Exxon Valdez Oil Spill Trustee Council

DRAFT FY17 – FY21 Work Plan for Restoration, Research and Monitoring Projects:

Fiscal Year 2021

Draft 22 October 2020

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EVOSTC Restoration, Research and Monitoring Projects
Draft FY21 Work Plan
Prepared by:
Exxon Valdez Oil Spill Trustee Council

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You can help the Trustee Council by reviewing this draft work plan and letting us know your priorities for the Fiscal Year. You can comment by:

Mail:	4230 University Drive, Suite 220 Anchorage, AK 99508-4650 Attn: Draft Fiscal Year 2020 Work Plan
Telephone:	907-278-8012 1-800-478-7745 Collect calls will be accepted from fishers and boaters who call through the marine operator.
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FY21 Proposal Funding Recommendations

The funding described in this document is for EVOSTC Restoration, Research, and Monitoring Projects and for Habitat Enhancement Projects. Please note that the funding amounts in this document are approximate and rounded up to the nearest hundred dollars. The Work Plan is a working document and may be revised as needed throughout the fiscal year. Please contact the EVOSTC office if you would like exact funding amounts.

					FY21 Funding Amount Recommended				
Page	**Project Number**	**Principal Investigator**	**Project Title**	**FY21 Requested**	**Science Panel**	**Science Director**	**PAC**	**Executive Director**	**Trustee Council**
6	21210100	EVOSTC Admin	EVOSTC Annual Budget	$2,004,300	Not Applicable	Not Applicable	$2,004,300	Not Applicable	$2,004,300
8	21120111	Pegau	PWS Herring Program - see Herring Research Program Projects table below	$1,320,700	$1,320,700	$1,320,700	$1,320,700	$1,320,700	$1,320,700
81	21120114	Lindeberg	Long-Term Monitoring Program – see LTM Gulf Watch Alaska table below	$2,579,500	$2,579,500	$2,579,500	$2,579,500	$2,579,500	$2,579,500
191	21120113	Janzen	Data Management Program	$253,600	$253,600	$253,600	$253,600	$253,600	$253,600
203	21110853	Kuletz, Kaler, Irons	Pigeon Guillemot Restoration Project	$68,500	$68,500	$68,500	$68,500	$68,500	$68,500
213	21200127	Hetrick, Campbell, Baird, Evans	Ocean Acidification Sampling	$34,300	$34,300	$34,300	$34,300	$34,300	$34,300
216	21210128	Hollmen, Labunski et al.	Status and trends of EVOS injured seabirds	$278,600[a]	Not Applicable[a]	Not Applicable[a]	Not Applicable[a]	Not Applicable[a]	$278,600[a]
221	20180119	Miranda	ADNR/DPOR Outreach Project	$49,100	Not Applicable	Not Applicable	$49,100	$49,100	$49,100
224	20200135	Miranda	Eagle Rock Facility Improvements	$6,419,000	Not Applicable	Not Applicable	$6,419,000	$6,419,000	$6,419,000
226	21210129	Thielke	Geospatial Wetlands and Hydrography Data Across the EVOS Region	$3,870,000	Not Applicable	Not Applicable	$3,870,000	$3,870,000	$1,798,500
228	21210130	Riemer	ASLC Infrastructure Project	$4,296,800	Not Applicable	Not Applicable	Not Applicable	Not Applicable	$545,000*
TOTAL REQUESTED, RECOMMENDED & APPROVED				$21,174,400	$4,256,600	$4,256,600	$16,599,000	$14,594,700	$15,351,100

[a]Funding approved in FY20 for FY21. See FY20 Draft Work Plan for details and comments. *Funding contingent upon the PI providing proof of a 50% match within 18 months.

Herring Research and Monitoring Program Projects

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The total for these projects can be found under 21120111-Pegau on the page one chart

Page	Project Number	Principal Investigator	Project Title	FY21 Requested	FY21 Approved	Science Panel	Science Director	PAC	Executive Director	Trustee Council
17	21120111-A	Pegau	Herring Program-Coordination & Logistics, Postdoctoral Researcher	$159,600	$159,600	Fund	Fund	Fund	Fund	Fund
27	21160111-B	Bishop	Herring Program - Annual Herring Migration Cycle	$272,800	$272,800	Fund	Fund	Fund	Fund	Fund
35	21120111-C	Branch	Herring Program - Modeling and stock assessment	$148,900	$148,900	Fund	Fund	Fund	Fund	Fund
46	21120111-E	Hershberger	Herring Program – Herring Disease Program II	$251,100	$251,100	Fund	Fund	Fund	Fund	Fund
53	21160111-F	Haught	Herring Program – ASL Study & Aerial Milt Surveys	$166,300	$166,300	Fund	Fund	Fund	Fund	Fund
63	21120111-G	Rand	Herring Program - Adult Pacific Herring Acoustic Surveys	$79,100	$79,100	Fund	Fund	Fund	Fund	Fund
72	21170115	Whitehead	Lingering Oil – Immunological Compromise of Fish	$242,900	$242,900	Fund	Fund	Fund	Fund	Fund

Long-Term Monitoring (LTM Gulf Watch Alaska) Program Projects

The funding described in this document is for EVOSTC Restoration, Research, and Monitoring Projects and for Habitat Enhancement Projects. Please note that the funding amounts in this document are approximate and rounded up to the nearest hundred dollars. The Work Plan is a working document and may be revised as needed throughout the fiscal year. Please contact the EVOSTC office if you would like exact funding amounts.

The total for these projects can be found under 21120114-Lindeberg on the page one chart

Page	Project Number	Principal Investigator	Project Title	FY21 Requested	FY21 Approved	Science Panel	Science Director	PAC	Executive Director	Trustee Council
88	21120114-A	Lindeberg	LTM Program - Science Coordination and Synthesis, and Postdoctoral Researcher	$222,300	$222,300	Fund	Fund	Fund	Fund	Fund
88	21120114-B	Hoffman	LTM Program -Administration	$402,300	$402,300	Fund	Fund	Fund	Fund	Fund
99	21120114-C	Arimitsu & Piatt	LTM Program - Forage Fish Distribution, Abundance, and Body Condition	$302,800	$302,800	Fund	Fund	Fund	Fund	Fund
109	21120114-D	Ostle & Batten	LTM Program - Continuous Plankton Recorders	$86,100	$86,100	Fund	Fund	Fund	Fund	Fund
114	21120114-E	Bishop	LTM Program - Seabird Abundance in Fall and Winter	$127,900	$127,900	Fund	Fund	Fund	Fund	Fund
123	21120114-G	Campbell	LTM Program - Oceanographic Conditions in PWS	$238,500	$238,500	Fund	Fund	Fund	Fund	Fund
130	21120114-H	Coletti	LTM Program - Nearshore ecosystems the Gulf of AK	$426,200	$426,200	Fund	Fund	Fund	Fund	Fund
140	21120114-I	Danielson	LTM Program - GAK1 Monitoring	$127,400	$127,400	Fund	Fund	Fund	Fund	Fund
145	21120114-J	Holderied & Baird	LTM Program - Oceanographic Monitoring in Cook Inlet/Kachemak Bay	$133,200	$133,200	Fund	Fund	Fund	Fund	Fund
153	21120114-L	Hopcroft	LTM Program - Seward Line Monitoring	$146,600	$146,600	Fund	Fund	Fund	Fund	Fund
160	21120114-M	Kuletz & Kaler	LTM Program - PWS Marine Bird Surveys	$36,200	$36,200	Fund	Fund	Fund	Fund	Fund
168	21120114-N	Matkin	LTM Program -Long-term killer whale monitoring	$139,500	$139,500	Fund	Fund	Fund	Fund	Fund

Page	Project Number	Principal Investigator	Project Title	FY21 Requested	FY21 Approved	Science Panel	Science Director	PAC	Executive Director	Trustee Council
174	21120114-O	Moran & Straley	LTM Program - Humpback Whale Predation on Herring	$177,000	$177,000	Fund	Fund	Fund	Fund	Fund
186	21200114-P	Lindeberg & Heintz	LTM Program – Lingering Oil Component Project	$13,100	$13,100	Fund	Fund	Fund	Fund	Fund

EVOSTC Annual Budget Description

Project Number: **21210100**

Project Title: EVOSTC Annual Budget

Primary Investigator(s): Elise Hsieh, EVOSTC Executive Director
Linda Kilbourne, EVOSTC Administrative Manager

PI Affiliation: EVOSTC **Project Manager:** ADFG

EVOSTC Funding Requested:

FY21
$2,004,300

Abstract:

The budget structure is designed to provide a clearly identifiable allocation of the funds supporting Trustee Council activities. The program components are:

- Administration Management
- Data Management
- Science Program
- Public Advisory Committee (PAC)
- Habitat Program
- Trustee Agency Project Management
- Trustee Agency Funding

The budget estimates detailed within those specified program components are projected based upon prior year actual expenditures and include the application of estimated merit step increases, as well as payroll benefits increases. Detailed 12-month budget component items cover necessary day-to-day operational costs of the *Exxon Valdez* Oil Spill Restoration Office and administrative costs associated with overseeing current Trustee Council program objectives.

FY21 Funding Recommendations (October 2020):

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

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Trustee Council Comments – FY21

Date: October 2020

The Trustee Council meeting was held on 14 October 2020 and fund recommendation is included in the table above. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Herring Research and Monitoring Program Project Descriptions

Project Number: **21120111**

Project Title: Herring Research and Monitoring Program

Primary Investigator(s): W. Scott Pegau

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $8,136,200

FY17	FY18	FY19	FY20	FY21
Auth: $1,252,900	Auth: $1,578,800	Auth: $1,996,900*	Auth: $1,986,800*,[a]	$1,320,700*,[a,b]

Requests include 9% GA.

*ADNR requires a bond posted ($2.6K for FY19) and annual fees for land use permits for underwater acoustic arrays ($2.7K annual for FY19-21; see FY19 Bishop, pg. 24). Includes additional ship-time support request for acoustic surveys ($10.3K for FY19-21; see FY19 Rand, pg. 64). Includes project 19170115, which will be part of the HRM program starting in FY19.[a]Includes additional year of tagging effort and analysis ($401.8K for FY20-21; see FY19 Bishop, pg. 24). Includes administrative review of reporting documents ($13K for FY21; see Pegau pg. 16). [b]Includes additional funds for existing post-doc to continue disease research ($68.9K for FY21; see Pegau pg. 16).

Funding From Non-EVOSTC Sources FY 17-21: $894,700

FY17	FY18	FY19	FY20	FY21
$157,200	$159,700	$203,200	$225,200	$149,400

Total Past EVOSTC Funding Authorized (FY12-20): $13,143,700

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $18,194,200

Total Non-EVOSTC Funding (FY12-21): $1,049,400

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*
The overall goal of the Herring Research and Monitoring (HRM) program is to: **Improve predictive models of herring stocks through observations and research**. The program objectives are to:

1) Expand and test the herring stock assessment model used in Prince William Sound.
2) Provide inputs to the stock assessment model.
3) Examine the connection between herring condition or recruitment to physical and biological oceanographic factors.
4) Develop new approaches to monitoring.

The program currently has seven projects: Modeling and Stock Assessment of Prince William Sound Herring; Surveys and Age, Sex, and Size Collection and Processing; Adult Pacific Herring Acoustic Surveys; Herring Disease Program; Annual Herring Migration Cycle; Genomic Mechanisms Underlying Lack of Recovery; and HRM Coordination.

Through these projects we expect to address areas of interest outlined within the HRM section of the FY17-21 invitation for proposals and examine potential long-term impacts of oil exposure. The modeling project and the postdoctoral fellows are the primary integrating efforts that use data and information from all the projects and the Gulf Watch Alaska and Data Management programs, though there is a high level of coordination and integration between all projects. The primary beneficiaries of our efforts are expected to be Alaska Department of Fish and Game, Prince William Sound herring fishermen, and, through publications, the larger scientific community.

Dr. Pegau serves as the program lead to ensure the proper coordination within the program, with other *Exxon Valdez* Oil Spill Trustee Council (EVOSTC)-funded programs, and as a point person for communications with the EVOSTC. An independent scientific oversight group exists that provides feedback on the program.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP appreciates creativity of PIs in the herring program to find ways to collect field data during the Covid pandemic. We may see more of the same pandemic-related restrictions on field work and access to labs, which will require alternative plans that were not stated in the program and project proposals. Each project should address the following questions. What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities? The SP understands that it may be challenging to develop extensive and detailed contingency plans for the future, but some planning is required. Will any unused funds for FY21 be repurposed for additional lab and/or data analyses? Or will they be requested to rollover to FY22 (pending proposal approval)? The SP noted that community outreach was postponed owing to safety concerns. However, as with the GWA program, the SP agrees with the Science Director's recommendation of finding internet-based solutions to community outreach. Issues related to the pandemic are likely to persist in 2021, too. Additionally, GWA monitors conditions for herring growth and recruitment, but the SP feels that the connection with the HRM program can be strengthened.

PI Response (10.2.20)

We feel that our ability to adjust sampling efforts to cover all sampling requirements in 2020 shows the connectivity between our projects and how each person is willing to help out the other projects. This resilience helps us to adjust to contingencies such as the COVID-19 pandemic. Short descriptions of the primary sampling contingencies follow.

Mile-days-spawn measurements could be obtained by contracting aircraft operators to collect video with date and location stamps. We currently use this equipment to provide backup to the observers. Age structure analysis and disease prevalence samples could be obtained through contracting with fishermen to capture herring using cast nets and jigs as we did in 2020. People in Cordova could be trained to collect samples for the disease project. Training materials were developed to provide the necessary information for the collection of disease prevalence samples. The equipment for the acoustic surveys is in Cordova and can be deployed by researchers that live there. The captain of the Auklet is very familiar with the sampling protocol and can assist if necessary. The tagging project can turn over

the data uploading to the charter vessel captain who has been trained in its use. He is a former researcher at Prince William Sound Science Center and has extensive experience with the equipment. Since no tagging is to occur in 2021, personnel with the tagging project can help cover projects that are unable to travel or short staff.

The postdoctoral researcher working with Dr. Branch is focused on connecting the data collected in the Gulf Watch Alaska program to information from the Herring Research and Monitoring Program. Outside of the postdoc's efforts, there are currently at least three manuscripts in progress that examine connections between herring growth or biomass with environmental conditions. Two are led by investigators in the GWA and one by the HRM coordination project.

Science Director Comments – FY21

Date: September 2020

Overall, the program is completing tasks on time. The COVID-19 pandemic caused travel and work restrictions but Dr. Pegau was able to coordinate with other field programs and the local community to collect samples for projects that were not able to conduct their regular sampling. Dr. Pegau's efforts are recognized and appreciated. The pandemic has also put outreach visits on hold. Many businesses and communities are moving toward video conferencing platforms to hold virtual events online - could this be an alternative way to effectively conduct outreach activities such as a community listening session? I understand that face-to-face meetings can be more effective and meaningful depending on the topics and participants, but this may be a way to sustain connections with communities, and this is also assuming that participants have access to video conferencing capabilities. The program is requesting additional funding for one existing project (see project A for details). The budget for the Herring Maturity Project was ended at the end of FY19 which has led to a $173,300 reduction in FY21 requested funding for the program.

PI Response (10.2.20)
Our outreach coordinator will work with the native village of Tatitlek to determine appropriate methods of outreach. We will determine if the communication infrastructure and cultural norms in the village are suitable for a virtual listening session. Our existing connection with the village allows for sharing of information during the herring spawn season and we hope that we can build upon that connection.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund*	Fund*	Not Reviewed	Fund*	Fund*

**Indicates this review group recommends a Do Not Fund decision for HRM Project #20170111-D Gorman.*

Science Panel Comments – FY20

Date: September 2019

The productivity of this program is quite high and the Panel commends the PIs for this. The Science Panel also appreciates the inclusion of postdocs, as well as undergraduate and graduate students, on herring techniques ranging from molecular, disease, to population approaches. For future proposals, please separate out peer-reviewed publications from agency and data reports and include subheading of published, in prep, in review if necessary. We would also like to see more interpretation and discussion of data and figures presented in the proposals; this is included in some of the proposals such as in project 20170111-B. The Panel is not looking for new or additional analyses in the proposals. We are looking for context and some interpretation to allow us to evaluate the proposal.

PI Response (10.2.19): Thank you for the guidance.

The Science Panel had some concern that survey efforts, though laudable, might miss significant amounts of herring in PWS. Herring are notorious for shifting spawning locations by tens or hundreds of kilometers over time. A discussion with herring program lead Pegau indicated that extra efforts have been taken through opportunistic and other sampling to explore the possibility that herring occur in significant quantities in other portions of PWS. Pegau noted that aerial surveys are quite extensive, much larger than the acoustic surveys. For example, ADFG flies over Kayak Island, but this area is not included in the PWS management area. It would be helpful if these non-Program efforts could be briefly described in future proposals and annual reports to provide context. It seems that the herring spawning at Kayak Island should be considered part of the PWS herring metapopulation.

PI Response (10.2.19): We will ensure more description of the survey effort is in the annual report.

Science Director Comments – FY20

Date: September 2019

Overall, the program is completing tasks on time. Synthesis efforts are well underway in preparation for the Science Synthesis Workshop in February 2020. The program is requesting additional funding for two existing projects (see project A and B for details). I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund*	Fund*	Fund*	Fund*	Fund*

**Indicates this review group recommends a Fund Contingent for HRM Project #19170111-D Gorman. Review group revised recommendation to Fund for Project #19170111-D.*

Science Panel Comments – FY19

Date: September 2018

We have no program specific comment except that we ask the PIs to evaluate the adequacy of their sampling design to make population-level inferences. Consider the acoustics survey, and age & length sampling.

Science Coordinator Comments – FY19

Date: September 2018

Revisions to the proposal forms were made to address the Science Panel's suggestions in the FY18 Work Plan. All proposals now include hypotheses, highlights and figures reflecting progress made during FY18. Program is on track except for uploading disease prevalence data to the workspace, but otherwise making excellent progress. The program is requesting an additional $20K to the original FY17-21 proposal annually for unexpected costs of permits and bonds that have arisen for FY19-21 (19120111-B Bishop) and ship time to continue acoustic surveys (19120111-G Rand). Starting in FY19, project 19170115 will be part of the HRM program to facilitate collaboration with the HRM Program and as per discussions with the HRM program and PI of project 19170115; this proposal is revised to include the budget for project 19170115.

PAC Comments – FY19

Date: September 2018

The PAC noted that the Science Programs have produced unique and very important long-term data sets. The PAC also commented on the thoroughness of how proposal information was presented, it was well organized and clear.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund*	Fund*	Fund*	Fund*	Fund*

**Indicates this review group recommends a Fund Contingent for Project #18170111-D Gorman. Update (11.21.17) Review group revised recommendation to Fund for Project #18170111-D Gorman.*

Science Panel Comments – FY18

Date: September 2017

Overall, the Panel is pleased with the Program's progress. The Panel strongly recommends that all proposals include hypotheses, highlights and figures reflecting progress made during the previous year(s), as did PIs for two of the proposals (18120111-C Branch and 18120111-E Hershberger/Purcell). The LTM proposal provide good examples of what the Panel is looking for, as they nicely addressed our previous request for this information. They also included a list of publications and datasets uploaded during the previous year, which we endorse and recommend that all proposals now include. This information is very helpful to determine whether changes are warranted in study plans for the upcoming year. Toward this end, improvements to the proposal forms will help. The Panel supports Scott's request to hire Maya Groner for the Post-doc position.

PI Response (10/11/2017)
As the program lead I will review the proposals to ensure they have the hypotheses, goals, and highlights as requested.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments. I will revise the proposal forms to address the Panel's recommendations.

PAC Comments – FY18

Date: September 2017

There are no program specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund Reduced	Fund Reduced	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

This is a complex proposal with many integrated parts. A key strength of the proposal is the required collaboration and cooperation of PI's from very different disciplines. This cohesion was an initial requirement for the herring program and Dr. Pegau has met this challenge successfully. There were, however, many questions and comments following the initial proposals presented earlier this year. The Panel appreciated the responses of Dr. Pegau and the PI's within the revised Herring Program. Most questions or comments requested clarification or more information and were not necessarily intended to point out shortcomings or errors. In this regard, the Panel was pleased and generally satisfied with the responses that we considered to be constructive and informative.

There was one aspect of the revised proposal that elicited some concerns: the brevity of scientific context and rationale for the herring program, as a whole. We acknowledge that this is a demanding request: it is difficult enough to provide such context for individual proposals, let alone a collection of proposals such as the integrated herring program. Nevertheless, the Panel would like to have seen more attention provided to explaining how the composite set of proposals addressed basic scientific issues. The two general hypotheses listed in the opening pages of the Herring program (i) bottom-up forcing and (ii) age-specific migration are fine, but there are many other fundamental

questions in the literature that are germane to the projects in the herring program. For example, within the initial overview of the herring proposals, there is scant reference to the potential impacts of climate change, as a factor that could affect herring or the research efforts directed at herring. We note, however that this specific issue is mentioned specifically in two projects. The Panel was somewhat reassured, however, when we heard directly from Dr. Pegau during a telephone conversation when he indicated that he shares some of this perspective but is constrained by time and assistance. There is some promise that the additional of a post-doc position may provide some assistance in this regard.

Date: May 2016

The Science Panel noted some possible inconsistency between the lists of hypothesis in the 'Program proposal summary' (Appendix A) and similar text from Appendix C. Appendix A presents text explaining the roles of a future post-doc position.

Appendix A states: " . . . the post-doc position will be directed to test the hypothesis: "Herring recruitment is driven by bottom up forcing and the total population level is determined by disease and predation."

Appendix C (HRM Coordination) repeats this hypothesis and adds two more: "Three hypotheses have arisen over the past seven years that guide our current efforts. Individual projects have additional hypotheses that they will address.

These three hypotheses are copied below (in Italic font):
H1: Herring populations exists in two states, high and low biomass, and the transition between states is rapid*. This hypothesis comes from the EVOS* supported *modeling effort of Dale Keifer (EVOS project 070810) prior to the formation of the integrated programs.* ***H2: Herring recruitment is driven by bottom up forcing and the total population level is determined by disease and predation.*** *A postdoctoral research position is proposed to allow a focused effort on using historical data to test this hypothesis.* ***H3: Larger herring migrate out of PWS during the summer, while smaller ones remain in PWS.***

The Panel was surprised by the inclusion of the specific hypotheses: H1 and H3. Also, we do not necessarily agree that these are three important hypotheses that have 'arisen over the last 7 years'. We note that there have been no publications of accessible reports to explain the origins of any of these hypotheses. This text is not well presented and is superfluous to the main thrust of most of the individual proposals. We recommend major editing and appropriate modification of related study plans.

Under the project called "HRM Coordination" there is general text referring to a post-doc position that reads as follows (in Italic font) with sentences numbered.
(1) The focus of the postdoctoral research will be to examine connections between herring recruitment and condition with the physical and biological environmental conditions. (2) We will be seeking proposals for the postdoctoral position in which the specifics of the approach will be described. (3). The intent is to address the hypothesis: Herring recruitment is driven by bottom up forcing and the total population level is determined by disease and predation. (4) The postdoctoral position is proposed to as a method that allows a focused effort on using historical data to test this hypothesis. (5) Testing this hypothesis is expected to inform the population modeling effort in a

manner that improves the predictive capacity of the modeling. (6) The improved model would then lead to resource managers having a better understanding of potential changes in the population.

Revision of Items 3-5 is strongly advised. Items 3-5 present a specific hypothesis that has already been examined in a number of papers for different herring populations. This comment does not mean to imply that the hypotheses are incorrect, or inappropriate, but it does unnecessarily restrict the scope of the postdoctoral position. It may be simpler and more productive to limit the 'focus' to examining connections between herring recruitment and condition with the physical and biological environmental conditions. The Panel also points out that a UAF doctoral student, Fletcher Sewall, located at NOAA's Ted Stevens Marine Research Institute with Ron Heintz, is examining potential relationships between PWS herring recruitment and environmental and ecological factors. Sewall's results may help jump start efforts by the post-doc and there may be possibilities of collaboration. Finally, the recruitment process for the post-doc described on page 31 was confusing but was explained by PI Pegau more clearly over the phone. The text should be clarified.

The Panel reflected on the scope of the herring proposals and whether there might have been other types of approaches. One example was raised during the phone call with Scott Pegau during which it was suggested that a review of the 2015 Incardona et al. paper may be helpful to consider whether low levels of lingering oil might have chronic impacts on recruitment. The Panel was surprised by the categorical rejection of this suggestion and that such experimental approaches may not have merit. We do not concur.

The Panel also reflected on the types and scope of synthesis work that might be conducted by the post-doc, and others, during the next 5 years. The Panel noted that there were a number of potential process-based connections that might be examined – such as connections between disease and predation. Further, there are potentially relevant data on other factors that might affect herring that are not considered in either the herring or LTM programs, such as juvenile salmon competition and impacts on herring growth of condition, or pinniped predation, etc.

**Incardona, J., M. G. Carls, L. Holland, T. L. Linbo, D. H. Baldwin, M. S. Myers, K. A. Peck-Miller, M. Tagal, S. D. Rice, N. L. Scholz. 2015. Very low embryonic crude oil exposures cause lasting cardiac defects in herring and salmon. Scientific Reports, 5:13499*

Science Coordinator Comments – FY17

Date: September 2016

I concur with the Science Panel's comments. I appreciate the Team Lead and individual PI's careful attention to the Panel's May comments and feel that the applicable changes made to the Program will benefit both the Herring and Long-Term Monitoring Programs.

Date: May 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel and Science Coordinator's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120111-A**

Project Title: Herring Program – Program Coordination, Postdoctoral Researcher

Primary Investigator(s): Scott Pegau

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $1,140,900

FY17	FY18	FY19	FY20	FY21
Auth: $138,400	Auth: $270,200	Auth: $302,500*	Auth: $270,200*	$159,600*[a]

Requests include 9% GA. *Includes additional $13K for program administrative assistance. [a]Includes additional $68.9K for existing post-doc to continue disease research.*

Funding From Non-EVOSTC Sources FY17-21: $261,400

FY17	FY18	FY19	FY20	FY21
$26,000	$26,600	$90,000	$90,500	$28,300

Total Past EVOSTC Funding Authorized (FY12-20): $2,720,100

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $3,081,000

Total Non-EVOSTC Funding (FY12-21): $373,100

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20*

This proposal is to provide coordination of the Herring Research and Monitoring (HRM) program. In addition to the coordination efforts, it includes a postdoctoral researcher examining the relationships between herring diseases and physical and biological oceanographic conditions. Furthermore, it covers the community involvement and outreach activities of the program. The goal of the project is to provide coordination within the HRM program and with the Gulf Watch Alaska (GWA) and Data Management (DM) programs. The objectives of the project are:

1) Coordinate efforts among the HRM projects to achieve the program objectives, maximize shared resources, ensure timely reporting, and coordinate logistics.
2) Oversee a postdoctoral researcher.
3) Provide outreach and community involvement for the program.

Coordination is primarily through e-mail and teleconference. The management team of GWA and the lead of DM are included in the emails to HRM principal investigators to ensure they are aware of our activities. We also plan joint principal investigator meetings and community involvement activities.

The postdoctoral researcher, Dr. Maya Groner, was hired at the end of FY17 and is focusing her research on understanding the combined impacts of environmental conditions and disease on herring population dynamics using a field collected data, experiments and population models.

Outreach efforts are focused on providing up-to-date information on the projects and their findings. Community involvement includes regular communications with the Alaska Department of Fish and Game, to stay aware of their findings and observations. We also are participating with GWA in listening sessions in villages within the spill affected to seek additional local and traditional ecological knowledge.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP is very pleased to see the excellent productivity of the postdoctoral researcher. The PI has made a request for 4 months of additional funding. The SP noted that EVOSTC supported her for 3 years during FY18, 19, and 20. We also noted that she has NPRB funding for FY21. Thus, the SP seeks clarification. Is the postdoc not fully covered by NPRB for this final year? The SP wishes to ensure that she is fully funded to fully utilize her talents for the duration of this project but wants to make sure that her time is not already covered by NPRB. Please clarify.

PI response (10.2.20)
No, Dr. Groner has some external funding, but it isn't enough to support her through FY21. The additional four months of salary requested is what would be required to support her through the end of this cycle of the Herring Research and Monitoring program and allow her to better combine the work supported by the North Pacific Research Board with the work included in this program.

Looking ahead, the SP is very interested in the incorporation of disease into the herring assessment model. In advance, the SP encourages the PIs to work with Trevor Branch. Specifically, can the model be configured to test its sensitivity to transmission rates? As an example, the herring model was recently examined with alternative assumptions about maturity and it was found that the model was not very sensitive to these assumptions. So, one maturity schedule was adopted. Understanding the model's sensitivity to disease transmission could help focus the remaining disease work.

PI response (10.2.20)
Maya Groner and Trevor Branch are both interested in continued collaborations aimed at calculating disease parameters that can feed into the BASA and evaluating the role of disease in the BASA. The first step towards this goal is the calculation of realistic parameters for disease mortality that can be used in the BASA. Over the past six months, Groner has been working closely with John Trochta, Trevor's graduate student, as he develops a model that can calculate herring mortality due to VHS (viral hemorrhagic septicemia) using time series data on seroprevalence across age classes. The model has currently been tested on an artificial dataset to test its performance. Because it is performing well, the next step is to calculate mortality using the VHS seroprevalence timeseries dataset collected by Paul Hershberger in PWS. We are also applying a variation of this model to the PWS Ichthyophonus timeseries data to calculate mortality due to Ichthyophonus as a function of disease prevalence across age classes. Mortality estimates from both models can be used in future iterations of the BASA.

Currently, transmission is not directly included in the BASA. However, it is a key parameter for disease models. Epidemiological models that include transmission estimates can be used to project disease spread under different scenarios (e.g., differing population size and structure, with varying levels of immunity) in order to identify scenarios that could lead to high mortality. Building dynamic disease models that can feed data into the BASA is a direction that we would like to pursue in the next funding period. Sensitivity analyses could then be performed on both the disease models and the BASA to determine which parameters most influence disease mortality and population estimates, respectively. The parameter estimation that is being conducted during this funding period is critical to that goal.

Given the addition of so much more herring research and observations since the 1980s, the SP encourages the PIs, perhaps in collaboration with other scientists, to develop a new) synthesis on PWS herring that would become the new authoritative reference.

PI Response (10.2.20)
This comment was taken from the comments provided to project 21120111-F. There are many references that are important to our work. The book Herring Expectations for a New Millennium is a common reference. As suggested, it is time to revisit either a single paper like Norcross et al. (2001) A synthesis of the life history and ecology of juvenile Pacific herring in Prince William Sound, Alaska. A single manuscript may be too limited in scope and it may be better to work on a book with chapters more similar to Herring Expectations for a New Millennium.

What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
The most likely impacts are to the principal investigator meeting and in outreach efforts. We anticipate that the principal investigator meeting will become a virtual meeting. We plan to investigate the appropriate means to hold a listening session with at least one village in Prince William Sound. We anticipate supporting other projects in field sampling if needed. The disease work being conducted by Dr. Groner can be accomplished by working at home.

Will any unused funds for FY21 be repurposed for additional lab and/or data analyses?

PI Response (10.2.20)
We do not anticipate any unused funds. It is more likely that we may have to make small budget modifications within the existing funding to allow contracting sampling assistance if needed.

Science Director Comments – FY21

Date: September 2020

The PIs request for additional funding ($56.9K) to use existing VHS and *Ichthyophonus* disease data to quantify transmission processes in wild herring populations is justifiable. Results are of value for a more realistic incorporation of disease in the herring age-structured-assessment model and for creating disease models that can explore a variety of different environmental and/or demographic scenarios. The amount requested is small relative to the value of the work proposed. Dr. Groner is highly productive and there are no concerns that the work will not be accomplished.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel is pleased to see the involvement of an intern; however, we are concerned with the validity of the interpretation of the data by an inexperienced reader. For example, it was pointed out that many scales in recent years have had unusually closely spaced annuli and there was discussion whether these were true annuli or false annuli that shouldn't be considered when aging. The Panel notes that there is a Committee of Age Reading Experts (CARE) that may be able to help address such difficulties. Age readers benefit from years of experience to interpret annuli. If there is agreement about the apparent closely spaced annuli in recent warm years, would it be possible to look at archived samples to see if the same annuli patterns in past warm years?

PI Response (10.2.19): There appears to have been a misinterpretation of what was presented in the work plan. The intern imaged and measured the scales. They were not responsible for aging the fish. That is done by the ADF&G led project. The intern's aging efforts were limited to agreeing on age before imaging, as was set up in the original protocols. The image library that the intern was updating provides an easy way to look at scales from previous warm periods. One can either look at the measured growth or the images of the scales.

Thanks to the panel for the reference to the Committee of Age Reading Experts. The discussion noted in the work plan was between the different aging labs within ADF&G to see how difficult scales would be read and why each person interpreted them the way they did.

The Science Panel had considerable discussion about the quantification of spawning. The following few paragraphs attempt to capture this discussion. Evidence presented in the Branch proposal indicates that herring spawn has shifted both in time (among years) and space, both within PWS and the adjacent area of Kayak Island. Similar temporal and spatial changes have occurred recently in other regions of the eastern Pacific, such as the Strait of Georgia. Based on the new (but preliminary) spatial-temporal analyses of spawning presented in the Branch proposal (project 20120111-C) the Panel requested clarification about survey effort and if some of the explanation for recent change might be related to limitations of resources for surveys. Additional information was provided by phone by Pegau. See HRM Program 20120111 comments (above). During the phone call, however, the Panel was advised that the relatively recent occurrences of spawning on Kayak Island since about 2010 (see Figure 2 in the Haught proposal (project 20170111-F) and Figures 5-6 in the Branch proposal) are not included as part of the spawn estimates. If so, we would question the validity (or

biological justification) for such an exclusion. Further, and echoing previous comments provided by the Panel, we also question the validity of the continued use of 'mile days' as quantitative units of spawn. We suggest two things. First, that the summing of spawn lengths, for two consecutive days in the same location may serve to inflate spawn deposition for certain areas. We strongly advise that this procedure requires re-examination and explanation – but this recommendation should not be interpreted as a criticism of the aerial surveys per se. On the contrary, the Panel applauds the efforts made to locate and measure the spawning. Second, the Panel points out that a linear measure of spawn may vary significantly depending on the location where it occurred. This is self-evident: spawning on steep narrow beaches with patchy macrophytes would not be expected to have equal numbers of eggs as broad beaches with dense macrophytes. These statements are clear from diver surveys conducted in other parts of the coast, including a few years in PWS. In this regard the panel wonders if there would be merit in attempting to calibrate different spawning areas in terms of their egg-rearing capacity. Similar attempts have been made elsewhere.

PI Response (10.2.19): There appears to be a couple main points to these comments. The first is the potential for movement of the location of spawn within PWS and movement of spawn to locations outside of PWS. The second is the validity of the survey technique used.

The movement of spawn and the change in spawn timing has long been a topic of discussion among herring researchers working in PWS. Without a doubt there easily could be a shift of spawning to locations outside of PWS that are not observed. There has never been regular surveys of spawn on Kayak Island and that will need to be made clear to the modeling effort. We have tried several methods (volunteer aircraft surveys, remote camera, person on the ground, satellite imagery) to improve our understanding of spawn in that area, but we have not been able to find a reliable means to survey spawn on Kayak Island. The remoteness of the island and weather in the area limits our ability to reach those spawning areas. Regular surveys of Kayak Island are limited to some extent by the funds available; however, access to the area is a greater limitation.

Two indices considered for spawn documented from aerial surveys were 1) discrete miles of milt over the season and 2) the sum of miles of milt for all survey days (mile-days of milt). The advantages of milt observations compared to school biomass observations are 1) herring schools likely spawn a single time e.g., a single day, but a herring school may be observed for several days prior to, or after spawning, 2) milt is relatively easy to observe from the air and observation efficiency is generally not influenced by ocean bathymetry (Brady 1987). Discrete miles of milt do not account for multiple spawning events in the same area, so are unlikely to be a good index of total abundance in areas with multiple days of spawning on the same beach (Brady 1987). Mile-days of milt provide a better index to abundance because they account for multiple spawning days on the same beach (Funk 1994). Willette et al. (1999) collected paired spawn deposition survey estimates from dive surveys and aerial survey estimates of miles of milt; the short tons (dive survey) per mile of milt (aerial survey) were much larger on Montague Island beaches when compared to short tons per mile of milt in northern or northeastern PWS beaches. Montague Island shoreline typically has large shallow, subtidal areas with complex kelp structure while the northern and northwestern beaches tend to have a steeper gradient to deep waters and less complex kelp structure. Currently, biomass estimates derived from miles days of milt observations are weighted by district according to Willette et al. 1999.
Brady, J.A. 1987. Distribution, timing, and relative biomass indices for Pacific Herring as determined by aerial surveys in Prince William Sound 1978 to 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Prince William Sound Data Report 87-14, Anchorage.

Funk, F. 1994. Forecast of the Pacific herring biomass in Prince William Sound, Alaska, 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J94-04, Juneau.

Willette, T.M., G.S. Carpenter, K. Hyer, and J.A. Wilcock. 1999. Herring natal habitats, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 97166), Alaska Department of Fish and Game, Division of Commercial Fisheries, Cordova, Alaska.

We will continue to work with ADF&G to review the selection on the survey technique being used. The mile-days measure obtained from the ADF&G surveys could certainly be explained in more detail, and different ways of measuring have been explored. The danger to changing this metric is that it would break the long time series of consistent estimates over time, which would require the model to treat a new approach as a separate time series from the existing time series, and this would not be useful until the new time series included at least 4-5 years of data. Direct diver surveys for eggs would be expensive to start up again since this would require training divers in the methodology required, and again would require sufficient years to be useful. Past diver surveys were very useful because they provided an absolute measure of biomass, which although it was highly uncertain compared to the aerial surveys and the hydroacoustic surveys, provided an anchor point for the stock assessment (Muradian et al. 2019).

The Panel welcomed the development of mathematical models of VHS but had concerns with the model in this proposal. One of the stated motivations related to the idea that the benefits of herd immunity might be compromised by harvesting of older fish. Yet the S-E-I-C model presented does not take account of age structure. Despite this, there are stated aims to parameterize the model and publish a paper. What would be the goals of this paper?

PI Response (10.2.19): This is a good question and requires further explanation. Age is related to immunity. The older a fish is, the more likely it is to have experienced a VHS epizootic and to have immunity. There are several ways to explicitly or implicitly incorporate age into a model. As the panel suggests, one way to incorporate age into the model structure is to explicitly model it. For every age group modeled, this will add an additional 4 equations to the model, causing a shift from a relatively simple model to a fairly complex model that can be more complicated to solve, analyze and present. Alternatively, we can make some assumptions about the composition of herd immunity in older relative to younger fish. We can assume that older fish are more likely to be in the 'C' or carrier state, while younger fish are more likely to be in the 'S' or susceptible state. Thus, when we apply a fishing pressure to the population, we can adjust target the fishing to affect mostly older fish in state 'C' (i.e., in a gill net fishery), or an even proportion of fish in all states (i.e. a purse net fishery). Young fish can be added to the model as a 'pulse' of susceptible fish each year and the proportion of susceptible fish relative to carrier fish will determine the herd immunity of a population at any time. Because this is the first VHS model we are constructing and we will need to test parameters to calibrate the model, we prefer to keep the model simple. The focus of this paper will be on communicating and demonstrating key concepts that determine VHS epidemiology: immunity, population structure (w/ regards to disease states and population size), the parameterization of the model and the justification of the S-E-I-C design (as opposed to an SIR, or SI model). It is our plan, however, that this baseline model will serve as a template for more complex models that can incorporate additional factors such as age-structure and temperature-dependence, though the exact structure of any model version will be determined by

the research question being proposed. We are currently working with John Trochta and Trevor Branch to adapt this model to have an age-structure in a later paper that is focused on how serology (i.e. immunity data) can be used to infer unobserved processes in a VHS outbreak, such as mortality or transmission.

The concerns about the modeling were mitigated by the description (page 5 of project 20120111-C) of a simulation study using an age structured model of VHS based on a slightly different epidemiological model (S-I-R). This is potentially very useful indeed and will contribute to integrating the findings from the disease study with the stock assessment modeling.

PI Response (10.2.19): The disease team and modeling team are working in close collaboration on disease models, which will include age structure and be incorporated into the stock assessment, should simulations demonstrate this would be a useful addition.

Older fish are now spawning in 2019. This means those fish have strong immunity. The panel would be interested to see if juveniles or year 1-2 fish from this older cohort are more resistant as compared to juveniles or years 1-2 from younger spawners in the past. This would suggest that there is a transfer of immunity (transcriptome or genetic) which could be addressed by the Whitehead project (20170115) and certainly could be critical information for model.

PI Response (10.2.19): Great observation; we will absolutely be tracking the VHSV antibody status of individual year classes as they get progressively older. We are as excited as you are to see these results, and we expect to have them prepared in the 2020 report. One word of caution however; there is no indication that there is any vertical transfer of VHSV antibodies from the mother to the progeny; therefore, any immunity to VHSV detected in an individual year class would have been achieved via adaptive immunity (i.e. surviving prior virus exposure).

Science Director Comments – FY20

Date: September 2019

Dr. Pegau continues to provide valuable support and coordination within the herring program and with the Gulf Watch Alaska program. Post-doctoral researcher Dr. Groner is making timely progress on her three defined projects that investigate the effects of disease on herring. In FY19, administrative review services were approved, which resulted in a noticeable increase in the quality of the reporting products submitted to Trustee Council office. The PI is requesting an additional $14.1K to continue needed administrative services for FY20, which will include FY19 annual reports and FY21 work plans.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

We agree with the Science Coordinator that the PI and the HRM program would benefit from additional administrative assistance. We have no other project-specific comments.

PI Response (10/31/18): A new administrative assistant has been added to the coordination proposal as requested.

Science Coordinator Comments – FY19

Date: September 2018

New postdoc Dr. Groner's previous and current work will make useful contributions to the HRM program. The need for administrative assistance within the HRM program is still a concern with the Science Panel (see May 2016 FY17 comments): "On the other hand, the Panel supports strongly the need to provide additional assistance to Pegau, whose workload alone is a Herculean task." Dr. Groner is supporting the PI in the evaluation of reports and annual proposals being submitted to EVOSTC. While I greatly appreciate the PI's coordination work and effort, and welcome Dr. Groner's help with administrative work within the HRM program, I suggest additional experienced administrative assistance for the HRM program. At the PAC meeting, I was pleased to hear that the PAC understands and strongly supports the need for additional administrative assistance to improve and ensure the quality of reports and other documents that are produced by the program.

PI Response (10/31/18): A new administrative assistant has been added to the coordination proposal as requested.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel appreciates Scott's hard work and effort in the coordination of the Herring Research Monitoring Program. We were pleased to hear that PIs are compliant and rapidly uploading their data to the data portal. The panel is especially pleased to see Scott's involvement in promoting the inclusion of a postdoc in the Herring Program.

PI Response (10/11/2017) Thank you

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel also appreciates that Dr. Pegau's program has endured a number of changes in personnel, with some departing PI's and some new ones. Such changes can be disruptive, and the Panel heartily commends Dr. Pegau for his steady and dedicated supervision of a number of complex and varied management issues. In particular we salute the continued operational integration of the projects, especially the collaborative sharing of vessels and other forms of cooperation among PI's, both with and between the Herring and LTM programs.

The Panel appreciates the extension of the postdoc for a full three years.

Date: May 2016

The Panel strongly recommends that the Council consider the addition of funding to support a third year of the post-doc position, which the proposer currently budgets as funded for slightly more than two years. In recommending three years of funding, the Panel notes that much of the first year will be spent becoming familiar with existing programs and data. The proposal also needs to add a mentoring plan for the post-doc position. This plan could profit by including interactions between

the post-doc and Hershberger, whose disease research continues to inspire new insights into causes of the lack of herring recovery in PWS.

The request for an additional $500,000 in funding to allow for flexibility to respond to changing conditions is not supported by the Panel. If the Program would like to pursue expanded or new work, specific proposals for the expanded or new work should be submitted during the annual proposal cycle to allow for review by the Panel. On the other hand, the Panel supports strongly the need to provide additional assistance to Pegau, whose workload alone is a Herculean task.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21160111-B**

Project Title: Herring Program - Annual Herring Migration Cycle

Primary Investigator(s): Mary Anne Bishop

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $1,744,200

FY17	FY18	FY19	FY20	FY21
Auth: $381,900	Auth: $379,500	Auth: $275,800*	Auth: $434,200*,[a]	$272,800[a]

Requests include 9% GA.

