelet observed to date coincide with the warming event and reproductive failures documented for common murre (*Uria aalge*) and black-legged kittiwake (*Rissa tridactyla*) in the area (Hollmen et al. 2017). Continuing surveys will extend the data set to cover the current period of the dissipating warm water anomaly. We also propose to expand studies in Resurrection Bay to estimate productivity of marbled murrelets and pigeon guillemots by conducting intensive fledgling surveys, and establishing nesting studies as described in objective 4. The Resurrection Bay survey effort will be leveraged from funding and partnership with the National Park Service.

4. Estimate productivity of marbled murrelet and pigeon guillemot in Kenai Fjords and Resurrection Bay

Marine surveys provide an option for investigating reproductive performance of marbled murrelet and pigeon guillemot, using a ratio of juvenile-to-adult birds at sea during the fledgling and early juvenile period

as an index of productivity (Kuletz and Kendall 1998). Notably, the ratio does not provide a measure of fledglings per breeding pair, due to unknown proportions of breeding vs non-breeding after hatch year birds accounted in surveys.

We will conduct marine surveys and juvenile-to-adult age ratio counts during the fledging and early juvenile period to obtain an index of productivity. Identification of hatch-year birds will be based on plumage and behavioral characteristics (Kuletz and Kendall 1998, Kuletz et al. 2008, Arimitsu et al. 2010, Corcoran 2015) and each bird sighting will be categorized as definite AHY (after hatch year), probable AHY, probable HY (hatch year), or definite HY. Attempts will be made to photograph all probable or definite HY birds in order to provide additional support for age-class confirmation. Surveys will be conducted at weekly intervals throughout the fledgling and early juvenile season in July-August along the inner and outer Resurrection Bay coastline. For each survey, we will calculate a HY:AHY ratio and percentage of juveniles in the population following methods in Kuletz and Kendall (1998). Survey data from pre- and early incubation period will be available to represent counts of locally breeding adults as described in Kuletz and Kendall (1998). We will assume that HY birds recorded in Resurrection Bay originated from nests in the area.

5. Develop recommendations for future monitoring of population size and abundance patterns in Kenai Fjords

   Our project will deliver the first replication of statistically robust surveys conducted in 2006-2008, and analysis of trends and changes in spatial distribution specific to Kenai Fjords. The outcomes will facilitate recommendation for scope and frequency of future monitoring efforts to monitor population size, trend, and distribution of Kittlitz's and marbled murrelet in Kenai Fjords. Results from this project provide information to determine sample sizes and survey intervals for future monitoring of murrelet trends in Kenai Fjords, with desired power to detect a specified change.

C. Data Analysis and Statistical Methods

We will calculate annual population estimates of Kittlitz's, marbled and all *Brachyramphus* murrelets combined, along with pigeon guillemot, in the program DISTANCE (Buckland et al. 2001, Thomas et al. 2010), using line transect methods for birds on the water and strip transect methods for flying birds. We will separate the analyses by behavior (on water or flying) because flying birds are more conspicuous than birds on the water, and we therefore assume that all flying birds will be detected to a maximum distance of 100 m. We will estimate detection functions for all on water seabird observations combined using half- normal and hazard-rate keys with cosine, polynomial or Hermite adjustment terms and include species (marbled murrelet, Kittlitz's murrelet, unknown murrelet, or pigeon guillemot) as a covariate for the detection function. Weather (percent cloud cover and precipitation) and sea state (Beaufort scale and wave height) covariates also will be included as main effects and, for those that prove to be important on average, will be included as interaction effects with species so that the detection function can vary by species and weather or sea state if justified by the data. The full candidate set of models, then, includes two key functions, three adjustment terms, and all main and a limited number of 2-way interactions between species and weather or sea state. We will also include a full model with all main effect and 2-way interactions. We will select the most parsimonious model based on Akaike Information Criterion. Following Kissling et al. (2007), we will assume the probability of detection on coastal transects is the same as that of the offshore transects, in the respective stratum (inner bay and outer fjords). We will fit detection functions for offshore observations to a maximum distance of 300 m (i.e. the maximum distance for which birds will be counted). For each of four geographic strata, we will calculate variances empirically, using the mean group size, and determine within-stratum confidence intervals using a non-parametric bootstrap (Efron and

Tibshirani 1986). For each behavior, we will calculate density as the mean of stratum density weighted by stratum area, and population size as the sum of stratum density multiplied by stratum area. We assume independence between observations, and therefore will sum behavior-specific estimates of population size and variance to estimate total population size and variance (Cochran 1977).

We will estimate within-season densities for the subset of transects that will be repeated during each survey period (early, middle, late) in Aialik Bay and Northwestern Fjord/Harris Bay. For each survey, we will estimate a detection function for all *Brachyramphus* murrelets combined, and for Kittlitz's murrelet, marbled murrelet, and pigeon guillemot individually, on offshore transects included within the subset. We will compute stratified density estimates using a uniform key and cosine adjustment in the program DISTANCE (Thomas et al. 2010).

Spatial density maps will be produced using the 'two-stage' spatial density estimation method (Miller et al. 2013, 2019). In the first stage, standard distance sampling is used to estimate a detection probability along strip transects (described above). The detection probability then serves as an offset in a generalized additive model (GAM, Wood 2017) to estimate a spatial density surface and the effect of other covariates on counts (Miller et al.2013). Variance of estimates across both stages is then propagated using a parametric bootstrap procedure. Covariates (described above) will be included to describe density and the change in density within and between years. Specifically, we will use the GAM to explore changes in the density surface as a function of time to estimate temporal variance within and between years (e.g., Kissling et al. 2007). Long term changes in density will be estimated as an average effect of study (Arimitsu et al. 2011 versus that proposed here) and shorter term variance will be estimated as random effect variation within a study across years and as a spatial smooth of date within a season, including examining space-by-time interactions (e.g., Kissling et al. 2007).

Methods applied to coastal transects in Kenai Fjords will be followed to estimate seasonal abundance patterns in Resurrection Bay over a 14-year period (2011-2024). Species specific detection functions to be estimated in the present study will inform past survey data that has relied on within-season replicate surveys to assess variation in count data. Transect densities (birds/km2) will be used to estimate overall nearshore abundance in upper Resurrection Bay. Data will be log-transformed to estimate long-term (14-year) trends in relative seasonal abundances of the three focal species with simple regression analysis.