* Includes additional request for posting bond required by ADNR ($2.6K for FY19) and annual fees for land use permits for underwater acoustic arrays ($2.7K annual for FY19-20). [a]Includes request for additional year of tagging and analysis ($129K for FY20, $272.8K for FY21).

Funding From Non-EVOSTC Sources FY17-21: $75,000

FY17	FY18	FY19	FY20	FY21
$15,000	$15,000	$15,000	$15,000	$15,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,744,000

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $2,016,800

Total Non-EVOSTC Funding (FY12-21): $490,500

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

This project is a component of the Herring Research and Monitoring (HRM) program. The goal of the HRM program is to improve predictive models of herring stocks through observations and research. Within Prince William Sound (PWS), adult Pacific herring (*Clupea pallasii*) movements between spawning, summer feeding, and overwintering areas are not well understood. Addressing this knowledge gap will improve our ability to assess biomass trends and recovery of this ecologically important species. In 2013, we documented post-spawn migration of herring from Port Gravina to the PWS entrances by acoustic tagging adult herring and collecting data from the Ocean Tracking Network (OTN) acoustic arrays, which are located in the major entrances and passages connecting PWS with the Gulf of Alaska (GoA). However, the 2013 study could not establish movement direction and if herring were seasonally leaving PWS and migrating into the GoA. With funding from the *Exxon Valdez* Oil Spill Trustee Council in FY16, we obtained the ability to distinguish direction of movements between PWS and the GoA by deploying additional acoustic receivers at the OTN arrays. The primary goal of this 2017-2021 project is to clarify the annual migration cycle of PWS adult herring by leveraging this expanded acoustic infrastructure. The specific objectives of this project are to 1) document location, timing, and direction of Pacific herring seasonal migrations between PWS and the GoA; 2) relate large-scale movements to year class and body condition of tagged individuals; and 3) determine seasonal residency time within PWS, at the entrances to PWS, and in the GoA.

From 2017-2019 we tagged 491 fish, and depending on the tag year, 48% (2017) to 81% (2019) of the tagged herring were detected at the acoustic arrays located at the entrances to GoA. Preliminary analyses has shown that fish tended to enter the GoA at Hinchinbrook Entrance during spring and summer after spawning and return to PWS during the fall and winter. Length, weight, and condition have each been found to have a significant effect on the rate at which herring move from PWS to the entrance arrays. Recently, we tagged 235 herring on the spawning grounds during April 2020. With funding from the Alaska Ocean Observing System, University of Alaska will deploy an autonomous underwater vehicle (AUV) in PWS for ~75d this 2020-21 winter with the objective to detect our acoustic tagged Pacific herring. Our FY21 work will focus on uploading data from arrays, analyses, manuscripts, and final report writing.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

This project has provided solid evidence that PWS herring use the GOA as a summer feeding area. Other results indicate that migration out of PWS, to feeding areas on the shelf, may depend on the condition of herring. If so, this is valuable information and confirmatory evidence of similar, earlier results from Norwegian work by Slotte and Fiksen (2000) on state-dependent spawning migration (J. Fish Biol. 56: 138-162). Further, the results of this work indicate that migration is complex and may provide a sharp contrast to A. MacCall's hypothesis that young fish simply follow the older fish. The SP looks forward to discussion of these and other findings in future publications and reports. The new postdoc should be an excellent addition to this project.

PI Response (10.2.20)
We thank the Science Panel and Science Director for their funding recommendation and compliments. We feel confident that this project will benefit from the addition of the new postdoc and that the project will continue to provide novel insights into Pacific herring migration.

What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
During the COVID-19 pandemic, the PWSSC has been able to successfully conduct field and lab work. The remaining field work for this project includes uploading data from the underwater acoustic arrays. We can conduct this work safely by reducing the number of people aboard vessels and receiving COVID testing prior to longer trips. COVID testing in Cordova can be completed most days of the week with results received within a few hours. The community has also been successful with contact tracing and maintaining a low infection rate. In 2021, we will continue to exercise caution while generating mitigation plans that allow us to conduct field work. Under the worst case scenario (a local outbreak or other extenuating circumstances) our regular charter boat captain is trained and able to recover and redeploy the acoustic arrays as well as upload data from the receivers.

Will any unused funds for FY21 be repurposed for additional lab and/or data analyses?

PI Response (10.2.20)
We deployed > 230 acoustic tags in April 2020 that have a battery life of up to 2 years. We foresee the final data upload from our receiver arrays taking place during winter 2021/22. We would therefore carryover any unused funds for the final upload, as well as data analyses and manuscript preparation.

Science Director Comments – FY21

Date: September 2020

This project continues to provide valuable information on herring migration within and outside of PWS. In FY20, this project was able to collect herring samples for another HRM project for which the field trip was cancelled due to the COVID-19 pandemic. As discussed previously in the FY20 proposal, a new postdoc will replace the fisheries biologist that left the project. The postdoc will pick up where the biologist left off: she will be responsible for data compilation, acoustic array management and data uploads, and will assist the PI with the final report and publications related to the project. I do not have any concerns that the work will not be completed as proposed. The PI continues to produce: one manuscript in review and another in prep. I look forward to the AUV discoveries on overwintering herring.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The project has definitively shown that herring move outside of PWS. This phenomenon has been hypothesized for years, but this work has provided conclusive data. The Panel appreciates the proposed additional year of tagging but was originally hoping that the additional tagged fish could be released in the same previous year. We understand, however, that tagging that many fish in one year was likely not realistic. The Panel discussed the utility of an additional 219 tagged fish in FY20 and concluded that this add-on is worthwhile as the results should strengthen project findings and conclusions.

The Science Panel would like to share a few other thoughts with the PI. First, we noted that when tagging at spawning sites the fish were 'milting'. Does this mean that only males were tagged?

PI Response (10.2.19): Both males and females are tagged.

Second, the hypotheses are good and address key unresolved questions for herring in general. However, the Science Panel wondered if the potential results might be exactly opposite as stated. Specifically, might food-deprived adults migrate more?

PI Response (10.2.19): Currently we have migration data from the first two years of tagging. While our modeling results are preliminary, the movement probabilities and the linear constraints incorporated into the Multistate CJS model suggest that fish in good condition are more likely to move from PWS to the entrance arrays in the summer months (when fish migrate into the GOA) than fish in poor condition. If food-deprivation was a significant factor causing adults to migrate more, the opposite trend would be reflected by the model.

There is evidence that herring larvae in poor condition may be more prone to move/migrate. In either case, the results of tagging work could address this issue. Third, there is an interesting question of how and when (or what age) herring migrate away from spawning areas to offshore feeding areas and then return. The proposal mentions that it may be a learned behavior (which is supported by some scientists but not by the literature), but this remains speculative.

PI Response (10.2.19): During April 2019 tagging activities, we removed one scale for aging and were able to age 144 of the 165 fish tagged. Importantly, 3-year-old fish represented 32% of fish we were able to age. Thus, we believe the forthcoming receiver detection data will shed some light on the question at what age herring migrate. Regarding whether or not migration is a learned behavior, our proposal cites Corten's paper (2002) that suggested this might be the case, however, answering whether or not migration is learned is neither one of our project's hypotheses or objectives.

A particular difficulty with the 'learn from older fish' hypothesis is that the distributions of the age 0+ and 1+ cohorts usually are spatially disjunct from older cohorts, especially in populations or areas where herring migrate to shelf waters for summer feeding. Finally, the Science Panel asks that, when interpreting results from this project, the PI should be mindful that herring may demonstrate substantial changes in distribution, thus migratory patterns observed in one or a few years may not be static.

PI Response (10.2.19): The PI agrees with the Science Panel's statement and will take that into consideration when interpreting results.

Science Director Comments – FY20

Date: September 2019

This project provides valuable information on herring migration within and outside of PWS. In FY19, the Science Panel recommended increasing the sample sizes of tagged fish to improve the accuracy of these data and inferences. In response, the PI is requesting an additional $129K for an additional year of tagging of 210 fish in FY20 and an additional $272.8K for analysis in FY21. The fisheries biologist has left the project and he will be replaced with a new postdoctoral researcher in the near future. I understand from Scott Pegau that the postdoc will pick up where the biologist left off and all work will be completed as proposed. I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel applauds the PIs work and recognizes that it has greatly advanced our understanding of herring migration within and outside of PWS. It would be nice to be able to compute SE to be comfortable with the accuracy of these data and inferences, given the relatively small sample sizes. What would it take to tag 500 fish? Is it feasible?

PI Response (10/31/18): We catch fish right before spawning (many are milting when we tag them). Because of the reduced PWS herring population and predominance of younger and smaller age classes, we have had to search long and hard to locate, catch, and tag over 200 fish during the short pre-spawning window. We would like to suggest adding a 4th year of tagging in 2020 of at least 210 fish (right now spring 2019 is scheduled to be the final year for tagging). An additional year of tagging would boost our sample size of fish that move to the entrances to approximately 500 fish. By 2020, the dominant age class would be larger, and it will be easier to find and tag larger herring.

The PI's work has wide applications. For instance, results from this project help interpret historical ADFG data. We note that, in the FY17 annual report, the PI reports that there is the ability to remotely download data but the PI was not able to access data from all of the receivers. The PI also reports that some of the receivers were tilted. Was the tilting an unexpected event? Is the download problem linked to the tilting issue? What steps will be taken to address tilt issues and loss of data from happening in the future?

PI Response (10/31/18): We consulted with various people before putting out the receivers in March 2013 and were advised that biofouling would not be an issue at the depths we were deploying. It was not until the September 2017 upload, we noted that some receivers in the Ocean Tracking Network arrays had consistent tilts of 80-90 degrees. Looking at the tilts over time, it appears that biofouling is what is causing the tilting. Depending on the tides, sometimes we can upload receivers with 90 degree tilts. However, receiver tilting appears to affect receiver detection efficiency. We have put a second receiver nearby the 18 receivers that are tilting 80-90 degrees. We are going out 2x a year instead of just once to upload data at Montague Strait and Hinchinbrook Entrance. This way we can identify and resolve problems faster and mitigate data loss.

Science Coordinator Comments – FY19

Date: September 2018

PI is making good progress; project is on track. I am pleased to see the preliminary results from FY18. Additional receivers were deployed in February 2017 to determine what direction tagged herring travel after detection (back into PWS or out towards GOA) and there are unexpected costs

associated with expanding the acoustic receiving arrays ($6.9K annually) for permits and bonds required by ADNR.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel is once again very pleased with the quality of this proposal. These results are relevant and important; the PI has answered the questions that were asked.

PI Response (10/11/2017) Thank you

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

This appears to be a very productive project, in terms of acquiring valuable observations about herring movements in PWS. The original proposal was both well-presented and interesting. This generated questions from the Panel – which were addressed in detail. The Panel thanks the PI for detailed and thorough response to Panel interest and concerns, which put both her work and the proposal at large into broader perspective. We also appreciate the PI adjusting sampling based on Panel comments.

Date: May 2016

The Panel was pleased by the work and rapid reporting of results in the literature. While the Panel endorsed the elements and detail of the proposal, we wondered if the work was limited by funding, or whether there were some incremental tasks that might be considered. Specifically, we wondered if additional tag releases, from different areas and different times, might be considered. While speculative, we wondered if additional tagging might address some key hypotheses that cannot be considered within the present level of funding. For example, does the propensity to migrate out of PWS, or stay within PWS, vary with tagging (spawning) location, or perhaps fish size? Would there be merit in tagging at different times of year – and not only in the spawning season? The main comment was to suggest to the PI that additional increments to this work might be considered if such increments were cost-effective and addressed important hypotheses. Additionally, the Panel was very appreciative of the power analyses presented in the proposal, but cautions that sample sizes estimated for simulated herring in Table 1 may underestimate samples actually required for wild herring.

The Panel understands that annual migrations within PWS, while potentially interesting, are beyond the scope of the project as envisioned. However, we wonder if there may be supplementary data (e.g., herring bycatch in other fisheries) that may be useful to help cobble together a more complete picture of herring migration within and outside PWS.

A different comment on tagging reflects comments made during our call with Scott Pegau who indicated that recent genetics work showed significant differences between PWS herring and those of Kodiak. Less clear was whether there were any genetic differences found within PWS. Based on previously published work, the Panel thought that the likelihood of genetic differences among herring within PWS to be very small – but, on the other hand, if such differences were found then it would be sensible to ensure that tagging was conducted on each of any potential different stocks or sub-stocks. Perhaps a review of fish genetic research done by the Seebs when they worked for ADFG could reveal comparisons among PWS populations that could inform this issue.

The Panel would be supportive of additional project funding for increased tagging as discussed above.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120111-C**

Project Title: Herring Program – Modeling and stock assessment of PWS herring

Primary Investigator(s): Trevor Branch

PI Affiliation: University of WA **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $1,161,900

FY17	FY18	FY19	FY20	FY21
Auth: $124,300	Auth: $288,300	Auth: $297,000	Auth: $303,300	$148,900

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY12-20): $1,440,000

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,588,900

Total Non-EVOSTC Funding (FY12-21): $0

Abstract:

**This abstract is excerpted from the PI's Revised Proposal, dated 8/14/20, budget updated 8/14/20.*
Prince William Sound (PWS) herring collapsed shortly after the *Exxon Valdez* oil spill and has yet to recover. Here, we propose to continue the modeling component to the long-term herring monitoring project, which has as its chief goal an understanding of the current status of PWS herring, the factors affecting its lack of recovery, and an assessment of research and fishery needs into the future. Key products are the following (items 6-8 are related to the postdoctoral fellow):

1. The core product of the modeling project is the maintenance and updating of the new Bayesian age-structured assessment (BASA) model based on the ASA model used by the Alaska Department of Fish and Game (ADF&G), including annual assessment updates of PWS herring and the revision of BASA to fit to new data sources.
2. Adapting the BASA model to better model the disease component of natural mortality. Planned work includes simulation modeling of information that can be obtained from antibodies of viral hemorrhagic septicemia virus (VHSV) in herring (described by Hershberger, project 21120111-E), to examine whether such data can be used to estimate annual outbreak size, the susceptibility of different ages to VHSV, and the estimation of additional mortality due to VHSV.
3. Collation of catch, biomass, and recruitment time series from herring populations around the world to place the lack of recovery of PWS herring into context.
4. An initial exploration of factors that may be used to predict herring recruitment, including oceanography, climate, competition, and predation.
5. Management strategy evaluation to test alternative harvest control rules for managing the fishery in the future, given realistic variability in productivity over time, and the possibility that the population has

moved into a low productivity regime. Ecological, economic, and social factors would be considered in the Management Strategy Evaluation.

6. Examination of physical and ecological processes linked to PWS herring spawning, spawning survival, and survival of juvenile life stages.
7. Examination of physical and ecological processes on recruitment to the PWS and Sitka Sound herring populations.
8. Identifying environmental inputs for incorporation into the BASA model to improve recruitment predictions.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP congratulates the PIs on their progress in multiple lines of investigation. The publication of their global analysis of herring demonstrated the unusually long period of low biomass and low recruitment in PWS herring compared to other herring populations around the world.

In proposal 21120114-O, the SP noted a statement that humpback whales consume about 20% of the herring biomass -- the same amount that the fishery harvested annually. If this is true, then perhaps whale predation should be more prominently included in the model. A similar comment can be made about seabird predation. The SP looks forward to attempts to reconcile the relative importance of whales and seabirds to herring among proposals. Perhaps there is conflicting evidence (or assumptions) among the different projects within the HRM program? In Figure 4, humpback whale counts are mentioned and a brief explanation is offered with the conclusion that whales are not important (indeed, the coefficient relating summer whale counts to herring is positive, perhaps more suggesting of bottom-up influence of herring on whale counts). Also, in Figure 4, hatchery pink salmon demonstrate a negative effect, but they are not given much explanation in the text. As there is some ongoing interest in the role, if any, of hatchery pink salmon on the lack of herring recovery, further explanation would be appreciated.

PI Response (10.2.20)

The inclusion of whale predation could be integrated into the stock assessment, given reliable estimates of whale consumption. Other stock assessments have directly incorporated predator-prey relationships by linking population dynamics of the predator with the prey dynamics, but this requires a lot of data (e.g. time series of diet data, consumption rates, estimates on predator survival and growth, etc.). While we are not immediately aware of conflicting evidence amongst projects, the availability of predator (both whale and seabird) data and modeling approaches should be discussed with the other PIs to explore informing the stock assessment and clarify any potential issues. In Figure 4, we should note that two different whale time series are explored (the first is model estimates of total whale abundance in the summer, and the second is observed counts, not total abundance, in winter). The model accounts for the different seasons in which these time series are available. In addition, the effect estimates shown in Figure 4 are modeled on mortality so a positive humpback whale effect implies a top-down influence of whales. Finally, our conclusion on the unimportance of humpback whales hinges on model selection criteria results (not shown), which indicated that despite an estimated positive

effect of humpback whales on herring mortality, model fits were not improved substantially compared to models without a humpback whale effect on mortality. The same also applies to the negative effect of hatchery pink salmon (while there may be some effect, our modeling suggests most of the variability in PWS herring recruitment remains unexplained). Thus, while effects of these factors are suggested, they are uncertain and currently offer no benefit yet in improving stock assessment precision or accuracy.

The SP appreciates the implications of the departure of postdoc Dr. McGowan and the lag in start-up of replacement postdoc Dr. Dias on deliverables from this project. Despite his move to another position, will Dr. McGowan be able to publish his work on spatio-temporal patterns in herring spawning? Does his current employment allow an ability to wrap up other work he started? Specifically, what planned project work will no longer be completed? We look forward to Dr. Dias' work on the relationship between physical and population factors that may drive variability in spawning timing.

PI Response (10.2.20)
The work by Dr. McGowan on spatio-temporal patterns has been ready for submission to a journal for about 6 months but despite two rounds of ADF&G internal review, we have not yet received permission to submit. Planned follow-up work by Dr. Dias is ongoing.

What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
This project is relatively unaffected by COVID, except that the PI has extra teaching burden due to preparation for online teaching.

Science Director Comments – FY21

Date: September 2020
The PI and his team continue to make significant contributions to the modeling component of the HRM program and to scientific literature. The global herring meta-analysis of 64 herring populations is now published and includes many key findings for PWS herring. The preliminary modeling results that include disease data is promising. Post-doc objectives are revised due to the change in personnel and impacts of COVID-19 on productivity, which is reasonable. The new postdoc is highly qualified to continue the work.

PAC Comments – FY21

Date: October 2020
The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020
I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council

Fund	Fund	Not Reviewed	Fund	Fund

Science Panel Comments – FY20

Date: September 2019

The Science Panel is pleased with overall project progress and appreciates the ongoing multiple lines of investigation. The panel complements the PI and postdoc on the number of publications completed and in progress. While we very much appreciate collaborative efforts with Maya Groner to include disease dynamics in the model, we have concerns with connections to the disease data. The model does not include age structure; however, age structure influences disease. There are inconsistencies in proposal A and this proposal regarding the inclusion of the disease data in the model. Please see more detailed Science Panel comments about disease modeling under herring proposal 20120111-A (postdoc).

PI Response (10.2.19): We apologize for not including sufficient information in the description of the disease model. The disease model indeed does include age structure, without which it would be almost impossible to estimate the severity of disease in each year. We are currently running simulations to determine what information could be extracted from the immunity data in terms of annual severity, additional annual mortality, and the degree to which each age group is susceptible to disease. Nothing similar has ever been included in stock assessments of other species.

The proposal indicated that the BASA model overestimated herring biomass relative to survey data. This was interpreted as model mis-specification. Investigations into this model mis-specification included placing different priors on survey coefficient of variation, allowing for autocorrelated recruitment, and fixing the sex ratio. In addition, the Science Panel wondered whether changes in natural mortality M could be an additional potential explanation worth examining.

PI Response (10.2.19): One of the projects being done by PhD student Trochta, is examining factors that may influence changes in natural mortality, and results are almost ready for inclusion in future reports.

The panel noted that milestones and tasks were changed as the postdoc position evolved. These changes seem appropriate. The analysis of spatial variability in spawning looks to be a fruitful avenue of research. The Science Panel wondered if changes in spawning distribution could be related to historical serial depletion by fisheries. ADFG fish ticket data by stat area might provide some insights into this possibility. However, the panel appreciates that analyses of spatial distribution could be very substantial and time consuming.

PI Response (10.2.19): Dr. McGowan has examined spatial distribution of fishing, which shifted substantially over time. Further analysis of the fish ticket statistical areas data is planned, and some data issues need to be resolved at this point. Nevertheless, our initial impression is that shifts in fishing reflect shifts in the fish distribution, rather than fishing causing serial depletion, which results in shifts in spatial distribution of the fish. This is bolstered by continued large changes in spatial distribution in the absence of fishing post-collapse.

Science Director Comments – FY20

Date: September 2019

Significant progress has been made on the development of the BASA model since the start of the second five-year program in FY17. Products for FY19 include two manuscripts in prep and two in review. The primary objectives for the post-doc project have been revised to allow for a more in-depth examination of observed shifts in the location and timing of spawning in PWS over the past four decades. I agree with the Science Panel that this seems adaptive and appropriate.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel requests for future reports and proposals to please clarify that ADF&G is now using the model from this project. Timeline products: What juvenile data (ages 0-2) are now being incorporated into the model?

PI Response (10/31/18): The current BASA model was changed to start with age 0 but does not currently fit to any juvenile data. We ran a test series of model fits that included the aerial surveys of age 1+ schools in 2015 (only four data points were available), but this did not improve predictions for age-3 recruits. However, as the length of these surveys continues to grow, these and other juvenile data can be easily reincorporated into the most recent model.

How are these data collected and have scaling issues of juvenile to adult data been adequately addressed?

PI Response (10/31/18): When the model fits to juvenile data, these data are scaled using an estimated catchability parameter, so that the trend is captured but the absolute magnitude is scaled up and down automatically to match the adult surveys.

Can apparent increases in mortality of herring at ages 1-2 be distinguished from selectivity/catchability issues among aerial and acoustic surveys? The answers affect interpretation of the age(s) at which year class strength is determined.

PI Response (10/31/18): These are currently not incorporated into the BASA model, so the question cannot be addressed from the modeling perspective yet. It seems unlikely that changes in mortality could be estimated precisely enough from the aerial and acoustic surveys.

Regarding the antibody paper, is the PI working closely with Hershberger to get this done?

PI Response (10/31/18): We have the most up-to-date antibody data from Hershberger. Initial simulations suggested that it should be possible to estimate disease prevalence by year and age, but the actual data are much more ambiguous than the simulated data we tested. We are developing a more advanced age-structured simulation model to test how much information can be obtained from the noisier actual antibody data. We are in discussion with Hershberger on how best to proceed, but it looks like we may only be able to estimate annual disease prevalence rather than prevalence by both year and age

Different factors affect herring at different stages which is being incorporated into the ASA model. We find this valid and useful and are excited to see this published. In the FY18 work plan, the Science Panel suggested the PI to consider the development of a similar model for Sitka herring, which would be valuable as a contrast. We still believe this is an important exercise and it likely will be informative for PWS herring and valuable globally. As Sitka Sound is outside of the spill area, we encourage the PI to seek funding to accomplish this. Collaboration with ADFG in Southeast Alaska would be ideal.

PI Response (10/31/18): A Bayesian model is being developed in ADMB for Sitka by Jane Sullivan (ADF&G), although this has substantial differences in the data used, model assumptions, and functional forms of the individual components. At the present time we are not able to develop a new model for Sitka but will continue collaborating with ADF&G about how best to coordinate efforts.

Science Coordinator Comments – FY19

Date: September 2018

PI continues to be highly productive: two manuscripts published in FY18 and another in prep. I have no project specific comments

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel is pleased to see the data presented and supports the elimination of the Ricker SRR. The Panel has some suggestions regarding the model:

The BASA is a logical extension of the preceding ASA assessment model for PWS herring and may be of use to fishery managers as a model intended to determine such quantities as the stock abundance relative to the stock size threshold for opening a fishery. Some aspects of the BASA model pose

difficulties for the examination of environmental relationships. The Panel does not consider the present BASA to be an adequate operating model for purposes of Management Strategy Evaluation (MSE). EVOSTC research needs would be better met by implementing the following changes to the BASA model to aid in identifying critical population processes and environmental influences on PWS herring:

A. Extend the time series as early a date as possible (previous assessments go back to 1925). This will greatly increase the statistical power for examining environmental influences. The present BASA model begins in 1980, reducing the length of the time series.

PI Response (10/11/2017)
It is our indeed our intent to extend the time series of the BASA model further back in time than the current ASA model used by ADF&G for stock assessments. At present, both BASA and ASA start in 1980, because this marks the start of indices of abundance for this population. In the absence of biomass indices prior to 1980, annual stock assessment estimates of recruitment and biomass will be far more uncertain and less useful in examining the influence of environmental processes. However, prior to 1980, there are data on total catch, proportion at age in catch, and length at age are available (e.g. Reid 1971). It should be noted that while much more uncertain estimates of biomass and recruitment can be obtained prior to 1980, this is not true of most of the time series of explanatory factors, many of which rely on time series of data started under the EVOSTC program, or on satellite imagery. Indeed, there are far fewer explanatory variables extending back in time beyond 1980 that could be used in the analysis, reducing the usefulness of this exercise.

B. Allow the background natural mortality rate to vary in time and estimate it. An example methodology is provided by the Canadian herring assessments (DFO 2015). This should increase accuracy of recruitment estimates and allow additional insight into possible alternative population states. This also will examination of the influence of top-down drivers (predation) and comparison with trends in predator abundance.

PI Response (10/11/2017)
The Canadian herring assessments (DFO 2015) differ from BASA in two key ways: (1) they estimate varying natural mortality constrains by a random walk with autocorrelation, such that natural mortality cannot vary much from year to year; and (2) they do not estimate additional mortality from disease. There is considerable debate in the stock assessment literature about whether natural mortality can be estimated, since it changes with estimates of recruitment and selectivity. Indeed, in the DFO models, there are unrealistically large changes in natural mortality over time from 0.15 to 1.2 (Figure 5, DFO 2015). Setting that technical issue aside, allowing time-varying natural mortality in BASA would remove the ability to estimate additional mortality from disease, since any signal in natural mortality would be soaked up by time-varying natural mortality. This would compromise goal 2 of the project: the inclusion of new antibody data for VHSV into BASA. It is therefore premature to alter the structure of BASA at this time.

C. Consider constructing a similar BASA model for the Sitka fishery. To the extent that Sitka shares previously-identified large-scale environmental influences with PWS (Williams & Quinn 2000), combined models will increase statistical power. Conversely, if this pattern of correlation no longer applies in recent years, comparing models should help isolate the important differences or changes in the PWS system relative to Sitka. A long-term Sitka

assessment may possibly allow the time-series gap in PWS assessments (no assessments 1957-1971) to be filled on the basis of correlated recruitment patterns.

PI Response (10/11/2017)
This would be a very interesting addition, especially if the correlations in recruitment for Sitka, Seymour Canal, and Kah-Shakes have continued beyond the 1993 end point in Williams & Quinn (2000). Indeed the herring meta-analysis (in prep.) from the 2011-2016 program examines factors that might explain recruitment in all herring populations worldwide. A new model for Sitka is beyond the scope of our proposal, and would require substantial additional work, but if additional funds are available to support this expansion, we would gladly construct another BASA-type model for Sitka.

The Panel strongly encourages addressing items A and B before the use of the BASA model for analysis of environmental influences and to take into consideration item C, even though it is not within the scope of the proposal the additional model will add to the already high quality of this project. The Panel also noted the merits of conducting sensitivity analyses to evaluate the importance of errors in assumptions or parameters, such as natural mortality, on model performance. Together with Items A and B, this would help to determine when the model is ready for MSE.

PI Response (10/11/2017)
Sensitivity tests for model parameters are an integral part of the model assessment process for BASA. For instance, Muradian et al. (2017) reran the model with natural mortality of 0.15 and 0.35 in addition to the base value of 0.25 (excluding disease mortality), and also examined retrospective runs to test for bias in recent years.

The Panel whole-heartedly supports the request to use the CPPG funding (total $150K) toward 1.5 years of salary for another postdoc (David McGowan) to conduct synthesis work via modeling project with Trevor Branch. However, herring program needs to request an additional $150K for the remaining 1.5 years (part of FY19 and FY20) needed to create a three-year synthesis, which would provide the minimum time needed for achieve appropriate synthesis.

PI Response (10/11/2017)
We are excited to start work with David McGowan.

References:
DFO 2015. Stock assessment and management advice for BC Pacific herring: 2015 status and 2016 forecast. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Pacific Region, Science Response 2015/038.

Williams, E. H., Quinn, T. H. 2000. Pacific herring, Clupea pallasi, recruitment in the Bering Sea and north-east Pacific Ocean, I: relationships among different populations. Fish. Oceanogr. 9:285-299.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The original proposal, and the revision, was very well presented. The Panel appreciates the feedback from the PI on our concerns and the removal of some aspects of the proposal as suggested by the Panel. We understand the PI's justification to retain other aspects.

Date: May 2016

This is a well-written proposal that clearly shows the linkages with most of the other projects. The proposal lists six tasks, that are listed below (in Italics), with some short comments from the Science Panel on each.

(1) maintenance and updating of the new Bayesian age-structured assessment (BASA) model based on the ASA model used by ADF&G, including annual assessment updates of PWS herring and the revision of BASA to fit to new data sources such as the age-0 aerial survey, condition data, and updated age at maturity.

The Panel wondered what was meant by 'condition data'. Does this refer to the estimates of condition that can be derived from ASL data or does it refer to something else? Also, we assume that the updated maturity data would come from the Gorman proposal. The Panel also had some discussion on the benefits of new information on size-at-maturity and age-at-maturity or both for BASA. Regarding maturity data, we repeat that there is broad evidence of temporal and spatial structuring of herring on spawning grounds, and sometimes even in over-wintering areas. During spawning, larger, older fish tend to spawn earliest, and perhaps even at different locations than younger fish. Sampling during the spawning time can lead to bias in estimates of age composition, and may lead to errors in assumptions about age-at-maturity. Therefore, the Panel endorses the approach to provide empirical estimates of age-at-maturity with such temporal and spatial structuring in mind (also see Panel comments on Gorman proposal).

(2) Adapting the BASA model to better model the disease component of natural mortality. Specifically, this would be based on new methods for detecting antibodies of viral hemorrhagic septicemia virus (VHSV) in archival and planned future collections of herring serum.
The Panel endorses this task.

(3) Continued collection and expansion of catch, biomass, and recruitment time series from all herring populations around the world to place the lack of recovery of PWS herring into context given patterns of change in herring populations around the world.
The Panel is puzzled and perhaps ambivalent about this. This seems like a worthy task but the implications for PWS seem remote. Providing that this task is not a big-ticket item, it does not present any issues, although it is not clear why this needs to be shown as a distinct task, when it could have been conducted sub-rosa.

(4) An initial exploration of factors that may be used to predict herring recruitment, including oceanography, climate, competition, and predation.
The Panel strongly endorses this task.

(5) A management strategy evaluation to test alternative harvest control rules for managing the fishery in the future, given realistic variability in productivity over time, and the possibility that the population has moved into a low productivity regime. Ecological, economic and social factors would be considered in the MSE.
The Panel does not foresee the resumption of active herring fisheries in PWS anytime in the near future. Therefore while this task may have eventual worth, it belongs closer to the back-burner than the front.

(6) Simulations to evaluate which data sources are the most useful in assessing future herring biomass, based on an MSE of the impact of each form of data on the accuracy of the BASA model.
We recommend caution. While it may be sensible to proceed with data evaluation, it also is essential to have a concurrent examination of the efficacy and integrity of some of the key databases used in the assessment model. In particular the factors that might affect the time series of acoustics data have not been well explained in any document to date. Similar comments might be made about some other types of data used in the assessment model (see comments made in response to the Moffitt and Gorman proposals).

The proposal would also benefit from a discussion of how this model could be transferred to ADFG for their future use.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120111-E**

Project Title: Herring Program – Herring Disease Program II (HDP)

Primary Investigator(s): Paul Hershberger

PI Affiliation: USGS **Project Manager:** USGS

EVOSTC Funding Requested FY17-21: $1,157,900

FY17	FY18	FY19	FY20	FY21
Auth: $197,800	Auth: $228,900*	Auth: $236,700*	Auth: $243,300*	$251,100*

*Requests include 9% GA.*Includes additional annual request used for processing additional herring plasma samples ($22.5K annually FY18-21).*

Funding From Non-EVOSTC Sources FY17-21: $321,400

FY17	FY18	FY19	FY20	FY21
$61,700	$63,600	$64,000	$65,200	$66,900

Total Past EVOSTC Funding Authorized (FY12-20): $1,778,500

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $2,029,600

Total Non-EVOSTC Funding (FY12-21): $405,600

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/16/20, budget updated 8/16/20.*

We will investigate fish health factors that may be contributing to the failed recovery of Pacific herring populations in Prince William Sound. Field samples will provide infection and disease prevalence data from Prince William Sound and Sitka Sound, serological data will indicate the prior exposure history and future susceptibility of herring to viral hemorrhagic septicemia virus (VHSV), and diet information will provide insights into *Ichthyophonus* transmission mechanisms. Laboratory studies are intended to validate the newly developed plaque neutralization assay as a quantifiable measure of herd immunity against VHS and provide further understanding of disease cofactors including salinity and investigate possible routes of transmission. Information from the field and laboratory studies will be integrated into the current ASA model and inform a novel ASA-type model that is based on the immune status of herring age cohorts.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

Excellent progress has been made on multiple lines of investigation. The SP is very pleased to see the completion of MS student thesis as part of this research project. The SP has a few questions.

PI Response (10.2.20)
We would like to thank the Science Panel and Science Director for their thoughtful review of our proposal. Responses to specific questions are included below:

Figure 6 does not indicate that Ichthyophonus occurs in pink salmon. Please clarify whether pink salmon were not included in the analysis or whether they were included but not found to have Ichthyophonus.

PI Response (10.2.20)
Figure 6 and pink salmon susceptibility to Ichthyophonus:
Sequencing data used to inform the figure were obtained from a combination of sources including an archive of Ichthyophonus isolates we maintain at USGS - Marrowstone and any isolates we have been able to obtain from global research partners. The figure is intended to reflect representative fish species from various regions; it is not a comprehensive list of all known susceptible species. However, in a previous publication (Gregg et al. 2016), we canvassed the scientific literature to identify all fish species known to be naturally infected with Ichthyophonus. Infections were confirmed in over 145 fish species, from the Barents Sea, AK, to the southern tip of Africa, in the Atlantic and Pacific Oceans, and in freshwater on 6 continents (list included below). Pink salmon were not included on this list; however, the amount of Ichthyophonus sampling effort in pink salmon remains unknown.

Also, in Figure 3 fish that are viral exposed and unoiled have greater mortality than exposed and oiled, but the text downplays this result. It seems to the SP that if the results were reversed (oiled + virus had LOWER survival) but of similar magnitude then the PIs might be making a bigger deal of this. Please discuss mechanisms for this result and elaborate on its significance or provide clearer reasons why the result is not biologically meaningful. Could it be that oil has an effect on the virus and offers some disease resistance?

PI Response (10.2.20)
Figure 3 and differences between treatments:
Correct, this figure did appear to demonstrate reduced VHS susceptibility among groups that survived prior exposure to oil. We have performed some iteration of this experiment 6 times throughout the past several years and the results have been ambiguous (no difference in 3 of the trials, and slightly less susceptibility among the oil-exposed groups in 3 trials). Results depicted in Figure 3 were from a pilot experiment that was used to inform the design of our definitive experiment for 2020. Since submission of this proposal, the definitive experiment has been initiated, and the mortality results are analogous to those reported in Figure 3 (albeit even greater separation between the groups). The purpose of the definitive experiment is to determine the reasons for the differences between the treatment groups by performing full genome sequencing and RNA Seq. Although we have hypotheses that may account for these susceptibility differences, I am reluctant to speculate at this point because we should have scientifically justifiable explanations within the next several months.

What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
We don't anticipate impacts to laboratory work. The USGS has given permission for people to continue working through the COVID-19 pandemic. We would work with researches in Cordova to collect and process field samples, as was done in 2020.

Science Director Comments – FY21

Date: September 2020

The PI and project continues to maintain a high level of productivity. I have no concerns or project specific comments.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel appreciates the continued progress and willingness to adaptively manage the project to continue to produce novel results. The Panel wondered what the long-term direction of the program will be. The Panel also recognizes the integrative effort to work our understanding of disease into the model with Branch.

PI Response (10.2.19): We envision a several long-term goals for the Herring Disease Program. First, we are working towards complete validation and integration of the VHSV antibody assay into tools that can both hind-cast prior disease mortality events and forecast the potential for future disease epizootics. The hope is that we will be able to hand off a fully-vetted laboratory technique to the ADF&G pathology lab in Juneau, who will be able to work directly with ADF&G herring managers to incorporate near-real time disease metrics into their stock assessments. Second, during the next 5 years, we are interested in investigating potential interactions between pink salmon production in PWS and herring disease, as there are several diseases that cross over between the two species. Our hope is that the Herring Program will make pink salmon / herring interactions a theme and point of emphasis during the next 5-year project block (plans to discuss at the PI meeting in October 2019). Third, we are working towards understanding the basic transmission mechanisms for Ichthyophonus. It is our hope that elucidation of these processes will translate directly into tools that can forecast upcoming Ichthyophonus disease epizootics.

Science Director Comments – FY20

Date: September 2019

Funding for this project was leveraged to learn more about the pathogens of concern to Pacific herring which resulted in three papers and one book chapter that provide new insights into these pathogens. Information and knowledge gained from this project makes a significant contribution to disease research in other geographic areas and species. Efforts to investigate the possibility of zooplankton as an intermediate Ichthyophonus host have not yielded clear results. Thus, the PI will be shifting this focus to investigating the possibility of transmission through the consumption of walleye pollocks eggs. I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel remains impressed with the level of productivity of the PI and the project. At what age are Abs first present in serum? Is there a difference between Sitka and PWS fish in this regard? In the comparison, were fish of the same age between the sites were they all just pooled? It is not clear in the figure. If younger fish are most impacted by VHSV and survivors are the ones with serum Abs, then it is an interesting question and related to the Whitehead studies on when herring mount an Ab response and if this differs between populations. Some clarifications would be appreciated. We would like to see more detail regarding this topic so we can better understand the intriguing data presented.

PI Response (10/31/18): We would like to thank the Science Panel and Science Coordinator for their constructive feedback on the proposed FY '19 work in the Herring Disease Program. We are also very excited about the VHSV antibody results from the fish health surveys in PWS and Sitka Sound. At this point, we are reluctant to overanalyze these observational data until we have more experimental data to facilitate their interpretation. Specifically, we have spent most of the summer of 2018 assessing the levels of antibodies in additional groups of wild herring and determining how these antibody levels correspond to population herd immunity against VHSV. We hope to have these results summarized for the final report of the FY'18 project. Additionally, we suspect that the antibody data presented in Figure 1 may be more meaningful when analyzed by herring year class in Dr. Branch's revised ASA model. We will be working with Dr. Branch to facilitate this integration during the fall of 2018.

Also, does warmer water enhance disease prevalence?

PI Response (10/31/18): The question of temperature and disease is rather complex, and Hershberger is currently working to address this issue in more detail by co-authoring a chapter in a Disease Ecology Textbook, describing the impacts of global climate change on disease. In short, the proximate effects of temperature are disease-specific. However, temperature can also influence host, pathogen, and plankton (intermediate host) assemblages that indirectly influence certain diseases.

Science Coordinator Comments – FY19

Date: September 2018

This novel project continues to make excellent progress and be productive: three papers have already been published in FY18 and two more are in review. I am also impressed with the level of productivity of the PI and the project.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel is pleased with the results, supports the additional funding requested, and finds the request to be reasonable and justified. Would it be beneficial (and cost-effective) for the Post-Doc (Maya Groner) to help with this project without compromising her proposed research plan? If it can be
managed, the Panel feels that this involvement would benefit both the new post-doc and this project.

PI Response (10/11/2017)
Thank you. We anticipate integrating Dr. Groner's work into the HDP, as we feel Dr. Groner's contributions will be beneficial the HDP, the Herring Research and Monitoring Program, and her scientific career. We foresee no conflicts and we are eager to start working with her.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The PI adequately responded the questions the Panel raised about methodologies. The Panel fully supports the proposal by this PI. The brevity of this response should be seen as a tribute to the continued excellent work done in this project and the inter-projected cooperation and collaboration.

Date: May 2016

As in the past, the Panel reviewed the Herring Disease Program II proposal favorably overall. However, the Panel noted that some of the draft text was repetitious from previous submissions. Further, the Panel noted that not all of the previous objectives were fulfilled, especially related to inter-population comparisons. Therefore, there are some distinct revisions that should be considered and incorporated in a final version of the proposal. The following are the points that were discussed:

Several of the Objectives were from the previous 5-year proposal and there was not a clear rationale why these were nearly identical to the previous proposal. While an extension of the earlier objectives makes sense, inadequate descriptions of previous accomplishments and application of these accomplishments will advance the knowledge of disease in PWS herring in the coming 5 years.

Pathogen-free herring have already been established to the Science Panel's knowledge. The proposal should explain how these fish will be used in studies, not how they are cultured. The Panel feels it is critical that disease free populations should be established for PWS and a Sitka or Kodiak/Cook inlet. That is, genetically distinct populations that may have differing disease susceptibilities.

The plaque neutralization assay data were already presented. The proposal should explain how these data will be employed in the coming 5 years. The past proposal indicated that there was to be a comparative study of herring populations from SE Alaska, including populations that are now established as genetically different from PWS fish. These include Sitka and Cook Inlet or Kodiak populations. Puget Sound populations may have different life histories and demographics so geographical comparisons may be less relevant than data from other Alaskan populations. At the Synthesis Symposium in Anchorage 2 years ago, a discussion of the immunity and exposure differences of populations was prominent, but this approach is not described clearly in this proposal.

Taking into account the very recent discovery of the unique genetic character of PWS herring, this comparative population susceptibility to disease becomes a high priority to the Science Panel.

Further, the Panel noted that there is some interesting new technology (high throughput pathogen monitoring systems based on Fluidigm's Biomark TM technology**) that could be relevant to basic questions about the presence and persistence of diseases in Prince William Sound herring. The Panel is also aware that the PI is familiar with these technical developments. Therefore, we would be interested in learning why such an approach was not considered – or alternatively, if such an approach could be considered in a revision of the proposal.
*(**https://pag.confex.com/pag/xxiv/webprogram/Paper21716.html)*

Science Coordinator Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Date: May 2016

I concur with the Science Panel's comments. The proposal would benefit from further discussion of how the work completed by this team from 2006 to present informed the proposed work.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21160111-F**

Project Title: Herring Program – Surveys and age, sex, and size collection and processing

Primary Investigator(s): Stormy Haught

PI Affiliation: ADFG **Project Manager:** ADFG

EVOSTC Funding Requested FY17-21: $831,500

FY17	FY18	FY19	FY20	FY21
Auth: $166,300	Auth: $166,300	Auth: $166,300	Auth: $166,300	$166,300

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $272,500

FY17	FY18	FY19	FY20	FY21
$54,500	$54,500	$54,500	$54,500	$54,500

Total Past EVOSTC Funding Authorized (FY12-20): $725,200

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $891,500

Total Non-EVOSTC Funding (FY12-21): $325,700

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

This project conducts spring aerial surveys to document Pacific herring (*Clupea pallasii*) milt distribution and biomass as well as the distribution and abundance of sea lions, other marine mammals, and birds associated with herring schools or spawn. It also provides a research platform (R/V Solstice) for disease sample collection and processing. Finally, it collects and process age, sex, and size samples of herring collected by the acoustics survey, spawning surveys, and the PWS Herring Research and Monitoring Program disease sampling. Aerial survey and age, sex, and size data have been collected since the early 1970s and are an essential part of the age-structured model used by the Alaska Department of Fish and Game to estimate the historical and future biomass for fisheries management. Acoustics surveys have been conducted consistently since 1995 and the age-structured model is also tuned to acoustics biomass estimates. This project helps meet the overall program goal to improve predictive models of herring stocks through observations and research by providing necessary inputs to the age-structured assessment models of the Alaska Department of Fish and Game and the *PWS Herring Research and Monitoring Program* Bayesian model.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

This project continues to execute good field work and the PIs are to be commended for finding creative ways to get samples during the pandemic. Deliverables are being achieved on time. The SP appreciates the comment that care needs to be exercised in the interpretation of age, sex and length composition as cast nets are selective for males. The SP seems to recall studies that demonstrated this with larger fish (more likely to be females) at greater depths than males. Are there comparative gear studies that would allow for correction of the bias associated with cast nets? Perhaps there is a gear study that compared paired sample collections by purse seine and cast nets? If so, this would be useful to document and incorporate.