Productivity indices based on fledgling surveys are calculated using methods described in Kuletz and Kendall (1998). For each year, core survey period will be selected based on criteria in Kuletz and Kendall (1998), and HY:AHY ratio will be examined. We will explore relationship between densities of HY birds and AHY birds using regression analysis and trends using models described in Gerrodette (1987) and Kuletz and Kendall (1998).

D. Description of Study Area

The study will take place in the northern Gulf of Alaska along the southeast Kenai Peninsula coast. The study area is located within the spill area, and covers coastal areas of the Kenai Fjords from Cape Resurrection to Gore Point (Figure 2.). The north, east, south and west bounding coordinates are approximately 60.2475, -149.2892, 59.2784, and -150.8995. The study area contains fjords with tidewater glaciers (Aialik Bay, Northwestern Fjord, and McCarty Fjord), deglaciated fjords (Resurrection Bay and Nuka Bay), a convoluted coastline, and numerous islands. The study area encompasses state and federal lands (including the Alaska Maritime National Wildlife Refuge and the Kenai Fjords National Park). These fjords generally run north-south with open exposure at their southern entrances and island sites which are largely influenced by the physical conditions in the Gulf of Alaska.

The contrasting habitats throughout the study area including deepwater fjords with varying degrees of glaciation/deglaciation and protected riparian versus open marine influences offer opportunities to investigate preferred habitats of selected species and potential changes that will occur with further glacial recession. In these fjord systems, shallow marine sills mark former submerged glacier termini and separate ocean basins into inner and outer fjords. The outer fjords are exposed to the oceanic conditions of the Gulf of Alaska, while the inner fjords are somewhat estuarine and influenced by runoff from glaciers extending from the Harding Icefield. The uplands at the head of Resurrection Bay possess old-growth forest that provides nesting habitat for marbled murrelet both near the bay and up to at least 15 km inland; whereas, the uplands of Aialik, Northwestern, and McCarty Fjords have not yet developed old-growth cover and are likely nesting areas for Kittlitz's murrelet. Pigeon guillemot nest in rocky areas along much of the coastline and islands of the inner and outer fjords. All of these differing habitats within our overall study area will provide a rich ecological dataset for interesting comparisons and contrasts among the three seabirds in the proposed study.

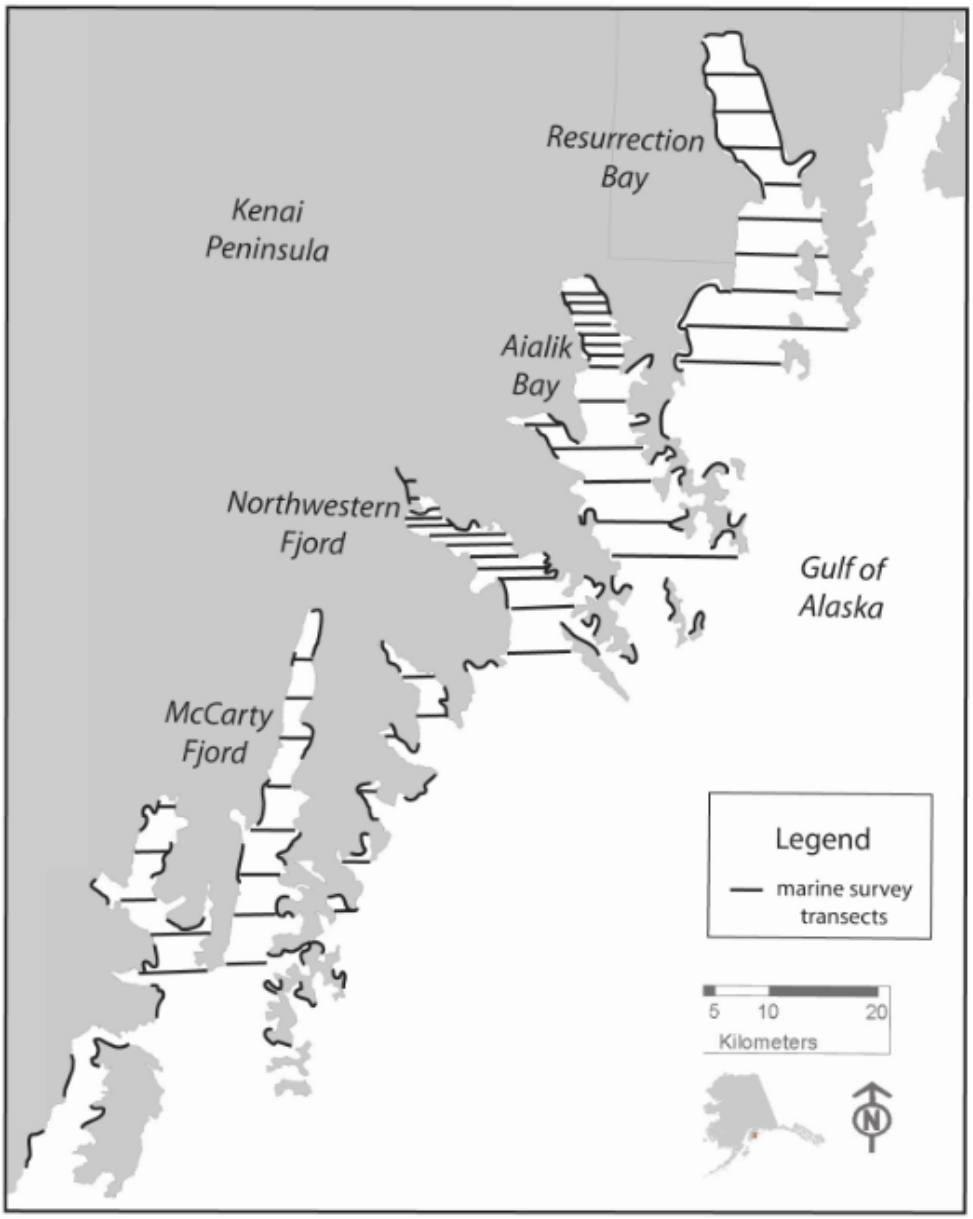

Figure 2. Map of the study area showing proposed survey transects.

4. COORDINATION AND COLLABORATION

A. Within an EVOSTC Funded Program

Gulf Watch Alaska

Our study area overlaps with sampling areas for the Gulf Watch program. We will coordinate on field logistics, data collection, and data sharing. Nearshore GWA PIs (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.