PI Response (10.2.20)
I am not aware of any existing comparative gear studies that would allow for correction of historical PWS cast net data. Paired purse seine/cast net sampling would not be feasible. We target actively spawning herring (in the milt cloud, usually in depths <2m) with cast nets and pre-spawn/staging schools (offshore, usually in depths > 12 fathoms) with a 150 x 17 fathom purse seine. However, pairing cast net samples with other gear deployable in shallow water, such as beach seine or variable mesh gillnet would likely provide insights into any potential cast net male bias. It is possible that males bias in cast net samples is reflective of a truly male biased sex ratio within the milt cloud. Deploying additional gear types while sampling actively spawning herring could help elucidate the observed bias.

From a bigger picture perspective, the SP noted that a 33-year old study (Brady 1987) is still being cited as the authority on the behavior of herring in PWS. Given the addition of so much more herring research and observations since the 1980s, the SP encourages the PIs, perhaps in collaboration with other scientists, to develop a new synthesis on PWS herring that would become the new authoritative reference.

PI Response (10.2.20)
This comment has been shared with the program coordinator for discussion in the development of future work.

What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
We operated somewhat normally during 2020 but did cancel our purse-seine surveys. ADF&G vessel surveys have since resumed and there are not expected to be cancellations for the coming spring. Some vessel crew substitution may be needed if out of state crew (USGS disease studies) are unable to participate due to travel restrictions.

Will any unused funds for FY21 be repurposed for additional lab and/or data analyses?

PI Response (10.2.20)
Our aerial survey gear is badly in need of upgrade. We currently use Panasonic toughbooks and a custom ArcPad application. ArcPad will no longer supported by ESRI in the next year. In 2020, we had regular issues with our older toughbooks failing to pair with newer bluetooth GPS units. Statewide, other herring survey programs have moved on to using modern tablets (ipads), paired with tablet-

specific external gps unit (garmin glo), and the new ESRI Collector application (ArcPad replacement). We are hoping to use any funds we saved through lack of 2020 vessel surveys on the purchase of new aerial survey data collection kits. We have worked with ADF&G programmers to ensure an easy transition to the new machines with little change in data fields.

Science Director Comments – FY21

Date: September 2020

This is a monitoring project that provides important information and data to almost all EVOSTC herring work, including the BASA model. Spring activities conducted abroad the R/V Solstice were cancelled due to COVID-19 related concerns. However, members of the community and ADFG staff were able to collect cast net samples of actively spawning fish. A few tasks are delayed due to COVID-19 but will still be completed within FY20.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel recognizes this is a monitoring project that provides important information and data to nearly all EVOSTC herring work, including the BASA model. Project goals are being completed on time. Although this project provides routine monitoring data, it nonetheless raises questions that may be worthy of investigation, perhaps as part of a program synthesis. For example, as pointed out in the Branch proposal, the PWS herring population now seems unique among many in the world for the long-term duration of low biomass or, stated differently, an apparent lack of recovery. Could this perspective be influenced a paucity of information related to spawning and distribution of herring in other areas of PWS or areas immediately adjacent – such as Kayak Island? Could there be other instances of herring spawning, perhaps in substantial quantities, that go undetected? If this were the case, could other survey methods be used? For example, synoptic larval surveys are frequently used by other agencies, especially in Atlantic waters, to monitor distribution and abundance.

PI Response (10.2.19): It is unlikely that substantial herring spawning events go undetected. The PWS area (including Kayak Island) is heavily trafficked by boat and airplane. Our first indication of spawn is often through pilot or vessel report. In addition to the herring aerial survey program, ADF&G receives regular reports from air taxis, private pilots, fishers, and subsistence users during PWS herring spawn timing. Also, Other PWS HRM program activities including acoustics, tagging, disease, and ASL surveys

are running concurrent to the aerial survey program and making vessel-based observations of herring concentrations.

Many PWS commercial herring permit holders live in Cordova and the general interest in, and subsistence value of PWS herring among residents is high. Considering the amount air and vessel traffic in the sound, it is unlikely that significant spawning events, similar in magnitude to those observed in the Port Gravina and Hawkins Island areas in recent years, would go unobserved and unreported. However, we undoubtedly miss small, short-timed "spot spawning" events.

Although we do survey Kayak Island, survey coverage is less frequent than PWS proper (1-3 Kayak Island surveys per year, usually prompted by a report of spawn activity beginning). This is primarily because of it's location and the fact that we have not historically included this area in the index. If there is strong interest for increasing the frequency of Kayak Island surveys this could be accommodated with an increase in survey budget.

The estimates generated by the aerial surveys were designed to be an index of relative abundance, comparable across the historical time series. As such, it is important to keep survey methods as consistent and repeatable as possible to retain comparability among years (also the reason we do not include Kayak Island in the current mile days of milt total…it is not included in the historical index). Although we acknowledge that other methods exist and may even produce more refined estimates of biomass, they would lack historical comparability. Unless a clear benefit was apparent, we would not support discontinuing the current program in favor of other methods

Science Director Comments – FY20

Date: September 2019

I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel appreciates the substantial effort involved in this work and the quality of this proposal. We especially want to acknowledge and express appreciation for the inclusion of retrospective data summaries, as shown in Figures 1-4. We further recognize that this work is fundamentally important for all of the herring projects. We note specifically the comment that weather impacted aerial survey efforts in 2018 (39.5 hours in 2018) and also that 2018 represented an

"historical low" for the estimated mile-days of spawn. Did the adverse weather and low sampling effort contribute to the low estimate?

In view of the vital importance of this estimate of spawn we wondered if the PI had concerns about the adequacy of the survey effort. Specifically, was it limited by resources?

PI Response (10/31/18):2018 survey efforts were limited by the unusual prevalence of poor visibility and/or high wind flight conditions. Funding, staff availability, and pilot/aircraft availability were adequate in 2018.

We also suggest that any further retrospective information about the aerial surveys, especially any data regarding the spatial coverage and temporal frequency and duration of flights could be useful for future analyses, particularly with reference to potential changes in herring distributions. Can and or should the mile-days reported be standardized by sampling effort?

PI Response (10/31/18): Temporal and spatial data exists for historical surveys and a detailed spatial analysis of survey routes could be informative. The estimates generated by the aerial surveys were designed to be an index of relative abundance, comparable across the historical time series. As such, it is important to keep survey methods as consistent as possible to retain comparability among years. Unless a clear benefit was apparent, we would not support weighting mile-days of milt estimates by survey effort.

To reiterate we strongly encourage support for adequate survey effort to verify that the observed reduced spawn extent isn't an artifact of reduced survey coverage - and to ensure that major spawning is not missed. As with some other field sampling projects in the HRM program, the Science Panel is concerned that sampling effort is adequate to make population-level inferences.

PI Response (10/31/18): Aerial surveys can only occur during Visual Flight Rules conditions as weather conditions allow. We fly when the weather allows. Estimates of mile-days of milt should be considered an index, and the surveys were designed to provide an estimate of relative abundance comparable across the historical time series. As such, changes in the method should be avoided if possible, to retain the comparability of these estimates. Linear regression, using number of surveys (x) vs. mile-days of milt (y) shows a highly significant positive relationship when applied the entire time series (1973-2018, Figure 2). High numbers of surveys were flown 1981-1992, coinciding with high estimates of mile-days of milt during the same period (Figure 1)

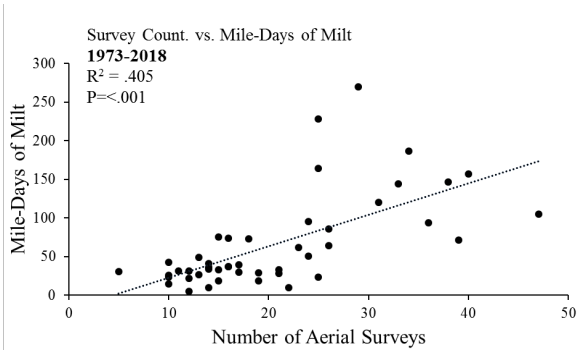


Figure 1. Number of aerial surveys vs. mile-days of milt 1973-2018

When restricted to the post-commercial fishery time-period (1993-2018, although commercial openings occurred in 1997 and 1998), the relationship is much weaker (Figure 3). The 1981-1992 time-period, when high numbers of surveys coincided with high estimates of mile-days of milt, appears to be driving the strong relationship in figure 2. The poor relationship in recent years (1993-2018) suggests that reduced estimates of spawn extent are not likely an artifact of reduced survey coverage, although, admittedly, this is a simplistic analysis.

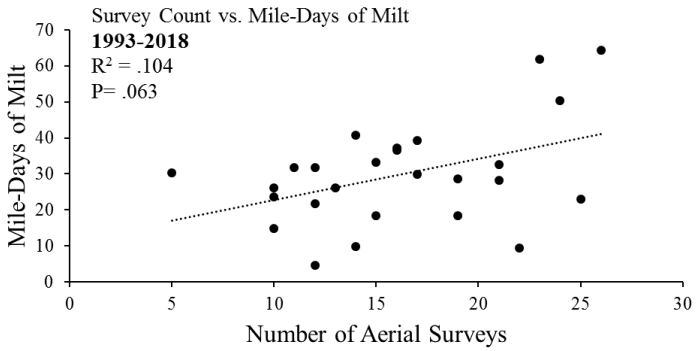


Figure 2. Number of aerial surveys vs. mile-days of milt 1993-2018

We suggest that herring body condition index be related to zooplankton data and other parameters (see Batten et al. which examined herring body condition index with phytoplankton data).

PI Response (10/31/18): We will work with other PIs in the PWS HRM program and others to determine what existing zooplankton data sets are available for analysis.

We appreciate that the PI followed our suggestion from FY18 for conducting ground-truthing aerial observations with skiff surveys and recommend this to be continued for the remainder of the project (FY19-21).

PI Response (10/31/18): We were able to ground truth 100% of observations in 2018 due to the limited spatial and temporal extent of spawning activity. Historically, mile-days of milt were not adjusted for ground truth observations. Due to the concerns of standardized survey methods and year-to-year comparability of this index we did not adjust for ground truth observations in 2018. The final estimate for 2018 mile-days of milt (4.52) would have been reduced by about .3 miles if adjusted for ground-truthing.

Science Coordinator Comments – FY19

Date: September 2018

This project provides important support and useful data for other HRM projects. Project is on task and preliminary results from FY18 are presented. PI is coauthor on a publication that is in review.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel appreciates the support this proposal provides to the entire herring program. The basic survey approach looks reasonable (based on successful work of past years) and the budget also looks reasonable.

This proposal seems to one that provides important technical services to the herring program as well as to ADF&G. The text under 'Executive summary' is well-presented, forthright, detailed and appreciated. This text is also very 'Alaska-centric' – and almost appears defensive of existing approaches and methodology. A case in point concerns the use of 'mile-days' as the fisheries-independent index of herring abundance. This usage should be examined, both within, and outside of the context of the assessment model. There may be valid, biological reasons why 'mile days' could tend to inflate estimates of escapement, depending on the circumstances. This comment should not be taken as a criticism of this proposal but applied to the entire herring program. The metric of spawning is fundamental to PWS herring and it warrants more attention – especially analyses of spatial and temporal variability, combined with herring population characteristics (size, age, etc.) As noted in last year's work plan, similar comments can be made about the acoustic work.
The Panel feels that the entire herring program would benefit from a detailed review of the past work, including times and locations of surveys, acoustic gear used for each survey. This recommendation was also expressed in last year's work plan.

PI Response (10/11/2017)
The text is Prince William Sound centric because it explains the history of the data collection that this proposal continues. The usage various data sets within the ASA model has been examined and reported in the final report for project 16120111-Q Population modeling by Trevor Branch and in the Masters thesis of Melissa Muradian (2015). We reference the work of Willette et al. (1999) as one effort to examine the usage of mile-days-spawn. The mile-days-spawn is only considered an index of the population and not meant to be considered a direct measure of the spawning biomass. The ASA model includes historical dive surveys that the modeling project show as an anchor for the aerial survey data. In the past the logistics of conducting dive surveys were considered to make the effort too expensive to propose. With declining biomass in PWS and reduced dive surveys in Southeast Alaska there may be opportunities to develop a reasonably cost program conducted by divers trained for this type of survey. We will work to determine the feasibility and cost of conducting dive surveys in PWS. We will also continue to consider other approaches (rake or ROV surveys) to determine if a scientifically defensible survey can be conducted by alternate means.

There has been work examining the spawning characteristics, but none of it has been published yet. Dick Thorne was working on a manuscript detailing the shifts in timing and location of spawning in relation to predation pressure by whales, and we will have to follow up to determine the status of

that effort. We have tried to use water temperature to help predict spawn timing for guiding survey timing. There appears to be a temperature that spawning does not occur below (~14.5C), but overwinter water temperatures have not been a consistent predictor of when spawning will begin. Spawn location, timing, and the relationship to environmental conditions are things appropriate for the analysis that David McGowan has proposed in his postdoc. The required aerial and acoustic survey information exists for that analysis.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel raised concerns about the need for ground-truthing that the PI explained could not be completed due the lack of vessel availability. The Panel recognized this explanation but feels strongly enough about the importance of this activity that the we would be supportive of a Trustee Council decision to award modest additional funds needed to complete this activity pending an appropriate proposal.

Date: May 2016

The Panel recognizes that this project provides essential information and services for all other projects on the herring program. To reiterate the list of activities, the proposed project will:

1) conduct spring aerial surveys to document milt distribution and biomass;
2) document distribution and abundance of sea lions, other marine mammals, and birds associated with herring schools or spawn;
3) provide a research platform (R/V Solstice) for an adult herring acoustics survey and disease sample collection and processing; and

4) collect and process age, sex, and size samples of herring collected by the acoustics survey, spawning surveys, and disease sampling.

While supportive of all of these tasks the Science Panel has the following comments on several topic items (underlined below).

Distribution and abundance of sea lions, other marine mammals, and birds. The Panel strongly endorses this line of inquiry and notes that evaluation of the potential impacts of pinniped predation on herring is an active area of research in other parts of the northeast Pacific. The proposers should familiarize themselves with current research.

Aerial surveys. The Panel is aware of the discrepancy between results of past aerial surveys of milt and estimates made from SCUBA diver surveys, as discussed in the paper by Hulson et al (2008). Further, as explained in the Hulson paper, there was a substantial difference between aerial survey estimates of milt and estimates based on dive surveys. In view of the importance of estimates of milt, and/or egg deposition for herring assessments, the Panel strongly recommends that some effort be made to 'ground-truth' the aerial surveys. Specifically, at least some of the aerial survey data should be checked by visits to the site to confirm the geographic distribution of eggs. This does not necessarily require quantitative SCUBA surveys to estimate total egg counts (as was done by Willette et al. 1999). Simpler, less expensive approaches could be considered, such as site visits on small vessels, and use of grappling hooks to look for presence/absence of eggs. Regardless, some effort must be made to calibrate the aerial survey data on milt distribution.
Ideally, this effort such an effort at ground-truthing could even provide opportunities to provide some retrospective calibration of past milt surveys. We note elsewhere (see comments on Gorman proposal) however, that an additional measurement of 'gonad weight' could provide very useful information related to 'age-at maturity'. Such an addition to the routine sampling would be relatively inexpensive.

Acoustics surveys. The Panel notes the pivotal role of acoustics survey data in the assessment methodology. However, we also note that this is the only time-series data that have not been systematically examined to account or any variation attributable to varying survey designs or modification of equipment – which could include vessel types. Of course, we are aware of the 2008 paper by Thorne et al. (written as a companion paper to the Hulson paper in the same journal). However, unlike aerial survey data (from which there is a large and readily accessible data base), and also unlike the ASL (age-sex-length) databases, there is no readily accessible database on the historical acoustics data. However, there should be such a database, especially if such data are used in support of vital biomass assessments. Therefore, a recommendation from the Panel is for the development of a report on the acoustics data, as it is used, and has been used for herring assessments. Such a report should point out the strengths and limitations of such data, with emphasis on any methodological factors that might affect temporal trends in the data. Finally, to conform to normal protocols for assessments, we advise that the data, as it is used in the assessments, should be made accessible.

Hulson, P-J. F., Miller, S. E., Quinn, T. J. II, Marty, G. D., Moffitt, S. D., and Funk, F. 2008. Data conflicts in fishery models: incorporating hydroacoustic data into the Prince William Sound Pacific herring assessment model. – ICES Journal of Marine Science, 65: 25–43.

Willette, T. M., Carpenter, G. S., Hyer, K., and Wilcock, J. A. 1999. Herring natal habitats, Exxon Valdez Oil Spill Restoration Project. Final Report (Restoration Project 97166), Alaska Department of Fish and Game, Division of Commercial Fisheries, Cordova,Alaska.

Thorne, R. E., and Thomas, G. L. 2008. Herring and the "Exxon Valdez" oil spill: an investigation into historical data conflicts. ICES Journal of Marine Science, 65: 44–50.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Footnote: This project has gone through several titles and PIs
FY12: 12120111-F Buckhorn Juvenile Herring Abundance Index
FY13: 13120111-F Buckhorn Juvenile Herring Abundance Index
FY14: 14120111-F Buckhorn Juvenile Herring Abundance Index
FY15: 15120111-F Buckhorn Juvenile Herring Abundance Index
FY16:16120111-F Rand Juvenile Herring Abundance Index and 16160111-T Moffit ASL Study & Aerial Milt Surveys began
FY17: the work in 16120111-F was rolled into 16160111-T to create 17160111-F Moffit ASL Study & Arial Milt Surveys.
FY18: the project has a new PI, correct number is 18160111-F Haught
FY19: the project has a new PI, correct number is 19160111-F Haught
FY20: the project has a new PI, correct number is 20160111-F Haught
FY21: the project has a new PI, correct number is 21160111-F Haught

Project Number: **21120111-G**

Project Title: Herring Program – Adult Pacific Herring Acoustic Surveys in PWS

Primary Investigator(s): Peter Rand

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $379,900

FY17	FY18	FY19	FY20	FY21
Auth: $74,200	Auth: $73,800	Auth: $75,500*	Auth: $77,300*	$79,100*

Requests include 9% GA.

**Includes request for additional $13K annually for FY19-21 for ship-time support and associated indirect costs to conduct more thorough surveys.*

Funding From Non-EVOSTC Sources FY17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY12-20): $634,800

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $713,900

Total Non-EVOSTC Funding (FY12-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

We are continuing to conduct hydroacoustic surveys and calculate biomass estimates of pre-spawning biomass of Pacific herring in Prince William Sound (PWS), providing a long-term relative abundance index for the Bayesian age-structured assessment model (BASA). This work primarily addresses Objectives 1 (expanding and testing the BASA model) and 2 (providing input to the BASA model). Since 1993, the Prince William Sound Science Center (PWSSC) has conducted acoustic surveys as a cost-effective approach to estimate pre-spawning biomass of adult Pacific herring just prior to the spawning period. Here we propose to continue this sampling during 2021. **Our main goal for this proposed project is to produce a reliable estimate of pre-spawning biomass of the population of Pacific herring during 2021 in support of the BASA model.**

As in recent years, we intend to continue to survey the two main spawning aggregation regions (Port Gravina and Fidalgo, and along the northeast coast of Montague Island). This will allow us to continue generating estimates of the pre-spawning herring biomass in PWS and provide an alert to changes in biomass in these two different regions. While our survey does not include the full extent of spawning habitat in PWS, we assume that surveys in these two regions account for the majority of spawning activity that occurs each spring. We feel this is a reasonable assumption given results from aerial surveys that monitor herring aggregations, predators, and distribution of milt. While we have focused on these two regions in recent years, other regions may also be surveyed depending on in-

season results of aerial surveys and other indicators. We propose to carry out this assessment in spring (March-April). This project will use the Alaska Department of Fish and Game data from direct sampling for age, sex and length in the estimates of biomass. The estimate will then be provided to the modeling project.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

For the short-term, the SP recommends approving the request for $10 K again (also see last year's SP comments) this coming year to support a second vessel for the reasons stated in the proposal. However, again the SP had an extensive discussion on the value of this project to the program. The SP recognizes the utility of the information provided from this project as a component of the stock assessment process. We also note that the EVOSTC has supported this work for decades but, relative to virtually all other projects, there has been a paucity of published scientific reports, published either in the grey literature or in peer-reviewed journals. This project has untapped opportunities to test hypotheses and to advance the understanding of the biology, life history and dynamics of Pacific herring in PWS. The perspective of the SP is that there is scope to address a number of important aspects of herring biology that could be presented in citable literature. In particular we note that the reliance of the project on reports that are now more than 30 years old does not inspire confidence that the work continues on the cutting edge with respect to the understanding the biology of herring in PWS or elsewhere. We note that the cited literature in the present and past proposals, and the annual reports, comments mainly on aspects of distribution and changes in distribution in time, and, especially, temporal changes in oceanographic conditions and temporal distribution changes in distribution and abundance of other species that might impact herring. There might also be scope to comment on the ways that schools are configured by depth and other hydrographic variations. Surely, there must be more that the proponents can do to synthesize results from past work. We strongly encourage the PI and their colleagues to consider how they might extract more useful information from past and recent work.

Moving forward this project will need integration, synthesis, and hypotheses testing to be considered for awards for the next Invitation. Also, future proposals should contrast the current acoustic survey with those performed by Dick Thorne and ADF&G and contemporary hydroacoustic surveys done elsewhere on herring to justify the proposed survey methods and sampling gear.

PI Response (10.2.20)

It is my understanding that the main objective of this project was to provide estimates of herring abundance during the spring, spawning period independent of the aerial milt survey. That has been my focus and has been articulated in my proposals. Along with my annual reporting of biomass estimates to EVOSTC and detailed descriptions of the monitoring results in different PWS regions, I did publish a manuscript during this period that focused specifically on some the key biological aspects of herring during their spawning period (Rand, P.S. 2018. Pacific herring response to surface predators in Prince William Sound, Alaska, USA. Marine Ecology Progress Series 600:239-244). These observations, using an uplooking transducer mounted on the seafloor, provided a detailed description of the temporal variability of schools, including density and depth dynamics. In addition, by use of split-beam

technology, I was able to describe swim speeds of both predator and prey and how herring reacted in the presence of surface predators. I also contributed information on acoustic survey methods to a synthesis chapter in 2019.

I do understand the value of synthesizing some of the past acoustic survey data. Dick Thorne did share with me various drafts of incomplete manuscripts that were never submitted for publication. If this is a priority for the SP, I would be glad to pursue additional analyses of past data, but this would require additional PI time to accomplish. I would be glad to scope out what it might require in a future EVOSTC proposal.

In addition, I believe the technology I am currently using (split-beam, 120 kHz Biosonics system) is adequate to meet the basic objectives of monitoring. I am aware of other technologies (e.g. broadband) that have some advantages. This technology may be able to discriminate species, but I don't think this is a significant source of error in our current monitoring efforts. During the pring 2016 Kevin Boswell and Bree Zenone deployed a broadband system and collected data at aggregation sites, but I don't think those data were ever analyzed. At the time, I believe analytical methods were still under development.

There are other areas of research that I think are important and timely and may be amenable to hypothesis testing. Specifically, I have been discussing potential studies examining the importance of kelp (both as a spawning substrate, but also as important habitat for juvenile herring). Given the rising interest in kelp commercial production in Prince William Sound, I think focusing on this topic would be worthwhile. It has implications for herring reproductive success and recovery. I am aware of acoustic approaches to describing benthic habitat, and this might be a very cost-effective way of describing spawning habitat associated with past and current herring aggregation sites.

Regarding contingency plans, if I have any unused funds in my project in 2021, I can begin some work on compiling and analyzing past acoustic data as requested by SP. We were able to accomplish some field work this past spring, and I am hopeful we will be able to complete the field work next spring. I appreciate the extra funds provided by EVOSTC to support an extra vessel. Because the R/V Solstice was not available during this past spring, it was critical to have these funds available to charter a separate vessel to conduct field work.

Science Director Comments – FY21

Date: September 2020

Additional survey sites in eastern PWS based on aerial observations of milt and predators in those locations were included in FY19 and FY20 which was made possible from additional funds granted by the Trustee Council for ship-time on this project. Acoustic calibration was also performed at one of these sites. This also allowed for two simultaneous surveys in both eastern and western regions of the herring spawning range and addresses the Science Panel's concerns about the adequacy of survey spatial coverage in the FY19 Work Plan. The expanded survey coverage will continue in FY21.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel had a discussion about the utility of adult acoustic surveys. It was noted that such data played an important role in resolving a data conflict previously in the BASA model. The BASA model could be used to evaluate the importance of acoustic versus aerial survey data to model results. The Science Panel also had a discussion about the Biosonics echosounder and wondered whether this is still the optimal tool for such assessments. However, the panel does not have adequate expertise in this area to answer this question.

While it is gratifying to see that this project is cognizant of the merit of expanding the areas ensonified, it is still worrisome to the panel that some portion of the herring population may now occur in areas that are not examined. We note, for instance that NOAA is capable of conducting large (massive) scale acoustic and fishing surveys of the Bering Sea using large vessels that are capable of working in adverse weather. A fundamental question is this: is the PWS herring population diminishing in abundance (and perhaps spatial distribution) or has the population shifted its distribution to locations they are not presently observed? This comment is not meant to be critical of the PI or this specific project (although it may be useful if this issue were addressed directly in this proposal). Rather we suggest that this may be a salient question directed to the collective research community working on herring and related species in PWS.

PI Response (10.2.19): It is important to keep in mind that the acoustic survey effort is guided by results of a spatially-extensive aerial survey conducted by ADF&G each spring. We do, in fact, respond to aerial survey observations within season (i.e. presence of schools, milt, and/or herring predators) by adapting our survey effort spatially. For example, during the spring 2019 season we surveyed Canoe Pass and Double Bay, regions that have not historically been the focus of the PWS adult acoustic survey, but showed evidence of significant herring aggregations based on aerial observations. While Kayak Island is recognized as an important spawning site, surveying that site would require significantly more funding to cover ship time on a larger vessel. Expanding the survey to include this site would constitute a new survey approach that would produce a new time series. It would take many survey years for an expanded survey like this to generate insight into population dynamics across a broader survey region.

There are echosounders of higher quality in the marketplace (e.g. SIMRAD ES series), with certain advantages, including a much easier and more straightforward field calibration procedure, but it is hard to justify given the great expense of purchasing a new system. There have been some advances in

fisheries acoustics, particularly the application of broadband systems. The primary advantage with these systems is the ability to discriminate species within schools based on backscatter resonance from swim bladders (e.g. Stanton et al. 2012). There are still relatively few applications of this technology, and I do not see the advantage of applying this technology to adult herring assessments in PWS given the aggregations are composed almost entirely of Pacific herring based on results of net captures at the locations we survey. I do see how this technology might improve our ability to survey juvenile herring, as they are often found in mixed species assemblages in PWS bays based on observations from trawling in PWS bays during the HRM juvenile herring surveys conducted during 2012-2016. Determining precise size distribution and maturity status of adult individuals is critical to monitoring the population, and, at this time, I do not see how acoustic survey technologies could offer any advantage over direct net capture. I intend to track the development of this technology to determine how we might improve our assessment approach in the future.

Stanton, T.K., C.J. Sellers, and J.M. Jech. 2012. Resonance classification of mixed assemblages of fish with swimbladders using a modified commercial broadband acoustic echosounder at 1-6 kHz. Can. J. Fish. Aquat. Sci. 69:854-868.

Science Director Comments – FY20

Date: September 2019

Additional survey sites in eastern PWS based on aerial observations of milt and predators in those locations were included in FY19 which was made possible from additional funds granted by the Trustee Council for ship-time on this project. Acoustic calibration was also performed at one of these sites. This also allowed for two simultaneous surveys in both eastern and western regions of the herring spawning range and addresses the Science Panel's concerns about the adequacy of survey spatial coverage in the FY19 Work Plan. The expanded survey coverage will continue in FY20 and FY21. I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel understands that both competition and cooperation for vessel time can occur. We further understand that results from acoustic surveys have an immediate impact on biomass

assessments and other understanding of herring distribution and biology in PWS. Therefore, we have questions and concerns about the spatial and temporal consistency of herring distributions in PWS and the adequacy of the present acoustic surveys to detect change. This is not a criticism. Instead, it is a question about the adequacy of the spatial coverage of the surveys. We observe broad environmental changes that could impact herring distributions and we are concerned that potential changes in herring distributions could go undetected. Shifts in Pacific herring spawning distributions have been observed in other regions (e.g., SE AK, British Columbia). Thus, we support the request for additional funding to continue simultaneous surveys. We would also like to know what is the extent aerial surveys can be used to inform the acoustic surveys? Does the timing of each survey allow this?

PI Response (10/31/18): Thanks for clarifying your concerns about the acoustic survey. It is important to note that each survey we conduct relies on information from the following sources:

1. Aerial surveys conducted by ADF&G. This helps us in terms of timing and in identifying what areas to focus on in our survey. Observations of particular interest are the presence and distribution of predators (particularly sea lions and whales). Based on my experience in recent years, we receive information from 2-3 aerial surveys just prior to and during our acoustic survey, and we have found them very helpful to help us focus our field effort.
2. Some early, reconnaissance surveys by a vessel charter in the eastern sound (particularly in Fidalgo and Gravina, and along Hawkins Island, beginning in mid-March). These surveys (both visual surveys for predators and evidence of herring aggregations from ship-board sonar) provides additional information early in the season.
3. During a typical vessel charter day during our survey, we run long transects during the day to observe predators and roughly map out the area that contains any herring schools (based on ship-board sonar). This is done at a higher speed (compared to our nigh time transects with our tow fin deployed) to enable us to cover a relatively large area and determine the rough boundaries of our survey area.
4. To maximize spatial coverage over the night, we use a sawtooth transect design and adjust the length of each transect leg based on our observations leading up to the time of the survey so we can be assured we are covering a large enough area.
5. In addition, we do visit some bays where herring predators were noted in the ADF&G aerial survey (outside our traditional focal areas in Gravina/Fidalgo and NE Montague Island region). To date, none of these bays have yielded evidence of herring aggregations.

In short, I am confident that our survey coverage has been adequate to capture any changes that might be occurring in the distribution of spawning herring in PWS. Maintaining the amount of shiptime we have used in past survey years will allow us to continue this level of survey coverage into the future.

Science Coordinator Comments – FY19

Date: September 2018

PI is making good progress, has already published one manuscript in FY18. Project is on track, even ahead of schedule for some tasks. PI anticipates compressed field seasons in the future due to recent patterns of fish distribution and behavior and multiple projects competing for R/V Solstice ship time. There has been difficulty in scheduling acoustic sampling that will allow for a complete survey. Thus, PI is requesting additional funding ($10.3K annually for FY19-21) for 5 days of separate ship time for two simultaneous surveys in both eastern and western regions of herring spawning range. A complete acoustics survey is a critical component of the age-structured model, as it is the primary current data component driving population trends and the resulting forecasts.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel agrees that the acoustic surveys provide valuable information toward achieving the goals of the herring program. As noted in last year's work plan, the Panel appreciates the progress made to date but would like to see included results from the previous years, history of assessments and maps of survey tracks.

PI Response (10/13/2017)
We thought the results from previous years was already available on the AOOS Gulf of Alaska data catalog. We are working with the Data Management program to make it available as soon as possible. The history of assessments and maps of survey tracks are available in the cruise reports and EVOS annual reports from 2000-2016. Raw data from 1993-1999 was not collected digitally and is no longer available, only the final processed biomass estimates remain. We will work with the data management program to make these available through the AOOS data catalog.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel particularly appreciated the assembly of the historical acoustic database. This database is one of two key databases used for annual biomass assessments. Such an accessible database supported by an accessible report is an essential component for continued biological assessments.

Therefore, we salute the progress made to date but urge the complete of the documentation of past acoustic surveys.

Date: May 2016

This proposal was well-written, and the objectives are very clearly stated: "to continue a long term data set of biomass estimates of the spawning population of Pacific herring in Prince William Sound." This proposal primarily addresses Objectives 1 (expanding and testing the herring ASA model) and 2 (providing input to the ASA model). Since 1993, the Prince William Sound Science Center (PWSSC) has been carrying out acoustic surveys as a cost-effective approach to estimate the biomass of adult Pacific herring just prior to the spawning period. The stated goal is to "produce a reliable estimate of adult biomass of the spawning population of Pacific herring for each year during 2017-2021 in support of the age-structured assessment (ASA) model".

The Panel notes that this work provides essential information for the herring assessment model, and for this reason the work should continue as proposed. We also note and commend the PI for ensuring that the continuity of this work will continue as it has been conducted in the past. The Panel has several concerns and comments, however, one of which was mentioned in the response to the Moffitt proposal. That is, there is not a readily accessible database of the past acoustic surveys. Ideally there should have been annual reports showing dates and time and location of surveys, and locations where herring were, and were not, found. As much as possible these last surveys should also have commented on any issues (technical, methodological or biological) related to species identification and other factors that might have affected that validity of the data. In lieu of this and in recognition of the vital importance of these past acoustics data to the herring assessment process, the Panel recommends that a quantitative synopsis of past work be prepared, as an essential element in the assessment process. Further, the Panel appreciated that comments on target strength of herring, but also notes that there have been changes in size-at-age, and perhaps condition of PWS herring during the past several decades. Could such changes affect target strength? Perhaps there have been other changes? Therefore, we wonder how such changes in the physical and biotic environment would have affected estimates of herring biomass. Clearly there may be other concerns about acoustic work as reliable indicators of herring biomass. In view of such uncertainties, the Panel encourages the PI to take a more rigorous and critical approach to acoustic assessments. We suggest that such an approach would be, in the longer term, the most valuable information that could be provided, regardless of whether it supported, or challenged the historical time-series of acoustics data. The PI of this project, more than anyone else, is in a position to put many assumptions to the test – while still providing the necessary data that will provide a time-series input to the assessment model.

Science Coordinator Comments – FY17

Date: May 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21170115**

Project Title: Genomic mechanisms that underlie lack of recovery of Prince William Sound herring following the 1990s collapse

Primary Investigator(s): Andrew Whitehead

PI Affiliation: UC Davis **Project Manager:** USGS

EVOSTC Funding Requested FY17-21: $1,761,000

FY17	FY18	FY19	FY20	FY21
Auth:$224,700	Auth:$492,800	Auth:$478,000*§	Auth: $322,700§	$242,900§

*Requests include 9% GA. *Includes additional $54.9K recommended by the PAC for oil dosing equipment. §Includes additional requests for travel ($2.6K) to the HRM Annual PI meeting for FY19-21.*

Funding From Non-EVOSTC Sources FY17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY17-20): $1,518,200

Total EVOSTC Funding Authorized (FY17-20) and Requested (FY21): $1,761,000

Total Non-EVOSTC Funding (FY17-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The long-term health of fisheries is of crucial importance for the economic health of our coastal communities and for the food security of our nation. Therefore, the causes and consequences of changes in stock abundance merit careful scientific evaluation. The causes of the collapse of the Prince William Sound (PWS) Pacific herring stock are controversial, and the reasons for the lack of recovery remain a mystery. In the research proposed here we interrogate the genome structure and genome function of PWS fish to test hypotheses about the causes and consequences of the collapse, by revealing ecological, evolutionary, and genetic mechanisms governing the demographic trajectory of PWS fish over the past ~30 years. Conspicuous events that coincided with the dramatic PWS collapse include the *Exxon Valdez* oil spill four years previous and the emergence of disease. We test hypotheses concerning the effects of oil exposure, the effects of disease challenge, and their potential interactive effects on herring health and fitness. We test predictions and hypotheses by reconstructing genome-wide genetic change through time (over the past 30 years) in PWS fish and compare this to population genetic change through time in two reference site populations. Furthermore, a series of laboratory-based experiments will test for population differences in their response to oil exposure in early life and subsequent resilience to pathogen exposures. Physiological measurements and patterns of genome-wide gene expression will serve to reveal similarities and differences in mechanisms of response to these stressors between PWS and reference population fish. These studies should provide novel insights into the causes and consequences of recent

dramatic demographic changes in PWS fish, potentially inform novel intervention strategies, and provide modern genomic resources for management and conservation of Pacific herring.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

No comments or concerns. What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities?

PI Response (10.2.20)
I am happy to report that we were able to conduct our animal experiments in 2020 despite COVID-19 disruptions, though not without difficulty. However, our ability to process samples for molecular (gene expression) work has been significantly delayed since our research laboratory at UC Davis was shuttered for over four months, and is now open but with limited personnel allowed on site. We may be able to make up this time in the time remaining on the grant, but it is possible that we will need to request a no-cost extension to finish some of the work.

Only one more animal experiment is planned for 2020-2021, and it is currently ongoing. It should be completed by December 2020. In the event of another COVID spike, we anticipate being able to complete this experiment because animal research at our facilities is considered mission-critical, and animal care staff are considered essential. Because of that, staff will retain access to animals, including experimental breakdown, in the event of COVID-19 related facility closures. That being said, our molecular lab is not immune to being shut down in the event of another COVID-19 lockdown. In that case, molecular data collection will again be delayed. While we currently have access to our molecular lab, we are prioritizing that molecular work over computational work. Computational work is portable, and will take priority if our access to laboratory facilities becomes restricted again.

Science Director Comments – FY21

Date: September 2020

Progress continues to be made. Methods and analyses developed by the PIs for this project were applied to another project results of which were recently published in the journal *Science*. The vacant post-doc position was replaced by a highly qualified candidate. I have no concerns or other comments.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel offered several comments for consideration. First, findings from this project are applicable to herring in polluted environments elsewhere, as well as other forage fishes. Second, simultaneous exposure is not applicable anymore given the conditions in PWS now. Are there data in Atlantic herring where simultaneous exposure resulted in decreased immunity? If so, it may differ from sequential exposure. Third, a recent paper (by Ward et al. 2017. Evaluating signals of oils spill impacts…PLOS ONE DOI:10.1371/journal.pne.0172898) concludes that there was little overall effect of oil as an explanation for ecological change. Therefore, it seems possible that one of the outcomes of this work could be a conclusion that there was a genomic effect related to the oil spill, but it did not manifest into changes in herring abundance. That possibility notwithstanding, this work has considerable novelty and merit. It should proceed as proposed.

PI Response (10.2.19): Thank you.

Science Director Comments – FY20

Date: September 2019

This project continues to make significant progress in FY19. I appreciate the highlights from FY19 which are presented in detail. Regarding genome sequencing and assembly, is there anything that needs to be taken into consideration when using Atlantic herring long-range genome assembly for project herring long-range ordering and scaffolding (besides the unanticipated 3 months of additional computational work)? Will this affect any interpretation of data/results?

PI Response (10.2.19): Long-range scaffolding off of the Atlantic herring genome will allow us to collapse our fragmented genome together. This will improve our ability to annotate the genome. Given our experience with other fish genomes, genome order is highly conserved, especially among such closely related species as Atlantic and Pacific herring. That being said, there may be some genomic rearrangements in the Pacific herring that distinguish it from the Atlantic herring. However, this will not affect any interpretations of the Pacific herring population genomics data.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel was very pleased with the project and its development and the extent to which the PI has trouble-shot various approaches and arrived a rigorous way to address questions without being able to simultaneously access samples from all populations. The reallocation of funds by the PI to purchase the oil dosing system had the unanimous support of the science panel, and we look forward to seeing further results. The PI has made rapid use of technological advances in genomic analysis leading to what we considered "great bang for the buck". The Science Panel and Science Coordinator remained impressed with this work and the broad application these results will have to other fisheries globally. We are excited to see comparisons made with data from Puget Sound. We continue to be enthusiastic for your project and appreciate your hard work and efforts.

Science Coordinator Comments – FY19

Date: September 2018

PI continues to make excellent progress. Milestones and tasks are on track. The first draft of a reference genome assembly for herring has been completed. Differences in the seasonal timing of spawning from each population requires oil dosing for these considerably complex experiments to be highly reproducible so accurate and robust population contrasts can be made. The results of this experiment will make valuable contributions in determining the potential of PWS herring to resist disease after exposure to oil compared to other stocks and will be an important contribution to understanding the dynamics of herring as well as the potential effects for fish stocks exposed to other oil spills globally. Noted is that there is strong support for this project from the PAC and recommendation for an additional $50K for the cost of the oil dosing equipment. To facilitate collaboration with the HRM Program and as per discussions with the HRM program and PI this project will be part of the HRM program starting in FY19; this proposal is revised to include travel costs to the annual HRM PI meeting.

PAC Comments – FY19

Date: September 2018

The PAC discussed the fact that the PI reprogrammed funds to purchase an oil dosing system that was not in the original project budget. It was discussed that prior similar studies would have been strengthened by use of this equipment. The PAC noted the need for high tech equipment in genetics work and recommended the additional funding of $50K for the oil dosing system for this project.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel was pleased to see the integration with Paul Hershberger's disease work, linking them to see if see if there is a genomic change in response to these different pathogens in the PWS herring population. The Panel appreciates that goals are being achieved ahead of schedule and cost-effectively, allowing for additional samples at other locations. The Panel approves the shift of funds from future years to FY18 to get the postdoc onboard to work with the data being generated. There are many great collaborations being made. The Panel is excited to have the entire genome and transcriptome for herring mapped for other studies, including the possibility of adding more value to herring stock responses in Southeast Alaska. There might be another source of archived samples in Pacific Northwest (Doug Hay - Barkley Sound?).

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

This innovative proposal complements the Herring Research and Monitoring Program by conducting a retrospective (pre-spill to present) analysis of genome diversity and the potential impacts of oil exposure on immune deficiency, as well as an assessment of the ability of current genetic diversity to cope with ongoing disease issues. The current Herring Program is focused primarily on stock assessments and current factors affecting the lack of recovery (e.g., whale predation, disease monitoring, and recruitment issues). The Science Panel is supportive of the proposal because of the potential to answer important questions about the cause of the herring population crash as well as important genetic factors that may inhibit recovery. Notably, this project combines genome (Whitehead) and disease (Hershberger) expertise and makes use of valuable genetic samples archived by ADFG pre-spill to present. The Panel is quite enthusiastic about this new approach and opportunity to assess the evidence for mechanistic ties between oil and herring immune deficiency by bringing genomic expertise to bear on herring disease issues. The PI has an excellent track record of productivity and expertise. A major strength of the proposal is the utilization of fish tissues samples that have been archived for almost 30 years at ADFG. This work draws upon ADFG's existing tissue collection, in combination with advanced genomic techniques, to provide a unique (and possibly unparalleled) view into the population, genetic and evolutionary history of Alaskan herring before, during and after the oiling event. This unique opportunity to utilize ADFG samples, collected

and archived across decades, will facilitate a novel approach to the pressing problem of lack of herring recovery and result in valuable information regarding the PWS herring genome.

The PI builds a strong case in support of the hypothesis that oil exposure has suppressed the immune response of herring to disease thereby contributing to the crash and slowing recovery of PWS herring. The PI is uniquely positioned to address this question given that he has found strong evidence that exposure to PAHs and oil on the Atlantic and Gulf Coasts respectively has suppressed immune responses of killifish. The PI works with Paul Hershberger, who has produced internationally groundbreaking herring disease work supported by EVOSTC funding. The second tier of experiments will rear disease-naïve herring embryos from PWS and two other stocks, expose embryos to oil, and determine if there is a difference in response and in genome diversity with disease response genes. Rearing and exposure of fish will take place in the laboratory of Paul Hershberger, who has vast experience in producing disease naïve fish. This research on herring immune deficiency will be valuable in determining the potential of PWS herring to resist disease after exposure to oil compared to other stocks and will be an important contribution to understanding the dynamics of PWS herring, as well as the potential for fish stocks in general exposed to other spills elsewhere. In addition, the research is valuable regardless of the outcome (i.e., whether the link between oil and herring immune deficiency is supported mechanistically and whether or not there is a genetic diversity bottleneck effect) as the proposed work has the potential to contribute significantly to our understanding of both the causes of herring decline and the failure to recover to date – key issues to the mission of the EVOSTC.

The proposal's costs have been reviewed and are found to be appropriate for this level of technological capacity and typical for these types of advanced genomic techniques.

General Comments:
The PWS herring population collapsed several years after the spill and has not since had a sustained period of incremental growth. Scientific reports that describe potential causative linkages are matched by an approximately equal number of reports that describe alternative explanations for either the collapse, or lack of sustained recovery, or both. In short, even after several decades of research, we are still uncertain about whether there have been any long-term impacts of the spill on herring, or the herring collapse in 1993-94 and the lack of any sustained recovery. This project has the greatest potential to have a retrospective look at the past in a scientifically meaningful way.

This proposal has an unprecedented capacity to apply novel, highly technical research on Alaskan herring genomics to actually test the hypothesis that exposure to oil during the egg (or embryo) and early larval stages has led to a decrease in the genetic capacity of PWS herring to resist naturally-occurring, endemic disease organisms. This retrospective genome determination from archived genetics samples would determine if present-day PWS herring would be detectably different than their ancestors residing in PWS prior to the spill, and from other Alaskan herring populations. The proposal consists of several tests. One would be based on a time-series analyses of archived samples of herring collected and stored annually since the spill to test for change in the frequency of alleles related to disease resistance or susceptibility in PWS versus areas that were not exposed to oil. A related test of differences in disease resistance of PWS herring from other herring would be based on laboratory experiments of reared herring from PWS and two other populations.

The proposal is important to EVOSTC and the State of Alaska. It addresses the most fundamental question of the herring program: what is the impact of the spill on herring and what factors are now affecting recovery? This project builds off the current herring monitoring program, and, most importantly, builds off the unique collection of archived herring collections from ADFG, the work proposed in this proposal, regardless of the results, will reflect positively on the EVOSTC. Moreover, the proposed work will likely have worldwide implications and applications for coastal marine fishes.

Specific Technical Comments:
As is often the case with such novel, groundbreaking proposals, the Panel had a number of questions that the PI should address and submit to EVOSTC before reaching a final decision on the recommendation for funding the proposal. We are confident, given the expertise and track record of the investigators, that the PIs will submit appropriate details to these comments:

1. Add technical detail on pathogen exposure experiments. The Panel had several questions that need clarification. Which pathogens will fish be exposed to? Are these from purified sources that can be used at different times of exposure? Given the population differences and pathogen responses, this is a key detail that needs to be included. Will embryos/larvae from the different populations be tested simultaneously for oil and disease exposure in the lab? If not what assurances will be made that exposure (oil as well as pathogens) conditions are identical across populations? For example, how reproducible is the oiled gravel treatment and the pathogen challenge? What steps will be taken to ensure and verify this reproducibility? What will be the age of embryos at collection? That is, 10-14 day embryos may have a different transcriptome than 5-7 day embryos because they might have been exposed to environmental stressors such as UV, desiccation and salinity changes.

2. Aim 3 needs more details on replication, exposure duration and intensity.

3. Functional annotation of genes. It would be useful to mention existing genomic resources for similar species to assure the Panel that these genes and others of potential relevance can be identified and the genome annotated.

4. Add detail on retrospective population genomics sampling. Please provide information on where fish were sampled and the age classes of collected fishes to clarify how the longitudinal time series will be interpreted. For example, age 3 fish collected in 1993 would not have been exposed to oil, but age 8 would have been. Additional information is needed to ensure that samples were representative of the population at the time of sampling and that sample numbers are sufficiently large and were preserved in such a way that genomic level data can be recovered from the samples.

5. Ignoring alleles with less than 5% frequency. While this makes sense, with N=50 individuals, this means that genotypes with fewer than 3 individuals will be discarded. Depending on the degree of polymorphism, if diverse populations have large numbers of rare genotypes, this could result in many genotypes being ignored. This is a question, especially if disease perhaps maintains diversity via negative frequency dependent selection. It would be helpful if the PI could address this potential issue.

6. Clarify Hershberger's role and budget needs. There appears to be considerably more effort from Hershberger than indicated by the total dollar request. We assume that this is the result of "in-kind" contributions, but it would be good to document the source of those funds so that we can both be assured that they will happen and to account for any leveraging of funds. The Panel noted that this sort of in-kind contribution might be time sensitive and this is another very good reason to support funding the project in this cycle.

7. Add additional detail on the budget. Please clarify budget details for each objective to allow the reviewers and Trustees to know what the cost for each piece of the work would be and to assess what funds from other projects (both those funded by EVOSTC and others) might be being already leveraged in this proposal (see #6).

Science Coordinator Comments – FY17

Date: September 2016

This proposal comes from a highly qualified team and offers a new and novel approach. I concur with the Panel's comments and recommendations for further detail.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel and Science Coordinator's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Long-Term Monitoring (Gulf Watch Alaska) Program Project Descriptions

Project Number: **21120114**

Project Title: Long-Term Research and Monitoring Program (Gulf Watch Alaska)

Primary Investigator(s): Mandy Lindeberg

PI Affiliation: NOAA **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $12,766,200

FY17	FY18	FY19	FY20	FY21
Auth:$2,278,800	Auth:$2,574,900	Auth:$2,540,100*	Auth:$2,792,900*,[a]	$2,579,500*,[a]

Requests include 9% GA.

**Funding includes additional requests in FY19 for four projects. See project proposals for more details. [a]Includes additional funding requests for two existing projects and one proposed for FY20-21. See project proposals for more details.*

Funding From Non-EVOSTC Sources FY17-21: $16,292,300

FY17	FY18	FY19	FY20	FY21
$3,205,100	$3,260,300	$3,027,500	$3,421,800	$3,377,600

Total Past EVOSTC Funding Authorized (FY12-20): $24,012,965

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $26,592,265

Total Non-EVOSTC Funding (FY12-21): $18,086,500

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/28/20, budget updated 8/28/20.*

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

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

Sampling and outreach activities during FY20 have been disrupted by the novel coronavirus pandemic. However, some GWA projects have found ways to continue collecting data and maintain their long-term legacy datasets. In FY21, the program management team will continue to work with EVOSTC staff to revise

and finalize the science synthesis report after a successful workshop with the Science Review Panel. Work on syntheses, peer reviewed publications, ecosystem indicators, and final reports will be a focus for the program as the end of the 5-year funding cycle approaches. Overall, there are no changes to GWA program management. Due to COVID-19 impacts, several projects have requested moving funds between categories for the remainder of FY20 and during FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel appreciates the creative measures taken to accomplish field work and surveys during the Covid pandemic. We may see more of the same pandemic-related restrictions on field work and access to labs, which will require alternative plans that were not stated in the program and project proposals. Each project should address the following questions. What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities? The SP understands that it may be challenging to develop extensive and detailed contingency plans for the future, but some planning is required. Will any unused funds for FY21 be repurposed for additional lab and/or data analyses? Or are they requested to rollover to FY22 (pending proposal approval)? Other ways to accomplish field work - i.e., other vessels that could be used or other projects that can be leveraged?

PI Response (10.2.20)
The GWA program appreciates the Science Panel's comments on program improvements and their understanding during these trying times. The primary goal of the GWA program and projects is to complete all field work, analyses, and deliverables on time including spending out all budgets by the end of FY21.

We realize the COVID-19 pandemic could continue to impact our progress in FY21. If we experience further delays due to the pandemic, our PIs now have a better understanding of how this will impact their projects given their experience in the past six months under various agencies, organizations, and mandates. If the pandemic precludes spending funds as planned, projects will prioritize alternate activities that take FY21 unused funds and repurpose them for creative solutions or other objectives, as the Science Panel suggests (e.g., additional lab and data analyses). If it is clear funds cannot be spent in FY21, we will notify the EVOSTC Executive and Science Directors that we will be requesting they be rolled over (spring 2021) and then submit a detailed FY22 Work Plan for approval as part of the normal EVOSTC funding cycle (August 2021). Please see PI responses to the Science Panel, at the project level, regarding their plans for further COVID-19 delays. They have addressed the Science Panel's concerns to the best of their knowledge at this time.

Overall, the PIs did a much better job of interpreting project data and results as requested by the SP in previous reviews. It is also noted that the PIs are making progress to address SP synthesis report comments.

PI Response (10.2.20)
Thank you for your comment. The program management team has worked with the projects to prioritize interpreting project data and results in our Work Plans. We enjoyed the February workshop

with the Science Panel, appreciate the time the Science Panel took to review the synthesis reports and provide detailed comments, and believe our interactions with the Science Panel greatly improved the synthesis report product and future publications.

Science Director Comments – FY21

Date: September 2020

The program continues to leverage funding and resources to enhance collaborative efforts. Sampling and outreach activities during FY20 have been disrupted by the novel coronavirus pandemic. Some GWA projects have found ways to continue collecting data and maintain their long-term legacy datasets due to the program's diverse partnerships and motivated PIs developing creative solutions. These efforts are recognized and appreciated. Due to COVID-19 impacts, several projects are requesting allocation of funds between categories for the remainder of FY20 and during FY21. See individual projects for details. I have no overall program concerns or questions.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel appreciates that the reports and proposals continue to be carefully prepared and well written. We note that there is good leverage and integration within projects and with the Herring Research and Monitoring program, and there is notable progress on synthesis. Projects are also meeting milestones in a timely manner. The Panel is pleased that the two admin projects have been combined as recommended. For future proposals, please separate out peer-reviewed publications from agency and data reports and include subheading of published, in prep, in review if necessary. We would also like to see more interpretation and discussion of data and figures presented in the proposals; this is included in some of the proposals such as in project D. The Panel is not looking for new or additional analyses in the proposals. We are looking for context and some interpretation to allow us to evaluate the proposal.

PI Response (9.27.19)
The Gulf Watch Alaska program is proud of its achievements and values the science panel's feedback. There is always room for improvement and in future proposals we will focus on providing more interpretation and discussion including the separation of various types of publication products accordingly.

Science Director Comments – FY20

Date: September 2019

Field sampling projects have been completed as planned for FY19. Science synthesis efforts are continuing to progress. PIs continue to leverage funding and resources to enhance collaborative efforts. Overall, there are no changes to the original proposals submitted except for two projects (see project M and project H below) and the addition of a lingering oil project proposal for FY20 (see project P below). I concur with the Science Panel's comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

Science Panel is pleased to see the continued increase in quality of the program and the program proposals. Science Panel was pleased with the increased emphasis by PIs on dissemination and publication of results from individual projects. The Panel encourages all PIs to bring their data together to tell a story that encompasses a bigger picture, which may be partially accomplished through the proposed synthesis papers.

PI response (10/10/18)
The GWA program management team (PMT) and principal investigators (PIs) are devoted to the success of the program and maintaining professional quality. Currently, the program and PIs are focused on data syntheses for the 3rd year (monitoring year 8) science synthesis report, which will be a series of peer reviewed papers doing just that, bringing data together to tell bigger picture stories. In the long-term, we are discussing continued cross-component analyses and synthesis projects - including various modeling efforts - that will continue into the next 5-year (FY22-26) funding cycle.

Science Coordinator Comments – FY19

Date: September 2018

The GWA program continues to be productive. I'm looking forward to the synthesis products that will be coming out of this program which will make important contributions in understanding how environmental changes have affected the GOA. I recognize that there are unforeseen circumstances (i.e., loss of previously leveraged vessel time) that have led to these project needs for FY19-21. The program is requesting an additional $189K (includes GA) annually for four projects to replace agency-supported vessel charter costs that are no longer available, resume summer forage fish surveys and aerial survey validation in PWS, and partially fund a postdoc to support science synthesis efforts. I

appreciate the process that was used to assess unfunded project needs which demonstrates that the Program Management Team and PIs are continually evaluating the GWA science program and determined to improve the projects where needed and fill knowledge gaps that exist.

PAC Comments – FY19

Date: September 2018

The PAC noted that the Science Programs have produced unique and very important long-term data sets. The PAC also commented on the thoroughness of how proposal information was presented, it was well organized and clear.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel is very pleased with Mandy's role in coordinating logistics and synthesizing results. The Panel is pleased about the hiring of Rob and Donna as the Science Coordinator and Program Coordinator, respectively, and looks forward to working with them. The quality of this proposal has improved greatly compared to previous years. The Panel is encouraged to see data presented and the evaluation of past years data to determine what the projects should do in the future. This Program has published many papers, which is a positive development and the panel is excited about the Long-Term Ecological Research funding (National Science Foundation) awarded to some of the projects. The Panel was encouraged and about Rob's plans for synthesis products including an analysis and publication(s) on biological impacts of the recent environmental changes.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments. I also greatly appreciate the addition of point 7 in the proposal and will add it as a requirement for future proposals.

PAC Comments – FY18

Date: September 2017

There are no program specific comments

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund Reduced	Fund Reduced	Fund Reduced	Fund Reduced	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund Reduced	Fund Reduced	N/A	N/A	N/A
Sept 2016	Fund Reduced	Fund Reduced	Fund Reduced	Fund Reduced	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel appreciated the thorough and organized responses to our comments. The responsiveness of the program to Panel concerns was very much appreciated. Project specific comments for each proposal are included on each proposal's individual page below.

Date: May 2016

This LTM Program includes spatially and temporally linked studies that monitor abundances of many important predator-prey systems, especially ones involving forage fishes, a key forage-fish-consuming marine mammal – humpback whales, seabirds, and an apex predator – the killer whale, all in the context of continued monitoring of historic long-term transects for physical, chemical, and biological (phytoplankton, zooplankton) parameters . This set of concurrent temporal information holds promise for understanding how ocean conditions and climate change are modifying the PWS and NGOA ecosystems. Unfortunately, the proposed program did not seem to build off of the Program's 2013 Synthesis document. There is a lack of some descriptions of previous work where needed and an absence of depth of hypotheses, comparisons and evolving discussions on the work proposed, so much of which is a continuation from past or related projects. For example, there continues to be a lack of discussion in individual project designs of previous scientific work that may be used to develop their hypotheses or that could be treated as a contrasting interactive web of species.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-A and B**

Project Title: LTM Program
Program Management I – Synthesis and Coordination, Postdoctoral Researcher
Program Management II – Administration, Science Review Panel, PI Meeting Logistics, Outreach and Community Involvement

Primary Investigator(s): Mandy Lindeberg (PM I)
Katrina Hoffman (PM II)

PI Affiliation: NOAA, PWSSC **Project Manager:** NOAA

***PM I* EVOSTC Funding Requested FY17-21:** $1,105,600

FY17	FY18	FY19	FY20	FY21
Auth: $226,800	Auth: $227,600	Auth: $212,800*	Auth: $216,100*	$222,300*

Requests include 9% GA.
** Changes reflect transfer of funds for GWA program coordinator position from PM I to PM II (NOAA contract to NOAA Grant) for FY19-21 (no new additional funds are being requested. See Science Coordinator comments for details). Total also includes an additional requested $62.3K per year to partially fund a postdoc position for science synthesis efforts for FY19-21.*

***PM I* Funding From Non-EVOSTC Sources FY17-21:** $514,300

FY17	FY18	FY19	FY20	FY21
$105,400	$105,400	$105,400	$105,400	$92,700

***PM I* Total Past EVOSTC Funding Authorized (FY12-20):** $1,591,800

***PM I* Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21):** $1,814,100

***PM I* Total Non-EVOSTC Funding (FY12-21):** $579,300

***PM II* EVOSTC Funding Requested FY17-21:** $1,728,900

FY17	FY18	FY19	FY20	FY21
Auth: $277,100	Auth: $282,400	Auth: $382,500*	Auth: $384,600*	$402,300*

Requests include 9% GA.

***PM II* Funding From Non-EVOSTC Sources FY12-21:** $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

** Changes reflect transfer of funds for GWA program coordinator position from PM I to PM II (NOAA contract to NOAA Grant) for FY19-21. No new additional funds are being requested. See Science Coordinator comments for details.*

Total Past EVOSTC Funding Authorized (FY12-20): $2,744,700

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $3,147,000

Total Non-EVOSTC Funding (FY12-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The Program Management I (PM I) project provides program coordination and science synthesis of data for the *Exxon Valdez* Oil Spill Trustee Council's (EVOSTC's) integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services program, referred to as Gulf Watch Alaska (GWA). The Program Management II (PM II) project is the administrative and outreach component of GWA. The Prince William Sound Science Center (PWSSC) serves as the fiscal agent for non-Trustee Agency recipients of GWA funds. The workplans for these two projects are combined because together they represent management of the GWA program.

The program management team (PMT, collectively PM I and PM II) oversees more than two dozen principal investigators (PIs), collaborators, and science reviewers to produce and integrate a wealth of scientific information on the northern Gulf of Alaska ecosystem and spill-affected area and share that information with others. Program coordination and science synthesis (PM I) improves linkages between monitoring efforts spanning large regional areas (from Prince William Sound to lower Cook Inlet and the Alaska Peninsula). Program coordination includes facilitating within program planning and sharing of information between PIs, other Trustee-funded programs, and non-Trustee organizations. High quality products and science synthesis efforts help communicate monitoring results by delivering reports, publishing data, developing scientific papers, supporting outreach, and integrating information across the entire program. Program administration, science review panel, logistics, and outreach (including website), and community involvement (PM II) complements work under the PM I project. The administrative portion of the PM II project oversees funds for non-Trustee Agencies, while also providing travel and logistics for GWA in-person meetings and teleconferences.

FY20 was disrupted by the COVID-19 pandemic and the PMT worked with all program members to identify scientific priorities and adapt schedules and budgets accordingly. We maintained all of the program administration and some online outreach activities, which included contributing four articles to *Delta Sound Connections*, producing a few program presentations/outreach products, continuing science synthesis efforts in revising our synthesis report and related manuscripts, leading a new *Deep-Sea Research II* special journal issue for the Gulf of Alaska, and contributing time series indicators to inform ecosystem-based fisheries management in the Gulf of Alaska. The PMT also held the 2020 Science Synthesis Workshop with EVOSTC staff. Overall, there are no changes to this projects' objectives or total budget request.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel agrees with the Science Director on her comments regarding outreach activities going virtual. There should be no reason why these activities should not continue unless these communities do not have internet access.

PI Response (10.2.20)
Thank you for the suggestion. We will reach out to the native villages in Prince William Sound to gauge the potential for in-person or virtual engagement in FY21. We will be sensitive to their capabilities and interests and will endeavor to engage in low-risk interactions due to the pandemic and interactions that are otherwise culturally and socially sensitive, appropriate, and welcomed. If novel engagements in the Prince William Sound villages are not possible due to COVID-19 and community connectivity capabilities, we will explore pivoting towards re-engagement in meaningful ways with already established relationships of native communities in the Kachemak Bay area.

The Science Panel would like clarification on the role of the new postdoc. How will this person be onboarded (remotely, in-person)? What aspects will Rob Suryan continue to work on and what will be the responsibility of the new postdoc? Will the postdoc be able to accomplish these goals remotely? The request seems reasonable on its surface, but the SP would like to see the more specific goals and activities of the postdoc specified.

PI Response (10.2.20)
Our current plan is for the postdoc to be onboarded remotely. This has worked successfully with Sarah Traiger, the new postdoc in the Nearshore Component (replacing Ben Weitzman), and we are confident remote onboarding will work in this situation, too. Rob will continue to fulfill the science coordinator position in working with the management team and PIs in directing cross-program science synthesis, continuing collaborations with other Gulf of Alaska sampling programs, and developing Work Plans for the next EVOSTC funding cycle. The new postdoc will be incorporated into these efforts as much as possible. The primary responsibility of the postdoc will be to lead data synthesis efforts identified as priority analyses and manuscripts by program management and PIs. The postdoc will be lead author on these efforts and Rob will primarily act in an advisory role.

Science Director Comments – FY21

Date: September 2020

The GWA Science Coordinator and program PIs presented synthesis papers at the Science Synthesis Workshop in February 2020, the results of which will make significant contributions to the literature regarding ecosystem effects of marine heatwaves. The Program Management Team continues to provide exceptional leadership to the program, which has been critical especially during this time of a global pandemic.

PI Response (10.2.20)
The GWA management team and PIs thank the Science Director and the Science Panel for their support of our science synthesis efforts and their understanding of the many challenges that COVID-19 has presented to our program while conducting research.

Local and traditional ecological knowledge roundtable-type symposiums have been postponed due to the coronavirus pandemic. Many businesses and communities are moving toward video conferencing platforms to hold virtual events online - could this be an alternative way to effectively conduct outreach activities such as a community listening session? I understand that face-to-face

meetings can be more effective and meaningful depending on the topics and participants, but this may be a way to sustain connections with communities, and this is also assuming that participants have access to video conferencing capabilities.

PI Response (10.2.20)
Thank you for the suggestion. Per our response to the Science Panel's similar comment above, we will reach out to the native villages in Prince William Sound to gauge the potential for in-person or virtual engagement in FY21. We will be sensitive to their capabilities and interests and will endeavor to engage in low-risk interactions due to the pandemic and interactions that are otherwise culturally and socially sensitive, appropriate, and welcomed. If novel engagements in the Prince William Sound villages are not possible due to COVID-19 and community connectivity, since our group has already established relationships with some of the native communities in the Kachemak Bay area, we may be able to pivot towards re-engagement in meaningful ways there.

Redirection of funds is being requested for FY21: 1) The EVOSTC supports GWA's Science Coordinator position, Rob Suryan, at $130K for FY21. However, the Science Coordinator is now a permanent NOAA employee and a portion of his salary ($110K) is requesting to go towards a full-time postdoc. 2) Due to travel restrictions associated with the COVID-19 pandemic the travel by the GWA management team will be reduced in FY21. PIs are therefore requesting $6.7K in travel be moved to commodities to help with peer reviewed publication fees for GWA PIs. 3) PIs are requesting to transfer unused $19.8K from program Science Review Panel travel to Personnel ($7.7K), Contractual ($6K) and Commodities ($6.1K) to cover increased costs such as insurance and maintenance at PWSSC, and also hardware, software and other unanticipated expenses related to the cost of transitioning the Program Coordinator from NOAA to PWSSC which was approved in FY19 and has overall been a cost-saving measure. I support these reasonable redirection and transfer requests of funds. I concur with the Science Panel's request for more details on the specific goals and duties of the postdoc.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Panel appreciates the Quarterly Currents and the links to media (e.g., newspaper articles) with a range of topics. The Science Panel wonders whether this effort can also benefit public outreach. For example, could this publication be modified such that all or selected parts can be included in Riley

Woodford's ADFG's Wildlife News email? This may also be a good opportunity to provide a product for communities as requested by the Science Coordinator. Science Panel concurs with the Science Coordinator's comments.

PI Response (9.27.19)
We are pleased with how well the Quarterly Currents have been received. Expanding the distribution list is a great idea and we appreciate the suggestions. We will look into these suggestions and others, keeping the EVOSTC Science Coordinator apprised of opportunities.

Science Director Comments – FY20
Date: September 2019

The Program Management Team members have developed a solid relationship over time, with each role explicitly defined and appear to provide seamless coordination and administrative support to the program. The Science Coordinator and program PIs continue to make progress on the synthesis papers; results will be presented at the Science Synthesis Workshop in February 2020. The Program Management II continue outreach efforts and I am pleased to see that another Traditional Ecological Knowledge (TEK) session(s) with spill-affected native communities will be scheduled for FY20. While these sessions have received positive feedback from the communities and researchers, it has also been noted that community members would like to receive products that report project results. In your proposal on pg 14 under Objective 4, it states that "We engage Trustee Agency managers and community members with interests in the spill area, including those who can provide a perspective on traditional ecological knowledge, to learn how data and information products can best serve them. We generate products to meet those needs and improve understanding of ecosystem processes affecting variation in spill-affected resources." It is not clear to me in the proposal or in the Outreach products in Section 7, which products have been dispersed back to the communities where the TEK sessions have taken place. Although presentations are made to the communities, I suggest that a simple fact sheet product or something similar that reports results for distribution to the communities, including their schools. If this is already being done, please clarify.

Program Management II requests permission to transfer unused $21K from program Science Review Panel travel to Contractual ($15K) and Commodities ($6K) to cover increased costs such as insurance and maintenance at PWSSC, and also hardware, software and other unanticipated expenses related to the cost of transitioning the Program Coordinator from NOAA to PWSSC which was approved in FY19 and has overall been a cost-saving measure. I support this reasonable transfer request of funds.

There is one personnel change, the postdoc hired in FY19 recently took a new position within another TC-funded project. However, he continues to contribute to the synthesis products as originally assigned. Program staff are working on filling the position and do not expect any interruptions in progress.

PI Response (9.27.19)
The Gulf Watch Alaska Management Team is pleased the science coordinator appreciates our efforts and efficiencies running a large program. We also welcome suggestions for outreach and communicating program science as resources allow. The program has created visual schematics created about the Nearshore and Pelagic components. We envision developing interpretive text for these which will allow the schematics and the processes described within them to serve as stand-

alone items that can be circulated to and/or displayed within communities. We intend to round out the set with schematics describing some of the key processes monitored by the Environmental Drivers component. We will evaluate the opportunity to create additional fact sheets of results beyond those items. However, that role may best be served by ensuring distribution of Delta Sound Connections to each of the communities in question. Across the years of the program, Delta Sound Connections provides a carefully curated assemblage of articles that explain program findings in lay terms.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel continues to be impressed with the leadership of the PMT. The long list of publications and presentations is a reflection of the effective guidance applied by the PMT.
Science Panel shares the Science Coordinator's concern that the postdoc is not lead author on any of the synthesis papers and the scientific growth for the product. Synthesis is part of the GWA program as stated in the original proposal: Program Goal C-Assess monitoring data holistically in order to better understand the range of factors affecting individual species and the ecosystem. And Objective 2-Provide and document integration of monitoring results – This includes cross-program standardization of data collection, GWA science synthesis products, and publications. However the Science Panel recognizes that this would be a good opportunity to inexpensively fund a program experienced postdoc.

The Science Panel is pleased that the graduate student will transition to a 60% postdoc in FY19 as this provides a career opportunity for him as well as synthesis opportunity. The Panel felt it was important that this is a true change in position from graduate student status and there was some concern expressed that the 40% portion of the position would remain in a "graduate student mode". It is important from a career perspective that the postdoc make independent contributions to synthesis efforts.

PI Response (10/10/18)
We appreciate the positive feedback regarding GWA PMT leadership and our attempts to continually improve the program. Regarding postdoc mentoring, we understand the importance of providing opportunities for senior authored papers and professional development for a postdoc working with GWA. The immediate supervisors of the postdoc, D. Esler (19120114-H, Nearshore) and R. Suryan (19120114-A, this project), both formally held academic positions and have experience mentoring postdocs and graduate students. We have discussed and would develop the equivalent of a postdoc

individual development plan, similar to what is required at academic institutions. As a 3-year postdoc position, there is ample time for contribution as both senior and co-author on publications currently in progress and yet to be identified, both synthesis-focused and otherwise. The student would transition to 100% postdoc following completion of degree requirements. This indeed would be a transition out of "graduate student mode" to an emphasis on career development and professional advancement.

Science Coordinator Comments – FY19

Date: September 2018

The Program Management Team continues to provide excellent leadership for the GWA program. The GWA Science Coordinator is making progress with Science Synthesis products which includes 4 manuscripts to date. PMII has been productive with outreach activities and products.

There are two requests from the PMT. The first is for the GWA Program Coordinator's funding to be transferred to PMII (would be NOAA grant through PWSSC instead of NOAA contract) to avoid the costly overhead fees associated with the new NOAA contractor. The second is to partially fund a postdoc at $63.2k/yr (includes GA) for FY19-21 that will be dedicated to synthesis efforts across components. Current PI time is largely devoted to collection and presentation of data within their projects, hiring a qualified postdoc who can link data streams from throughout the program would result in high value, broad-scale product in a timely manner. The postdoc candidate is well qualified; as a current PhD student in the GWA program, he is already familiar with the Program and has been highly productive. He is scheduled to complete his dissertation in 2019 so timing would work out well. The candidate is already being funded 0.40 FTE for FY19-21. What are the candidate's current responsibilities for FY19-21? If these responsibilities are different than working on synthesis products, how will they be distributed and accomplished or will these tasks be in addition to working on synthesis products?

PI Response 8.31.18
The graduate student's current responsibilities in FY17-21 for a 0.40 FTE appointment with GWA is field data collection, logistics, data management, and analysis with the Nearshore component. When this candidate completes their degree in FY19 and switches to full-time, their current employer (USGS) will not have the additional 0.6 FTE funds to support their full-time employment. The nearshore PIs and GWA Science Coordinator are confident that the candidate could maintain their current 0.40 FTE GWA responsibilities while contributing an additional 0.60 FTE to GWA science synthesis in FY19-21. The GWA Science Coordinator is currently the only person devoted to science synthesis and he is committed to leading one manuscript and supporting all others to the extent possible. The addition of a postdoc would provide much needed support to the Science Coordinator and to PIs who are volunteering to lead synthesis manuscripts. We feel this is a unique opportunity to obtain support for GWA science synthesis efforts while only having to request funding for an additional 0.60 FTE - and to avoid trying to replace the graduate student's knowledge and expertise in our program after completing their degree and moving on to full-time employment elsewhere.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

As stated above, the Panel is pleased with Mandy's leadership skills and very pleased with the proposal and organizational structure. The Panel appreciates the different management aspects of this proposal and proposal 18120114-B and suggests consolidating these two proposals into one Program management proposal. This would help to clarify how the two program management components relate to one another and to demonstrate lack of duplication.

PI Response (10/11/2017):
The Program Management Team appreciates the Science Panel's suggestion to consolidate the management proposals: 1) 18120114-A or Program Management I and 2) 18120114-B or Program Management II projects. We are willing to consolidate the program management proposals and reports; however, the budgets for PMI and PMII need to remain separate and would be reported on separately. We will work with EVOSTC staff to develop a reasonable format for consolidation and tracking.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments. I will work with Mandy to address the Panel's suggestion.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Science Panel was pleased with the proposal and organizational structure. The structure of the coordinating committee and science review Panel sets the mechanisms for evaluation and adaptive management of the project. We also appreciated the responsiveness to Panel requests to streamline the budget.

Date: May 2016

The Panel is encouraged and gratified by Mandy Lindeberg's acceptance and participation in the role of Science Lead and looks forward to her leadership. The Panel did express concern that the science coordinator position is intended to be filled after the start of the Program. This key position will be responsible for the design and implementation of the Program and it may take longer than anticipated to find an individual with the appropriate education and skill sets. Is there a plan in place, if the hiring process takes longer than planned or a qualified candidate is not identified? If the position is not a NOAA employee as hoped, will this impact the projected five year cost?

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-B**

Project Title: LTM Program - Program management II – Administration, Science Review Panel, PI Meeting Logistics, Outreach, and Community Involvement

Primary Investigator(s): Katrina Hoffman

PI Affiliation: PWSSC **Project Manager:** NOAA

SEE 20120114-A and B above for FY19-FY21

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel appreciates the PI's coordination activities. The Panel suggests combining this proposal with 18120114-A into one Program management proposal.

PI Response (10/11/2017):
See response in section above for project 18120114-A.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel appreciated the responsiveness to Panel requests to streamline the budget.

Date: May 2016

The administrative budget is substantial and the Program should be cautious with regard to such costs.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-C**

Project Title: LTM Program – Monitoring long-term changes in forage fish distribution, abundance, and body condition in PWS

Primary Investigator(s): Mayumi Arimitsu & John Piatt

PI Affiliation: USGS **Project Manager:** USGS

EVOSTC Funding Requested FY17-21: $1,318,900

FY17	FY18	FY19	FY20	FY21
Auth: $198,800	Auth: $229,800	Auth: $292,100*	Auth: $295,300*	$302,800*

Requests include 9% GA.

*Totals in FY19-21 include additional annual requests of $70,850 per year that will be used to reinstate summer validation sampling of Herring Research and Monitoring Program aerial juvenile forage fish surveys (funding secured through PWSRCAC) and summer acoustic-trawl surveys.

Funding From Non-EVOSTC Sources FY17-21: $1,802,400

FY17	FY18	FY19	FY20	FY21
$256,000	$256,000	$256,000	$517,200	$517,200

Total Past EVOSTC Funding Authorized (FY12-20): $1,983,600

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $2,286,400

Total Non-EVOSTC Funding (FY12-21): $2,763,400

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

Identifying drivers of change in forage fish populations is key to understanding recovery potential for piscivorous species injured by the *Exxon Valdez* oil spill. The goals of the Gulf Watch Alaska (GWA) forage fish monitoring project are to provide information on the population trends of forage species in the Gulf of Alaska (GOA) and to better understand how underlying predator-prey interactions influence recovering species and pelagic ecology within Prince William Sound (PWS) and the GOA. Sampling in FY18 indicated predator and prey abundances in PWS were low and forage species such as capelin and sand lance continued a multi-year trend of low occurrence in seabird diets in the GOA. During summer 2019 sampling we encountered spawning capelin and large energy-rich sand lance in PWS, providing the first signals that these forage fish populations may be recovering. Our continued sampling will provide insight into how forage fish populations respond to the persistence of or recovery from the recent Pacific marine heatwave.

Due to COVID-19 pandemic and State/Federal mandates, we were unable to conduct fieldwork in 2020. We propose to redirect FY20 spending that would have occurred for fieldwork to 1) maintenance and update of trawl gear, and 2) funding to support a student or post-doc with training in acoustic data analysis to help accomplish GWA forage fish project goals and synthesis. If approved, these expenditures in FY20 would balance out with no changes to our originally proposed

project total budget. Middleton Island work is underway, and sampling will be comparable to previous years. In FY21, we will continue summer aerial survey validation in conjunction with the Herring Research and Monitoring program, summer acoustic-trawl sampling, and the fall integrated predator-prey survey in PWS. We will also conduct seabird diet sampling at Middleton Island during spring/summer (Apr-Aug).

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

In general, the Science Panel supports the request to repurpose unspent FY20 funds for a graduate student or postdoc and equipment replacement. The SP appreciates the PI's detailed response to the Science Director's questions. What is the contingency plan for any FY21 unspent funds due to pandemic related restrictions?

PI Response (10.2.20)
As in 2020, we will make efforts to conduct as much of the work as possible. This may include contracting Cordova locals whenever possible to help with fish sample collections and aerial survey validation and implementing the large-vessel COVID-19 safety plan to conduct vessel-based surveys. The specific measures we take will depend on state and federal guidance at the time. If we are unable to conduct field work we anticipate using FY21 funds that would have paid for fieldwork on continued analysis and write-up of the data in hand. If necessary, we will request to roll over unspent FY21 funds into FY22 to complete these activities (pending approval).

Science Director Comments – FY21

Date: September 2020

Field work in 2020 was canceled due to the COVID-19 pandemic and this changed the amounts spent in some categories in FY20: the project spent $33K less in salary and overtime, $3K less in travel for field work, and $32K less in vessel charter costs (total of $68K unspent for FY20). The PIs are requesting to redirect FY20 spending that would have occurred for field work to 1) maintenance and update of trawl gear for $13.5K, and 2) funding to support a graduate student or postdoc with training in acoustic data analysis to help accomplish GWA forage fish project goals and synthesis for $54.5K. I support the redirection of unspent funds in FY20 to FY21 but would like to see a detailed description of the responsibilities of the graduate student or postdoc and what remaining synthesis activities need to be accomplished for FY21. Also, is maintenance and update of trawl gear regularly scheduled and normally funded by USGS?

PI Response 9.10.20
We propose to redirect FY20 spending that would have occurred for field work to 1) maintenance and update of trawl gear for 13.5K, and 2) funding to support a student or post-doc with training in acoustic data analysis to help accomplish GWA forage fish project goals and synthesis for 54.5K. If approved, these expenditures in FY20 would balance out such that there are no changes to our originally proposed project total budget.

Is maintenance and update of trawl gear regularly scheduled and normally funded by USGS?

The trawl gear is central to the forage fish project as trawl sampling is required to ground-truth species composition and fish size for scaling the acoustic data to biomass. The modified herring trawl net and hardware we use for this application were purchased with funds from EVOSTC in 1995 during the APEX project. This gear needs to be replaced because it's worn and rusty from years of use, and some parts of the net, hardware, and gear that we use to move and install the trawl are failing. There are no USGS maintenance or base funds to support this kind of gear replacement, and equipment replacements such as this are usually purchased with project-specific funds.

Provide a detailed description of the responsibilities of the graduate student or postdoc and what remaining synthesis activities need to be accomplished for FY21.

Funding to support a student or post-doc in FY21 will be used to help process and analyze acoustic data that will help us meet our project objectives. These specific objectives include the following:

1. Estimate an index of forage fish availability in seasonally predictable predator foraging areas, including species composition and biomass within persistent predator foraging areas and density and depth distribution using acoustic-trawl data collected during the Integrated Predator Prey surveys.

2. Estimate an index of euphausiid availability in seasonally predictable predator foraging areas, including species composition and biomass within persistent predator foraging areas and density and depth distribution using acoustic – trawl data collected during the Integrated Predator Prey surveys.

3. Assess changes in forage fish abundance indices on acoustic-trawl surveys during summer.

4. Relate whale, marine bird, and forage fish indices to marine habitat, including oceanographic metrics and zooplankton biomass.

5. Relate marine bird and humpback whale presence to prey fields identified during acoustic surveys, including spatial coherence of bird and whale presence/absence, acoustic estimates of forage fish and euphausiid biomass.

We anticipate this student will focus on analyses of the acoustic data, particularly with respect to schools metrics and apportionment of acoustic backscatter indices to species and size frequencies. These analyses will directly address objectives 1-3, and contribute to analyses for objectives 4-5.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel appreciates the PIs response to last year's comments. The panel noted that seabird diets show an increase in the relative abundance of herring in seabird diets, whereas HRM projects are not seeing an increase in herring. This is something that is worth investigating together with the HRM projects. Please include this comparison and potential interpretations of its causes in your FY19 annual report. This sort of comparison should also be included in the science synthesis paper. There are many possible explanations, but they point to the likelihood that bird diets may not provide useful proxies for fish abundance.

PI Response (9.27.19)
We appreciate this suggestion from the science panel and we plan to address the issue in greater detail in our FY19 annual report. There are several reasons the Middleton seabird diets do not reflect the findings of the Herring Research and Monitoring program spring spawning stock biomass trends for Prince William Sound, including the following: 1) herring are not a primary prey species as they contribute a relatively small proportion (< 3% of prey biomass across years) of seabird diets sampled at Middleton; 2) more than 75% of the herring in rhinoceros auklet chick diets between 1993-2018 were juvenile herring (i.e., a mix of age-0 and age-1, < 10 cm in length), in recent years (especially 2013 and 2017) larger size classes of herring were represented in Middleton seabird diets; and 3) tagging studies indicate that shorter foraging trips are less costly, however, when preferred species are less available offshore Middleton Island seabirds can increase foraging range to include coastal mainland areas where juvenile herring occur.

Minor question: regarding Figure 1 (page 3), on the top panel, what species do the clear bars at the top represent? This is missing from the figure legend.

PI Response (9.27.19)
The clear bars represent "other". Thank you for pointing this out, we will correct the legend in future use of this figure.

Science Director Comments – FY20

Date: September 2019

This project is on track and meeting goals as planned. No changes are proposed for FY20. This project continues to provide useful data on forage fish population trends in PWS. It will be interesting to see if capelin and sand lance abundance continues to increase from FY19 in FY20 and how these patterns correspond with climate data.

PI Response (9.27.19)
Thank you for this input. We also are very curious to see how sand lance and capelin populations respond over the next couple of years.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel recognizes the importance of annual ground-truthing of aerial surveys, and supports reinstating aerial surveys especially given that HRM has secured funding from RCAC for aerial surveys. The Science Panel wondered about the interannual spatial and temporal consistency of acoustic surveys. Shouldn't they be conducted over as broad an area as possible? It was noted that a lot of PWS has not been surveyed. Specifically how much of PWS is surveyed, including the deeper areas? Can the PIs advise whether this is important?

PI Response (10/10/18)
From our original 2012-2016 research program we concluded that a reduced and targeted set of summer acoustic transects would be an efficient way to conduct forage fish surveys over a broader area within Prince William Sound (PWS). These acoustic transects were designed with information on the distribution of forage fish in PWS, and were meant to sample high density forage fish areas important to breeding marine birds during summer in PWS. The summer surveys (conducted in 2014-2016) include 463 km of transects at 16 locations throughout the Sound. They target nearshore and relatively shallow areas because that's where the majority of forage fish biomass is concentrated in the Sound during summer. Accordingly, the shallow nearshore areas contain greater densities of marine birds than deeper offshore areas during summer as these are predators of sand lance, capelin, and juvenile herring. The Integrated Predator Prey surveys (Fall) began in the second funding cycle (FY17-21) with the purpose of better integrating the humpback whale, forage fish, and fall marine bird surveys. They were designed around three historically important humpback whale feeding areas where krill and juvenile and adult herring occur in coastal (<50m) and deeper waters (<300m) of PWS. The fall surveys include 139 km of transects in Montague Strait, Bainbridge Passage, and Port Gravina.

The Science Panel is also curious to know what the value added of this project over data already captured by herring surveys as most of the forage fish found in this project appear to be herring. Can the herring data be used to help assess forage fish abundance? The Science Panel realizes that the goals of these two projects are different, but could data and perhaps vessels be shared between this project and the HRM herring surveys?

PI Response (10/10/18)
Herring are very important prey in many areas of PWS and when populations are at high levels, they are the dominant prey item. However, herring alone does not support predator populations in PWS. Capelin, krill, and sand lance, are also important prey items. Our proposed survey work does not duplicate herring research. The Herring Research and Monitoring (HRM) program's aerial and GWA acoustic surveys of herring and forage fish are complementary as they sample different scale, habitats, and target species/size classes during the same time period. Broad-scale aerial surveys are useful for counting schools of juvenile herring and Pacific sand lance along shorelines. Finer-scale acoustic trawl surveys are better suited for capelin, juvenile walleye pollock, juvenile and adult herring, and krill. HRM acoustic surveys occur during spring and focus on herring spawning; the other important prey for predators in PWS that are noted above are not quantified by these herring-specific acoustic surveys. It

would not be possible for GWA and HRM to share vessels for acoustic surveys because of differences in timing of surveys and survey objectives involving multi- vs. single-species surveys.

Science Coordinator Comments – FY19

Date: September 2018

Project is on track except for some metadata which is in progress and anticipated to be completed in fall 2018. I am encouraged to see that PIs are coauthors on a publication in review.

Questions were emailed to PI for response on 8.30.18
Are there any results besides the Middleton Island data to report for FY18?

PI Response 9.4.18
The only field work for this project that has occurred so far in FY18 is Middleton Island. The Integrated Predator-Prey (IPP) surveys in Prince William Sound will take place 11-20 September. These results will be reported in the FY18 annual report

The project requested an additional ~71K (includes GA) to resume June aerial forage fish surveys which will provide data for (1) validation for the HRM aerial surveys (which will now be funded by RCAC) and juvenile and adult herring indices for the ASA model, and (2) acoustic indices for important forage fish (capelin and sand lance) age structure and body condition during summer, species composition of zooplankton, juvenile pollock, herring for understanding food web dynamics. In regards to supporting the HRM aerial surveys, results from the first 5 yr program show that "validation efforts suggest herring and sand lance schools can be classified to species by aerial observers. Additionally, adult herring schools were always classified correctly; but smaller age-classes (i.e., age-0 and age-1) of herring could not be reliably distinguished from one another and were therefore combined as juvenile herring for our work conducted in July."(16120114-O Final Report) and "In both this work and the previous effort, the majority of misidentified fish involved age-0 herring and sand lance." and "Because the transformation of these age-0 fish usually occurs sometime in July, we conclude that identification errors by aerial observers would be lower in June when age-0 herring and sand lance are not visible from the air." (HRM project 15120111-R Aerial Survey Support Final Report). So, if HRM is resuming aerial surveys in June and these aerial surveys have already been validated with acoustic surveys in 2012, 2013 and 2014, it's not apparent why these surveys need to be validated again with acoustic surveys.

PI Response 9.4.18
First just to clarify, the aerial survey validation is separate from the acoustic surveys. The aerial survey validation includes directed sampling of specific fish schools detected by the aerial observer. To do this, our team on the ground (in skiffs or a larger vessel) was directed to schools by the pilot after he had assessed the species and age of the schools. We collected fish using jigs, purse seine, cast net, or video to ground-truth the pilot's observations, which ultimately provided a measure of uncertainty in the pilot's observations.