Herring Research and Monitoring

We will coordinate with the Herring Research and Monitoring program on field plans, data collection, and data sharing to build research and logistical synergies between our proposed project and ongoing research. We will offer our data on seabird diet deliveries, and will coordinate any potential sampling opportunities during our field work. Areas of shared interest include information about juvenile and specific age class herring in seabird diet samples, and energy content of herring. We have coordinated with PI Gorman on sharing of data and sampling opportunities.

Data Management

We will provide all data from our project to EVOSTC funded Data Management initiatives.

B. With Other EVOSTC-funded Projects

We will collaborate with Elizabeth Labunski (Proposal title: Status and recovery of Kittlitz's and marbled murrelets within an EVOS affected area, Kachemak Bay) and will coordinate survey efforts and methods to facilitate site comparisons with data on murrelet abundance and productivity indices. We will also explore opportunities to organize a workshop to discuss and further facilitate integration of data collection and analyses of population trends, productivity, and environmental factors among study areas.

Through collaboration with Robin Corcoran of the Kodiak National Wildlife Refuge, we plan to share results with FY20 proposed project "Population trends and nesting ecology of the marbled murrelet in the Kodiak Archipelago". With study-designs emphasizing marine surveys and productivity, both projects will contribute to a geographically broad examination of stressors influencing marbled murrelets within the EVOS zone. Specifically, we plan to share post-hoc evaluations of raw data collected and population trends between projects. By comparing population trends observed in Kenai and the Kodiak Archipelago we can determine which stressors are unique to each environment and which are influencing murrelets at broader scale. Additionally, archives of samples collected from adults (collected during at-sea captures) and nestlings (opportunistically collected at nest sites) can be used for diet estimation and comparison among sites. This collaboration will provide valuable information on region-wide status of marbled murrelet and help identify the scale of threats to the species.

Additionally, ongoing research by University of Alaska Fairbanks (Seward Line and Long-Term Ecological Research site) will provide substantial synergies 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.

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, and with whom we will partner on both research and public outreach components of the project. Our surveys that count all species of seabirds will provide added value to the refuge by providing data on at-sea abundance of tufted puffin, a species recently identified for a Species Status Assessment.

The USFWS Alaska Region Migratory Bird Management Office supports this project, and we will collaborate and coordinate with them on methods, data collection, and data sharing. The project addresses several goals prioritized in the Kittlitz's Murrelet Conservation Action Plan published by the USFWS Migratory Bird Management Office in 2009.

Kenai Fjords National Park 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 Park Service 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 synergistic with the proposed project. Our contact with Kenai Fjords National Park is Shauna Potocky.

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

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 of the fjords, and we are coordinating collaborations on data collection and sharing with PIs Esler (USGS) and Kurtz (NPS).

The ADFG supports the 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 the 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.

D. With Native and Local Communities

The Alaska SeaLife Center, the Alaska Maritime National Wildlife Refuge, and the Kenai Fjords National Park, are partnering to engage the public and local communities through diverse outreach, education, and community science programs.

With the Alaska Maritime National Wildlife Refuge, 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 Alaska Maritime National Wildlife Refuge monthly newsletter.

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 has the ability to reach thousands of visitors and to 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 has the ability to reach an additional one thousand students. In total, Kenai Fjords National Park programming reached 321,596 visitors in 2018.

Researchers at the Alaska SeaLife Center will continue 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 delivers class room 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.

5. DELIVERABLES

Data and metadata: survey count data, habitat variable data, still photo imagery.

Data products: Population size and density estimates, productivity estimates, bird distribution patterns, population trend estimates, phenology.

Reports, publications and presentations: Annual and final programmatic reports, anticipated three peer-reviewed publications, presentations at conferences including the Alaska Marine Science Symposium.

Outreach and education products: Project website, interpretative ranger talks, distance education module, school lesson plan module, project highlight updates in AMNWR Newsletter, project presentations at Kachemak Bay Shorebird Festival, Seward Seabird Festival, and Homer Discovery Labs.

6. PROJECT STATUS OF SCHEDULED ACCOMPLISHMENTS

Project milestone and task progress by fiscal year and quarter, beginning February 1, 2020. Yellow highlight indicates proposed fiscal year Work Plan. Fiscal Year Quarters: 1= Feb. 1-April 30; 2= May 1-July 31; 3= Aug. 1-Oct. 31; 4= Nov. 1-Jan 31.

	FY20				FY21				FY22				FY23				FY24			
Milestone/Task	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	X	X			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	X	X			X	X			X	X			X	X			X	X		
Surveys	X	X	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
Nesting parameters																	X	X	X	X
Reporting																				
Annual reports					X				X				X				X			
FY work plan			X				X				X				X				X	
Final report*																				X
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

*Final report date of submission as specified in grant agreement.

7. Budget

Budget Forms are attached.

Sources of Additional Funding:

A grant from the National Park Service will support seasonal coastal surveys in outer Resurrection Bay during the first project year ($14,690). These surveys will contribute complementary data to nesting area surveys, and nearshore surveys in 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 $5,105,00 (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.

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9. Project Personnel

Curriculum vitae for senior personnel is provided.

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Short Curriculum Vitae

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EDUCATION

Ph.D., Physiological Ecology, University of Helsinki, Helsinki, Finland (2002)
D.V.M., University of Helsinki, Helsinki, Finland (1992)

PROFESSIONAL INTERESTS

Physiological ecology, marine ornithology, marine ecology, conservation biology, decision analysis

PROFESSIONAL EXPERIENCE

Research Associate Professor of Marine Science (University of Alaska Fairbanks) (2005-)
Research Assistant Professor of Marine Science (University of Alaska Fairbanks) (2002-2005)
Visiting Scientist, U.S. Geological Survey, National Wildlife Health Center,WI (1997-2002)
Assistant Professor of Basic Veterinary Sciences (University of Helsinki) (1992-1996)
Visiting Scientist, National Biological Survey, Pacific Islands Science Center, HI (1994)

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Nichols, J.D., Hollmén, T.E., and J.B. Grand. 2016. Monitoring for the Management of Disease Risk in Animal Translocation Programmes, EcoHealth DOI: 10.1007/s10393-015-1094-4.

Sethi, S.A. and T.E. Hollmén. 2015. Conceptual models for marine and freshwater systems in Alaska: Flexible tools for research planning, prioritization, and communication. Arctic 68:422-434.