In practice, the aerial surveys need to be ground-truthed every time they are conducted to validate species and age composition of fish observed from the aircraft – similar to targeted net sampling conducted during vessel-based hydroacoustic surveys. We validated the aerial surveys in 2014, 2015, and 2016. While the aerial surveys have been conducted in some years without ground-truthing, those surveys lack calibration and estimates of uncertainty. Furthermore, in addition to species and

age composition, direct sampling of fish allows specimens to be collected for laboratory analyses (otolith analysis, stable isotope, energetics, etc.).

Acoustic surveys in deeper water compliment the aerial surveys where fish are only observed in shallow nearshore waters. Additionally, the aerial shoreline surveys take 2 weeks to complete in the plane, and a boat needs to be on the water wherever the plane happens to be working. Because the boat is slow and can't leave from Cordova every day to get to all areas of PWS, and because validation only takes a few hours out of every day, it makes the most sense to use the vessel to also conduct summer acoustic surveys while it waits for the plane. Whether we do the acoustic surveys or not the vessel costs are the same (i.e., 2 weeks of charter time), so the summer acoustic-trawl surveys would just be value-added to make the project most efficient.

Perhaps, more importantly, these data can be used to understand how prey resources influence marine bird trends during the breeding season and how prey resources affect humpback whale distribution and abundance. June survey data will aid in the understanding of how animals are responding to the blob, effects of which are still being observed in 2018. However, from the FY12-16 project final report (Appendix A), it appears that observations from Middleton Island support results from the summer forage fish surveys. Therefore, can the Middleton Island seabird breeding season diet sampling data be used as a proxy for the June forage fish surveys?

PI Response 9.4.18
Middleton Island seabird diets are a good proxy for what's happening with many forage fish in the GOA and PWS. For example, we do think that Middleton diets are representative for capelin and sand lance, however, due to low occurrence in seabird diets in most years, they are likely insufficient for tracking PWS juvenile herring populations. Furthermore, it is prudent to sample fish within PWS because these habitats are oceanographically and structurally different from Middleton, and it's possible that changes can affect one area and not the other. Directly sampling forage fish in PWS will better relate to marine bird surveys that GWA is conducting in PWS. Finally, the summer 2014-2016 acoustic-trawl surveys were important because they provided indices of other important pelagic taxa not sampled effectively with aerial surveys, such as krill, young of the year walleye pollock, and gelatinous zooplankton. The summer acoustic surveys are especially interesting because they documented the middle-trophic conditions in PWS during the marine heat wave years (2014-2016) and continuing this time series could be very valuable moving forward as we document the recovery following this major perturbation. For example, we find in Cook Inlet that common murres have just experienced their third year in a row (at least 2016-2018) of complete failures, which is directly related to food availability and indicates the ecosystem has not bounced back yet. PWS was the center of distribution for the murre die-off over the winter of 2015-16, we have a very unique forage fish dataset from those years but we need more years of data to put them into context as the system recovers. For FY17-21 proposals, we prioritized continuation of the Middleton diet data collection as it provides the best and longest timeseries information on forage fish for the GOA region, however, it is not a replacement for summer forage fish sampling in PWS.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel was gratified to see a broader and stronger use of the Middleton Island monitoring data into the overall project and appreciates the sound science being conducted by the PIs. Huge improvements were made in data management, which can be attributed to the leadership of the Program.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund Reduced	Fund Reduced	Fund Reduced	Fund Reduced	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund Reduced	Fund Reduced	Fund Reduced	Fund Reduced	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel expressed some concern about how the data would be interpreted. The PIs recognize they cannot provide sound-wide abundance estimates because of limited spatial sampling, but do not consider the implications of their limited sampling being a biased subset of potential sampling locations (only locations with whales). Some interpretations seem potentially circular: if there are fewer predators and fewer prey is that because the prey populations have declined and predators are declining or moving elsewhere, or because predators have reduced prey populations and are

foraging elsewhere? Presumably within a season the correlation might even shift from initially positive to negative as the season moves on. Care will need to be taken in the interpretation of these data and what they mean for forage fish abundance. The PIs should carefully consider exactly how and for what the data will be used.

Regarding the Middleton Island sampling, the Panel considered the relevance of this sampling both on biological and geographic considerations. It was not clear to us how the PIs would use data on presence in the diet to estimate abundance of forage fish? Presumably the bird diet is not just a strict reflection of abundance due to prey selectivity, spatial patterns in abundance of different prey species, etc. The Panel has concerns regarding the location of this work in the project and recommends the removal of the proposed effort at Middleton Island.

Date: May 2016

This project is part of a newly proposed "Integrated Predator-Prey Survey" program that seeks to integrate three proposed projects (Arimitsu, Moran, Bishop) into a single integrated survey. The survey would be conducted in the fall and would target persistent humpback whale feeding locations.

While the Panel is supportive of continued forage fish work, there are concerns regarding the actual integration of the three projects. The proposal appears to be an integration of PIs collecting data at the same time and location through a shared vessel. It was unclear from any of the three proposals how the data would actually be integrated to address the hypotheses of the Integrated Predator-Prey Survey. If the intent is not a true integration, then the project should be renamed accordingly. Also, based on the focus on known seabird and marine mammal foraging areas, the proposal should note that it does not intend to scale-up results to the level of PWS. Moreover, the Panel was unsure of how the seabird diet data from Middleton Island would be incorporated into the Survey, given its offshore GOA location, 130 km southwest of Cordova. The other projects are benefiting from data collected at the same time and location, but Middleton Island is not within any of the anticipated survey areas. The Panel acknowledges that inclusion of Middleton Island allows incorporation of a set of important seabirds not included elsewhere in the LTM Program, specifically an auklet, black-legged kittiwake, and puffins. The proposal is short on methodology. The Panel requests the proposers to expand the description of their methods as there is insufficient information for a thorough review.

Science Coordinator Comments – FY17

Date: September 2016

I concur with the Panel's comments and, like the Panel, remain concerned regarding the applicability of the proposed Middleton Island data set. I appreciate the desire to maintain an existing data set but do not believe that the data is useful to either the individual project or the overall LTM Program. A stated goal of this project is an integrated data set from simultaneous surveys of three component projects to reduce vessel cost while combining sampling efforts with spatial and temporal consistency. Middleton Island is not within any of the proposed survey areas and the data will not be collected at the same intervals as the rest of the project. I recommend removing the requested amount for this work ($40,000 for FY17) from the funding request and removing the scope of the work for the entire five-year Program.

Date: May 2016

I concur with the Science Panel's comments. I support the individual projects that are part of the proposed "Integrated Predator-Prey Survey" but cannot determine how, if at all, the projects will actually integrate beyond sharing vessel time. The Middleton Island bird diet work appears incongruous with the other projects.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel and Science Coordinator's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-D**

Project Title: LTM Program - Continuous Plankton Recorders

Primary Investigator(s): Clare Ostle, Sonia Batten

PI Affiliation: MBA, NPMSO **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $406,200

FY17	FY18	FY19	FY20	FY21
Auth: $76,500	Auth: $78,800	Auth: $81,200	Auth: $83,600	$86,100

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $932,500

FY17	FY18	FY19	FY20	FY21
$183,700	$183,900	$186,300	$188,300	$190,300

Total Past EVOSTC Funding Authorized (FY12-20): $1,583,800

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,669,900

Total Non-EVOSTC Funding (FY12-21): $1,525,000

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The Continuous Plankton Recorder (CPR) transect samples the Alaskan shelf from lower Cook Inlet across the slope into the open Gulf of Alaska, providing a now 20-year record of taxonomically resolved, seasonal, near-surface zooplankton and large phytoplankton abundance over a wide spatial scale. Sampling takes place approximately monthly, six times per year, usually between April and September. Outputs from the project include indices of plankton abundance (e.g., large diatom abundances, estimated zooplankton biomass), seasonal cycles (phenology of key groups) and community composition (e.g., appearance of warm water species, change in dominance by some groups). Variability in any, or all, of these indices might be expected to flow-through to higher trophic levels such as herring, salmon, birds and mammals that forage across the region, some of which have been impacted by the *Exxon Valdez* oil spill. Results show that interannual variability in plankton dynamics is high and plankton responded clearly and rapidly to the warm conditions of 2014-2016, with changes evident in abundance, composition and timing. We are not proposing any major changes to this project for FY21.

The 2020 CPR tows have not been impacted by COVID-19 but there will be some delay in finalizing the 2019 CPR data due to restrictions to lab access. We are not proposing any major changes to this project for FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel thanks Sonia for her leadership on this project and is pleased that she will remain as a co-PI. This project continues to generate meaningful information that is used by other researchers.

PI Response (10.2.20)
Thank you for this comment, I am happy to pass the torch on to Clare Ostle but to also stay involved in a supportive role.

The SP was intrigued by the record in Figure 3 but had some questions and requests for additional clarification about the interpretation of these patterns. For example, the SP did not follow the arguments about the 2017 data point supporting the idea that productivity was reduced during the heatwave. The SP was also interested in how the pre-heat wave record (prior to 2014) generally showed a positive correlation between diatom abundance and small copepod abundance, whereas the heat wave data showed a negative correlation between the two, with just one year (2017) looking more like the pre-2014 years. This led us to wonder about correlations between temperature and top down vs bottom up control as in the work of Ken Frank and colleagues. We understand the limitations of any purely correlational dataset, but nonetheless look forward to seeing additional interpretation of this excellent data set in future updates and in publications, which the PI continues to turn out.

PI Response (10.2.20)
Thank you for this comment. We are exploring the implications of our results on understanding the balance of top down versus bottom up processes that may be operating during and after the heatwave and a manuscript is in preparation. To clarify our comment about productivity in the heatwave and the data from 2017 to now, prior to the heatwave we had noted a positive relationship between large diatoms and small copepods, which would be consistent with a bottom-up forced system. In the heatwave years diatoms were very low but small copepods were high. It could be an effect of grazing pressure by the copepods on the diatoms (i.e., primary productivity may still have been good, but standing stock was kept low by the grazing pressure) and it could have been triggered by an absence of predation on the small copepods allowing them to develop high densities and to graze down the diatoms (so top down effects being evident). However, in 2017 we still had high abundances of copepods AND high diatoms, so this similar density of copepods was not able to deplete the diatoms in 2017 making it more likely that primary productivity was better in 2017 than in the earlier heatwave years, perhaps because of nutrient availability. It does look like predation on the small copepods was reduced during and after the heatwave, but we also need to allow for faster growth and shorter generation times in the warmer conditions enhancing small copepod numbers.

Science Director Comments – FY21

Date: September 2020

The FY20 CPR tows have not been impacted by the coronavirus pandemic, but delays are expected in finalizing the FY19 CPR data due to restrictions to lab access. Dr. Batten has become the executive secretary of PICES and will remain on this project as co-PI. Dr. Clare Ostle is taking on the role of coordinator of the Pacific CPR survey and as the lead PI on this project. There continues to be substantial funding leveraged and project productivity.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

This project continues to do very good work. We appreciate the leveraged funding and continued collaboration with other EVOSTC projects and continues to produce important scientific publications. We again note the comparison of physical processes with herring in the GOA (2016 paper) which provides a good example of what analyses and synthesis can be achieved with these types of higher trophic data.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

Science Director Comments – FY20

Date: September 2019

Project goals are being met on time. This project continues to add valuable data to the existing long-term time series. I concur with the Science Panel's comments.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel would like to note that the PI's 2016 Fisheries Oceanography paper is a great example on how to present synthesis of data across trophic levels. The PI presented and discussed the preliminary results well. This project continues to produce valuable data and the Science Panel appreciates that this project has a diversity of other funding sources.

Science Coordinator Comments – FY19

Date: September 2018

PI continues to have a record of staying on track. This long-term time series continues to provide information to other projects. No other comments.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel has no project specific comments.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel has no project specific comments.

Date: May 2016

The Panel notes this is a continuing time series of zooplankton information useful to a variety of other projects. The proposer (Batten) has a solid record of producing timely results, including a consistent dataset.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-E**

Project Title: LTM Program - Long-term monitoring of marine bird abundance and habitat associations during fall and winter in PWS

Primary Investigator(s): Mary Anne Bishop

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $557,300

FY17	FY18	FY19	FY20	FY21
Auth: $90,100	Auth: $92,700	Auth: $121,900*	Auth: $124,800*	$127,900*

Requests include 9% GA.
** Totals in FY19-21 include additional annual request of $26,200 to conduct November & March surveys in bays of PWS.*

Funding From Non-EVOSTC Sources FY17-21: $145,000

FY17	FY18	FY19	FY20	FY21
$53,000	$53,000	$0	$0	$39,000

Total Past EVOSTC Funding Authorized (FY12-20): $810,400

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $938,300

Total Non-EVOSTC Funding (FY12-21): $391,500

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The fall-winter marine bird surveys in Prince William Sound (PWS) will continue to build upon a 13-year time series (2007-2020) of marine bird abundance and habitat associations. Surveys occur onboard research vessels conducting oceanographic, fisheries, or marine mammal surveys, thereby increasing opportunities for cross-project collaboration and reducing project costs. Our September surveys are integrated with Gulf Watch Alaska (GWA) pelagic component's forage fish assessments of prey availability (21120114-C) and humpback whale monitoring (2120114-O) with all three projects sharing logistics, timing, and location of sampling. These integrated surveys allow us to estimate forage biomass at the same locations in which marine birds and humpback whales are feeding, thereby providing comparable information on both predator density and prey availability. This is the one survey that may be cancelled due to the COVID-19 pandemic in fall of 2020. Our November and March surveys are in conjunction with the GWA project monitoring of oceanographic conditions in PWS (21120114-G) and enable us to extend our long-term dataset of marine bird observations within juvenile herring bays of PWS. For all surveys we use established protocols employed by all other GWA marine bird survey efforts (Kachemak Bay/Cook Inlet, Seward Line/Gulf of Alaska, PWS summer). Of the marine birds that overwinter in PWS nine species were initially injured by the *Exxon Valdez* oil spill, including three species that have not yet recovered or have unknown recovery status. By monitoring marine birds during fall and winter, we will improve our predictive models of species abundance and distribution across PWS in relation to biological and

physical environmental factors. Our long-term monitoring has shown that the nonbreeding season cannot be characterized as a single time period when describing marine bird distribution and suggests that multiple surveys are required to quantify wintering populations and understand changes in distribution. Finally, with new funding from the PWS Regional Citizens' Advisory Council, we will conduct additional and complementary marine bird surveys in the tanker escort zone and adjacent bays during February. Survey data will be combined with GWA data. We are proposing no major changes to this project in FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel would like an update on the fall survey - was it cancelled? What is the contingency plan if the survey did not happen?

PI Response (10.2.20)
We, along with our collaborators (USGS, NOAA), had agreed to assess the viability of conducting the September Integrated Predator Prey survey by mid-August 2020. At that time, infection of COVID-19 in the state of Alaska was widespread. Unfortunately, as a result, USGS was forced to cancel the survey due to crew number restrictions on the USGS vessel and commercial travel restrictions for USGS employees. For the September surveys, our marine bird observer conducts surveys while onboard the USGS vessel, as the marine bird observations are paired with the concurrent acoustic surveys for forage fish and euphausiids. We considered placing our marine bird observer onboard the NOAA whale boat. However, given the time constraint of the whale survey (6 days) and transit distance between Whittier (where vessel is docked) and Cordova (to pick up and drop off bird observer), there would not have been enough time to survey the acoustic/marine bird transects while also conducting the necessary whale fieldwork.

Given the status of the pandemic in Alaska, limited survey time, and constricted space available on the whale survey vessel, we concluded that we would not conduct the marine bird surveys this year. Instead, we decided to wait to conduct the surveys with USGS in fall 2021 and in the meantime we (along with our USGS and NOAA collaborators) would focus this fall on analyzing the data from the four previous surveys (September 2014, 2017-2019). Any cost savings remaining at the end of FY21 will be requested to roll into FY22 for analyses and manuscript preparation.

If further delays due to COVID-19 occurred in FY21, any cost savings would be used to collaborate with PI Campbell's Prince William Sound oceanographic surveys (project 20120114-G). Specifically, biologist Schaefer would conduct marine bird surveys along the three acoustic forage fish/marine bird surveys transect lines (Bainbridge, Montague, Port Gravina; 2-3 d of total charter cruise) and in return would assist Campbell with his oceanographic data collection. While this field work would not replicate all the surveys that are typically conducted as part of the Integrated Predator Prey surveys, it would prevent a second consecutive year of no data from the three permanent transects.

We do not foresee having to cancel the November and late February/early March surveys as they involve only two people on one boat, both PWSSC personnel residing in Cordova (Schaefer & Campbell). The Cordova community has been successful with testing (available most days of the week with results obtained within hours) and contact tracing to maintain a low infection rate. We request that both scientists self-isolate prior to the cruise.

POn page 4 the proposal mentions the bioenergetics model which was published in 2015; the basis for the estimate that seabirds consume 10% of the adult herring biomass is not clear. The number reported in the proposal is different than that reported in the paper, please explain the discrepancy. Could it be that the assumptions made in the 2015 paper were not well supported because they were based on studies of common murre diets from other regions, but neglected the one winter diet study of murres and murrelets in Alaska (Kachemak Bay)?

PI Response (10.2.20)
Our proposal stated: "We also developed a bioenergetics model for marine birds in winter. Our model results highlight the importance of herring to marine birds in Prince William Sound during winter and suggest that predation by marine birds may have an important top-down effect on the Prince William Sound herring population. Our model shows that in winters with relatively high numbers of marine birds or with relatively low adult herring biomass, as much as 10% (1,864 t) of the adult biomass can be removed by avian predators (Bishop et al. 2015). This relationship is especially important considering the recent historically low estimates of the Pacific herring population in Prince William Sound (P. Rand, PWSSC, unpubl. data)."

The bioenergetics model was developed and published in 2015 in Fisheries Oceanography using USFWS data from 10 winters collected over an 18-year period (winter 1989/90 – 2006/07). The sentence mentioned by the Science Panel is an abbreviated version from the original Bishop et al. (2015) publication (page 6, results, second paragraph) that stated: "Our model showed that in winters with relatively low adult herring biomass, such as 1999–2000, or winters with relatively high numbers of marine birds, such as 1992–93, as much as 10% (1864 t) of the adult biomass can be removed by avian predators …".

In the Bishop et al. (2015) publication, we outline our assumptions in the methodology, and we do discuss the Kachemak Bay study (Sanger 1987) and their results for common murre and murrelet diet studies during the 1977-78 winter within the context of murrelet diet studies that occurred in PWS during the summer. It seems that further empirical data on winter marine bird diets and a fuller grasp of forage fish availability would improve our understanding of top-down impacts of marines on forage fish.

*Bishop, M. A., J. T. Watson, K. Kuletz, and T. Morgan. 2015. Pacific herring (*Clupea pallasii*) consumption by marine birds during winter in Prince William Sound Alaska. Fisheries Oceanography 24:1-13. https://doi.org/10.1111/fog.12073*

Sanger, G. A. 1987. Winter diets of common murres and marbled murrelets in Kachemak Ba, Alaska. Condor 89:426-430. DOI: 10.2307/1368499

Additionally, the paper reports impact of seabird predation on juveniles and adults and only adult biomass is highlighted in the proposal. Why?

PI Response (10.2.20)
Marine birds consumed more biomass of juvenile herring than adult herring. Unfortunately, as stated in the Bishop et al. (2015) publication, there were no data for total available juvenile herring in Prince William Sound, so we were unable to estimate the proportion of juvenile herring consumed relative to total available biomass. In the discussion section of the paper, we discuss the potential impacts of marine bird consumption on juvenile herring, such as exacerbation of low juvenile survival. In the future, we will clarify this point in our proposal.

Also, the HRM acoustic project proposal reports changes in winter herring biomass which agrees with data from this proposal. However, the data reported here do not seem to translate to the summer and fall herring distributions reported in the acoustic project. Please reconcile.

PI Response (10.2.20)
In the current funding cycle, our Prince William Sound fall/winter marine bird surveys occur annually during September, November, and late Feb/early March. The September survey is a collaborative Integrated Predator Prey survey that includes marine bird observations (this project), whale sampling (PIs Moran and Straley, project 20120114-O), and acoustic forage fish surveys (PIs Piatt and Arimitsu, project 20120114-C). During the September survey, we relate our marine bird observations to prey fields identified as part of the concurrent hydroacoustic sampling. As designed for FY17-21, the September Integrated Predator Prey survey is the only survey for which we have simultaneous sampling of marine birds and forage fish. The November and late Feb/early March marine bird surveys are conducted in collaboration with Dr. Rob Campbell (project 20120114-G).

In the past, we collected marine bird observations concurrent with Juvenile Herring Acoustic surveys in November and March (PI Rand, 16120111-F). However, the juvenile herring acoustic surveys were discontinued after 2016. Data from those past surveys (specifically 2007-2012) were used for the analysis and recent publication (Schaefer et al. 2020) referred to on page 3 of our proposal. Acoustic surveys for adult herring do still occur as part of the HRM program, but those typically occur during late March/early April, 2-3 weeks after completion of our marine bird surveys. Other acoustic forage fish surveys occur during the summer (PIs Piatt and Arimitsu, project 20120114-C), but we only survey marine birds during fall and winter (September – early March).

Schaefer, A., M.A. Bishop, and R. Thorne. 2020. Marine bird response to forage fish during winter in subarctic bays. Fisheries Oceanography. https://doi.org/10.1111/fog.12472.

Science Director Comments – FY21

Date: September 2020

The FY20 fall survey may be cancelled due to COVID-19 concerns. Otherwise, milestones and tasks are being accomplished as planned. The preliminary results in the proposal continue to be presented in great detail which is appreciated.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

Project is making good progress in a timely manner. The Science Panel has no specific comments or questions.

PI Response (9.27.19) Thank you for your comments.

Science Director Comments – FY20

Date: September 2019

PI continues to make good progress. I appreciate the detailed summary of results from FY18 and FY19. No specific comments or questions.

PI Response (9.27.19) Thank you for your comments.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	

Science Panel Comments – FY19

Date: September 2018

Was the same NOAA vessel leveraged by both projects during the March cruises? The Science Panel asks that the PMT and the PIs communicate with trust agencies, such as NOAA, USFWS and ADFG, to see if they could also use this vessel for any agency activities. We understand the reason for nearshore bay surveys and would like to know if using ships of opportunity is really efficient and if effort and funds should be redirected from open water to preferred nearshore habitats. Can parts of Figure 2 surveys be eliminated if they are not proving to be useful? Is it possible to leverage ship time for surveys from project 19120114-G Campbell? Specifically, there appears to be considerable overlap in

spatial sampling proposed in bays in this proposal [Fig 4] with those in Campbell [Fig 1 from 19120114-G], and Campbell proposes 6 times yearly sampling.

PI Response (10/10/18)
Yes, the same National Oceanic and Atmospheric Administration (NOAA) vessel was leveraged by both humpback whale and fall/winter marine bird projects (18120114-O, Moran & Straley, and 18120114-E, Bishop) during FY17 and FY18.

We will coordinate with agencies such as NOAA, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game to see if they could also use the dedicated marine bird survey vessel for additional activities.

Our surveys cover three basic habitat types: open waters, bays, and passages. The first 10 years of our surveys onboard ships of opportunity included all three habitats. However, when the juvenile herring surveys were discontinued in 2016 there was no longer coverage in the bays because the available ships of opportunity only covered open waters and passages. By using a dedicated marine bird vessel in November and March we can once again target bays for surveys in addition to continuing our data collection in open waters and passages while in transit between bays. The within-bay transects would be fixed, thus sampling within bays would not be opportunistic. The in-transit transects are while taking the shortest route between fixed bay transects and would also be relatively consistent, reducing spatial variability of the marine bird surveys. Given the geographic extent and high variability of the PWS ecosystem, sampling open-water areas while traveling between sampling locations is valuable to understanding distribution of marine birds in PWS. For example, our past surveys have identified several areas of high marine bird densities in open waters including Montague Strait and Orca Bay. Also, our current survey design is the most efficient way to sample bays distributed throughout PWS.

Finally, we are currently in communication with Dr. Campbell (project 19120114-G, PWS oceanography) regarding vessel-sharing during November and March. Dr. Campbell's sampling events typically occur over a 3-day period, while our surveys take approximately 6 days, so there would be additional personnel costs on his end. In addition, in its current configuration the vessel (R/V New Wave) would need to be modified to accommodate a marine bird observer. Specifically, a small observing platform would need to be fabricated that would be placed on top of the cabin. We recognize that combining efforts could ultimately reduce costs by ~20%, so talks are ongoing.

Science Coordinator Comments – FY19

Date: September 2018
PI continues to make good progress and the project is on track. PI continues to be productive and has another manuscript in prep for FY18. This project provides important data for regional comparisons of marine bird densities and other GWA projects in the Environmental Drivers group. NOAA vessels were leveraged for FY17 and FY18 for this project and 18120114-O Moran & Straley to conduct winter and early spring surveys and will no longer be available for FY19 and beyond. Funding ($24K includes GA) is requested to continue the November and March cruises to continue work as described in the original project proposal. This study has shown that marine birds aggregate in nursery bays during nonbreeding seasons which may impact juvenile herring populations, knowledge which would contribute to the HRM program. Additionally, both projects 114-O and E are proposing to continue a spring/March cruise with requested funding. Is each project requesting its own vessel? If so, is there any way to share a vessel in March to reduce costs?

PI Response 9.5.18

Yes, each project is requesting their own vessel. When identifying projects with unfunded needs, we did have a lengthy discussion about sharing vessels, as the nearshore team also requested funding for March survey in PWS (that project did not rank in top 3 to request funds). We concluded that projects 19120114-E (fall/winter seabirds) and 19120114-O (humpback whales) would not be able to share a charter vessel. March surveys for marine birds and whales have different objectives, methods, and proposed spatial coverage (Figs. 1 and 2) and, therefore, require separate survey vessels. For example, the marine bird surveys (Fig. 1) are fixed transects sampled annually using the chartered vessel as the survey platform. In contrast, the whale survey route changes annually depending on where the whale and herring aggregations are (Fig. 2), and once an aggregation is encountered, the chartered vessel that is also used as the survey platform engages in focal following of predators and prey. Timing also differs. For marine birds, surveys would be conducted in early to mid-March before spring migration. On the other hand, we attempt to time whale surveys just prior to herring spawning in late March or early April. This is often too late for winter bird work.

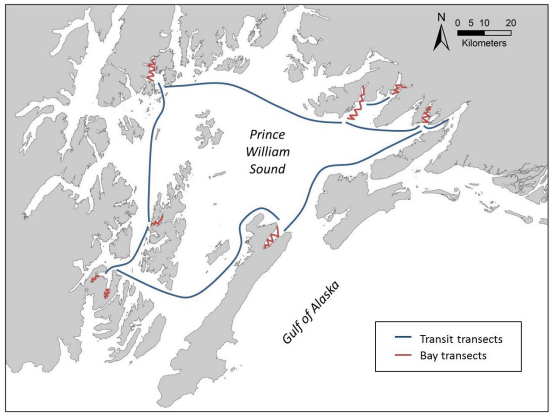


Figure 1. Proposed dedicated marine bird surveys to occur in November and March in Prince William Sound, AK. Surveys will replicate our longest time series (2007 - 2016) and most consistent data.

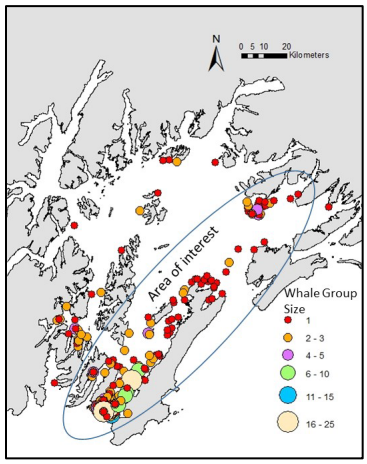


Figure 2. Area of interest for spring whale surveys in Prince William Sound, AK. Given limited vessel time, effort will focus on southern PWS an area of high whale and pre-concentrations.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

This proposal was very well presented and seems very reasonable. The Panel was pleased to see that the PI incorporated previous suggestions into the proposal. The Panel commends the PI's effort to integrate seabirds and mammals in her work on herring.

Regarding a statement on pg. 66 of this proposal: "As currently designed for FY17-21, the fall/winter marine bird project will not be working directly with the PWS Herring Research and Monitoring Program." The Panel would like clarification on what is meant here. The Panel recommends coordinating and collaborating to the extent reasonable.

PI Response (10/11/17):
Thank you for the opportunity to clarify our coordination and collaboration with the Herring Research and Monitoring (HRM) program. In past years, we have placed a marine bird observer onboard HRM project cruises. The HRM program has no scheduled cruises between September 2018 and March 2019. Thus, we are not able to collaborate directly with HRM during FY18. However, this project will share data with the HRM program and we will explore possibilities for joint publications.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel was pleased with the changes made by the PIs in response to Panel comments, including the methodology. Some concerns were raised about the interpretation of data given that survey tracks are specifically targeted to the presence of whales. If survey tracks are chosen because of whale foraging presence, then how useful will it be to use these data to detect associations? Almost by definition any birds in their survey will be associated with whales. The question is, how close and are they interacting? Is 150 m close enough? Too close?

Date: May 2016

The Panel noted that the proposal was difficult to review as a majority of the text was copied from the other Predator-Prey Survey proposal. It was challenging to find information within the text specific to this project. The Panel requests a revised proposal that focuses on the details of this specific project and how its data will be integrated into a wider cross-project set of analyses of interacting forage "fish", and piscivorous seabirds, and whales (humpback whales explicitly) .

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-G**

Project Title: LTM Program – Monitoring of oceanographic conditions in PWS

Primary Investigator(s): Robert Campbell

PI Affiliation: PWSSC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $1,142,300

FY17	FY18	FY19	FY20	FY21
Auth: $218,700	Auth: $223,400	Auth: $228,300	Auth: $233,300	$238,500

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $1,425,000

FY17	FY18	FY19	FY20	FY21
$300,000	$300,000	$275,000	$275,000	$275,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,945,300

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $2,183,800

Total Non-EVOSTC Funding (FY12-21): $1,774,900

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

This project will continue physical and biological measurements to assess trends in the marine environment and bottom-up impacts on the marine ecosystem of Prince William Sound (PWS). Regular (~6 per year) vessel-based surveys of PWS will be conducted to maintain ongoing time series observations of physical (temperature, salinity, turbidity), biogeochemical (nitrate, phosphate, silicate, dissolved oxygen), and biological (chlorophyll-a concentration, zooplankton abundance and composition) parameters in several parts of PWS. Sampling sites include central PWS, the entrances (Hinchinbrook Entrance and Montague Strait), and four priority bays that were part of the *Exxon Valdez* Oil Spill Trustee Council-funded Sound Ecosystem Assessment project in the 1990s and the ongoing Herring Research and Monitoring project.

Additionally, an autonomous profiling mooring will be deployed in central PWS to provide high frequency (twice daily) depth-specific measurements of the surface layer that will be telemetered out in near real-time. The profiler will include measurements that complement the survey activities (temperature, salinity, oxygen, nitrate, chlorophyll-a, turbidity). An *in situ* plankton camera was recently developed for the profiler and is used to enumerate zooplankton, large phytoplankton and other particles, with some taxonomic discrimination.

Spring and early summer observations in PWS indicate the timing of the spring bloom was near the climatological average and is continuing a trend towards lower productivity over time – satellite chlorophyll observations in spring 2020 have been the lowest in the 23-year record. Following a winter of temperatures near the climatological average, the surface layer in central PWS returned to above average temperatures in 2020, to approximately the same levels as during the marine heatwave of 2013-2016. COVID-19 impacts to this project were delays to one survey (spring bloom cruise) and sample analyses in the laboratory. The remaining cruises in 2020 should proceed as planned. We are not proposing any major changes to this project for FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The proposal makes a general statement about some unspent funds that the PIs will work to draw down as they catch up on our work. Please provide an update on the sample analysis and a more concrete plan (or options) for expenditure of unused funds.

PI Response (10.2.20)
Analysis of zooplankton samples is continuing the 2019 samples, there are still two Prince William Sound cruises to process and most of the 2019 Kachemak Bay samples to do. Staff quarantine and the pandemic shutdown stopped work entirely for almost two months, and the need to minimize overlaps by staff in the lab resulted in reductions in throughput for several weeks. Part of the time away from the lab was used to focus on a manuscript on the Kachemak Bay plankton time series which is nearly ready to submit.

Analysis of zooplankton samples has now been ramped up under phase 3/4 of the Reopen Alaska Responsibly plan. At current rates we estimate that if things go extremely well, we may be able to have the samples counted by the usual January deadline; at worst we should be a month or two late.

We will be hiring a second technician to help with the analysis of phytoplankton and nutrient samples. At projected maximum burn rates we think we may be able to catch up on unspent funds by January, but expect to roll over a small amount (likely < $25K) because we anticipate that the second technician will still be working on samples into the next fiscal year of the project and that expense is unbudgeted in year 5. We do not currently expect that we will need to roll over funds beyond FY21.

Going forward, we anticipate no issues in conducting the work planned for this project, assuming the number of COVID-19 cases in Cordova remains low.

Science Director Comments – FY21

Date: September 2020

One cruise was delayed and sample analysis may be delayed because of COVID-19 health mandate restrictions, otherwise milestones and tasks are being completed on time. The PI continues to maintain a high level of productivity; one manuscript published in FY20 and several more in prep.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel is pleased that the plankton camera is running again on the autonomous profilers. We note this project continues to be productive. Data show the magnitude of bloom has changed but the timing has not. Do you have indications about the reasons for these findings? Might it have something to do with increased water column stability and reduced nutrient flux (freshwater input and/or upwelling)? Is there some indication about the potential influences of increased temperature, freshwater input (e.g. increased glacial melt), or photoperiod? This project, and two others, noted the switch among warm- and cold-water zooplankton. Is there evidence to indicate the mechanism to be differential local production or advection of these species from other areas? The Panel appreciates the amount and quality of the data and would like to see if data analyses can address the questions above.

PI Response (9.27.19)
I thank the science panel for their comments. The mechanisms forcing the spring bloom in Prince William Sound (PWS) are as complicated as one might expect, and the first approximation appears to be an interaction between light, stability (primarily thermal but also salinity), and wind mixing (Eslinger et al. 2001: doi 10.1046/j.1054-6006.2001.00036.x; Henson, 2007: doi 10.1357/002224007784219002). Stability is set up in ~April/May and the bloom initiates if it is not disrupted by wind mixing. The timing of the bloom will therefore depend on the timing of stability onset and wind events, while the magnitude will depend on the amount of nitrate available at the surface -- the bloom terminates after nitrate is depleted in surface waters.

We do not have a tremendously long time series of the nutrient biochemistry in PWS, but the system is largely advective, and much of the nitrate input is likely from deepwater renewal events that bring in off-shelf waters (high salinity, low oxygen and high nitrate) to the basins of PWS in summer when downwelling relaxes. That deep water is mixed up into the surface waters over the winter and is what drives the spring bloom. At depth in PWS there is a modest trend towards increased salinity over the last few decades (Campbell, 2018: doi 10.1016/j.dsr2.2017.08.014), which is presumably driven by decreased downwelling and enhanced deepwater transport. That would imply that nitrate flux might actually be increasing somewhat in the deep waters of PWS.

The Campbell (2018) study also found a shoaling of mixed layer depths in the last 40 years, which seems a likely explanation for the reduction in overall productivity, as the science panel suggests. An interesting pattern that we have observed at the profiler site since the onset of the 2013-2014 marine heat wave (MHW) is a fairly consistent negative temperature anomaly in waters immediately underlying the mixed layer. This can be seen in 2018 in the profiler temperature anomaly panel (2nd from top) of Fig. 7 of the project 20120114-G FY20 work plan. Given that deep waters of PWS are exhibiting a warming trend, the presence of a cold anomaly suggests to me that the surface mixed layer is much thinner presently than in the climatology, which manifests as cooler anomalies at depth. In other words, the shoaling and strengthening of the mixed layer means that "deep water" (which is cooler) is found closer to the surface than previously. It follows that the total amount of near-surface

nitrate available to the phytoplankton in the seasonal mixed layer will be reduced which will ultimately result in a smaller bloom.

With regard to zooplankton species compositions, even prior to the MHW, Russ Hopcroft (Seward Line PI) and I noticed that the species we designate now as "warm species" were often present in PWS in low abundance, but comparatively rare on the shelf along his GAK line. We hypothesized that PWS may be a refugium of sorts for those species. Smaller embayments around the periphery of PWS (particularly the non-glaciated ones) can become considerably warmer in summer than central PWS or on the shelf. So the MHW may have made the environment in PWS a more amenable habitat to those species, and conversely less amenable to the canonical subarctic taxa we designate as "cool water" ones. The two year lag between the onset of the MHW and the largest anomalies is interesting, but could be due to enhanced local production or advection -- they are not mutually exclusive. It seems likely that the reality was a mix of the two - some species have always been present and did better doing the MHW years (a closer look at stage compositions may be informative), while others were advected northward by the prevailing currents. At least one species, Corycaeus anglicus, was extremely rare prior to the MHW (not seen some years, 1-2 observations in others) but is now prevalent throughout PWS.

The questions highlighted by the science panel are of considerable interest and are the focus of ongoing analyses that the science panel can expect to see in future reports. Our focus in the last years was fairly broad descriptive manuscripts on the hydrography and the plankton ecosystem in PWS (published in the Gulf Watch Alaska/Herring Research and Monitoring Deep-Sea Research II volume). In FY19 we have been focused on synthesis activities, a manuscript on the profiler and plankton camera (reviews received September 23, 2019 and will be accepted pending revisions), and a manuscript in preparation on the Kachemak Bay plankton ecosystem. We are looking forward to diving into more of the details in future work.

Science Director Comments – FY20

Date: September 2019

Project tasks are being completed on time. The PI continues to be productive: two manuscripts presenting project results are currently prep. Observations from this project are being leveraged by other researchers for additional related proposals. No specific comments or questions.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

Science Panel appreciates this time series and looks forward to seeing how the zooplankton community in Cook Inlet relates to oceanographic conditions. The Panel notes that there was a significant increase in warm water zooplankton species in 2016/2017 (Figure 5) after the blob occurred and would like to see analyses that might explain that lag response. We acknowledge that analyses are underway and encourage the PI to publish.

PI Response (10/10/18)
A region-wide comparison of the results of the Prince William Sound (PWS), Seward Line, and lower Cook Inlet projects has been identified as a good potential synthesis manuscript topic and is part of our ongoing science synthesis discussions. Analysis of a now 40 year conductivity and temperature at depth (CTD) profile database in the PWS region shows that temperatures there tend to lag those in the Gulf of Alaska (GOA; as proxied by the Pacific Decadal Oscillation index) by about 12 months (see Fig. 12 in Campbell 2018). Temperature anomalies did shift towards positive anomalies in late 2013 in PWS as they did in the GOA during the emergence of the marine heatwave. An estimate of heat flux at the mid-PWS National Data Buoy Center buoy (Buoy 46060) suggests that heat flux out of the surface ocean in PWS was low in the marine heatwave years (late 2013-2016), which has also been proposed as the mechanism for the genesis of the marine heatwave (e.g., Bond et al. 2015). We take from this that the same atmospheric phenomenon (the "ridiculously resilient ridge" as stated in Swain 2015) that drove the formation of the marine heatwave in the central GOA was also operating in PWS and led to those positive anomalies. The transport lags into PWS discussed in Campbell (2018) then led to temperature anomalies in PWS remaining elevated longer than they were in the GOA, well into 2017. There was already some indication of a higher prevalence of warm water zooplankton species in PWS in 2013, but it is a good observation that it was not until 2015/2016 that they are almost uniformly prevalent. We would attribute that to both the lag due to transport and the lag that one can expect from a biological system responding to a physical forcing. McKinstry and Campbell (2018) discuss in detail some of the species shifts observed during the marine heatwave years (see section 4.2. Climatic shifts and zooplankton variation). Briefly, several of the "warm water" species identified in Fig. 5 of project 19120114-G's FY19 work plan have been observed in PWS for some time; many of them fell into what our Indicator Species Analysis termed "winter taxa." While recently comparing our observations with those by Russ Hopcroft's along the Seward Line, we have noticed that a number of those species tend to be more prevalent in PWS and hypothesize that it might be some sort of refugium for those species. We would extend that hypothesis and suggest that those already present warm-water species were at a comparative advantage during the marine heatwave years (and cool-preferring species may have conversely been at a disadvantage), and so there was a trend to become more prevalent over time as conditions remained advantageous. So rather than there being a large shift in 2015, there was a trend towards more warm water species over time (with some noise, as one expects from plankton observations). There are other possible explanations, but this is perhaps the most plausible hypothesis given the available data. Approaching the question quantitatively would be difficult, but we will be vigilant for potential opportunities. The basic life histories of many of the warm water diagnostic species (Mesocalanus tenuicornus, Clausocalanus anglicus, Corycaeus pacificus) are not well described in general (really, Calanus pacificus is the sole exception), much less so in Alaska, and even less is known about their vital rates. As the GWA oceanographic time series extend beyond the impact of the marine heatwave, program PIs expect to be able to say more about the lags in zooplankton populations.

Science Coordinator Comments – FY19
Date: September 2018

PI is making good progress and project is on task. I appreciate the preliminary results presented in the proposal. Good to read that PI is already collaborating with HRM postdoctoral research McGowan who just started in FY18.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel believes the PI is conducting important work that supports the goals of the EVOSTC. The Panel was happy to see that there are peer-reviewed publications in press and encourages the PI to keep publishing.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel has no project specific comments.

Date: May 2016

The Panel acknowledges the value of continued time series of physical, chemical, and biological primary production data to provide the basis for analyses of how changing environmental conditions are affecting the higher trophic level animals of the PWS and other spill-affected regions of the Northern Gulf of Alaska.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-H**

Project Title: LTM Program – Nearshore Ecosystems in the Gulf of Alaska

Primary Investigator(s): Heather Coletti, Brenda Konar, Katrin Iken, Dan Esler, Thomas Dean et al.

PI Affiliation: NPS, USGS, NOAA, Coastal Resources **Project Manager:** USGS

EVOSTC Funding Requested FY17-21: $2,118,200

FY17	FY18	FY19	FY20	FY21
Auth: $401,900	Auth: $452,700	Auth: $411,400	Auth: $426,100*	$426,200*

Requests include 9% GA. **Includes additional annual requests of $24K for FY20-21 to support increased operating costs for the RV Alaskan Gyre.*

Funding From Non-EVOSTC Sources FY17-21: $2,256,400

FY17	FY18	FY19	FY20	FY21
$410,000	$410,000	$410,000	$389,600	$513,200

Total Past EVOSTC Funding Authorized (FY12-20): $3,252,000

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $3,678,200

Total Non-EVOSTC Funding (FY12-21): $3,502,800

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

Nearshore monitoring in the Gulf of Alaska (GOA) provides ongoing evaluation of status and trends of more than 200 species, including many of those injured by the 1989 Exxon Valdez oil spill. The monitoring design includes spatial, temporal and ecological features that support inference regarding drivers of change. Continued monitoring will lead to a better understanding of variation in the nearshore ecosystem across the GOA and a more thorough evaluation of the status of spill-injured resources. This information has been used in a number of management contexts and will be critical for anticipating and responding to ongoing and future perturbations in the region, as well as providing for global contrasts. In FY21, we propose to continue sampling in Kachemak Bay (KBAY), Katmai National Park and Preserve (KATM), Kenai Fjords National Park (KEFJ), and Western Prince William Sound (WPWS) following previously established methods. Monitoring metrics include marine invertebrates, macroalgae, birds, mammals, and physical parameters such as temperature. In addition to taxon-specific metrics, monitoring includes recognized important ecological relations such as predator-prey dynamics, measures of nearshore ecosystem productivity, and contamination. In FY20, due to the COVID-19 global pandemic, normal field operations were significantly reduced. Minimal sampling was conducted in KEFJ and WPWS, while none was completed in KATM. Most intertidal work was completed in KBAY, but upper trophic level surveys were significantly reduced there. We anticipate normal proposed field operations for FY21. Due to the reduction in field costs in FY20, we are proposing to use some of those funds to support a graduate student at UAF to examine variation in carbon sourcing to nearshore

consumers across all four nearshore component regions, using samples collected in recent years, which will contribute to interpretation of monitoring data.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP appreciates the plan to fund a MS student with savings associated with cancelled surveys and other sources.

PI Response (10.2.20)
The nearshore component appreciates the support of the Science Panel regarding our plan to support a MS student with savings associated with modified field efforts during the COVID-19 pandemic during 2020.

The Science Panel appreciates the creative measures taken to accomplish field work and surveys during the Covid pandemic. We may see more of the same pandemic-related restrictions on field work and access to labs, which will require alternative plans that were not stated in the program and project proposals. Each project should address the following questions. What are the program and project contingency plans for FY21 in regard to accomplishing goals and field activities? The SP understands that it may be challenging to develop extensive and detailed contingency plans for the future, but some planning is required. Will any unused funds for FY21 be repurposed for additional lab and/or data analyses? Or are they requested to rollover to FY22 (pending proposal approval)? Other ways to accomplish field work - i.e., other vessels that could be used or other projects that can be leveraged?

PI Response (10.2.20)
The nearshore component of GWA is planning a full field season for FY21. The primary goal of the nearshore component is to complete all spending in FY21. However, if COVID-19 restricts field activities, we have the following contingency plans:

- *As in FY20, we will conduct as much field work as we safely can. We expect that much of the work scheduled for Kachemak Bay in FY21 could be completed, following FY20 activities and precautions. Also, small skiff and crew configurations were used to conduct limited sampling in western Prince William Sound and Kenai Fjords in FY20 and would be implemented in FY21. As needed, we will coordinate with vessel operators (contracted and USGS) to consider use of smaller, core crews to collect data in areas beyond skiff range.*

- *Any cost savings resulting from reduced FY21 field work will be:*
    a) *Used to support the MS student through an existing agreement with UAF.*
    b) *Used to support additional prioritized lab analyses not covered under the current agreement with UAF (such as compound-specific isotope analysis and otolith aging).*
    c) *Used for staff time toward additional data analyses expanding science products, including marine bird community analyses, evaluating trends in under-analyzed species (e.g., predatory snails, limpets), and evaluating spatial and temporal variation in sea otter diets.*

d) *Used to fund an extension of the current postdoc appointment to produce additional synthesis products such as: contrasts of GWA data to marine monitoring findings from the lower 48, and evaluating marine predator characteristics and how they influence vulnerabilities to different types of perturbations (e.g., oil spills versus marine heatwaves).*
e) *If needed, a detailed request will be made in the Work Plan schedule to carry over funds into FY22 to finish options pursued in a-d.*

Science Director Comments – FY21

Date: September 2020

Due to the coronavirus pandemic, FY20 scheduled field work for this project was drastically reduced and, in many cases, cancelled. $64K remains unspent for FY20. The PIs are requesting that these funds be used to support a master's student at UAF starting in January 2021. The focus of the student's thesis will be to examine variation in the sources of carbon (phytoplankton vs. macroalgae) to nearshore lower and mid-level trophic consumers and how that variation may manifest itself in organismal responses (for example: growth rates). The results from this project will provide insight of the drivers of annual changes that are detected during annual monitoring. The PIs state that in-kind funding from NPS and UAF will be provided to support the project and student. I support this request. Additionally, a new postdoc, Dr. Sarah Traiger, has been hired by USGS to replace Ben Weitzman, who vacated this position in FY19 but remains a GWA PI through his position at NOAA.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Panel would like to see more detail on the increase in operating costs. Is the additional request for $24K for previous costs or for this year's increase in operating costs? Will this be an annual request?

PI Response (9.27.19)
The costs of operating the US Geological Survey (USGS) research vessel Alaskan Gyre are increasing through time, while the base contribution of USGS facilities money has remained static (Fig. 1). The

base contribution from USGS still allows the boat to be used at a fraction of the cost of charter vessels (see estimates below); however, this does not cover as much of the total operating costs as in past years. USGS has prepared a business plan for operating and maintaining the Alaskan Gyre, which resulted in the need to increase costs to projects. These increased costs are being required of all users of the Alaskan Gyre, not just Gulf Watch Alaska projects.

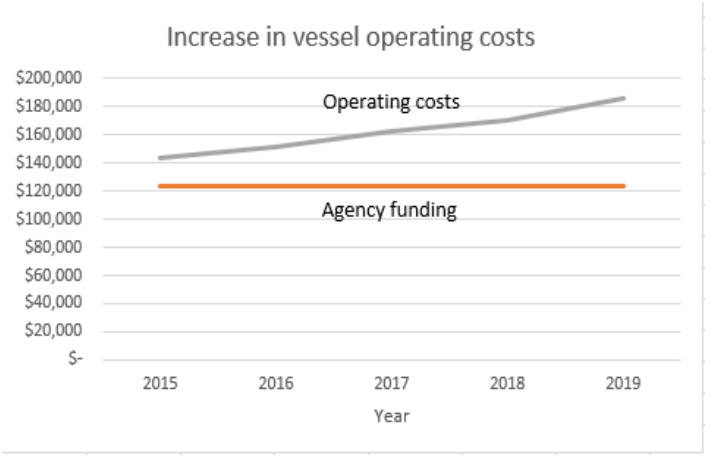


Figure 1. Annual costs of operating the USGS research vessel Alaskan Gyre relative to the agency funding allocation.

The increase in overall operating costs reflects increases in nearly all of the specific costs of running the Alaskan Gyre. However, a sizeable proportion of the increased costs are associated with a few specific items, including personnel (captain salary and benefits), maintenance (shop rates and material costs are increasing), and harbor fees. All of these costs are essential for safely and effectively operating the vessel. The budget request for FY20 is for costs anticipated in that fiscal year, not previous years' costs. We also are requesting funds for FY21, anticipating that operating costs will not go down. If additional funding is not approved, field time on the Alaskan Gyre could be reduced by as many as 19 days. Charter boats used for nearshore sampling have ranged from $3600 to $5000 per day. Our request for additional funds, assuming at least 50 days of Gulf Watch Alaska use annually, is less than $500 per day. Moreover, some of the Gulf Watch Alaska work involves trawling for forage fish and the Alaskan Gyre has been specifically outfitted to do this work.

In FY19 we requested the exploration of the relationships among species. The PIs did not address this inquiry. We note the PIs responded with an example that mussel density has increased, and Fucus and sea stars have declined but no other interpretations were offered or reported in the FY18 annual report. The Panel requests PIs address this and present possible mechanisms for this change. This certainly should be included in the synthesis paper(s). We appreciate the listed collaborations with a wide variety of groups.

PI Response (9.27.19)
We agree with the science panel that understanding inter-specific relationships is important and that the nearshore component is particularly well-suited for evaluating those, given the large number of species monitored across multiple trophic levels and the sampling design in which all data streams are spatially coordinated. Below we describe our efforts to date along these lines, as well as plans for additional exploration in the near future.

The Nearshore program is the lead on two of the Gulf Watch Alaska synthesis manuscripts currently in progress. One of the these manuscripts is specifically focused on inter-species and community relationships and titled "Synchronous Region-wide Responses in Intertidal Community Structure to a Marine Heat Wave in the Gulf of Alaska." This synthesis product will focus on changes in intertidal community structure at long-term monitoring sites that stretch across the Gulf of Alaska from Prince William Sound to the Katmai Peninsula over the period from 2006 through 2018, with emphasis on changes that occurred during the 2014-2016 marine heatwave. We are examining site specific changes in intertidal temperature as well as changes in percent cover of intertidal algae and invertebrates during this period. Preliminary analyses indicate that differences in community structure exist across sites; however, synchronous trends across sites in heatwave years over very large spatial scales suggest influence of large-scale oceanographic events. While mean water temperatures differ across sites and regions (i.e., Katmai generally colder), all regions exhibited anomalous warming during heatwave years indicating that the heatwave may be driving these synchronous responses of the biological community in the intertidal.

We also will be continuing to explore inter-specific relationships within the nearshore component and across components. The USGS postdoc position, recently funded by the EVOSTC, will support an early-career scientist as they work with Gulf Watch Alaska principal investigators to evaluate interspecific relationships as part of synthesis efforts.

Additional species-environmental relationships are in our FY18 Annual Report (Coletti et al. 2019), as well as in the annual NOAA Gulf of Alaska Ecosystem Status Report (Coletti et al. 2018), we identified warming water temperatures (heatwave) as a possible driver for coincident responses of several species, representing various trophic levels, across the nearshore environment in the northern Gulf of Alaska. These include both direct responses of warming surface temperatures and also indirect effects through interspecific interactions. We documented negative anomalies of rockweed in three of the four regions and sea stars across all regions coincident with warm water temperatures. We hypothesized that the decline in sea star abundance was likely due to sea star wasting disease (Konar et al. 2019), which was first detected in 2014 and is generally associated with warm water temperature anomalies (Eisenlord et al. 2016). We documented positive anomalies during 2015-2019 for large mussels. This is likely due, in part, to a response to the reduced predation pressure given the synoptic decline of sea stars. Continued positive anomalies of large mussels in Katmai National Park and, to a lesser degree, in Kachemak Bay coincide with continued negative anomalies of sea stars in these two regions. A decline in small mussel density (an indicator of recruitment) was also observed during the 2015-2017 period, possibly because of the decrease in Fucus as available settlement habitat or some reduction in primary productivity.

We also published a paper specific to the sea star decline to document pre- and post-heatwave community structure and examined possible static drivers of those communities (Konar et al. 2019). Sea star wasting disease and then subsequent declines in sea stars resulted in a sea star assemblage that is responding to different environmental variables, and has drastically altered ecological function by the reduction of species composition and loss of large predatory sea stars. Understanding the delicate interplay of environmental variables that influence sea star assemblages could expand knowledge of the habitat preferences and tolerance ranges of important sea star species within the northern Gulf of Alaska.

In 2016, a paper was published in Ecosphere (Coletti et al. 2016) highlighting the overall nearshore monitoring program while simultaneously providing examples of linkages across metrics to detect and infer causes of change. In one example specific to Kenai Fjords National Park, we documented changes in the proportion of various prey types in the sea otter diet that coincided with changes in the abundance of the mussel, Mytilus trossulus. This is likely a bottom-up driven interaction as mussel abundance in Kenai Fjords is very high while sea otter abundance is considered low, but stable and likely at carrying capacity for this region.

Coletti, H. A., J. L. Bodkin, D. H. Monson, B. E. Ballachey, and T. A. Dean. 2016. Detecting and inferring cause of change in an Alaska nearshore marine ecosystem. Ecosphere 7(10):e01489. 10.1002/ecs2.1489.
Coletti, H., J. Bodkin, T. Dean, K. Iken, B. Konar, D. Monson, D. Esler, M. Lindeberg, R. Suryan. 2018 Intertidal Ecosystem Indicators in the Northern Gulf of Alaska in Zador, S. G., and E. M. Yasumiishi. 2018. Ecosystem Status Report 2018: Gulf of Alaska. Report to the North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99301. https://www.fisheries.noaa.gov/resource/data/2018-status-gulf-alaska-ecosystem.
Coletti, H., D. Esler, B. Konar, K. Iken, K. Kloecker, D. Monson, B. Weitzman, B. Ballachey, J. Bodkin, T. Dean, G. Esslinger, B. Robinson, and M. Lindeberg. 2019. Gulf Watch Alaska: Nearshore Ecosystems in the Gulf of Alaska. Exxon Valdez Oil Spill Restoration Project Annual Report (Restoration Project 18120114-H), Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
Eisenlord, M. E., M. L. Groner, R. M. Yoshioka, J. Elliott, J. Maynard, S. Fradkin, M. Turner, K. Pyne, N. Rivlin, R. van Hooidonk, and C. D. Harvell. 2016. Ochre star mortality during the 2014 wasting disease epizootic: role of population size structure and temperature. Philosophical Transactions of the Royal Society B: Biological Sciences 371.
Konar, B., T. J. Mitchell, K. Iken, H. Coletti, T. Dean, D. Esler, M. Lindeberg, B. Pister, and B. Weitzman. 2019. Wasting disease and environmental variables drive sea star assemblages in the northern Gulf of Alaska. Journal of Experimental Marine Biology and Ecology. https://doi.org/10.1016/j.jembe.2019.151209

Science Director Comments – FY20

Date: September 2019

This project continues to contribute nearshore system data to long-term time series, some of which date back more than five decades, and many that were initiated soon after the oil spill. Information from this project is being used in a number of management contexts including data contributions to the annual stock assessments Ecosystems Considerations Chapter to the North Pacific Fishery Management Council which informs managers on essential fish habitat and sensitive early life stages of federally managed fish species and providing data to the Bureau of Ocean Energy Management on habitats and sensitive species to support environmental analysis for the OCS Cook Inlet Lease Sale 244 NEPA.

The USGS research vessel Alaskan Gyre is one of the primary research platforms that supports Gulf Watch Alaska work, logging at least 50+ days of use annually. Funding for the Gyre has been largely cost-shared by USGS; however, operating costs have increased. Thus, this project is requesting additional annual funding of $24K (includes GA) for FY20 and FY21 to cover increased operating expenses of the USGS research vessel Alaskan Gyre. Even with the rise in operating expenses, costs for the Gyre remain well below those of private charters and the Gyre is already specifically outfitted to meet Gulf Watch Alaska project field requirements. Without additional funds to support the increase in operating costs, the number of field days may need to be reduced resulting in decreased field activities and less data collected. I understand that situation, for clarification please identify what operating costs are specifically increasing.

PI Response (8.28.19)

All costs are increasing including personnel, maintenance, and fuel. At the same time, the base contribution of USGS facilities money has remained static. The base contribution from USGS still allows the boat to be used at a fraction of the cost of charter vessels; however, this doesn't cover as much of the total operating costs as in past years. USGS has carefully devised a business plan for operating and maintaining the Gyre, which resulted in the need to increase costs to projects.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

Science Panel is curious to know if this project interacts with the LTER program and specifically whether LTER and EVOSTC funding are responsible for different sampling locations.

PI Response (10/10/18)
With the start of a new long-term ecological research (LTER) site in the northern GOA, the nearshore component will continue to actively engage with the Environmental Drivers component as we explore linkages from the offshore to the nearshore environments. Currently, that includes a proposed synthesis product examining the relationship between offshore and coastal temperatures. An additional proposed synthesis product includes biological responses to the marine heatwave. As for the sampling sites within the nearshore component, they were randomly selected to allow for inference across the regions of the GOA prior to the start of GWA. Kachemak Bay sites are the exception and are a continuation of historical sampling.

We recognize that there are several informative time series of individual species, but would like to see analyses to explore the relationships among species. Current analyses only report single species trends over time, which are certainly useful, but given the rich literature on species interactions in these nearshore systems (e.g., keystone effects of sea stars) it seems that assessing correlations among taxa across space and/or time would be a profitable approach that might produce hypotheses for the extent to which changes observed were the direct effect of environmental variation vs indirect effects mediated through species interactions.

PI Response (10/10/18)
We agree that assessing correlations among taxa across space and time will be a valuable contribution. For example, the nearshore component submitted a section to the NOAA GOA Ecosystem Status Report showing negative anomalies of Fucus and sea stars, with concurrent positive anomalies for large (>= 20 mm) mussel density across the GOA. The negative anomaly for Fucus and sea stars is correlated with

warm water temperatures in nearshore areas. The decline in sea star abundance was likely due to sea star wasting disease, which was first detected in 2014 and is generally associated with the warm water temperature anomalies. The positive anomalies during 2015-2017 for large mussels is possibly a response to the reduced predation pressure given the synoptic decline of sea stars. A decline in small mussel density (an indicator of recruitment) was also observed during this time period, likely because of the decrease in Fucus as available settlement habitat and possibly reduction in primary productivity. If funded, the postdoc working with GWA would conduct analyses exploring linkages within and across components.

Please provide clarification on the overarching hypotheses referred to in the text under Figure 6 in the proposal.

PI Response (10/10/18)
To clarify the overarching hypotheses referred in our FY19 EVOSTC work plan: Our overarching goal is to understand drivers of variation in the GOA nearshore ecosystem. The foundational hypotheses of the Nearshore Project include: (1) What are the spatial and temporal scales over which change in nearshore ecosystems is observed? (2) Are observed changes related to broad-scale environmental variation, local perturbations, or underlying ecological processes? (3) Does the magnitude and timing of changes in nearshore ecosystems correspond to those measured in pelagic ecosystems?

Science Coordinator Comments – FY19

Date: September 2018

Project milestones and tasks are on track. I am gratified to see the data from this project being used in several manuscripts that have been published, in review or in prep during FY18.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel appreciates the amount of data being collected on multiple nearshore sites. There is not a clear integration with oceanographic studies, but there is enough substance to make this a meaningful, stand- alone nearshore ecosystem project. The Panel is very pleased with their productivity and integration of students into the studies.

PI Response (10/11/2017):

The nearshore component greatly appreciates the Science Panel's support of our progress towards an integrated nearshore program. There have been recent discussions to use oceanographic data, initially temperature, across all components to examine linkages between offshore and nearshore systems. We anticipate that analyses of temperature data will be our first step in integrating other oceanographic processes to pelagic and coastal systems for the GWA program.

The Panel would like to see more of the synoptic surveys, what they are finding or not finding temporally and on a spatial scale. A question from the Panel for the PIs to ponder: Have egg-eating seabirds/waterfowl changed their distribution regarding location in time and space to herring spawning?

PI Response (10/11/2017):
Several PIs in the nearshore program did publish a paper in Ecosphere (http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1489/full) that examined temporal trends in sea otter abundance, energy recovery rates, and demographics at varying spatial scales. However, based on the design of the nearshore component, an exercise examining trends across space and time could be done for a variety of species. We are meeting as a component prior to the PI meeting in November to examine data trends to date and develop product ideas for the next 1-3 years within the nearshore component. Specific to the Science Panel's question about changing seabird/waterfowl distribution, we have set aside time for cross-component bird data integration and synthesis discussions at the PI meeting in November. All parties will have data summaries to discuss and determine how we may be able to look at trends over time, and changes in distribution, and integration with data from other components, including environmental drivers.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A

Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel wished to draw attention of the PIs to similar recent declines in mussels in the Gulf of Maine in the Atlantic. No action is required by the PIs, but they might find parallel research on a similar problem interesting. A paper by Sorte et al. in Global Change Biology would be once place to look: Sorte, C. J. B., Davidson, V. E., Franklin, M. C., Benes, K. M., Doellman, M. M., Etter, R. J., Hannigan, R. E., Lubchenco, J. and Menge, B. A. (2016), Long-term declines in an intertidal foundation species parallel shifts in community composition. Glob Change Biol. doi:10.1111/gcb.13425

Date: May 2016

The Panel has no project specific comments.

Science Coordinator Comments – FY17

Date: May and September 2016

I have no project specific comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-I**

Project Title: LTM Program – Long-term Monitoring of Oceanographic Conditions in the Alaska Coastal Current from Hydrographic Station GAK-1

Primary Investigator(s): Seth Danielson

PI Affiliation: UAF **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $680,800

FY17	FY18	FY19	FY20	FY21
Auth: $146,800	Auth: $148,400	Auth: $132,600	Auth: $125,600	$127,400

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $575,000

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$285,000	$290,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,132,600

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,260,000

Total Non-EVOSTC Funding (FY12-21): $575,000

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

This project continues a nearly half-century time-series of temperature and salinity measurements at hydrographic station GAK-1. With first sampling in 1970, the data set consists of nominally monthly conductivity-temperature versus depth casts and a mooring outfitted with seven temperature/conductivity recorders distributed throughout the water column and a fluorometer at 20 m depth. The project monitors five important Alaska Coastal Current (ACC) ecosystem parameters that quantify and help us understand hourly to seasonal, interannual, and multi-decadal period variability in: 1) temperature and salinity throughout the 250 m-deep water column, 2) near surface stratification, 3) surface pressure fluctuations, 4) fluorescence as an index of phytoplankton biomass, and 5) along-shelf transport in the ACC. All of these parameters are basic descriptors that characterize the workings of the inner shelf and the ACC, an important habitat and migratory corridor for organisms inhabiting the northern Gulf of Alaska, including Prince William Sound, and resources injured by the Exxon Valdez oil spill. We are aware of over 100 publications utilizing data collected at station GAK-1, and since 2010 the citation list has grown by nearly five publications per year. These publications range from physical, chemical, and biological oceanography to climate studies, fisheries research, fisheries management applications, and ecosystem-based management applications. Recent water temperatures remain warmer than the long-term average throughout the water column, while near-surface waters have freshened over time and near-bottom waters have salinized. An increase of stratification that carries important and far-reaching implications for ecosystem dynamics. We are not proposing any major changes to this project in FY21. COVID-19

pandemic impacts include missed and reduced surveys and delays in data processing. The 22-year CTD profile for the May Seward Line time series is intact. Moving forward, we anticipate being able to make our regularly scheduled monthly CTD profiles. We propose no major changes for FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

It was not clear to the SP if cancelled and reduced surveys led to a reduction in costs. If so, what are the proposed plans for the surplus?

PI Response (10.2.20)
We were able to avoid a couple thousand dollars in vessel charter costs, however, these costs were offset by increased personnel expenses caused by needing to implement adjustments to the planned field activities and in having to establish new field protocols. In addition, our overall productivity decreased due to reduced access to our lab facilities so the personnel cost of getting the work done has increased. The modest cost savings realized from reduced surveys were offset by these additional personnel expenses and resulted in minimal change to the original budget.

At this point we have a working set of protocols that allows us to accomplish our field work with reduced risk by dictating on-board social distancing, low-risk pre-cruise behaviors, and other safety measures. Going forward, we hope that we will be able to continue our operations as proposed. Each month's cruise is assessed on a case-by-case basis that includes consideration of ongoing rates of community spread, whether any field party member has been in close contact with any COVID-19-positive individuals, and other factors. Unused funds will be used in FY21 to 1) help cover the increased salary costs of planning and executing each field activity and 2) to facilitate additional analyses of the GAK1 data as we continue to track down the still unknown causes of the near-bottom salinity increase.

We are experiencing backups at the manufacturer's calibration facility and, while we hope that this does not preclude getting the mooring instruments recalibrated in time for the 2021 deployment, if this were to happen we would turn to other instruments in our inventory to avoid having to deploy uncalibrated instruments. These instruments have been identified already and set aside to prepare for this possibility.

Science Director Comments – FY21

Date: September 2020

This project experienced some impacts from the coronavirus pandemic including missed and reduced surveys and delays in data processing, but data loss is minimal. This long-term data set (50 years!) continues to collect critical data for all research conducted in the Gulf of Alaska.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel recognizes that this is an important project to monitor oceanographic changes, which are relevant to all the projects conducted in the GOA. The project continues to produce useful and informative data.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

Science Director Comments – FY20

Date: September 2019

The long-term time series provided by this project has been used by over 90 publications, which is an increase of 21 more publications since the FY19 project proposal was submitted a year ago, demonstrating how valuable and useful these data are for understanding GOA ecosystem dynamics and trends. I appreciate the funding contribution (~$700K) by UAF toward a replacement survey vessel for conducting monthly CTD profiles and annual mooring deployments following the breakdown of the R/V Little Dipper in 2017. I concur with the Science Panel's comments.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

Science Panel is interested in understanding better how the LTER program is integrated with the GAK1, Seward line and nearshore monitoring, specifically activities and monitoring.

PI Response (10/10/18)
Please see nearshore ecosystems (19120114-H, Coletti et al.) and Seward Line (19120114-L, Hopcroft) projects for comprehensive responses to this comment.

Science Coordinator Comments – FY19

Date: September 2018

Milestones and tasks have been completed on planned. Thanks for the update regarding the replacement update for the R/V Little Dipper. Pleased to see that additional funding from other sources have been secured for the new set of moorings, this will add to the important long-term time series provided by the GAK1 mooring.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

This is an important long-term data collection project that needs to continue. The Panel supports the research and welcomes the news of the Long-Term Ecological Research (National Science Foundation) funding awarded to the PIs, which will ensure the stability of gathering long-term data while expanding the scope of the project. PIs are using graduate students productively.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel has no project specific comments.

Date: May 2016

This long-term data set provides critical information to both Programs and to researchers beyond the Programs. The resultant data are heavily used. The Panel supports the continued funding of this work. The Panel also awaits seeing new analyses that integrate these environmental variables into the changing abundances of members of the food webs of importance.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-J**

Project Title: LTM Program – Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay

Primary Investigator(s): Kris Holderied and Steve Baird

PI Affiliation: NOAA and KBRR **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $796,300

FY17	FY18	FY19	FY20	FY21
Auth: $169,700	Auth: $174,400	Auth: $183,400	Auth: $135,700	$133,200

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $1,007,800

FY17	FY18	FY19	FY20	FY21
$205,000	$213,000	$215,000	$182,800	$192,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,411,500

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,574,700

Total Non-EVOSTC Funding (FY12-21): $2,159,800

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The Cook Inlet/Kachemak Bay monitoring project provides year-round, high temporal resolution oceanographic and plankton community data to assess the effects of seasonal and inter-annual oceanographic variability on nearshore and pelagic species affected by the Exxon Valdez oil spill. We continue a 9-year time-series of year-round, monthly shipboard oceanography surveys along the estuarine gradient from Kachemak Bay into southeast Cook Inlet, as well as an 18-year time series of continuous nearshore water quality station observations in Kachemak Bay. Shipboard sampling includes conductivity-temperature-vs-depth casts, and phytoplankton and zooplankton net tows. Outputs from the project include seasonally resolved patterns and interannual shifts in oceanography, plankton abundance and community composition, and harmful algal species. The project provides oceanographic and plankton data to support the Gulf Watch Alaska Nearshore Component in Kachemak Bay and provides year-round information on estuary-shelf oceanographic gradients to help evaluate the effects of local (within estuary) and remote (shelf, North Pacific) climate forcing on nearshore and pelagic ecosystems. Results show that: 1) water temperatures remained anomalously warm through December 2019 (up to 2°C above average), but cooled rapidly in January 2020 with colder air; 2) zooplankton community species composition and phenology changed during the marine heatwave, but not overall abundance; and 3) harmful phytoplankton species continue to be detected and project data are being used to assess environmental drivers of harmful algal blooms as well as toxin transfer in the marine food web. Due to COVID-19 restrictions, we were unable to complete some small boat surveys in FY20 (Feb-July). Nutrient samples were not

collected and water quality sondes were not switched out from March - June at Seldovia, and April - May at Homer.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel appreciates the PI's response to the Science Director's question. As a follow up: Are higher charter costs associated with a higher daily rate for the NOAA vessel or more overhead?

PI Response (10.2.20)
To clarify, the vessel charter funds are not for the NOAA Kasitsna Bay Lab small boat, as only boat fuel is funded by the GWA project for those boat operations. A larger private vessel is chartered for lower Cook Inlet surveys that cannot be accomplished with a small boat, including the cross-Inlet entrance survey in the spring and winter survey in southeast Cook Inlet. Private vessel daily rates are currently higher than previous years, which may be due to pandemic-related changes in vessel availability.

Also, what are the budget implications of cancelled or reduced surveys? What are proposed plans for a surplus, if any?

PI Response (10.2.20)
Based on our experience in conducting small boat operations under COVID-19 protocols in summer 2020, we anticipate accomplishing all our planned oceanographic field work in Kachemak Bay and Cook Inlet in FY21. In the event that boat operations are further restricted due to the pandemic, our contingency plan would be to request repurposing of funds for boat fuel (for NOAA Kasitsna Bay Lab small boat), vessel charter (contracted larger private vessel), and personnel time for field sampling, to support more personnel time (Kasitsna Bay Lab contractor and KBNERR staff) for data analyses and syntheses. If pandemic-related changes need to be made later in FY21, we may need to request roll over of some of the funds to FY22.

Science Director Comments – FY21

Date: September 2020

This project continues to collaborate with Trustee and non-Trustee agencies. Bad weather conditions and coronavirus related restrictions impacted some field work. The detailed preliminary analyses are appreciated. The PIs are requesting to move $3K from the KBNERR budget to the NOAA Kasitsna Bay Laboratory budget in FY21 to cover additional small boat field work and data analysis efforts by Kasitsna Bay Laboratory contract staff. This request seems reasonable but needs further clarification: What is the $3K currently designated for and why is it no longer needed? Is the purpose of this additional small boat field work described in this proposal? The proposal says, "...started working under contract with NOAA Kasitsna Bay Laboratory in FY20 to assist with data analysis, data synthesis, and field sampling." Will this $3K go toward this contractor? And the work associated would be related to the expanded synthesis efforts with other investigators from the Environmental Drivers and Nearshore components?

PI Response 9.10.20:

What is the $3K currently designated for and why is it no longer needed?
$3K is for boat fuel and travel in the KBNERR budget. Boat fuel is still required, but surveys will be completed with the NOAA Kasitsna Bay Lab, versus KBNERR, boat. Funds originally designated for KBNERR travel are not expected to be needed due to COVID-19-related restrictions. We are proposing to use those funds to cover increased vessel charter costs (which are also in part related to COVID-19 restrictions) which are part of the NOAA KBL budget request.

Is the purpose of this additional small boat field work described in this proposal?
We are not proposing additional small boat field work, but that the small boat surveys will be conducted only with the NOAA KBL boat.

The proposal says, "...started working under contract with NOAA Kasitsna Bay Laboratory in FY20 to assist with data analysis, data synthesis, and field sampling." Will this $3K go toward this contractor?
The $3K that we are requesting to move between the KBNERR and NOAA KBL budget will not go to the contractor, but to boat fuel and vessel charter costs for surveys. Separately, prior year funds that had to be de-obligated from a NOAA labor services contract will be re-obligated for contractor support to assist with data analysis and data synthesis. The budget narrative did not state this clearly, however the changes (for $3K) were correctly identified (highlighted in yellow) in the detailed FY21 NOAA budget. The sentence for the Work Plan should have stated: "We propose to move a small amount of FY21 funds (~$3K) from the KBNERR budget (for boat fuel and travel) to the NOAA Kasitsna Bay Laboratory budget (for boat fuel and vessel charter contract), without any change to our total budget request."

The work associated would be related to the expanded synthesis efforts with other investigators from the Environmental Drivers and Nearshore components?
Yes, the funds to be re-obligated would be used for contractor support for expanded synthesis efforts with investigators from the Environmental Drivers (including changes in zooplankton communities across the GWA study area) and Nearshore components (including the influence of oceanographic drivers on nearshore communities at small spatial scales). We are excited about the opportunity to conduct more synthesis in FY21 with the longer GWA time series.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The project is meeting goals on time. The Panel initially had concerns with this project being outside of the core area of interest but we are pleased to see the usefulness of these data and the insights produced with connections to the EVOSTC-funded programs as a whole. This project collaborates with and provides data to Trustee and non-Trustee agencies. The Science Panel wonders whether quarterly plankton sampling could provide important new data on herring larvae that could be useful for collaborations with HRM projects.

PI Response (9.27.19)
We appreciate the comments of the science panel and Science Coordinator and are grateful that the ecosystem monitoring efforts supported by the EVOSTC in Kachemak Bay/Cook Inlet have also enabled additional collaborations with other funding agencies. We agree with the science panel that ichthyoplankton sampling to assess seasonal patterns in herring and other forage fish larvae would provide important data for both the Herring Research and Monitoring and Gulf Watch Alaska programs and we would be interested in further discussions with the Gulf Watch Alaska/Herring Research and Monitoring teams and science panel on how that might be incorporated into the program. The Kachemak Bay National Estuarine Research Reserve conducted a pilot study in Kachemak Bay in 2018-2019 to assess seasonal changes in nearshore fish communities and their sampling included both larval and adult fish. We will be analyzing those data in conjunction with our zooplankton and oceanographic data to improve our understanding of seasonal patterns in forage species and will work with other Gulf Watch Alaska and Herring Research and Monitoring investigators on those analyses. Kachemak Bay National Estuarine Research Reserve has also proposed a non-program project to the EVOSTC that would expand the pilot study efforts and provide seasonal information on larval, juvenile and adult fish that fills a current gap in our understanding of food web responses to environmental changes. Additionally, US Geological Survey researchers (including Gulf Watch Alaska principal investigators Yumi Arimitsu and John Piatt) have conducted forage species sampling in Cook Inlet with hydroacoustics and trawls for the past four summers, under a Bureau of Ocean Energy Management-funded program.

In addition, the Gulf Watch Alaska program is collaborating with other ichthyoplankton sampling programs including the Recruitment Processes Alliance at the NOAA Alaska Fisheries Science Center. To date, this involves including some of the ichthyoplankton time series in one of Gulf Watch Alaska's synthesis manuscripts (Suryan et al.) and leveraging the Gulf Watch Alaska/Long-term Ecological Research oceanographic vessel platforms of opportunity to collect ichthyoplankton samples for the NOAA Recruitment Processes Alliance to analyze. We intend to work with researchers and data from across these projects this year and are excited about how that will help us better understand nearshore and pelagic ecosystem changes and linkages.

Science Director Comments – FY20

Date: September 2019

This project continues to provide important oceanographic and plankton data to help understand nearshore and pelagic food web dynamics. I appreciate the detailed results reported for FY19. This project will begin new collaboration(s) with non-program projects in FY20 - it is encouraging that other non-program projects will be leveraging TC-funded project data and vice versa. I concur with the Science Panel's comments.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel is pleased to see the multivariate analyses of community composition relating changes in temperature and chlorophyll and would like to see these type of analyses in other projects. In regard to the FY17 annual proposal, we would like clarification on how the Kachemak Bay phytoplankton samples in 2016 were processed improperly and what will be done to prevent this from happening again in the future. We note the increase in tunicates; what species are they? Are they pyrosomes as reported from SE AK and along the US west coast?

PI Response (10/10/18)
We appreciate the Science Panel's comment on our multivariate analyses for zooplankton community composition and plan to work with other Environmental Drivers component projects on more of these analyses in FY19. In FY16, the phytoplankton samples from all our EVOSTC-funded shipboard sampling stations were processed normally. However, some of the samples from intensive phytoplankton sampling at the Kasitsna Bay Lab dock (part of other NOAA programs) were processed with a different Lugol's preservative concentration that did not work effectively and has not been used since. While the dock sampling is not part of our EVOSTC-funded work, we do use those data to provide a better temporal context for our monthly shipboard sampling. Regarding tunicates, we have not detected pyrosomes in our zooplankton samples; we also have not detected an increasing trend in the tunicate larvaceans that appear through the 2016 results included in our last annual report. We will update those results in our FY18 annual report.

Science Coordinator Comments – FY19

Date: September 2018

I am pleased to see data from this project being used by several other GWA projects. Two papers using project data have already been published in FY18, demonstrating the usefulness of these data. I appreciate seeing the preliminary results from FY18. Project is on track. Steve Baird is an appropriate replacement for Jessica Shepherd as project PI.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel was happy to see that the PIs explained how data from this study tie into the decline in sea stars, marine mammal and seabird mortalities and changes in the presence of zooplankton species. The Panel was pleased to see how the funding is being used and how the PIs found connections as previously requested.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

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

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Do Not Fund	Do Not Fund	N/A	N/A	N/A
Sept 2016	Do Not Fund	Do Not Fund	Do Not Fund	Do Not Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Science Panel appreciated the PI's responses to our comments. The proposal is fundamentally sound. However, our primary concern was not addressed. The proposed research is beyond the core area of interest, and it remains unclear how the study would significantly advance the core mission of EVOSTC and justify a second cycle of $800,000 in funding.

As noted in a follow-up Panel discussion with the Program Team Leads, the results from the original research proposal in Cook Inlet and Kachemak Bay provided data that may be useful to those interested in this project's study area, and, for example, the proposal may serve those with an interest in harmful algal blooms, bivalve mariculture, invasive species and to EVOSTC PIs currently sampling in PWS but who would be pleased to expand activities to the project area. However, the proposal did not demonstrate actual use of these data by other projects in either the Long-Term Monitoring Program or the Herring Program and it still remains to be seen just how relevant these data will be to EVOSTC.

Date: May 2016

The Panel does not recommend funding this project. The investigators propose to modify sampling conducted in 2012-2016 to profile oceanographic variables (water temperature, salinity, nutrients) and plankton from ship and shore in lower Cook Inlet and Kachemak Bay in response to the anomalously warm waters in 2014-2015. The warm-water event was concurrent with harmful algal blooms with consequences for shellfish, otters and murres, much like elsewhere along the West Coast. Higher frequency sampling (monthly, quarterly) on the eastern side of the study area together with semiannual (spring, fall) sampling across the entrance to Cook Inlet would better resolve the exchange of water masses and nutrients between the Gulf of Alaska and a hotspot for primary production and foraging by fishes, seabirds and marine mammals near lower Cook Inlet and outer in Kachemak Bay in response to changing oceanographic forcing. To compensate for this increased effort, sampling at locations on the northern side of Cook Inlet is proposed to be reduced.

The Panel does not feel that the proposed research is a priority, given the cost and the relative lack of connection to the larger program. Answers to the proposed hypotheses are largely self-evident as stated and seemingly could be tested with data already in hand. A more compelling justification for the proposed research would have been helpful. For instance, hypothesis 1 that lower Cook Inlet is mostly synchronous with PWS suggests that continued oceanographic measurements in Cook Inlet may be redundant. It is not clear that extending a modified version of the previous five years of research via monitoring would significantly advance our understanding of productivity and links to nearshore species, seabirds and marine mammals in the study area, especially given the expense of the project. The proposal also would have benefitted from a robust statement of how the expected outcomes of the proposed research would be integrated with those from the rest of the program. The methods appear to be appropriate; though including a fluorometer with the CTDs to profile chlorophyll fluorescence throughout the water column would have been beneficial.

Science Coordinator Comments – FY17

Date: September 2016

I concur with the Science Panel's comments. The project offers sound science and is managed by an experienced team but the applicability of the data toward addressing the LTM Program's hypotheses appears weak at best after the first five years of funding.

Date: May 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel and Science Coordinator's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-L**

Project Title: LTM Program – Seward Line Monitoring

Primary Investigator(s): Russell Hopcroft

PI Affiliation: UAF **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $697,900

FY17	FY18	FY19	FY20	FY21
Auth: $132,700	Auth: $136,100	Auth: $139,500	Auth: $143,000	$146,600

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $7,180,300

FY17	FY18	FY19	FY20	FY21
$1,424,000	$1,438,000	$1,411,800	$1,466,000	$1,450,500

Total Past EVOSTC Funding Authorized (FY12-20): $1,021,500

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,168,100

Total Non-EVOSTC Funding (FY12-21): $7,780,300

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

We are continuing multi-disciplinary oceanographic observations begun in fall 1997 in the northern Gulf of Alaska. Cruises occur in early May and early September to capture the typical spring bloom and summer conditions, respectively, along a 150-mile cross shelf transect to the south of Seward, Alaska. The line is augmented by stations in the entrances and deep passages of Prince William Sound. We determine the physical-chemical structure, the distribution and abundance of phytoplankton, microzooplankton, and mesozooplankton, and survey seabirds and marine mammals. These observations enable descriptions of the seasonal and inter-annual variations of this ecosystem. Our goal is to characterize and understand how different climatic conditions influence the biological conditions across these domains within each year, and what may be anticipated under future climate scenarios. Beginning in 2018, funding as one of the National Science Foundation's Long-term Ecological Research (LTER) sites allowed expanded sampling on the shelf upstream of Prince William Sound, including near Middleton Island, to help better understand spatial variability on the shelf. Last year (2019) saw near record summer temperatures on the shelf that persisted through fall offshore, a harsh winter drew most of this heat out of the system, returning May 2020 to the climatological mean. Warm-water associated zooplankton with smaller body size and lower lipid content rebounded during fall 2019.

Some LTER components have been impacted by COVID-19. March and April GAK1 monthly trips did not occur but the May 2020 survey was executed using a skeleton science team of 3 and the summer

survey with half the normal science compliment. The September cruise will continue as planned. We are not proposing or anticipating any major changes to this project for FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP appreciates the PIs creativity to get the surveys done under Covid restrictions. The SP also wishes to thank Dr. Coyle for his contributions to this project over the years and wishes him well in his retirement.

PI Response (10.2.20)
Thank you. Our overall success did not come without a great deal of effort to make it happen, including the transition from having Ken Coyle as the night shift lead. We expect him to continue a minor role as we transition curation of his databases.

Although we had a transitory hiatus on some laboratory work, we expect to fully use our FY20 funds as allocated to support laboratory analysis of the samples collected. At present, we anticipate some return to normality in our FY21 operations, with spring and summer cruises on Sikuliaq and a return to Tiglax during the fall.

Science Director Comments – FY21

Date: September 2020

I concur with the Science Panel.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel is pleased regarding the publications resulting from this project. In the FY19 work plan, we asked how the Long-Term Ecological Research (LTER) program is integrated with the GAK1,

Seward line and nearshore monitoring, specifically activities and monitoring. We would like more clarification and details on what parts of this project are being funded by the LTER vs. EVOSTC.

PI Response (9.27.19)
We agree it can be confusing to track who is contributing to the various parts of the oceanographic surveys being conducted in the northern Gulf of Alaska. EVOSTC funds the Seward Line transect in addition to transects in Prince William Sound (PWS) during spring and fall cruises. The National Science Foundation funds the Northern Gulf of Alaska Long-term Ecological Research (LTER) program, which leverages EVOSTC spring and fall funding for the Seward Line and directly funds three additional transects upstream and downstream of the Seward Line, thereby greatly expanding the spatial coverage of oceanographic sampling (and seabird/marine mammal surveys - see 20120114-M). NSF LTER also fully funds the summer survey of all four sampling lines plus PWS (see Table 1).

Table 1. Funding sources for Northern Gulf of Alaska survey transects by spring, summer, and fall seasons.

	EVOSTC	***NSF LTER***	***NPRB***	***AOOS***
Spring Surveys				
Seward Line & PWS	***X***			
Cape Suckling, Copper River/Middleton Island, and Kodiak Island/Albatross Bank Lines		***X***		
Summer Surveys				
Seward Line & PWS		***X***		
Cape Suckling, Copper River/Middleton Island, and Kodiak Island/Albatross Bank Lines		***X***		
Fall Surveys				
Seward Line & PWS	***X***			
Cape Suckling, Copper River/Middleton Island, and Kodiak Island/Albatross Bank Lines		***X***		
Ship time	***X***	***X***	***X***	***X***
Zooplankton processing	***X***	***X***	***X***	***X***
Logistics (travel, shipping, dock fees, etc.)	***X***	***X***	***X***	***X***

The Seward line program has always been based on consortium funding (even during the joint NSF and NOAA GLOBEC years) and the LTER addition adds to the significant foundation that Gulf Watch Alaska (with EVOSTC/North Pacific Research Board [NPRB]/Alaska Ocean Observing System [AOOS]) have built. The sum of the parts is much greater than what one would be able to accomplish if Gulf Watch Alaska and LTER were run by two different groups on two different sets of cruises. For example, Gulf Watch Alaska and LTER both benefit greatly from shared vessel time (e.g., mobilization, demobilization, and transits). EVOSTC also benefits from LTER with the addition of ship time in PWS during summer ($50K/day). LTER brings a lot of funding for students so that data collected under Gulf Watch Alaska will find even more applications than would have been possible without the LTER expansion.

Science Director Comments – FY20

Date: September 2019

The PIs continue to be highly productive, with one accepted manuscript and four additional manuscripts in review this past year. As mentioned in the proposal, funding as one of the NSF's Long-Term Ecological Research sites starting in 2018 has allowed for expanded sampling on the shelf upstream of PWS, including Middleton Island, to help better understand spatial variability on the shelf. These long-term time series data are used by management agencies such as ADFG for salmon forecasting and NOAA for their GOA Ecosystem Status reports. No specific comments or questions.

PI Response (9.27.19)
We appreciate these comments and are encouraged by our expanded efforts and the key oceanographic information we can provide to agencies.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

Science Panel is interested in understanding better how the LTER program is integrated with the GAK1, Seward line and nearshore monitoring, specifically activities and monitoring.

PI Response (10/10/18)
The Northern Gulf of Alaska (NGA) LTER program provides a massive leveraged expansion of the GAK1 (19120114-I) and Seward Line programs (19120114-L), by adding additional monitoring transects, times of year, measurement types (and resolutions), process studies, ecological modeling efforts, and educational activities that each extend the reach of both the GAK1 and Seward Line time-series. Put another way, the NGA LTER adds (both logistically and financially) to the GWA program rather than replaces or duplicates its activities. Please see the nearshore ecosystems project (19120114-H, Coletti et al.) for comprehensive response regarding integration between the Environmental Drivers component, the LTER, and the Nearshore component.