Ulman, S.E.G., Hollmén, T.E., Brewer, R., and A.H. Beaudreau. 2015. Predation of seabirds by Pacific cod Gadus macrocephalus near the Aleutian Islands, Alaska. Marine Ornithology 43:231-233.

Hollmén, T.E., and J.C. Franson. 2015. Infectious Diseases, Parasites, and Biological Toxins. In: Sea Ducks in Ecology and Conservation of North American Sea Ducks, Studies in Avian Biology, CRC Press/Taylor & Francis Group.

Rosenberg, D.H., Petrula, M.J., Schamber, J.L., Zwiefelhofer, D., Hollmén, T.E., and D.D. Hill. 2014. Seasonal movements and distribution of Steller's eiders (Polysticta stelleri) wintering at Kodiak Island, Alaska. Arctic 67(3):347-359.

Frost, C.J., Hollmén, T.E., Reynolds, J.H. 2013. Trends in annual survival of Steller's eiders molting at Izembek Lagoon on the Alaska Peninsula, 1993-2006. Arctic 66:173-178.

RECENT COLLABORATORS

Amundson, C. Alaska Science Center, USGS
Christie, K. Alaska Department of Fish and Game
Churchwell, R. Alaska Department of Fish and Game
Coletti, H. Southwest Alaska Network, National Park Service
Counihan, K. Alaska SeaLfe Center
Esler, D. Alaska Science Center, USGS
Flint, P. Alaska Science Center, USGS
Frost, C. Migratory Bird Management, Alaska Region, USFWS
Grand, B. Auburn University
Hatch, S. Institute for Seabird Research and Conservation
Huntington, H. Huntington Consulting
Kutz, S. University of Calgary
Latty, Christopher, Arctic National Wildlife Refuge, USFWS
Lovvorn, J. Southern Illinois University
Maniscalco, J. Alaska SeaLife Center
Matz, A. Fairbanks Fish and Wildlife Field Office, USFWS
Miller, M. Southern Illinois University
Nichols, J. Patuxent Wildlife Research Center, USGS
Oksanen, A. Finnish Food Authority
Powell, A, University of Florida
Reynolds, A. University of Alaska Fairbanks
Romano, M. Alaska Maritime National Wildlife Refuge, USFWS
Schamber, J. Alaska Department of Fish and Game
Sethi, S. Cornell University
Ward, D. Alaska Science Center, USGS
Wilson, H. Migratory Bird Management, Alaska Region, USFWS
Winsor, P. World Wildlife Fund

John M. Maniscalco
P.O. Box 1329, 301 Railway Ave.
Seward, Alaska 99664
907-224-6378
johnm@alaskasealife.org

EDUCATION

University of Alaska Fairbanks – Doctor of Philosophy in Marine Biology, May 2015
University of Alaska Fairbanks – Master of Science in Fisheries, May 1997
University of Alaska Southeast – Bachelor of Science in Biology, May 1992

RESEARCH EXPERIENCE

Research Scientist – Alaska SeaLife Center (ASLC) - 6/2000 to present

- Supervise/manage studies of Endangered Steller sea lions including remote video monitoring (behavioral, population, and vital rate studies), scat collection, biopsy darting, brand resightings, and capture, sampling, and branding of pups, video equipment installation/maintenance/repair
- Assist with and supervise seabird monitoring studies including monthly at-sea surveys and remote monitoring research of nesting murres and kittwakes
- Coordination and collaboration with ASLC, NMFS, and ADF&G personnel on a variety of wildlife research objectives, publications, policy considerations, and exchange of technical information
- Apply for and maintain permits for endangered species and land use with USFWS, NMFS, USFS, USCG, and Alaska State Agencies based on environmental assessments and impact statements
- Collect, analyze, publish data, provide conclusions and technical advice on species of concern
- Biopsy dart and collect blubber samples from walrus, work with Alaskan native hunt community for scientific samples and studies, analyze data, write reports
- Supervise diet studies of sport caught fish, analyze data, write reports
- Convey findings of research through oral and poster presentations locally and at international conferences and symposia
- Apply for grants; major and minor grants have been awarded
- Review manuscripts for scientific journals, proposals, and symposium publications
- Operate and service vessels as needed

Researcher – U.S. Fish and Wildlife Service and National Park Service – 5/1992 to 9/1998 –

- At-sea seabird, marine mammal, and acoustic fish surveys – south coastal Alaska
- Pigeon Guillemot nesting and productivity research – Prince William Sound
- Marbled Murrelet dawn watches – Kenai Fjords
- Operating vessels as needed – south coastal Alaska
- Monitoring numbers and behaviors of Steller sea lions and harbor seals – Glacier Bay N.P.

SELECTED PUBLICATIONS

Tanedo, S.A., T.E. Hollmen, **J.M. Maniscalco**, S.E.G. Ulman. *In Review*. Using remote video techniques to identify environmental factors influencing annual productivity of a colony of black-legged kittiwakes (*Rissa tridactyla*) in the Northern Gulf of Alaska.

Maniscalco, J.M., W.D. Ostrand, R.M. Suryan, and D.B. Irons. 2001. Passive interference competition by glaucous-winged gulls on black-legged kittiwakes: a cost of feeding in flocks. Condor. 103(3):616-619.

Maniscalco, J.M., W. Ostrand, and K. Coyle. 1998. Selection of fish schools by flocking seabirds in Prince William Sound, Alaska. Colonial Waterbirds. 21(3):314-322.

Ostrand, W.D., K.O. Coyle, G.S. Drew, **J.M. Maniscalco,** D.B. Irons. 1998. Selection of forage-fish schools by murrelets and tufted puffins in Prince William Sound, Alaska. The Condor 100:286-297.

Maniscalco, J.M., W.D. Ostrand. 1997. Seabird behaviors at forage fish schools in Prince William Sound, Alaska. Pages 175-189 *In*: Proceedings – Forage Fishes in Marine Ecosystems, Alaska Sea Grant College Program, AK-SG-97-01.

Jemison, L.A., G.W. Pendleton, K.K. Hastings, **J.M. Maniscalco,** L.W. Fritz. 2018. Spatial distribution, movements, and geographic range of Steller sea lions (*Eumetopias jubatus*) in Alaska. PLoS ONE 13(12):e0208093.

Maniscalco, J.M., P. Parker. 2018. Maternal and offspring effects on the timing of parturition in Steller sea lions. Canadian Journal of Zoology 96:333-339.