The LTER expands spatial coverage, with transect measurements near Kodiak, Middleton Island, the Copper River, and Kayak Island. In this regard, the LTER greatly improves connectivity between the recently added GWA seabird diet studies at Middleton Island associated with the forage fish project (19120114-C, Arimitsu and Piatt) and the Environmental Drivers Component. The LTER provides increased temporal coverage with the addition of cruises each July. New process studies complement the monitoring of the GWA program by examining ecosystem dynamics to provide deeper mechanistic understandings of the controls that impact the ecosystem at all of the Seward Line stations, including GAK1. New measurements include carbon export, iron concentration and limitation, plankton growth (both primary and secondary), and the role of the Copper River plume in stimulating production. Modeling will help us better understand ecological consequences of events such as the recent marine heatwave and the manner in which the runoff, iron, and the shelf carbon cycles impact the shelf ecosystem. Additional expansions from collaborative efforts also include assessments of the macro-jellyfish (funded by the Pollock Conservation Cooperative Research Center), larval fish (to be analyzed

by NOAA), and various physiological measurements (funded by the North Pacific Research Board and the National Science Foundation [NSF]).

Additionally, the LTER program is providing ship time in support of the new mooring that will be deployed on the mid/outer shelf near Seward Line station GAK7. A modest amount (9%) of this mooring's new equipment was leveraged with LTER and GAK1 project funds; the bulk of the new equipment comes from the MJ Murdock Charitable Trust (50%) along with the Alaska Ocean Observing System (28%) and University of Alaska Fairbanks (UAF) (13%). This mooring will provide year-round core physical, chemical, and biological monitoring that will immediately open doors to extending and comparative analyses with data from the Seward Line, GAK1, and the GWA mooring in PWS (project 19120114-G) maintained by the PWS Science Center. LTER is also facilitating measurements at much higher resolution than have been possible under GWA. Use of R/V Sikuliaq on one cruise per year allows us to integrate undulating towed CTD measurements, 5-frequency fisheries acoustics, water column velocity profile measurements, and many other novel underway data collections such as surface nitrate and surface heat fluxes that have not been possible in the past. For example, we now are using a nitrate sensor to collect full-resolution macronutrient profiles from the CTD in real-time.

The LTER program maintains a significant outreach component as part of its activities, and in the NGA project we have teamed up with NOAA's Teacher at Sea program. We also will have several undergraduate NSF internships to award each summer and will directly fund multiple UAF graduate students who will work with both GAK1 and Seward Line data to increase our publication output.

We note that Figure 5 in 19120114-G Campbell and Figure 2 in this proposal tell conflicting stories. The Panel would like the PIs to consider why this may be and see this reconciled. The Science Panel is curious to know what the PI's thoughts are regardingthe change in 2016-17 zooplankton species (warm vs. cold) and if this observed change is related to herring declines over the same period.

PI Response (10/10/18)
The Environmental Drivers PIs have been pondering differences between the GOA shelf and PWS since the inception of the program. On the shelf, we think these species are constantly seeded into the branch of the North Pacific current that flows northward as the Alaska Stream, with warmer waters favoring longer survival and potentially even their reproduction. These species are then mixed across the shelf and into the Alaska Coastal Current by winds and other processes during their northward transport. As noted in Campbell's response (19120114-G, PWS oceanography) to this question, we can only conclude that these warm-water taxa have taken a better foothold in PWS than on the shelf proper, possibly due to lags in warming and cooling in PWS. There are, however, other possible explanations that we are exploring. For example, Campbell's sampling is confined to the upper 50 m (compared to 100 m for the Seward Line project) and occurs in bays rather than the deeper passages of PWS; both factors possibly favoring higher catches of these species. Furthermore, most cold water GOA species move downward into deeper waters during winter, and this then leaves these southern species (that don't move downward) as the prominent community members in surface waters during winter. More fully examining these differences between projects is planned as one of the synthesis activities during the current 5-year funding cycle.

While it is true that these warm-water taxa are less energetic than many resident species, even the resident taxa appeared to be atypically lipid-poor during the warm years, so it is hard to know which was of greater influence in potentially affecting herring populations.

Science Coordinator Comments – FY19

Date: September 2018

Milestones and tasks have been completed as planned. PI continues to be productive: one paper is accepted and another published in FY18. This project, along with the GAK1 monitoring, is an important long-term data collection project. I look forward to seeing results from sampling around Middleton Island and the integration with the predator-prey project.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

This is an important long-term data collection project that needs to continue. The Panel is enthusiastic about the incorporation of an LTER site to expand the scope of this project. The Panel is pleased to see that sampling will occur around Middleton Island, and that there will be integration with the predator-prey project.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Science Panel appreciates transfer of funds among projects to support additional sampling relevant to the spill area.

Date: May 2016

The Science Panel notes that this transect of moorings has value as professed in the proposal for purposes of assessing long-term environmental forcing of the base of the pelagic food chains.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-M**

Project Title: LTM Program – PWS Marine Bird Population Trends

Primary Investigator(s): Kathy Kuletz, Robb Kaler

PI Affiliation: USFWS **Project Manager:** USFWS

EVOSTC Funding Requested FY17-21: $556,200

FY17	FY18	FY19	FY20	FY21
Auth: $24,900	Auth: $222,200	Auth: $24,900	Auth: $248,000*	$36,200*

*Requests include 9% GA.*Includes additional annual requests of $25.8K to extend at-sea seabird surveys to project 20120114-L.*

Funding From Non-EVOSTC Sources FY17-21: $277,900

FY17	FY18	FY19	FY20	FY21
$23,000	$56,000	$23,000	$57,100	$118,800

Total Past EVOSTC Funding Authorized (FY12-20): $1,201,700

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,237,800

Total Non-EVOSTC Funding (FY12-21): $375,700

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

We will carry out small boat surveys to monitor the abundance of marine birds in Prince William Sound (PWS), Alaska. The survey is conducted biennially (July of every other year; July 2018 and July 2021) during the current Gulf Watch Alaska (GWA) funding cycle (FY17-21). Fifteen July surveys over a 30-year period have monitored population trends of marine birds in PWS after the *Exxon Valdez* oil spill. These surveys are the primary means to determine whether populations injured by the spill are recovering. Data collected from 1989 to 2018 indicated that pigeon guillemots (*Cepphus columba*), marbled murrelets (*Brachyramphus marmoratus*), Kittlitz's murrelets (*B. brevirostris*) are exhibiting long-term declines in PWS. Black-legged kittiwake (*Rissa tridactyla*) densities have also declined in PWS, at that same time that nearly complete breeding failures have been observed (2016-2018). We will continue to examine overall population trends for all marine birds in PWS, which benefit the nearshore and forage fish components of GWA, the Herring Research and Monitoring program, and the pigeon guillemot restoration project at the Naked Island Group. Owing to the COVID-19 pandemic, the July 2021 marine bird survey was postponed until July 2021. The FY20 funds will be carried over and used in 2021. We were unable to include a seabird observer on the spring Seward Line cruise because of COVID-19 health mandate restrictions. However, we did participate in the summer cruise instead of spring and an observer will be on the September survey as planned.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP agrees with the plan to shift the survey from July 2020 to July 2021 and has no other comments or concerns.

PI Response (10.2.20)

We wish to thank the Science Panel and Science Director for their contributions towards improving this project, and for allowing us the flexibility to alter our field schedule. We anticipate being able to conduct field studies in FY21. In the event we cannot conduct Prince William Sound surveys, we will conduct surveys in July 2022 (pending approval of rolling over funds), and will continue analyses on existing data as appropriate. The LTER seabird component was able to conduct surveys in fall 2020, and we anticipate being able to do so again in 2021.

Science Director Comments – FY21

Date: September 2020

Due to the coronavirus pandemic and related federal agency health mandates, the PWS July survey planned for FY20 will be conducted in FY21 instead. The Seward Line and LTER surveys were conducted during the summer. I have no project specific comments or concerns.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund Reduced	Fund Reduced	Not Reviewed	Fund Reduced	Fund Reduced

Science Panel Comments – FY20

Date: September 2019

The Science Panel raised some questions about the additional funding request, which is mainly a result of obtaining LTER funding that now requires longer trips (and an additional July sampling date) that were not judged by the PIs to be needed for this proposal until now. The Panel notes July data could be valuable, but the original proposal was funded for the spring and fall surveys, which were decided on as the most important times of the year for these projects. If additional days of funding were obtained, to allow for the extended duration of fall and spring surveys, it is not clear what the seabird observer would be doing during those additional days or whether critical data being gathered.

PI Response (9.27.19)
We appreciate the careful review of our request for funds to support a marine bird and mammal observer on recently expanded oceanographic surveys in and around the spill affected area. Supporting additional survey days allows the seabird observer to continue collecting data following standardized protocols over a larger geographic area. This is significant when you consider the huge extent of the northern Gulf of Alaska and continental shelf, a spatially data poor region. Consideration of funding spring and fall surveys is appreciated and will ensure that we maintain the spring and fall Seward Line time series while also conducting seabird observations as part of the newly established National Science Foundation funded Northern Gulf of Alaska Long-term Ecological Research (LTER) survey lines from Cape Suckling to Kodiak Island.

Foregoing the July surveys would save $10.3 K, or 44% of the requested $23.3K per year. However, we believe this small amount of annual funding would provide a large benefit to understanding seabird ecology in the Gulf of Alaska. The July surveys (oceanographic and zooplankton), though a recent addition to the Gulf of Alaska offshore studies, will continue into the foreseeable future as a long-term monitoring component of Gulf Watch Alaska, with strong links to other Gulf Watch Alaska, LTER, and EVOSTC projects. The seabird component would be a missing aspect of the mid-summer LTER program. An important part of conducting the July LTER surveys is that the time period overlaps with and thus complements EVOSTC, LTER, and other projects, including:

- *The July survey captures an important part of the seabird's life cycle, being the summer breeding period. It thus occurs in conjunction with seabird productivity monitoring at selected Gulf of Alaska colonies by the Alaska Maritime National Wildlife Refuge and others.*
- *July surveys would correspond to Prince William Sound (PWS) marine bird surveys (US Fish and Wildlife Service/Migratory Bird Management, EVOSTC funded); ongoing surveys in the Lower Cook Inlet (US Geological Survey, Bureau of Ocean Energy Management funded); Kenai Fjords (National Park Service and EVOSTC funded project 19120114-H); and Middleton Island seabird productivity and diet studies (EVOSTC funded project 19120114-C).*
- *Without the July component, the offshore data misses an important seasonal component to better understand the northern Gulf of Alaska marine ecosystem, particularly as it relates to the period of highest marine productivity.*

In addition, the Panel is still very concerned about the every other year sampling (see FY19 Work Plan comments). While we appreciate the financial constraints explained by the PIs in their previous responses, we wondered whether the LTER surveys are conducted every year and whether there would be an opportunity for the project to reallocate funds to put a bird observer on those cruises to obtain some data annually.

PI Response (9.27.19)
We are a bit unclear about the every other year sampling comment. Comments referenced in the FY19 work plan state there were no "project specific comments" for this project. We are assuming the science panel is referring to comments made in the FY18 work plan. Our response to the FY18 comments are briefly summarized here.

- *We agree with the science panel that, ideally, we would improve trends analysis by adding surveys to include even numbered years to our current 'odd year' July surveys.*
- *Budgetary constraints make such an effort impractical (a rough estimate for an even year survey is $180K per year).*

- *Even selecting a much reduced number of transects to survey during even years (by 'subset of sites' we presume the panel is referring to transects), the cost of gearing up and operating a survey in PWS is not substantially reduced by reducing the number of transects.*
- *We have some indication of what a reduced level of effort can provide, based on an analysis conducted for US Fish and Wildlife Service by WEST, Inc. (Nielson et al. 2003). In brief, although the effect varied among species, on average, the coefficient of variation (CV) would not decrease substantially at 80% of our current effort, but increased substantially after that, which would greatly reduce our ability to detect population trends of < 50%. However, for many species with low CVs at 100% of the original sample size (i.e., CV around 0.2 or less), the CV almost doubles when the sampling effort is reduced to 30%; this would particularly affect power to detect trends for rare species and species of concern, such as Kittlitz's murrelet.*
- *If additional funds were added to this project to cover a reduced survey during even years, we would first want to conduct an analysis to determine what level of effort would be statistically robust, and how those transects or regions (sites) should be selected.*

Again, we are willing to investigate the concept of an even year survey, but we would like to hear recommendations from the science panel given the options discussed (e.g., full survey or reduced survey after power analysis with a defined sampling area).

The Seward Line and LTER surveys do include transects within PWS and because the LTER surveys occur every year a July survey could help compensate for, but not replace, the lack of data on summer seabird abundance in PWS during 'off years' of the PWS surveys. July Seward Line and LTER surveys can provide information on trends in seabird abundance but cannot replicate the experimental design of current PWS marine bird surveys to determine population abundance in oiled vs. unoiled areas of PWS. If support for a seabird observer on the July LTER cruises is not approved, it would not be feasible to reallocate funding from other parts of the project without compromising the continuation of the spring and fall Seward Line time series, or of the PWS marine bird surveys.

We would also like to add that we have attempted to obtain funds to support seabird surveys in conjunction with the LTER. While we have received temporary supplements, the support was not long-term, other than the original Seward Line spring and summer surveys, which are currently supported by the North Pacific Research Board.

Nielson, R., S. Howlin, L. McDonald. 2003. "Bootstrapping to investigate effects of sample size on variance and bias of estimated species totals for Prince William Sound Marine Bird Surveys". Report by WEST, Inc. to U.S. Fish and Wildlife Service, Anchorage, Alaska, April 28, 2003.

The Panel would like to know what the cost would be for only extending the spring and fall surveys. We recommend a fund for this project contingent on the removal of the new July survey on the LTER cruise from the FY20 proposal and budget.

Science Coordinator Notes: Additional funding request without the new July surveys including GA is $14.5K, revised total for this project including GA is $233,400.

Science Director Comments – FY20

Date: September 2019

Currently, this project provides data for assessing whether seabird populations injured by the spill are recovering in PWS. Project goals are being met on time. This project collaborates with the

nearshore and forage fish components of the program, the Herring Research and Monitoring program and the pigeon guillemot restoration project (20110853). Alaska Maritime National Wildlife Refuge (USFWS) also includes these data in their annual report on the status and trends of seabirds in Alaska.

The USFWS PIs also have been conducting seabird surveys twice a year (spring and fall) as part of the Seward Line project (20120114-L) starting in 2006. Starting in 2018, the Seward Line survey expanded via an NSF Long-Term Ecological Research (LTER) which added significantly more days at sea (8 extra days during spring and fall surveys, 18 days for new July survey). Because the Seward Line is now part of the LTER surveys, it is not possible to conduct only the Seward Line portion of the cruises. The extended surveys in 2018 and 2019 were funded by the North Pacific Research Board, with contributions from NFS and NOAA. However, these leveraged funds are insufficient to continue the extended Seward Line/LTER seabird surveys starting in FY20. Information from this effort provides data on the seasonal and interannual variability of seabird distribution in the northern GOA along strong cross-shelf and alongshore environmental gradients and integrates with and informs other GWA components. Observers also document marine mammal activity that is important to protected resources managers. This project is requesting an additional $25.8K annually (includes GA) for FY20 and FY21 to continue support for a seabird observer on the annual Seward line/LTER surveys and an additional July survey. I concur with the Science Panel's comments.

PI Response (9.27.19)
We thank the Science Coordinator for a summary of the justification for requesting additional funds and description of the heavily leveraged aspect of this opportunity.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

We have no project specific comments.

Science Coordinator Comments – FY19

Date: September 2018

Gratified that marine bird datasets will be integrated across the rest of the GWA program. Project is on track. No other project specific comments.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel is pleased with the work the PIs are conducting and impressed with the survey coverage. Would it be worth surveying a subset of sites to monitor annually?

PI Response (10/11/2017):
We agree with the Science Panel that, ideally, we would improve trends analysis by adding surveys to include even numbered years to our current 'odd year' July surveys. However, budgetary constraints make such an effort impractical. The additional time and costs would include boat preparation and post-survey maintenance, hiring extra personnel or covering salary of in-house personnel, lodging, per diem, fuel, and additional data control and analyses. Even selecting a much reduced number of transects to survey during even years (by 'subset of sites' we presume the panel is referring to transects), the cost of gearing up and operating a survey in Prince William Sound (PWS) is not substantially reduced by reducing the number of transects. A rough estimate of surveys during even years would be $150-180K per year, in addition to the current $222K per odd year under the current work plan. If additional funds were added to this project to cover a reduced survey during even years, we would first want to conduct an analysis to determine what level of effort would be statistically robust, and how those transects or regions (sites) should be selected. Such an analysis could be useful for future planning but would require additional funds for a contract or to cover time for the U.S. Fish and Wildlife Service (USFWS) biometrician. We have some indication of what a reduced level of effort can provide, based on an analysis conducted for USFWS by WEST, Inc. in 2003 (Nielson et al. 2003). In brief, although the effect varied among species, the conclusion was that, on average, the coefficient of variation (CV) would not decrease substantially at 80% of our current effort, but increased substantially after that, which would greatly reduce our ability to detect population trends of < 50%. The report states: "However, for many species with low CVs at 100% of the original sample size (i.e., CV around 0.2 or less), the CV almost doubles when the sampling effort is reduced to 30%." We add that for species of conservation concern, typically with low or variable numbers, an unusually low or high abundance estimate in any given year will result in much reduced probability of detecting change in the population over time. The report also notes, however, that "… a systematic sample of blocks across habitats will likely provide more precise estimates of species abundance than the stratified random sample." With additional years of data since 2003, analysis of sampling effort by habitats may help with design of a reduced effort during even years. Alternative to reduced surveying during even years, additional funds for the PWS marine bird surveys could be directed towards 'winter' (March) surveys. The March survey had fewer transects than July surveys, but has not been funded since 2010. The species composition of

PWS changes substantially between July and March, with nine species or species groups primarily represented only in March (see Table 1 of the WEST, Inc. report); these were waterfowl, seaducks, and grebes. March surveys would provide population estimates and trends for all species during this critical season.

Literature Cited:
Nielson, R., S. Howlin, L. McDonald. 2003. "Bootstrapping to investigate effects of sample size on variance and bias of estimated species totals for Prince William Sound Marine Bird Surveys". Report by WEST, Inc. to U.S. Fish and Wildlife Service, Anchorage, Alaska, April 28, 2003.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

The Panel has no project specific comments.

Date: May 2016

There are no project specific comments.

Science Coordinator Comments – FY17

Date: May and September 2016

I have no project specific comments.

Executive Director Comments – FY17

Date: September 2016

I have no project specific comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-N**

Project Title: LTM Program – Long-term killer whale monitoring

Primary Investigator(s): Craig Matkin

PI Affiliation: North Gulf Oceanic **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $726,100

FY17	FY18	FY19	FY20	FY21
Auth: $152,800	Auth: $151,300	Auth: $142,100	Auth: $140,300	$139,500

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY17-21: $125,000

FY17	FY18	FY19	FY20	FY21
$25,000	$25,000	$25,000	$25,000	$25,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,122,600

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,262,100

Total Non-EVOSTC Funding (FY12-21): $242,500

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

This project is a continuation of the long-term photo-identification based program that has continuously monitored killer whale populations in Prince William Sound since 1984. A primary focus has been on resident killer whales and the recovery of AB pod and the threatened AT1 population of transient killer whales. These two groups of whales suffered serious losses at the time of the oil spill and have not recovered at projected rates. Assessment of population dynamics, feeding ecology, movements, range, and contaminant levels for all major pods in the area will help determine their vulnerability to future perturbations and environmental change, including oil spills. In addition to population dynamics from annual photo-identification, this project uses other techniques to determine the health and trends of the population. These techniques have included biopsy/skin sampling to compare genetics between populations, occasional biopsy/blubber to investigate contaminants, prey sampling of flesh, fish scales, and whale scat to investigate diet, behavioral observation, and remote acoustic monitoring to determine important off-season habitat. During FY18 - FY20 remote recording hydrophones have been recovered and redeployed in Montague Strait, Hinchinbrook Entrance, and Kenai Fjords. We are using results of the acoustic monitoring and its indication of presence of whales over the year to adjust our field surveys. Between our surveys and contributed photos, we were able to confirm that 5 and likely all 7 of the remaining Threatened AT1 transient population have survived to 2020. AB pod has been at least partially photographed in 2020, although not traveling in a discreet pod and detailed photo analysis has not occurred. It appears there are no new AB pod calves. We were scheduled to begin an optional morphometrics

and body condition element to our program, but COVID 19 travel considerations have delayed this work. We are not proposing any major changes to this project for FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The minor requested budget reallocations seem to be well justified. The Science Panel is pleased to see the involvement of a UAF PhD student in the acoustic analysis portion of this project.

PI Response (10.2.20)
Thank you for reviewing our budget allocation. We are thrilled to have a PhD student included in our project.

Because of use of our own vessel and quarantining before cruises we were able to complete a full field season. We expect to complete a full field season in FY21. Due to COVID-19 there is hold up in the analysis of feeding and scat samples since federal labs have been closed. This is primarily funded by in-kind donation of services and data sharing arrangements; however, there may be a small amount of analytical funds that may need to be rolled over to FY22. This will become clearer before the end of the program fiscal year in February 2021.

Science Director Comments – FY21

Date: September 2020

This project continues to make good progress. One manuscript was published this year, another is in prep. Similar to and as previously approved for FY20, the PIs are requesting to reallocate funds between categories in FY21: $3.5K from Travel and $3.0K from Commodities to Contractual in FY21 to cover increased acoustic and other analytical costs. The PIs are also requesting to discontinue funds going to Northwest Fisheries Science Center ($2K) which will be used for other analysis under Contractual in FY21. These requests are justified.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel appreciates the work that comes out of this project and is pleased to see the involvement of a graduate student in this project. The Panel has no specific comments or questions.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

Science Director Comments – FY20

Date: September 2019

Project tasks and goals are being completed on time. A manuscript reporting killer whale feeding habits from chemical analyses is in prep. I appreciate the preliminary results reported for FY19, the addition of a grad student who will analyze the acoustic data, and the in-kind support for sample analysis. No specific comments or questions.

PI Response (9.27.19)
Thank you for your comments. We appreciate the positive feedback.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

We agree with the Science Coordinator that the diet analysis and understanding killer whale feeding ecology is important. It behooves the PI to locate another lab to process the biopsy samples and continue the work. We would like to know if the PI has any publications planned for the future.

PI Response (10/10/18)
Thanks for your comments regarding our long-term killer whale monitoring project and for giving me a chance to respond. I agree with the importance of a paper summarizing the results of the stable isotope and contaminant work as it relates to killer whale diet. We have obtained the commitment of another chemist at the Northwest Fisheries Science Center (NWFSC) who will completely reconstruct the statistical analysis (this is needed because the original chemist retired and is unreachable). Hopefully, this paper will be completed this winter.

In regard to continuing the blubber chemistry segment of the study there are a number of reasons that we have elected not to continue it, at least not on an annual basis. To summarize:

1. The NWFSC was supporting 90% of the costs outside of the fieldwork and has had their staff and budget seriously reduced in recent years. They can no longer support the chemist required to do the analytical, statistical, and interpretive work. Additional funds would be required to contract with another lab and chemist to take responsibility for this type of work.

2. We have attempted to eliminate the invasive aspects of our study that requires piercing of the whales' bodies. This was stimulated in part by the death of a southern resident killer whale (SRKW) that was clearly attributed to the infection resulting from the wound associated with tagging. Hence, within our project, and for killer whale research in the North Pacific, there is restructured emphasis on remote acoustic monitoring and collection of prey and scat material.

3. We have added a non-invasive, genetics-based scat study to examine feeding habits in more detail. This will be used in conjunction with the prey sampling program already in place to continue what we believe is a more robust and detailed examination of killer whale feeding ecology. This component of the project is possible due to the concurrent work being completed on the endangered SRKW population and the NWFSC desire to compare those results with our study. We could not fund this work independently within our budget. The geneticist, Dr. Kim Parsons, who is working with us on the project, provides the following response: "Molecular genetic prey identification from marine mammal feces has proved valuable for a number of species of interest. For southern resident killer whales, fecal genetic analyses have allowed us to generate data from a large (n > 400) number of fecal samples collected over multiple seasons and years. This sampling approach generates relative proportions of prey species detected in each fecal sample representing samples from across individuals, geographic regions and time periods. From these data, we have been able to genetically assign each fecal sample to individual whales and characterize the diet of the SRKW population across both seasons and geographic regions, detecting both common and rare, but potentially important, prey species. In addition, we are currently optimizing existing salmon genetic stock identification methods for future application to fecal samples, allowing us to assign salmon detected in killer whale feces to individual stocks. The unique ability to hone in on stocks of importance to endangered marine predators provides critical information supporting their conservation and management".
4. Chemical analysis of killer whale blubber certainly has value and contaminant trends as well as stable isotope values have been instructive. We could discuss a program of sampling at 3-5 year intervals to keep the trend data alive. There would need to be concurrent discussions in regard methods of funding this, particularly the lab work, interpretation, and analysis.

Our group sincerely thanks you for your consistent and unflagging support over the years, which has been the backbone for compiling a unique long-term database on killer whales in PWS/Kenai Fjords.

Science Coordinator Comments – FY19

Date: September 2018

Project tasks are being completed as planned. The PI's efforts to secure other funding sources is noted and appreciated. From the FY12-16 Final Report, it is apparent that biopsy sampling provided important results regarding contaminants and stable isotope analyses (i.e., probable changes in diet, contaminant levels supports this change in diet). However, the PI is deemphasizing the collection of biopsy samples for examination of feeding habits due in part to the retirement of the chemist at

NOAA Northwest Region who led the project. The biopsy sampling and data are one of the more intriguing aspects of this work at this stage.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel applauds the work being conducted by the PI demonstrating the impact of oil on killer whales depends on whether the group of whales is transient or resident. These results help refine the restoration goal of this species, which might otherwise not capture the genetic differences between pods. These differences suggest unanswered questions about their social activities, which will be further addressed by the PI. The Panel appreciates that the PI does an excellent job regarding outreach.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: May and September 2016

There are no project specific comments.

Science Coordinator Comments – FY17

Date: May and September 2016

I have no project specific comments.

Executive Director Comments – FY17

Date: September 2016

I have no project specific comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21120114-O**

Project Title: LTM Program – Long-term monitoring of humpback whale predation on Pacific herring in Prince William Sound

Primary Investigator(s): John Moran and Jan Straley

PI Affiliation: NOAA and UAS **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $865,700

FY17	FY18	FY19	FY20	FY21
Auth: $161,900	Auth: $155,000	Auth: $187,400*	Auth: $184,400*	$177,000*

Requests include 9% GA.
** Totals in FY19-21 include additional annual requests of $27,000 (+ 9% GA) that will be used to conduct an early spring survey (March). Funding for this survey was previously funded by NOAA.*

Funding From Non-EVOSTC Sources FY17-21: $814,000

FY17	FY18	FY19	FY20	FY21
$220,000	$220,000	$120,000	$127,000	$127,000

Total Past EVOSTC Funding Authorized (FY12-20): $1,280,600

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $1,457,600

Total Non-EVOSTC Funding (FY12-21): $1,150,700

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

The humpback whale monitoring project is part of the Gulf Watch Alaska (GWA) pelagic component's integrated predator-prey survey. Humpback whale predation has been identified as a significant source of mortality on over-wintering Pacific herring in Prince William Sound (PWS) and a likely top-down force constraining their recovery. Humpback whales in PWS have a higher percentage of herring in their diet and forage longer on herring during non-summer months than their counterparts in Southeast Alaska. Currently, North Pacific humpback whales in the Gulf of Alaska may be experiencing nutritional stress and increased use of inland waters like PWS could result in increased predation on herring. We will continue to evaluate the impact by humpback whales foraging on Pacific herring populations in PWS following protocols established during 2007/08 and 2008/09 (*Exxon Valdez* Oil Spill Trustee Council project PJ090804). Prey selection by humpback whales is determined through acoustic surveys, visual observation, scat analysis, and prey sampling. Chemical analyses of skin and blubber biopsy samples provide a longer-term perspective on shifts in prey type (trophic level from stable isotopes) and quality (energy content). These data are combined in an updated bioenergetic model that allows us to assess the impact of recovering humpback whale populations on the PWS ecosystem. By integrating with the forage fish and fall/winter marine bird components, we contribute to a comprehensive understanding of bottom-up influences and top-down controls on the PWS herring population. The COVID-19 pandemic caused us to postpone our spring 2020 survey, rescheduling for later in the year. At this time, we are hoping to complete the fall Integrated Predator Prey survey as planned.

However, COVID-19 related concerns may result in this survey being modified or cancelled. A decision will be made in late August or early September.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

What is the status of the spring survey that was rescheduled for fall/winter? If they will not occur, what is the contingency plan? Is there any prior experience in surveying whales and herring in that time of year that may serve as a reference level?

PI Response (10.2.20)
We were unable to complete the spring survey due to COVID-19 restrictions but did complete the September 2020 whale survey. While the spring survey is important for determining whale abundance and predation on spawning herring, the fall survey provides our longest time series of abundance trends. We plan on meeting all our obligations for year 5 of this funding cycle (FY21). If the COVID-19 situation in FY21 improves, we could add an additional survey with unused funds to capture seasonal trends in whale numbers. If we miss a field survey due to COVID-19, we would like to roll over unspent funds to fill this gap in FY22.

We have completed 7 spring surveys in Prince William Sound and have a sense of what whale numbers should be during the herring spawn. Observations made by the herring tagging team, aerial surveys, and ADF&G indicate that whale numbers remained low during the 2020 spawn. Although not directly comparable, preliminary results from the fall survey that was just completed indicates whale abundance is low, possibly an increase from 2019, but still below pre-marine heatwave levels, which is consistent with herring abundance trends in PWS.

A bioenergetic model is mentioned in the abstract but there appears to be no further mention of it in the proposal. The SP expected to see the data integrated into the model being that this is the final year of the project, and we also expect that this will be challenging. If this was not done, then explanation of why it was not is requested. The SP hopes that it was done and requests a description of the results.

PI Response (10.2.20)
The bioenergetics model will be done after all field and lab work has been completed in monitoring year 10 (FY21) as planned. We failed to highlight this in the Work Plan. The bioenergetic model will be similar to the model used in monitoring year 5 (Moran et al. 2018 and Straley et al. 2018):

Moran, J. R., et al. 2018. Regional variation in the intensity of humpback whale predation on Pacific herring in the Gulf of Alaska. Deep Sea Research Part II: Topical Studies in Oceanography 147:187-195.

Straley, J. M., et al. 2018. Seasonal presence and potential influence of humpback whales on wintering Pacific herring populations in the Gulf of Alaska. Deep Sea Research Part II: Topical Studies in Oceanography 147:173-186.

The proposal indicates top-down control of herring by the whales. What is the support for this mechanism? If this is really true, when whale counts went down in 2014 and 2015, wouldn't you expect that this would have been associated with an increase in herring numbers? The write-up gives the impression that both top-down and bottom-up controls are being argued at the same time. It is important to reconcile the importance of a whale effect in the herring modeling. Is such an effect supported by the model using available data? The treatment of the whale-herring relationship should be consistent across the whale and herring modeling proposals. There may be some room here for discussion among the PIs and integration of efforts. Please reconcile.

PI Response (10.2.20)
Whale numbers did not go down in 2014 and 2015, they remained high through April 2015 (Fig. 1). The opposite occurred; September 2014 had the highest count of whales that we have seen in Prince William Sound. In 2015 herring abundance dropped again (Fig. 2). We hypothesize that poor conditions in the Gulf of Alaska led to an influx of pelagic predators into the Sound, increasing top down forcing on herring. Unfortunately, there were no funded whale surveys until September of 2017, when we found that whale numbers had dropped significantly. Prior to the North Pacific marine heatwave, humpbacks focused on spring and fall aggregations of adult herring in Prince William Sound. Post heatwave, we saw increased pressure on young of the year and juvenile herring from the whales that remained in the Sound. This may have contributed to lower herring recruitment.

To see a recovery in herring numbers we need decent survival from egg to juvenile stages, which we suspect would be driven by bottom up processes. Once herring reach a size that they can form small schools, they become vulnerable to whale predation. In 2017-19, we observed increased predation by whales on age-0 herring. Age-0 herring are a low-quality food relative to adults, requiring whales to eat more mass for the same caloric gain. Our modeling effort should shed light on the impact of whale predation on juvenile herring in Prince William Sound (i.e., is their predation great enough to impact herring recruitment?).

We agree that we could improve coordination between the herring program and the Integrated Predator Prey team, we have made efforts to do so and will make it a priority in the future, especially because our data have now matured over a longer time period.

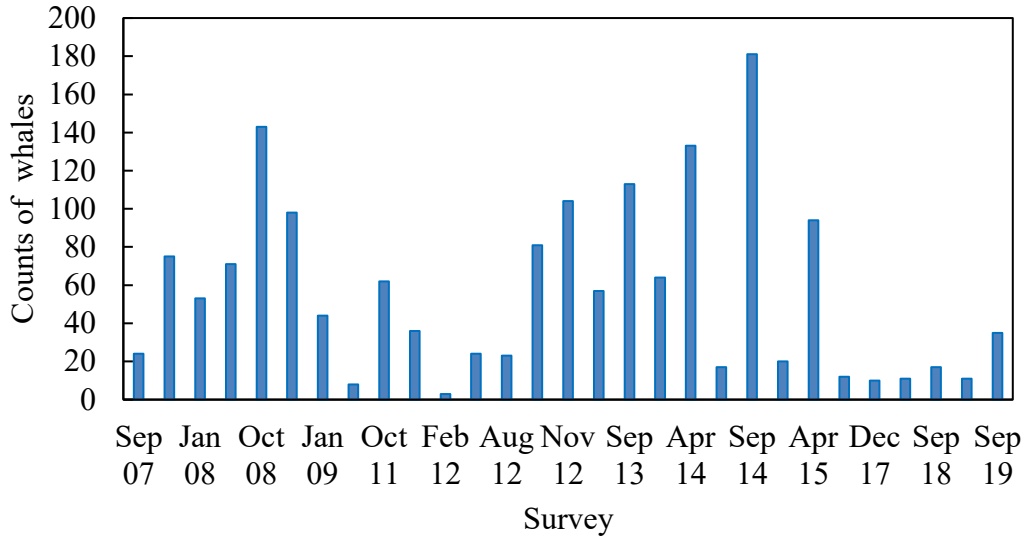


Figure 3. Counts of humpback whales in Prince William Sound provide an index of whale abundance, recent declines in whale numbers correspond to declines in herring biomass.

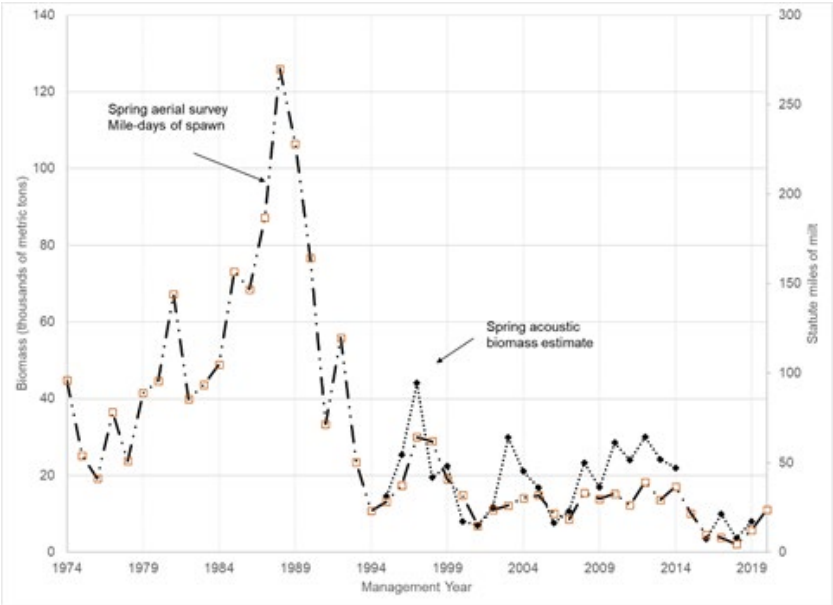


Figure 2. Herring increasing in Prince William Sound, but still not to pre-heatwave levels. (From the Herring Research and Monitoring program (Pegau, Haught, and Trochta) 2020 Ecosystem Status Report contribution.

The SP had a hard time separating the goal of the project from the broader Integrated Predator-Prey project. On page 6, overall project objective 2 addresses chemical analyses. Is this part of the whale project? If so, this raises follow-up questions on what was done, what was found, etc.

PI Response (10.2.20)
Knowing the quality of prey feeds into our energetic model and allows us to estimate the removal of prey species by whales. The Auke Bay Laboratory analyzes stable isotopes and energy density on prey items collected by both the whale and forage fish project. Understanding prey quality is crucial for

interpreting changes in predator/prey dynamics. For example: we have seen a change in the composition of euphausiids in Prince William Sound. Species such as Thysanoessa raschii *and* T. inermis *have dropped out of our samples while* Euphausia pacifica *and* T. spinifera *have increased. The species are not equal in their isotopic signatures and caloric value.*

Science Director Comments – FY21

Date: September 2020

The spring survey was postponed due pandemic related travel restrictions and lab work was delayed and resumed in mid-August. I have no specific comments or questions.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Panel would like the PIs to discuss: if there's a decrease in predation of herring in humpback whales, what age-class of herring would that affect and when would one expect to see a response in the herring population? These questions should be addressed and interpreted, not just in these comments but in future proposals and reports. We emphasize the inclusion of interpretation and discussion of data (not necessarily analyses), in the proposal.

PI Response (9.27.19)

This is an interesting question and knowledge of the biology of herring and whales is needed to fully address this question. Adult herring have a higher energy density than juveniles and form large, dense shoals during spawning and overwintering. Adult herring have been the preferred prey for humpback whales in Prince William Sound (PWS). Humpback whales follow overwintering herring into PWS in September through Montague Strait and then to Port Gravina through the winter and spring when spawning occurs. We have found ~200 whales feeding on large schools of herring in the early study years (2007-2014) and have more than 400 individual whales in our catalog. We have documented all age classes of herring being consumed by whales. The 2017-18 decrease in herring predation by whales parallels the dramatic decline of herring in PWS (Fig. 1 below).

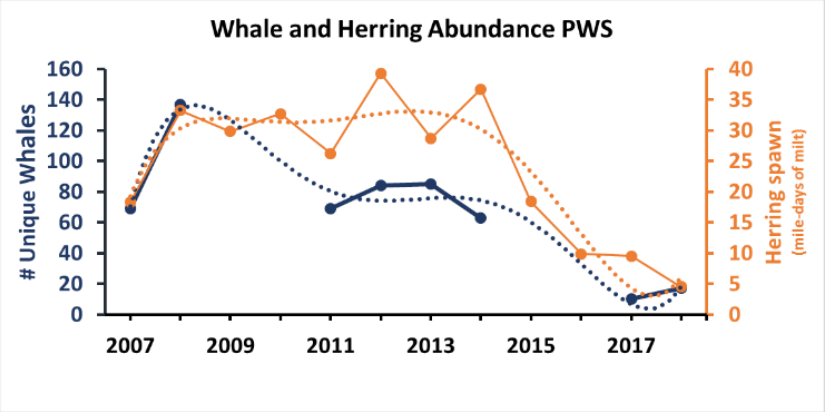


Figure 1 (Fig. 7 in our 2018 annual report). In PWS the humpback whale decline parallels the herring decline, their major food source. Miles-day herring spawn is used as an annual indicator for change in herring abundance. The trajectory could indicate a carrying capacity with a plateau, then steep decline (with a bit of a lag) during the marine heatwave (that never fully dissipated in the Gulf of Alaska, and re-intensified in 2018).

Humpback whales in PWS rely on adult herring as their primary prey in the fall and winter. With herring biomass at record lows in 2017-2018 far fewer whales (less than 20) were present in the same areas where up to ~200 whales had been documented feeding each year on herring during 2007-2014. However, when adult herring are scarce, we see a switch to age zero, one, and two year old herring. Younger herring form small, disperse schools which require increased foraging cost for the whales resulting in a lower energetic return. Whales increased their predation on juvenile herring beginning in 2015.

There has been insufficient recruitment of herring to determine what age structure would be most impacted by whale predation. The Gulf Watch Alaska integrated predator-prey surveys and the Herring Research and Monitoring program will discuss the possibility of determining answers to some of these questions. In the future, further discussion and the inclusion of interpretation of data will be addressed in proposals.

In Figure 1 of the proposal regarding the index on whale abundance: has there been a shift in whale distribution in recent years? It is important to try to distinguish changes in abundance with changes in distribution to the extent possible. The high variability in whale counts between sampling periods cannot be explained by whale population dynamics alone. There appears to be a seasonal signal in the counts, although this may not be a fixed effect. We would like to see mark and recapture methods applied to generate population estimates with confidence intervals, such as those used in Teerlink et al. (2015) to assess population estimates.

PI Response (9.27.19)
There has not been a shift in distribution within PWS, but an actual decline in numbers of whales sighted. Our effort and track lines have been consistent and cover most of the sound. Similar declines in humpback whale numbers have also been documented in Southeast Alaska. Neither of these regions are closed populations and there is potential that whales that generally feed in PWS are foraging elsewhere in the Gulf of Alaska. We are connected with a network of researchers in the North Pacific, including Hawaii and the California Current to determine if whales that formerly fed in PWS are now feeding elsewhere, or potentially deceased. We recently submitted the PWS humpback whale catalog to an automated matching program (happywhale.com) to see if these whales have been feeding

elsewhere in the North Pacific. Both PIs are leading working groups to determine declines in humpback whale numbers on the breeding grounds and in Alaska are the result of migration or mortality.

The variability among surveys is due to the behavior and biology of humpback whales. These are seasonal migrants that generally winter in tropical waters and feed in higher latitudes. The departure from feeding areas is staggered with some whales leaving early and some later, with some returning from the wintering areas earlier and some later. There also are some whales overwintering in higher latitudes. On the feeding areas, humpback whales are dispersed in summer and aggregate in the fall when herring come into deep bays and fjords to overwinter. Thus, a seasonal peak is evident in the fall and a seasonal low is evident in the winter, with numbers increasing in spring as whales return. The very low numbers in 2017 in September were alarming and persisted into 2018. A September survey is currently underway and we will soon know if conditions are staying the same or changing.

We will apply a mark-recapture model to these data, as we did for our earlier data (Straley et al. Deep-Sea Research Part II 147 (2018) pp. 173–186). As stated in our methods to assess the impact of predation more information is needed than an abundance estimate as described in our paper:

"Although mark-recapture models provide an estimate of abundance, they do not describe seasonal trends. Consequently, we used the number of unique whales seen each month for establishing seasonal patterns, then adjusted the pattern to account for the estimated number of whales present. The data used to describe the seasonal attendance pattern, included calves because by fall calves have become intermittently independent and become more independent with age (Straley, unpublished data). By fall calves were feeding on the same prey as other whales. We also included individuals identifiable in poor quality images. This number represents a lower bound to the daily attendance pattern for whales in each location. Daily attendance was estimated by fitting linear models to the observed numbers. Inflection points for linear models were determined visually. We used the attendance patterns to establish a lower bound (as described above) and the Huggins estimate of abundance to establish the upper bound to the whale attendance pattern."

Keep in mind the Teerlink et al. (2015) data were collected in a very small area of PWS in the summer and no data on prey were collected. The purpose was very different from our study. We are addressing how many whales each day are foraging on herring. While knowing how many whales in a season are present is relevant for some questions, that number provides little detail on day to day foraging. Also, we are studying this population of whales that mostly leaves during the winter (although a few overwinter), then returning in spring and they are often different whales. Hence, immigration and emigration are huge issues, which violates the basic assumptions of mark recapture models.

Science Director Comments – FY20

Date: September 2019

I am encouraged that a manuscript is in prep that will discuss the decline in humpback whale populations in conjunction with the marine heat wave. This will make another contribution to the growing list of manuscripts from this program that begins to examine ecosystem response to the marine heat wave. I concur with the Science Panel's comments.

PI Response (9.27.19)
The paper includes a 30+ year time series of data from Southeast Alaska as well. As a side note: two abstracts have been submitted to conferences. PI Straley will present at the the joint Wildlife Society

/Fisheries Society meeting on October 3 2019. Straley just submitted an abstract to the Ocean Sciences meeting in February 2020. Abstracts are available upon request.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel would like to see these data linked with forage fish and seabird data. If whales aren't there is it directly correlated with herring numbers? Namely, does reduced herring biomass lead to fewer whale observations?