Maniscalco, J.M., A.M. Springer, M.D. Adkison, P. Parker. 2015. Population trend and elasticities of vital rates for Steller sea lions (*Eumetopias jubatus*) in the eastern Gulf of Alaska: A new life history table analysis. PLoS ONE 10(10):e0140982.

Maniscalco, J.M., A.M. Springer, P. Parker, M.D. Adkison. 2014. A longitudinal study of Steller sea lion natality rates in the Gulf of Alaska with comparisons to census data. PLoS ONE 9(11):e111523.

Maniscalco, J.M. 2014. The effects of birth weight and maternal care on survival of juvenile Steller sea lions (*Eumtopias jubatus*). PLoS ONE 9(5):e96328.

Maniscalco, J.M., A.M. Springer, P. Parker. 2010. High natality rates of endangered Steller sea lions in Kenai Fjords, Alaska and perceptions of population status in the Gulf of Alaska. PLoS ONE 5(4):e10076.

Maniscalco, J.M., A. Hoover-Miller, D. Zatz. 2008. Remote monitoring of pinnipeds in Kenai Fjords National Park. Alaska Park Science 7:12-17.

Maniscalco, J.M., D.G. Calkins, P. Parker, S. Atkinson. 2008. Causes and extent of natural mortality among Steller sea lion (*Eumetopias jubatus*) pups. Aquatic Mammals 34:277-287.

Maniscalco, J.M., C. O. Matkin, D. Maldini, S. Atkinson, D.G. Calkins. 2007. Assessing killer whale predation on Steller sea lions from field observations in Kenai Fjords, Alaska. Marine Mammal Science 23:306-321.

Maniscalco, J.M., P. Parker, S. Atkinson. 2006. Interseasonal and interannual measures of maternal care among individual Steller sea lions. Journal of Mammalogy 87:304-311.

Recent Collaborators

Adkison, M. D. – University of Alaska Fairbanks
Fritz, L. W. – National Marine Fisheries Service, Alaska Fisheries Science Center
Hastings, K. K. – Alaska Department of Fish & Game
Hollmen, T. E. – Alaska SeaLife Center
Jemison, L. A. – Alaska Department of Fish & Game
Parker, P. – Alaska SeaLife Center
Pendleton, G. W. – Alaska Department of Fish & Game
Springer, A. M. – University of Alaska Fairbanks
Tanedo, S. A. – U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Center
Ulman, S. E. G. – Alaska SeaLife Center

Current Licenses & Certificates

- USCG Licensed Captain of vessels up to 100 gross tons on near coastal waters
- First Aid, CPR/AED
- 24 hr HAZWOPER

Marc D. Romano

Curriculum Vitae

Wildlife Biologist, Alaska Maritime National Wildlife Refuge, 95 Sterling Highway Suite 1, Homer AK 99603

Work ph: (907) 226-4608; Fax (907) 235-7783 E-mail: marc_romano@fws.gov

Education

M.Sc., Wildlife Science, Oregon State University, December, 1999
Thesis topic: Effect of diet on growth and development of seabird chicks
B.S., Environmental Studies, SUNY Environmental Science and Forestry College, May, 1993

Relevant Work Experience

April 2012 – present: Wildlife Biologist, USFWS, Alaska Maritime National Wildlife Refuge

Currently the lead biologist in charge of wildlife monitoring and research activities on refuge islands in the Bering Sea Unit of the Alaska Maritime NWR. Supervise field camps and a staff of seasonal wildlife technicians who conduct inventory and monitoring work in the Pribilof Islands. Lead point of contact for Refuge partners contributing to our work in the Bering Sea including state and federal agencies, Tribal governments, non-profit organizations, and university researchers.

September 2009 – April 2012: Marine Biologist, NMFS, Protected Resources Division

Was responsible for endangered species listing, critical habitat designation, and recovery planning for threatened and endangered marine species. Supported NEPA assessments and biological consultations for activities that had the potential to affect listed species.

October 2006 – September 2009: Wildlife Biologist, USFWS, Migratory Bird Management

Served as Project Leader in charge of a large-scale, long-term biological research and monitoring program within Papahanaumokuakea Marine National Monument. Coordinated field activities and supervised technicians at three remote monitoring sites within the monument. Authored a species status assessment for Laysan and black-footed albatross. Represented USFWS Region 1 Office of Migratory Bird Management at scientific meetings, including meetings of the North Pacific Albatross Working Group.

January 2003 – October 2006: Wildlife Biologist (GS-09), USGS-BRD, Alaska Science Center

Coordinated and led seabird and fisheries research and monitoring projects in Glacier Bay and Kenai Fjords National Parks. Recruited, trained, and supervised several crews of biological technicians conducting fieldwork. Designed and conducted seabird and marine mammal surveys in the Gulf of Alaska and Aleutian Islands.

Select and Relevant Professional Publications

Sydeman W.J., Thompson S.A, Piatt J.F., Garcia-Reyes M., Zador S., Williams J.C., Romano, M., Renner, H.M. 2017. Regionalizing indicators for marine ecosystems: Bering Sea–Aleutian Island seabirds, climate, and competitors. Ecological Indicators; 78: 458–469.

Renner, H.M., Romano, M.D., Renner, M., Pyare, S., Goldstein, M.I. & Arthukin, Y. 2015. Assessing the breeding distribution and population trends of the Aleutian Tern Onychoprion aleutica. Marine Ornithology 43: 179–187.

Edwards A.E., Fitzgerald S.M., Parrish J.K., Klavitter J.L., Romano M.D. 2015. Foraging Strategies of Laysan Albatross Inferred from Stable Isotopes: Implications for Association with Fisheries. PLoS ONE 10(7): e0133471.

Gutowsky, S.E., L.F.G. Gutowsky, I.D. Jonsen, M.L. Leonard, M.B. Naughton, M.D. Romano and S.A. Shaffer. 2014. Daily activity budgets reveal a quasi-flightless stage during non-breeding in Hawaiian albatrosses. Movement Ecology. 2:23.

Arimitsu, M., J. Piatt, E. Madison, M. Romano, and T. van Pelt. 2011. Status and distribution of the Kittlitz's Murrelet in Kenai Fjords, Alaska. Marine Ornithology 39:13-22

Madison, E., J. Piatt, M. Arimitsu, M. Romano, T. van Pelt, K. Nelson, J. Williams, A. DeGange. 2011. Status and distribution of the Kittlitz's Murrelet along the Alaska Peninsula, Kodiak, and Aleutian Islands, Alaska. Marine Ornithology 39:111-122

Piatt, J., M. Arimitsu, G. Drew, E. Madison, J. Bodkin, and M. D. Romano. 2011. Status and trends of the Kittlitz's Murrelet Brachyramphus Brevirostris in Glacier Bay, Alaska. Marine Ornithology 39:65-75

Arimitsu, M. L., J. F. Piatt, M. D. Romano, E .N. Madison, and J. S. Conaway. 2010. Kittlitz's and Marbled Murrelets in Kenai Fjords National Park, south-central Alaska: At-sea distribution, abundance, and foraging habitat, 2006–08: U.S. Geological Survey Open-File Report 2010-1181, 68p.

Romano, M.D., J.F. Piatt, H.R. Carter. 2007. First successful radio-telemetry study of Kittlitz's murrelet: problems and potential, in Piatt, J.F., and Gende, S.M., eds., Proceedings of the Fourth Glacier Bay Science Symposium, October 26–28, 2004: U.S. Geological Survey Scientific Investigations Report 2007-5047.

Select Recent Collaborators

Dr. Aaron Christ – U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge
Dr. Douglas Causey – University of Alaska, Anchorage
Brie Drummond – U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge
Dr. Robert Gill – U.S. Geological Survey, Alaska Science Center
Dr. Dennis Griffin – Oregon State Historic Preservation Office
Dr. Tuula Hollmen – Alaska SeaLife Center
James Johnson – U.S. Fish and Wildlife Service, Office of Migratory Bird Management
Robert Kaler – U.S. Fish and Wildlife Service, Office of Migratory Bird Management
Dr. Nabuo Kokubun – National Institute of Polar Research, Japan
Dr. Kathy Kuletz – U.S. Fish and Wildlife Service, Office of Migratory Bird Management
Dr. Irby Lovette – Cornell University, Laboratory of Ornithology
Dr. John Maniscalco – Alaska SeaLife Center
Dr. Steve Matsuoka – U.S. Geological Survey, Alaska Science Center
Dr. Rachael Orben – Oregon State University
Dr. John Pearce - U.S. Geological Survey, Alaska Science Center
Dr. John Piatt – U.S. Geological Survey, Alaska Science Center
Dr. Sanjay Pyare – University of Alaska, Southeast
Heather Renner – U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge
Dr. Martin Renner – Tern Again Consulting
Rachel Richardson – U.S. Geological Survey, Alaska Science Center
Dr. Daniel Ruthrauf – U.S. Geological Survey, Alaska Science Center
Dr. Joel Schmutz - U.S. Geological Survey, Alaska Science Center
Dr. William Sydeman – Farallon Institute
Dr. Akinori Takahashi - National Institute of Polar Research, Japan
Dr. Audrey Taylor - University of Alaska, Anchorage
Gerrit Vyn – Cornell University, Laboratory of Ornithology
Dr. Stepahni Zador – National Marine Fisheries Service, Alaska Fisheries Science Center

Erik E. Osnas
Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Alaska Region

EDUCATION

2004 *Ph. D. – Ecology, Evolution and Behavior,* Indiana University.
1998 *Master of Science - Zoology,* University of Western Ontario.
1995 *Bachelor of Science - Wildlife and Fisheries Biology,* University of California, Davis.

PROFESSIONAL EXPERIENCE

2015 to present, Wildlife Biologist (Biometrician), Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Alaska Region
2012 to 2015, Wildlife Biologist/Post-doctoral Research Associate, USGS Patuxent Wildlife Research Center, Laurel, Maryland
2012 Lecturer, Department of Ecology and Evolutionary Biology, Princeton University
2008 to 2012, Post-doctoral Research Associate, Princeton University
2005 to 2008, Assistant Scientist, Department of Forest and Wildlife Ecology, University of Wisconsin

SELECTED PUBLICATIONS

Kuletz, K. J., Cushing, D. A., Osnas, E. E., Labunski, E. A., & Gall, A. E. (2019). Representation of the Pacific Arctic seabird community within the Distributed Biological Observatory array, 2007–2015. *Deep Sea Research Part II: Topical Studies in Oceanography*.

Jennelle, C. S., Walsh, D. P., Samuel, M. D., Osnas, E. E., Rolley, R., Langenberg, J., ... & Heisey, D. M. (2018). Applying a Bayesian weighted surveillance approach to detect chronic wasting disease in white-tailed deer. *Journal of applied ecology*, *55*(6), 2944-2953.

Fleming-Davies, A. E., Williams, P. D., Dhondt, A. A., Dobson, A. P., Hochachka, W. M., Leon, A. E., Osnas, E.E. & Hawley, D. M. (2018). Incomplete host immunity favors the evolution of virulence in an emergent pathogen. *Science*, *359*(6379), 1030-1033.

Cohen, J. B., Hecht, A., Robinson, K. F., Osnas, E. E., Tyre, A. J., Davis, C., ... & Melvin, S. M. (2016). To exclose nests or not: structured decision making for the conservation of a threatened species. *Ecosphere*, *7*(10), e01499.

Osnas, E. E., Zhao, Q., Runge, M. C., & Boomer, G. S. (2016). Cross-seasonal effects on waterfowl productivity: Implications under climate change. *The Journal of wildlife management*, *80*(7), 1227-1241.

Osnas, EE, P Hurtado, and AP Dobson. 2015. Evolution of virulence across space during an epidemic. *American Naturalist*, *185*(3), 332-342.

Heisey, DM, EE Osnas, P Cross, DO Joly, JA Langenberg, and MW Miller. 2010. Linking process to pattern: estimating spatiotemporal dynamics of a wildlife epidemic from cross-sectional data. *Ecological Monographs,* 80: 221-240.

Osnas, EE, DM Heisey, R Rolley, and MD Samuel. 2009. Spatial and temporal patterns of chronic wasting disease: fine scale mapping of a wildlife epidemic in Wisconsin. *Ecological Applications,* 19: 1311-1322.

COLLABORATORS

Boomer, Scott, Division of Migratory Bird Management, U.S. Fish and Wildlife Service
Cushing, D. A., Pole Star Ecological Research, LLC. Anchorage, AK
Dhondt, Andre. A., Cornell Lab of Ornithology & Department of Ecology and Evolution, Cornell University

Dobson, Andrew P., Department of Ecology and Evolution, Princeton University
Fischer, Julian, Division of Migratory Bird Management, U.S. Fish and Wildlife Service
Fleming-Davies, A. E, Department of Biology, University of San Diego
Frost, Charles, Division of Migratory Bird Management, U.S. Fish and Wildlife Service
Gall, A. E, ABR, Inc., Environmental Research & Services
Hawley, Dana M., Department of Biological Sciences, Virginia Tech
Heisey, D. M., USGS National Wildlife Health Center (retired)
Hochachka, W. M., Cornel Lab of Ornithology, Cornell University
Hurtado, Paul, Department of Mathematics and Statistics, University of Nevada, Reno
Jennelle, C. S., Minnesota Department of Natural Resources
Kuletz, Kathy, Division of Migratory Bird Management, U.S. Fish and Wildlife Service
Labunski, Elizabeth A., Division of Migratory Bird Management, U.S. Fish and Wildlife Service
Runge, Michael, USGS Patuxent Wildlife Research Center
Samuel, M. D., USGS Cooperative Wildlife Research Unit, University of Wisconsin (retired)
Walsh, D. P., USGS National Wildlife Health Center
Zhao, Qing, Department of Wildlife Ecology, University of Missouri

Sadie E.G. Ulman
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Education

M.S. Wildlife Ecology, University of Delaware, Newark, Delaware, 2011
Thesis: Migratory Shorebird and Vegetation Evaluation of Chickaloon Flats, Kenai National Wildlife Refuge, Alaska
B.A. Zoology, University of Wisconsin, Madison, Wisconsin, 2004

Work Experience

2015– present Research Associate, Alaska SeaLife Center, Seward, Alaska
2013–2015 Research Coordinator, Alaska SeaLife Center, Seward, Alaska
2011–2013 Research Technician, Alaska SeaLife Center, Seward, Alaska
2008–2011 Graduate Research Assistant, Department of Entomology and Wildlife Ecology, University of Delaware, Delaware
2007 –2008 Assistant Aviculturist- AmeriCorps, Alaska SeaLife Center, Seward, AK
2007 Sandhill Crane Research Field Technician, Northern Prairie Wildlife Research Center, U.S.G.S., Jamestown, North Dakota
2006 Grassland Bird Research Field Technician, Wisconsin DNR and UW-Madison Department of Wildlife Ecology, Madison, Wisconsin
2005 Ruffed Grouse Surveyor, UW-Madison Department of Wildlife Ecology, Chatfield, Manitoba, Canada
2005 Wild Turkey Research Field Technician, Wisconsin DNR and UW-Madison Department of Wildlife Ecology, Madison, Wisconsin
2003–2004 Undergraduate Research Assistant, William Karasov Laboratory, UW-Madison Department of Wildlife Ecology, Madison, Wisconsin
2003 Purple Loosestrife Biological Control Intern, Wisconsin DNR Research Center, Monona, Wisconsin
2002 Mentored Undergraduate Field Research, Center of Limnology, UW- Madison, Madison, Wisconsin

Relevant and Other Publications

Tanedo, S.A., Hollmen T.E., Maniscalco, J.M., and S.E.G. Ulman. *in review.* Using remote video techniques to identify environmental factors influencing annual productivity of a colony of Black-legged Kittiwakes (*Rissa tridactyla*) in the Northern Gulf of Alaska. Condor.

Hollmen, T.E., Ulman, S.E.G., Tanedo, S., and Maniscalco, J. M. 2017. Seabirds as indicators of coastal ecosystem condition and change. Final Progress Report to Ocean Alaska Science and Learning Center, National Park Service.

Ulman, S.E.G., T. E. Hollmén, R. Brewer, and A. H. Beaudreau. 2015. Predation on seabirds by Pacific Cod (*Gadus Macrocephalus*) near the Aleutian Islands, Alaska. Marine Ornithology, 43, 231-233.

Ulman, S.E.G., Williams, C. K., Morton, J. M., DeLiberty, T. L., and B. N. Ness. 2019. Vegetation change on an Alaska estuary after the 1964 Great Alaska Earthquake. Northwest Science, 93, 16-22.

Recent Collaborators

Tracy DeLiberty, University of Delaware
Dan Esler, U.S.G.S- Alaska Science Center
Paul Flint, U.S.G.S- Alaska Science Center
Tuula Hollmen, Alaska SeaLife Center and University of Alaska- Fairbanks
John Maniscalco, Alaska SeaLife Center
John Morton, U.S. Fish and Wildlife Service
Brenna Ness, University of Delaware
Sarah Tanedo, Alaska SeaLife Center
Chris Williams, University of Delaware

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Alaska Maritime National Wildlife Refuge
95 Sterling Highway, Suite 1
Homer, Alaska 99603

August 16, 2019

Exxon Valdez Oil Spill Trustee Council
4230 University Drive, Ste. 220
Anchorage, AK 99508-4650

Dear Members of the Trustee Council:

Please accept this letter of support for the grant proposal by the Alaska SeaLife Center, in cooperation with the U.S. Fish and Wildlife Service, *Status and trends of Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem.* Alaska Maritime National Wildlife Refuge staff monitor and protect seabird populations across the refuge, including a large portion of the worldwide range of Kittlitz's murrelet, and also significant populations of the marbled murrelet and pigeon guillemot. Our refuge monitors these three species because they are important indicators of the health of the marine environment, and all three are of conservation concern. The proposed project will fill an important data gap, and when combined with other Fish and Wildlife Service and cooperator efforts, will provide critical trend information for an important portion of the range of these three species.

I applaud the Exxon Valdez Oil Spill Trustee Council's interest in gathering information on these three species, particularly in light of the lack of recovery of their populations following the Exxon Valdez oil spill. The Alaska Maritime National Wildlife Refuge recognizes the importance of the proposed project, and is committed to supporting both the proposal and the project, should it be funded. Our staff members, including Marc Romano and Aaron Christ, have worked with members of the SeaLife Center in developing this proposal. Moving forward, Marc, Aaron, and other members of the Alaska Maritime staff will assist with some of the fieldwork for the project and eventually the data analysis and completion of final products. In addition, Marianne Aplin and other Visitor Services staff here at the refuge will work with the SeaLife Center and Kenai Fjords National Park to create educational and outreach materials in support of this project.

Thank you for considering my enthusiastic support as you evaluate this proposal.

Sincerely,

Steve Delehanty
Refuge Manager
Alaska Maritime National Wildlife Refuge.

United States Department of the Interior

NATIONAL PARK SERVICE
Kenai Fjords National Park
P. O. Box 1727
Seward, Alaska 99664
907-422-0500

August 14, 2019

Dr Tuula Hollmen
Alaska SeaLife Center
301 Railway Avenue
PO Box 1329
Seward, AK 99664

Dear Dr. Tuula Hollmen,

It is my pleasure to write to you today on behalf of Kenai Fjords National Park and our support of the project: *Status and trends of Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem,* which will be submitted to the Exxon Valdez Oil Spill Trustees grant review committee.

Kenai Fjords National Park stewards critical ecosystem habitat that support a wide array of seabirds including the Kittlitz's murrelet, marbled murrelet, and pigeon guillemot, all of which are of unique interest to researchers, bird enthusiasts and park visitors. The park is interested in continuing to understand the various challenges and opportunities afforded to these species both within the landscapes and marine areas they utilize and that we, Kenai Fjords National Park, are tasked with managing. This research can be used to provide important scientific understanding and help to inform park management decisions.

In addition, Kenai Fjords National Park has the unique ability to communicate to a large scale audience because the majority of the park's in-person interpretive programming occurs on tour boats in both Resurrection Bay and within the fjords. Combined with our visitor center and educational programming, this project has the ability to reach approximately 300,000 visitors with its scope of study and findings. This also provides a unique opportunity to help share the positive human response and long-term work following the Exxon Valdez Oil Spill. Visitors and students will gain a deeper perspective regarding the spill's long-term effects as well as the benefits of continued post-spill efforts.

Kenai Fjords looks forward to building robust interpretive programming for our ranger-led boat tour programs as well as creating a specific distance-learning education program that will highlight this work and can be delivered to students during the academic year via our award winning distance learning education program. Shauna Potocky, Chief of Interpretation and Education will serve as your primary contact for these specific elements.

Thank you again for including Kenai Fjords National Park in this collaboration. If you have any questions or need to be in contact, please feel free to contact me at (907) 422-0500.

Sincerely,

Eric Veach
Superintendent
Kenai Fjords National Park

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Fish and Game

OFFICE OF THE COMMISSIONER
Headquarters Office

1255 West 8th Street
P.O. Box 115526
Juneau, Alaska 99811-5526
Main: 907.465.6136
Fax: 907.465.2332

August 14, 2019

To the Exxon-Valdez Oil Spill Trustee Council,

I would like to express my support for the Alaska SeaLife Center proposal entitled "Status and trends of marbled murrelet, Kittlitz's murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem: Applying remote sensing technologies to assess abundance, productivity, and response to environmental variability in the EVOS area." This study would provide important information on population trends of three seabird species negatively affected by the EVOS, and would enhance our understanding of how their populations respond to changing marine conditions. The repeat counts for Kittlitz's murrelets in Kenai Fjords described in this proposal will be especially valuable in assessing whether the population is stable or decreasing. All three species in this proposal are listed as Species of Greatest Conservation Need (SGCN) by the state of Alaska; therefore, the information gained from this study will be valuable in the context of conservation and management decisions.

Sincerely,

K. Christie

Katie Christie
Wildlife Biologist
Threatened, Endangered, and Diversity Program
Alaska Department of Fish and Game

United States Department of the Interior
National Park Service
Southwest Alaska Inventory and Monitoring Network
240 W 5th Ave., Anchorage AK 99501
Phone (907) 455-0675

August 16, 2019

To the EVOS Trustee Council:

I am writing in support of the proposal "Status and trends of Kittlitz's murrelet, marbled murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem" submitted by the Alaska SeaLife Center in partnership with US Fish and Wildlife Service.

This multi-year study proposes to assess the status and trends of marbled murrelet, Kittlitz's murrelet, and pigeon guillemot along the Kenai Peninsula Coast. The outer Kenai Coast, including Kenai Fjords National Park, is an important area for these species and a region impacted by EVOS. The species highlighted in this proposal have either not recovered or their recovery status is unknown. The overall goal is to provide information about trends in abundance and productivity of injured seabird species, thus supporting the EVOSTC in assessment of their recovery status. The proposal will build on existing data to extend time series, allowing for a greater understanding of the status and trends of these species.

As the marine ecologist for the Southwest Alaska Inventory & Monitoring Program (SWAN I&M) and as the component lead of the nearshore component of Gulf Watch Alaska, and EVOS TC supported program, I support this project. Insights in to the status, trends and productivity of important seabird species will also aid the monitoring program in determining causes of change while concurrently provide information to management agencies, such as NPS.

I also am writing to support the project in terms of shared logistics with the PIs. As highlighted in the proposal, there is spatial overlap in survey effort. When feasible, we will assist in data collection. We will also provide historical survey data to aid in the integration of results to elucidate factors influencing these populations at local and regional levels (Objective 6).

Thank you,

Heather Coletti
SWAN
Marine Ecologist

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15 August 2019

Dr. Tuula Hollmen
ASLC/UAF
301 Railway Avenue, Seward, AK 99664

Dear Dr. Hollmen:

I wish to express my support for your proposal, “Status and trends of Kittlitz’s murrelet, marbled murrelet, and pigeon guillemot in a changing Northern Gulf of Alaska ecosystem” to the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC). As a current EVOSTC Herring Research and Monitoring program Principal Investigator, the work you describe in your proposal holds relevance to studies I have worked on including juvenile Pacific herring over-winter energetics (2012-2016) and reproductive maturity among age cohorts of adult Pacific herring (2017-present) both conducted in Prince William Sound, Alaska. Seabirds are excellent samplers of the marine environment, particularly of young forage fishes. Any herring captured for this project could help extend the existing 9-year time series of juvenile herring energetics data previously funded through EVOSTC. Further, my current project on age at reproductive maturity among adult Pacific herring is particularly interested in gonad maturity indices of age 2 herring – an age class that may be represented in seabird diets. We know adult herring move in and out of Prince William Sound during the annual cycle, therefore, the spatial distribution of your sampling should complement ongoing work in the Prince William Sound region.

Best wishes for a productive seabird research study. Sincerely,

Kristen Gorman, Ph.D.
Research Ecologist
Prince William Sound Science Center
300 Breakwater Ave
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