PI Response (10/10/18)
Anecdotally, yes, the decline in whale abundance mirrors the recent drop in herring biomass. Prior to recent marine heatwave adult overwintering and spawning herring were the preferred prey for whales in PWS. Our 2017 and 2018 surveys found fewer whales in PWS and a shift in feeding behavior to more dispersed prey such as juvenile herring. We saw similar shifts in whale abundance and feeding behaviors in Southeast Alaska. Quantifying the relationship between whales, birds, and herring is one of the objectives of the Pelagic Component's integrated predator-prey surveys that were piloted in 2014 and adopted during the current five year funding cycle. We have acoustic data from herring schools in September and December of 2017 and March and September of 2018 to compare with earlier surveys. The December and March survey vessels were funded through NOAA, but with no additional support for data analysis. However, we are exploring options to have these data analyzed, which will collectively provide valuable information on the relationship between whales and herring when herring abundance is extremely low.

Also, changes in whale abundance should be distinguished from shifts in whale distributions to the extent possible. Comparison of whale trends in PWS with the greater North Pacific may be helpful.

PI Response (10/10/18)
Yes, there are two possibilities for the decline in whale numbers within PWS: 1) they died, or 2) they moved. Unfortunately, there is no effort to determine trends for the greater population of humpback whales in Alaska or any attempts to survey offshore.

The PIs are leading the SPLISH Project (Survey of Population Level Indices for Southeast Alaska Humpback) to assess trends in abundance, calf production, spatial and temporal distribution, prey composition, and body condition for humpback whales in northern Southeast Alaska, and work closely

with the Glacier Bay National Park long term monitoring program for humpback whales. These are the only projects in the state addressing humpback whale abundance trends.

Due to the lack of a comprehensive humpback whale survey in Alaska, data from our PWS and southeast Alaska surveys have been relied on by NOAA for section 7 consultations under the Endangered Species Act, establishing critical habitat, and evaluating unusual mortality events.

Science Coordinator Comments – FY19

Date: September 2018

The project is on track. NOAA vessels were leveraged for FY17 and FY18 for this project and 18120114-E Bishop to conduct winter and early spring surveys and will no longer be available for FY19 and beyond. Funding ($29.4K includes GA) is requested for only the spring cruise in March to continue work as described in both original project proposals. March surveys have provided an important assessment of spring conditions prior to herring spawning, whale abundance, and quantification of predator consumption of pre-spawning herring schools. These data are useful to the HRM program. Both projects 114-O and E are proposing to continue a spring/March cruise with requested funding. Is each project requesting its own vessel? If so, is there any way to share a vessel to reduce costs?

PI Response 9.5.18

Yes, each project is requesting their own vessel. When identifying projects with unfunded needs, we did have a lengthy discussion about sharing vessels, as the nearshore team also requested funding for March survey in PWS (that project did not rank in top 3 to request funds). We concluded that projects 19120114-E (fall/winter seabirds) and 19120114-O (humpback whales) would not be able to share a charter vessel. March surveys for marine birds and whales have different objectives, methods, and proposed spatial coverage (Figs. 1 and 2) and, therefore, require separate survey vessels. For example, the marine bird surveys (Fig. 1) are fixed transects sampled annually using the chartered vessel as the survey platform. In contrast, the whale survey route changes annually depending on where the whale and herring aggregations are (Fig. 2), and once an aggregation is encountered, the chartered vessel that is also used as the survey platform engages in focal following of predators and prey. Timing also differs. For marine birds, surveys would be conducted in early to mid-March before spring migration. On the other hand, we attempt to time whale surveys just prior to herring spawning in late March or early April. This is often too late for winter bird work.

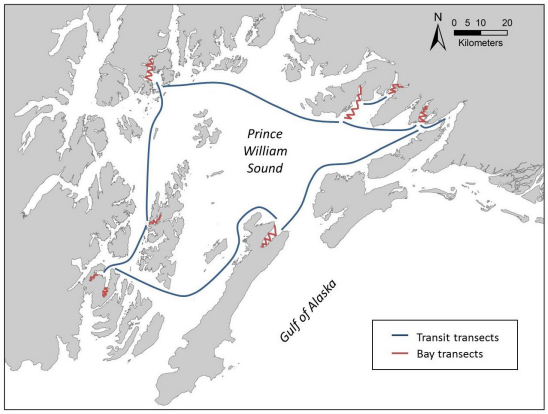


Figure 1. Proposed dedicated marine bird surveys to occur in November and March in Prince William Sound, AK. Surveys will replicate our longest time series (2007 - 2016) and most consistent data.

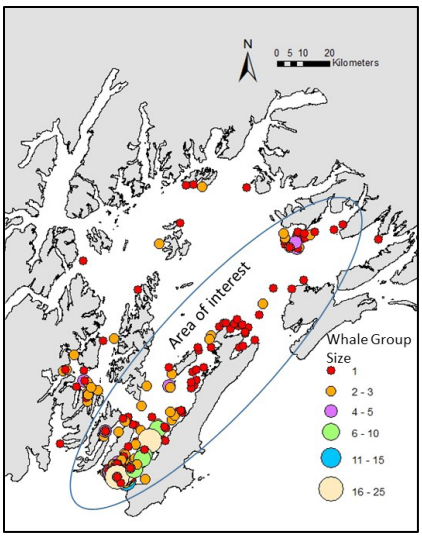


Figure 2. Area of interest for spring whale surveys in Prince William Sound, AK. Given limited vessel time, effort will focus on southern PWS an area of high whale and pre-concentrations.

PAC Comments – FY19

Date: September 2018

No project specific comments.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel was excited to see the results presented in Figure 1 in the proposal and encourages the PIs to make comparisons to the relevant study conducted by the National Center for Ecological Analysis and Synthesis (NCEAS) working group. Results shown in Figure 1 of the proposal are important and so strikingly incompatible with what was suggested previously by the time series analysis of the NCEAS working group (Ward et al 2017). That working group's model, of necessity, made some quite restrictive assumptions. Can the PIs look at the NCEAS model, and consider whether the new findings invalidate one or more key conclusions from that synthesis work?

PI Response (10/11/2017):
Thank you for the close review of project 18120114-O's work plan. Comparisons to Ward et al. (2017) are problematic because these authors depend on summer whale counts from western PWS (Teerlink et al. 2014), while our project focuses on fall/winter and spring time periods when herring form large, dense schools that are most vulnerable to whale predation. Observations of whales and prey when herring are aggregated allow us to study the potential impact of foraging humpback whales on herring as a possible contributor to the lack of herring recovery. The following are three important

differences between our approach and the Teerlink et al. (2014) approach to modeling whale predation on herring:

1. The Teerlink et al. (2014) study estimates the number of whales that use PWS in summer, not the number that are present at any given time (for example, 10 whales spending 90 days in the Sound would have the same effect on prey as 900 whales spending one day in the Sound). It is important to know how many whales are feeding on herring for how many days within the Sound and the Ward et al. (2017) paper does not address this.
2. Ward et al. (2017) used whale population estimates from summer surveys, when overall whale abundance is generally low in PWS compared to other seasons. Our work identified adult herring as the preferred prey of humpbacks in PWS, especially when herring are aggregated in the fall, winter, and spring (spawning); thus, whale numbers peaked in the fall and spring, and dropped during the summer months.
3. Neither Ward et al. (2017) nor Teerlink et al. (2014) identify prey consumed by humpback whales.

Additionally, the Panel is concerned that objective #3 may be overly ambitious and suggests re-wording and editing to "predation rate"?

PI Response (10/11/2017):
With regards to objective #3 being overly ambitious and the Science Panel's suggestion of rewording and editing to "predation rate"? We agree and will change the wording of this objective.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments – FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: May and September 2016

There are no project specific comments.

Science Coordinator Comments – FY17

Date: May and September 2016

I have no project specific comments.

Executive Director Comments – FY17

Date: September 2016

I have no project specific comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Project Number: **21200114-P**

Project Title: LTM Program – Lingering Oil Component Project

Primary Investigator(s): Mandy Lindeberg, Ron Heintz

PI Affiliation: NOAA, Sitka Sound Science Center **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $65,300

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	Auth: $52,200	$13,100

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $22,400

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$11,200	$11,200

Total Past EVOSTC Funding Authorized (FY17-20): $52,200

Total EVOSTC Funding Authorized (FY07-20) and Requested (FY21): $65,300

Total Non-EVOSTC Funding (FY17-21): $22,400

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/14/20, budget updated 8/14/20.*

Oil from the *Exxon Valdez* remains sequestered under beaches throughout the spill area. This lingering oil, as it is known, has been a source of concern for the federal and state government and the public for over 30 years. In 2015 the United States and State of Alaska governments advised the federal district court they would not be filing for additional damages based on the presence of lingering oil and the "reopener claim." In their joint status report, the Governments noted that, although the Governments would not pursue the additional claim, "[the *Exxon Valdez* Oil Spill Trustee] Council (EVOSTC) and its member agencies have discretion to consider and proceed with actions to reduce residual oil in the Spill area. . . ." In subsequent Council meetings, the Trustees noted their commitment to continuing lingering oil monitoring to ensure that the oil is not bioavailable or creating damage to the spill area habitat and its resources. Subsequent Councils requested EVOSTC staff develop a lingering oil monitoring project to address targeted areas to effectively monitor the presence and condition of lingering *Exxon Valdez* oil spill oil.

This project was developed in coordination with EVOSTC staff to provide a sensible monitoring program that continues past efforts. Past monitoring projects began with an initial assessment in 2001 where over 9,000 pits were excavated to estimate how much oil remained on beaches in Prince William Sound. Results from this survey showed oil was lingering in the environment longer than expected and not changing in its chemical composition or "weathering". Additional surveys were conducted from 2003-2015 to determine the oil's extent and to refine model estimates.

Recommendations from these surveys were to continue monitoring these known sites periodically on a 5-year cycle to maintain the oil chemistry time series and evaluate any change. This project fulfills those recommendations and has become an important case study in the long-term impacts of oil spills.

This project proposes a low-cost presence/absence approach to monitoring that can be combined with previously Council-funded modeling efforts to provide managers with up to date information on where oil is located and its potential to cause injury. COVID-19 mandate restrictions prevented this project from conducting the field survey in summer of 2020 and has been postponed until summer of 2021. The principal investigators are not changing project objectives or requesting additional funding, simply shifting tasks into FY21.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

No comments or concerns.

PI Response (10.2.20)
If further delays are experienced due to COVID-19 a request to roll over funds into FY22 will be made to complete the original project objectives.

Science Director Comments – FY21

Date: September 2020

Pandemic related restrictions prevented this project from conducting the field survey in summer of 2020 and has been postponed until summer of 2021. Since this sampling and monitoring is proposed for every 5 years, tasks from FY20 will simply shift to FY21. The PIs are requesting unused FY20 travel funds ($1.4K) to be reallocated to supplies for FY21.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Panel appreciates this low-cost project that addresses the need for periodic lingering oil monitoring. The Panel also expressed some concern regarding the description of sampling (page 5 of the proposal), "Samples will be collected from all pits in which oiling is visible. If oiled sediments are not observed, additional samples will be collected from locations where oil is known to exist." This statement might be misinterpreted as an unending search for oil. The Science Panel asks the proposers to please clarify.

PI Response (9.27.19)
We appreciate the Council's dedication to lingering oil and continued monitoring. We certainly do not want to get into an unending search for oil and have revised the narrative so there is a limit to our efforts. The sentences now read:

"In the event that our random selections fail to encounter contaminated sediments, we will re-open pits in known locations to obtain samples for archiving. NOAA maintains records of the specific locations where oil has previously been found. Should this approach be necessary we will collect no more than five total samples for archiving within the time we have available for sample collection."

Science Director Comments – FY20

Date: September 2019

This project proposes an effective low-cost presence/absence approach to monitoring that can be combined with previously Council-funded modeling efforts to provide managers with up to date information on where oil is located and its potential to cause injury. This project would fulfill the recommendations made by surveys conducted from 2003-2015 which were to continue monitoring these known sites periodically on a 5-year cycle to maintain the oil chemistry time series and evaluate any change in presence and weathering. The study design appears to have been well-thought out and methods are based on those previously established. The PIs are highly qualified, have been involved with Council-funded work since the Council's inception and previously led past lingering oil monitoring efforts.

PAC Comments – 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 – FY20

Date: October 2019

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

Lingering Oil Project Descriptions

(Please see the Long-Term Monitoring (Gulf Watch Alaska) and Herring Research and Monitoring Programs)

Data Management for Programs and Projects Descriptions

Project Number: **21120113**

Project Title: Data Management for Programs and Projects

Primary Investigator(s): Carol Janzen

PI Affiliation: AOOS **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $1,149,600

FY17	FY18	FY19	FY20	FY21
Auth: $218,000	Auth: $218,000	Auth: $218,000	Auth: $242,000[a]	$253,600[b]

Requests include 9% GA. *[a]Includes request for additional funding for data management services for two non-program projects.* *[b]Includes request for additional funding for data management services for three non-program projects.*

Funding From Non-EVOSTC Sources FY17-21: $14,400

FY17	FY18	FY19	FY20	FY21
$2,700	$2,800	$2,900	$3,000	$3,000

Total Past EVOSTC Funding Authorized (FY12-20): $4,026,342

Total EVOSTC Funding Authorized (FY12-20) and Requested (FY21): $4,279,942

Total Non-EVOSTC Funding (FY12-21): $2,978,600

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 9/30/20, budget updated 9/30/20.*

The *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) requires a data management program composed of tools covering the entire data lifecycle, from immediately after data collection, to long-term preservation, to discovery and reuse. During the 2012-2016 EVOSTC five-year funding cycle, the Alaska Ocean Observing System (AOOS) provided data management services for both the "Long-Term Monitoring of Marine Conditions and Injured Resources and Services" Program, referred to as Gulf Watch Alaska (GWA), and the "Herring Research and Monitoring" (HRM) Program. These two programs leveraged the existing data management capacity of AOOS, and have also helped inform and improve the overall AOOS data and metadata management, access, and visualization tools. The AOOS team and infrastructure continue to provide data services to the EVOSTC for the 2017-2021 funding cycle to maintain continuity and build upon the ongoing efforts and data management system development. New in 2020 (Year 9) was the addition of two Non-Program projects, which were added to the FY20 and FY21 Data Management workplans upon request from the EVOSTC. New in 2021 (Year 10) and added to this workplan is the addition of a third Non-Program project – "Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay." As before and with these new projects, AOOS will continue to provide access to the tools and services for which the principal investigators (PIs) of the GWA and HRM Programs depend. The Research Workspace will be maintained and supported to upload, organize, and document data, as well as to facilitate program administration. This platform is familiar to GWA and HRM PIs and allows data to be made promptly and securely available to team members and program administrators. The enhanced metadata editor accessed through the Research Workspace helps researchers more easily generate flexible yet robust, standards-compliant metadata. As in previous years, GWA and HRM Program data will be shared publicly (or 'published') through the AOOS Gulf of Alaska data portal, where it can be accompanied by any supplemental

files or project documentation. The same publication pathway for the FY20-21 additional Non-Program project datasets is planned. Publishing through AOOS is beneficial to making the data available to a wide-ranging and established network of resource managers, scientists, and the general public. In addition, the GWA and HRM Program and new Non-Program datasets will ultimately be submitted to DataONE with a digital object identifier (DOI) for long-term preservation and broad access across multiple data repositories. Through the AOOS data management system, the significant expertise of the data management staff within its technical partner organization, Axiom Data Science, is leveraged. The Axiom staff have extensive experience with the GWA and HRM Programs and their associated data through the prior nine years working with these programs. Building upon these established relationships and infrastructure, AOOS is well-poised to deliver continued success in its data management services to facilitate the access and curation of data from Program and Non-Program projects to support decision-making related to Spill affected ecosystems.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The SP remains very pleased with how well the Program is handling ongoing data collections. The SP appreciates the preliminary estimates of including a new non-Program project (21210128) in the Data Management Program. Given the pandemic, has diminished field work reduced the cost of maintaining data management for ongoing programs?

PI Response (10.5.20)

Thank you for the positive feedback on the handling of data collections within the Program. The management and coordination of the Gulf Watch Alaska and Herring Research and Monitoring Programs certainly also play a valuable role in facilitating a strong collaboration among the programs, which is an important element for upholding communications and responsiveness to deadliness across the projects.

The pandemic has diminished a portion of the GWA field monitoring for the 2020 season, whereas all HRM sampling requirements will be met for 2020. While we expect less data will be submitted to the Research Workspace in FY20, data preservation from existing data and continuity among future years of data continues to be a priority for the data management program. As such there are fixed costs associated with the storage of existing data and maintenance of a data system, which are a greater portion of the overall program costs than the variable costs of new data submissions. While there are no expected reductions for the fixed cost of maintaining the data management program, we expect a 5% reduction in effort for data submissions due to diminished field work for the GWA program. A portion of that effort reduction will be offset by special handling of data management relative to the pandemic, such as reworking metadata records to document data gaps related to the pandemic, reprocessing of existing datasets relative to data gaps, and dealing with possible data delays related to the pandemic (i.e., prolonged processing of laboratory datasets analyzed by third-parties, such as zooplankton and phytoplankton datasets, caused by lab closures, hence delayed data submission). Further, Axiom would like to apply any cost savings to a refactor of the Research Workspace metadata editor, which is used regularly by GWA and HRM PIs to meet their data documentation deliverables and is a requirement for data archive. A refactor of the metadata editor will ultimately improve the user friendliness of the tool by PIs by allowing them to take advantage of more time-savings steps when writing metadata. Additionally, this work would refresh the metadata schema to the most recent ISO

version to keep current with data repository requirements thereby improving the efficiency of the data archive process. Activities that will be accomplished within a metadata editor refactor include: updating the metadata codebase mapping to export more recent versions of the ISO schema (as required by DataONE and federal data repositories); expanding the metadata to include more keyword vocabularies and to more formally describe instrumentation and deployment information; and developing a middleware application to allow Axiom data managers to play a role in improving the metadata editor scheme and user interface (i.e. reducing the dependency on software engineers to implement changes).

Science Director Comments – FY21

Date: September 2020

FY21 budget includes additional funds for data management services for project 21210128 which was approved at the February 28, 2020 Council meeting. I do not have any specific program comments or concerns.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel appreciates the data management program services that this program provides. The Panel agrees with the Science Coordinator on the value of having all data from TC-funded science projects managed by this program and would like more information regarding the costs.

PI response (9.27.19)
The Data Management team appreciates the EVOSTC and Science Panel taking the time to share their positive impressions of this proposal, and for commending our efforts to improve the data management services provided in the previous five-year effort. Information related to the costs is provided in the below response to the Science Coordinator comments.

Science Director Comments – FY20

Date: September 2019

The Data Management Team continues to provide valuable support to the programs for seamless uploading and sharing of data with PIs and making data publicly available. I appreciate the well-organized proposal, including details of all FY19 program accomplishments. The program is requesting

an additional $71.7K for data management services for up to six non-program projects for FY20. The program is already managing data for the Gulf Watch Alaska and Herring Research and Monitoring programs. Data Management oversight of all TC-funded projects will ensure that data from all TC-funded science projects are consistently maintained, archived and made publicly available through AOOS and DataOne data portals. This will also help facilitate integration between all TC-funded program and non-program projects. However, I have requested the PI provide more detail as to why the cost is slightly higher per project for up to six non-program projects of FY20.

PI response (9.27.19)
The PI for the Data Management Program is not requesting additional hours for program management of the Non-Program projects. The individual project data management services provided by Axiom for these projects do not change much from year-to-year, with the exception of the first year when the new projects are being initiated (thus transferring, formatting, and documenting any associated legacy datasets), and in the final year (when datasets are being curated for archive). Some projects will also require additional time to onboard funded PIs to the Research Workspace, entrain them to the data management procedures consistently used across EVOSTC programs, and to familiarize them with metadata tool and best practices for authoring preservation-quality documentation in the first year. The 19110853 Pigeon Guillemot Restoration project will require curation of five or more prior years of data in order to update population statuses and trends. Thus, at the project onset, some historical data salvage effort will be necessary to consolidate, organize, standardize, format, and author standards-compliant metadata. The level of work for curating historical data requires effort beyond the routine annual data management workflow. Slight variation between projects on annual budgets are based on the project budgets provided us relative to anticipated data volumes and data workflow across years. The additional costs for providing data services to these new projects is highest in year 2020 as a result. Costs are also a little higher than middle-years during the last year of a project.

The data management services cost under the Axiom Data Science FY17-21 subaward alone for the Gulf Watch Alaska and Herring Research and Monitoring Programs is approximately $182,000 per year ($910,000 total across the 5 years, not including AOOS/ASLC charges or the 9% GA).

- *In the FY17-21 work plan for restoration, research and monitoring project draft by the EVOSTC in FY19, there are seven projects generating data in the HRM program and 11 in the GWA program for 18 total projects.*
- *On average, the data management service cost per project over the lifetime of the 5-year program is $10,111 per year.*

For the expanded data management services, the cost estimate provided in the FY20 workplan for the Axiom Data Science subaward is indeed highest in the first year at $63,000 for six projects (not including the AOOS/ASLC PI and contractual charges or the 9% GA). On average, the data management services cost under Axiom per project in FY2020 alone is $10,500 (6), which is slightly higher than the GWA and HRM project year average of $10,111. FY2020 is the first year for all the Non-Program projects, afterwhich the cost goes down for the next two years, increasing again near the end as needed for data curation and preparation for final archival. Assuming all projects are funded, the six projects total $246,000 over the next 5 years (not including the AOOS portion nor the 9% GA). Please see Tables 3 and 4 in the Workplan for more details.
Comparing the average annual cost per project per year normalizes the variable costs from year to year and the period of the programs (3 to 5 years).

Name	*Total Proposed Cost*	*Total Number of Funded Projects*	*Total Project Years**	*Average Project Cost*
HRM & GWA Programs	*$910,000*	*18*	*90*	*$10,111*
Non-program projects	*$246,000*	*6*	*25*	*$9,840*

The GWA & HRM projects are anticipated to each be funded over a 5-year duration, as per the FY17-21 workplans. Therefore, the total project years is 18 project * 5 years = 90 project years. The duration of the non-program projects varied across projects from 3 to 5 years. 3 projects proposed a 5-year duration (15), 1 project proposed a 4-year duration (4), and 2 projects proposed a 3-year duration (6), which equals 25 project years.

Over the entire lifecycle of the proposal non-program projects, the average per project per year cost is $9,840, which is on par with the average GWA and HRM program project cost per year of $10,111. The actual data management service cost for the non-program projects will depend on the actual number of projects that are recommended for funding by the Science Panel.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel applauds the Data Management team for the progress they have made with the program. The process for uploading and sharing data, making data publicly available appears to be seamless. The Data Management team provides detailed instructions and good support to PIs and programs, EVOSTC staff and reviewing committees. We recognize that the PI compliance is high, which is a reflection of how well the program is functioning and supporting the long-term monitoring programs. We note that Table A could be effectively summarized to highlight the high compliance rates and data availability.

Science Coordinator Comments – FY19

Date: September 2018

I use the Workspace to provide documents to the Science Panel and other reviewing committees. I greatly appreciate how much easier it is to share information. Program is on track except for one task due to technical difficulties and scheduled for the next quarter.

There is one question from the Science Panel in 2017 (from the FY18 Work Plan) that needs a follow up: Are the ADFG herring data sets available on the DataOne portal? If not, they should be made accessible.

PI Response (10/13/2017):
The ADFG Prince William Sound datasets have been submitted to the Research Workspace for sharing among collaborators. Some of these datasets have been made available to the public through both the GOA data portal and DataONE. An inventory of these datasets and their publication status are shown in the below table.

The data management team is awaiting a final decision from ADFG Commercial Fisheries division about whether to make the remainder of the data available publicly. We will update the EVOSTC and the EVOS Science Panel with this information as soon as we have a response.
Has this been done?

PI Response 9.6.18
The ADFG Prince William Sound datasets through 2017 (with the exception of the acoustic and scale measurement data) have been submitted to the Research Workspace for sharing among collaborators.

- *Some of these datasets have been made available to the public through both the GOA (Gulf of Alaska) data portal and DataONE.*
- *An updated inventory of these datasets and their publication status are attached. (See xlsx file attached).*

In March 2018, the data management team received the final decision from ADFG Commercial Fisheries division to allow the remainder of the data to be made available publicly with appropriate permissions.

- *A copy of this communication is attached below this response, as an email from Sherri Dressel.*

Since that time, the following actions have been taken by the Data Management team to prepare these data for archive.

1. The visualization of the Herring ASL data (including biomass, survey, ASL, spawn, marine mammal, and marine bird datasets) has been updated through 2017 in the GOA data portal.

2. For all datasets, the ADFG Use Constraints disclaimer described in the Dressel email below has been added to the portal overview page for each dataset and to the corresponding metadata.

3. The FGDC version of the historical metadata records (created by Steve Moffitt) has been migrated into the contemporary ISO metadata standard within the Research Workspace. This is a necessary precursor towards data archive and helps to ensure that metadata can be more readily updated by the PI in the coming years.

4. As the ADFG database structure evolved over many decades, there were inconsistencies in the presentation of some of the aerial survey data. In consultation with ADFG, updates were made to correct errors within the data files.

It should be noted that many of these data are long-term historical datasets that, while a considerable resource to the Herring Research and Monitoring Program, extend beyond the life of the 2012-2016 Data Management Program. It is our intention to help ensure the long-term preservation of these data by submitting them to DataONE within this funding cycle, assuming confirmation from ADFG about the readiness of those data.

PAC Comments – FY19

Date: September 2018

The PAC noted the importance of data management and supports providing more administrative support for uploading data, metadata, and reports.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel greatly appreciates the PI's efforts on this project. The coordination between the data management program and the HRM and LTM Programs has greatly improved. The proposal was well written and organized.

Can the PI confirm that data will be available and not require specially approved access to get to the data?

PI Response (10/13/2017):
The process for making data from the EVOS Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) programs publicly available is as follows. Project PIs upload preliminary and final datasets to the Research Workspace within one year of collection for sharing among collaborators. PIs maintain ownership of the data they have submitted to the Research Workspace; therefore, they have access to data from the 2012-16 and 2017-21 funding cycles without needing special permissions. Once data are finalized (e.g., within one year of data collection, in most cases) data are published from the Research Workspace to the AOOS Gulf of Alaska (GOA) data portal.
All data published to the GOA portal are accessible by the public with no restrictions or specially approved access. In the portal, these data are discoverable alongside the publicly-available final data from the 2012-2016 GWA and HRM projects. These data are further made available to the public through the Research Workspace DataONE member node, a preservation-oriented data repository that is openly accessible to the public. The DataONE archives, similar to the GOA portal, will continue to be updated with final data from the 2017 to 2021 funding cycle.

To navigate to the public-facing data in the GOA portal:

1. *Visit the AOOS website (http://data.aoos.org) and select the Gulf of Alaska portal (image below), or navigate directly to the portal at http://portal.aoos.org/gulf-of-alaska.*
2. *To view data, click on Data Layer Catalog*
3. *From the catalog labels on the left hand side, select the Gulf Watch or Herring Projects*
4. *Click on the project you want to open from the list.*
5. *To view data files, click 'Project Data' in the upper right (top image below). Browse the files and click those you want to download*

Are the ADFG herring data sets available on the DataOne portal? If not, they should be made accessible.

PI Response (10/13/2017):
The ADFG Prince William Sound datasets have been submitted to the Research Workspace for sharing among collaborators. Some of these datasets have been made available to the public through both the GOA data portal and DataONE. An inventory of these datasets and their publication status are shown in the below table.

ADFG Herring Surveys, Prince William Sound: aerial survey route, biomass, age sex length, and spawn
EVOS Herring Research Workspace c https://workspace.aoos.org/project/283281/files

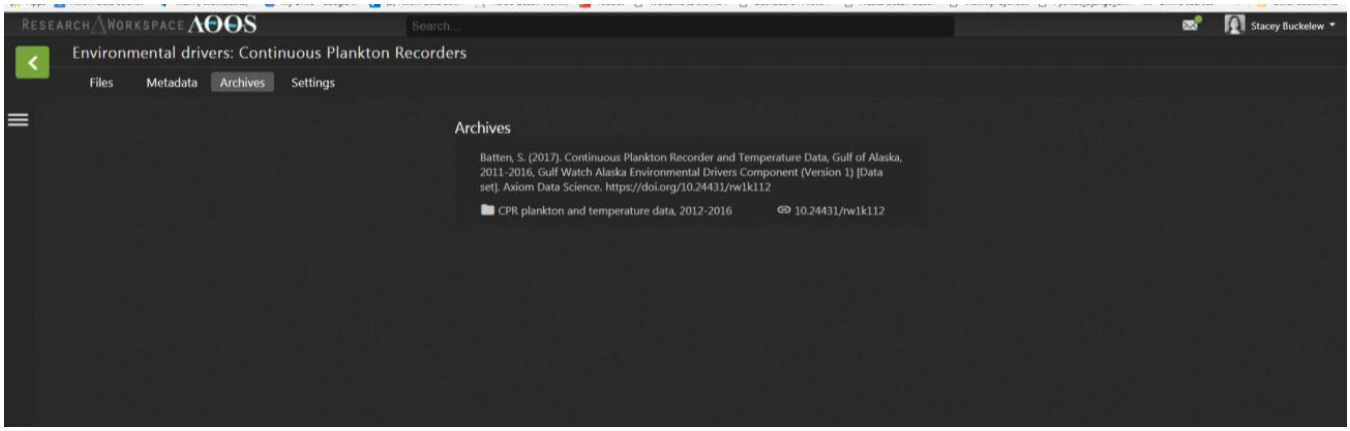
Dataset	Years	Public in GOA portal?	GOA portal link	Archived with DataONE?	DataONE doi link
Aerial herring biomass observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a692c-ea24-11e0-b73c-0019b9dae22b	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.16
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a753e-ea24-11e0-a20d-0019b9dae22b	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.17
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/79b1cc76-5f1f-41d7-bb79-3f7e995d6d89	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.18
Aerial survey marine bird observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/258864ed-5fe3-4ae1-af41-fee3222612aa/d3964546-4786-11e5-953e-00265529168c	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.19
Aerial survey marine mammal observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/00357656-e3b9-4d22-9d03-345ffb0b7320	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.20
Aerial survey sea lion observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/d39650b8-4786-11e5-9543-00265529168c	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.21
Age Sex Length Data	1973-2014	no	-	yes	https://search.dataone.org/#view/df35b.273.7
Age Sex Length Data	2015-2016	no	-	no	-
PWS Herring Acoustics	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-
PWS Herring Acoustic	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-

The data management team is awaiting a final decision from ADFG Commercial Fisheries division about whether to make the remainder of the data available publicly. We will update the EVOSTC and the EVOS Science Panel with this information as soon as we have a response.

What is the status on linking DataOne to Workspace for all the projects?

PI Response (10/13/2017):
In June 2017, we launched the Research Workspace DataONE1 Member Node, a preservation-oriented data repository serving as the archival home for datasets published from the Research Workspace (news release here). Datasets published from the Research Workspace to the Research Workspace

DataONE Member Node are issued a citable digital object identifier (DOI), and are discoverable through DataONE search interfaces alongside datasets and metadata from the other 40+ repositories that make up the DataONE federation. The final data holdings from the 2012-2016 GWA and HRM programs were archived in the Research Workspace DataONE Member Node and are now publicly discoverable and citable through both the AOOS Gulf of Alaska data portal2 and the DataONE Search3 catalog. These archived resources are linked to any related datasets from the EVOS historical data salvage project (conducted by NCEAS), which are also stored in DataONE. Within the Research Workspace, the GWA and HRM program datasets archived with DataONE are visible under the Archives tab within each project (see below image). Here PIs can view the resource title, DOI, and link to the associated data and metadata. Additionally, the DOI is reflected in the Gulf of Alaska data portal, from which any member of the public can navigate from the Gulf of Alaska portal to the archived dataset within DataONE.
In future Research Workspace updates, an archive page will be added to the EVOS GWA and HRM campaign which lists the archive dataset citations for the entire program (as opposed to individually by projects), and this list will include links to DataONE.



Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments. I greatly appreciated the Key Highlights section.

PAC Comments – FY18

Date: September 2017

The PAC emphasizes the importance of being able to access raw data, not just scientific papers. The PAC is pleased with the improvements made to make data available in recent years.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council

May 2016	Fund	Fund	Fund	Fund	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY17

Date: September 2016

We appreciate the Team Lead's thorough responses to our questions and comments. We do not have any additional questions or comments on the revised proposal.

Date: May 2016

The Panel appreciates the refocusing of the data management program to better meet the needs of the Programs and the EVOSTC. Making the data collected by the Programs available to other researchers and trust agencies is the primary goal of the data management program. The development and implementation of the data portal in conjunction with the partnership with DataONE in the first five-year program has helped to meet that goal.

The Panel was encouraged to see a more defined data policy that provided clear repercussions for non-compliant PIs. The Panel was gratified to learn that AXIOM has developed or is developing a presumably online training course for PIs on how to construct metadata for their projects, so as to address one cause for slow compliance with data submittal timetables.

The Panel is concerned about the availability of data from the first five-years of the Program to the new and continuing PIs. Milestone 2 on page 21 of the proposal needs further clarification. "Some PIs in the current funding cycle may need access to previously collected datasets in the Workspace." Does this mean that new and continuing PIs will not be able to routinely access data collected in the first five-year Program unless they submit a special request? Access to both the historical data assembled by NCEAS and data collected by projects in the first five years is critical to the success of both Programs.

The Panel strongly encourages the continued coordination and collaboration with both major Programs (Long-Term Monitoring and Herring Research) in the design and updating of the system.

The Panel was concerned that the Program lead was unable to answer several questions regarding the design of the Program and the PI appeared unfamiliar with the content of the proposal, thus inhibiting a full discussion of the Workspace functionality.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Non-Program Science Project Descriptions

Project Number: **21110853**

Project Title: Pigeon Guillemot Restoration Research in Prince William Sound

Primary Investigator(s): Kathy Kuletz, Robb Kaler, David Irons

PI Affiliation: USFWS **Project Manager:** USFWS

EVOSTC Funding Requested FY17-21: $530,700

FY17	FY18	FY19	FY20	FY21
Auth: $149,800	Auth: $173,400	Auth: $69,500*	Auth: $69,500*	$68,500*

Requests include 9% GA. *Includes USDA-FS request for ~$17K annually for permit fees. FY21 budget request reduced by $1K due to combining two surveys into one.

Funding From Non-EVOSTC Sources FY 17-21: $713,000

First line is from National Fish and Wildlife Foundation Grant, Second line is USFWS in-kind support

FY17	FY18	FY19	FY20	FY21
$215,600	$215,600	$0	$0	$0
$98,000	$98,000	$28,600	$28,600	$28,600

Total Past EVOSTC Funding Authorized (FY07-20): $2,608,200

Total EVOSTC Funding Authorized (FY07-20) and Requested (FY21): $2,676,700

Total Non-EVOSTC Funding (FY07-21): $2,420,300

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/17/20, budget updated 8/17/20.*

Historically, the Naked Island Group had the largest breeding population of pigeon guillemot (*Cepphus columba*) in Prince William Sound (PWS), Alaska, but it declined over 90% after the 1989 *Exxon Valdez* Oil Spill. Following the effects of the oil spill, predation of adults and their nests by introduced American mink (*Neovison vison*) was the primary factor limiting population recovery. During a 5-year pigeon guillemot restoration project, which included mink removal from guillemot nesting areas, counts of pigeon guillemots at Peak, Naked and Story islands have more than doubled from 2014-2018 (69 to 167 individuals) and numbers of nests increased more than four times (11 to 51 nests). In 2019, we began a second 5-year monitoring effort (2019-2023) at the Naked Island Group. Our objectives were to: (i) search for evidence of mink in guillemot breeding areas, (ii) monitor the recovery of pigeon guillemots, and (iii) monitor relative food availability, using black-legged kittiwakes (*Rissa tridactyla*) *as* indicators.

Overall, our 2020 effort to continue monitoring the population recovery of pigeon guillemots at the Naked Island Group was highly successful. No mink were recorded visiting bait stations and no mink tracks were observed at the 10 high-use areas identified during previous intensive trapping efforts. Guillemot population counts were conducted in early June and numbers of guillemots continued to increase at the Naked Island Group. Nest counts of black-legged kittiwakes were conducted and

while results are pending, initial impressions are 2020 is a "poor" year for fish availability in PWS. Together, these data will inform future management actions by determining if mink are absent from the islands, measure the rate of recovery of pigeon guillemots following the removal of mink, and provide an indicator for productivity patterns of ocean conditions to help interpret pigeon guillemot population trends.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

Table 1 on page 3 shows an increase in PIGU on Naked and Storey Island but not Peak Island. Do the PIs have ideas on why Peak is behaving differently than Naked and Storey?

PI Response (10.2.20)

We thank the Science Panel and Science Director for their contributions towards improving the project. Regarding the first question (i) why have the PIGU on Peak not increased as they have on Storey and Naked? We do not have a definitive answer. Based on the distribution maps for guillemot surveys since 2017 (which were not included in the FY21 Work Plan) it appears that locations on the east and west ends of Storey Island, and the eastern portion of Naked Island, have increased disproportionately compared to the majority of nesting areas on Storey, Naked, and Peak islands. These few "nesting hot spots" may be driving the high number of adults observed recently. Historically, Peak Island never had nesting 'hot spots' like those at Storey and Naked Islands; this pattern may be related to cliff types (nest site quality) or close access to more protected bays for foraging at Storey and Naked islands. A future project could examine the quality of nesting and nearby foraging habitat with respect to colony growth rates in different regions of the three islands.

The PIs noted that a single count of kittiwakes is insufficient and must be increased to two counts in FY22 and FY23 which raised three questions: 1) why not make two counts in FY21 also, 2) are data from previous years of single counts not usable, and 3) why was this not known before commencing the project?

PI Response (10.2.20)

1) *We proposed to make two counts in FY 21, but this was not clear in the Work Plan text. The proposed FY21 budget includes the two count (June and August) method.*

2) *We proposed the one count method in 2019, but were able to use remaining funds from a National Fish and Wildlife Foundation grant, which has since ended, to conduct two counts in 2019. As a result, 2020 was the first year using the single count method. As explained below, the data for many of the August colony counts appears comparable, but for several large colonies (>250 nests), it may not be representative of the June counts and thus not comparable to the long-term data.*

3) *The Prince William Sound (PWS) kittiwake colony monitoring project was initiated in 1985; nests were counted in June and young were counted in August. At that time, we also counted nests in August to compare with June numbers. The results were mixed, with more variability in the August counts. While the August nest counts were useful, we decided that the two-count method in June*

and August provided a better measure of kittiwake productivity. In 2019, when the PWS kittiwake colony monitoring work was included with the PIGU restoration project as an index to overall food availability, we decided that a single kittiwake count may be sufficient to determine overall productivity. However, in 2020, the first year of the single count, there was much predation at several large colonies early in the season. All the production was lost and the nests deteriorated, making them difficult to count. These predation events increased the variability in the kittiwake nest counts. Therefore, should that happen again, the two-count method provides more reliable data on kittiwake productivity.

Science Director Comments – FY21

Date: September 2020

This direct restoration project continues to be successful. PIs are completing milestones and tasks on time. I am pleased to see a manuscript was submitted to a peer-reviewed journal. The FY21 budget request decreased by $1K because the PIs will be able to combine the PIGU May/June survey and retrieving mink cameras into one trip instead of two; and flexibility in being able to select a period of optimal weather will also reduce the number of days necessary to complete the surveys. The FY22 and FY23 budget requests increased because of the additional survey time needed for the relative food availability study to ensure data are comparable with the 35 years of historical data and to include a 3% increase to adjust for increased annual costs (such as fuel) which were not included in the original project proposal. These requests are reasonable and justified. The annual ~3% adjustment results in the budget in FY22 and FY23 to increase $1K each year. The total requested increase for the FY22 budget is for $9.6K. The total requested increase for the FY23 budget is for $10.8K. I concur with the Science Panel.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

The Science Panel finds the results exciting and are expecting that the PIs will work in the coming year toward publication of the results of the mink eradication and at least preliminary results of the pigeon guillemot response. The data are compelling and support the authors' conclusions.

PI Response (9.25.19): Thank you for your comments. We also find the results exciting and we are working on a publication that will summarize the mink removal in pigeon guillemot nesting areas and

the results of the pigeon guillemot recovery to date. We hope to submit a paper by January 2020 if not sooner.

This has been a very successful active restoration project with an exponential increase of the population of pigeon guillemots on the Naked Island group from 69 birds in 2014 to 183 birds in 2019. This number is still far below the estimated pre-spill population of more than 2000 nesting guillemots at the Naked Island group and pigeon guillemots are still listed as not recovered in the spill area. Continuing this project for the next four years will allow us to monitor populations of pigeon guillemots in the absence of mink predation, and if the guillemot numbers start to decrease, then we have the opportunity to analyze what other factors may be affecting their recovery. This project also collects food availability data concurrently. Several other studies are collecting data on other population levels of species such as herring (various components of the Herring Research and Monitoring Program (HRM), humpback whales (J. Moran), killer whales (C. Matkin), and other marine birds in PWS (Kaler and Kuletz, Marine Bird Surveys; M. Bishop fall and winter seabird abundance). Environmental data such as sea surface temperature, zooplankton abundance, and currents in PWS are also being collected by components of the HRM and the Environmental Drivers component; these can all be used to determine which factors may be affecting changes in the population of guillemots.

In addition to pigeon guillemots, other bird species are beginning to benefit from the lack of mink predation at the Naked Island group. Dusky Canada geese, which declined on the Copper River Delta after the 1964 earthquake and are a species of concern for the ADF&G and the USFS, were at the highest level recorded in 2019. Tufted and horned puffins and parakeet auklets, while previously uncommon in PWS, are increasing in numbers which is important to tourism. A new black-legged kittiwake colony recently formed on Naked Island. We anticipate that arctic terns and black oystercatchers, once common on these islands, will also increase nesting efforts.

This project also continues the breeding black-legged kittiwake time series data which spans 36 years in PWS and include population trends and reproductive success. One of the main prey items for black-legged kittiwakes in PWS are juvenile herring and previous studies have shown that population trends and reproductive success track the availability of juvenile herring. Maintaining data collection for this time series was recently (2018) added to the PIGU project. The black-legged kittiwake time series have since been incorporated into a synthesis manuscript for Gulf Watch Alaska. Preliminary results show a response similar to other piscivorous predators to the decline in herring and the marine heatwave in the GOA. Inclusion of the black-legged kittiwake time series to synthesis efforts of EVOSTC programs (HRM and GWA) expands our understanding of ecosystem-wide impacts from depressed herring populations to multiyear marine heatwave in the GOA.

Science Director Comments – FY20

Date: September 2019

This project completed the first year of continued monitoring of population recovery at the Naked Island group following five years of mink removal efforts. No mink were detected in FY19. Numbers of guillemots continued to increase at the Naked Island group, up from 69 in 2014 to 185 in 2019. This project exemplifies positive results from direct seabird restoration efforts. Results from this project will be used in the next status TC report on injured resources. Productivity of black-legged kittiwakes was also monitored for the first time as part of this project as a proxy for seabird food availability. In the FY19 proposal, it is noted that kittiwakes have been monitored in PWS for 35 years and unpublished data have been used to classify years in terms of food availability (i.e., good,

moderate, and poor) for seabirds in PWS. Given that this is such an important long-term data set, this may be a good opportunity for collaboration with other program projects to investigate how kittiwake food availability and productivity responded to environmental changes over several decades, and to perturbations such as the marine heatwave in 2014-2016. I concur with the Science Panel's comments.

PI Response (9.25.19): The breeding black-legged kittiwake time series data spans 36 years in PWS and include population trends and reproductive success. One of the main prey items for black-legged kittiwakes in PWS are juvenile herring and previous studies have shown that population trends and reproductive success track the availability of juvenile herring. Maintaining data collection for the black-legged kittiwake time series was recently (FY18) added to the PIGU project. This long-term data set is incorporated in one of the four synthesis manuscripts being produced by the Council-funded Gulf Watch Alaska program. Preliminary results show a similar response as other piscivorous predators to the decline in herring and the marine heatwave in the GOA. Inclusion of the black-legged kittiwake time series to synthesis efforts of EVOSTC programs (HRM and GWA) expands the scope of understanding ecosystem wide impacts from depressed herring populations and a continued marine heatwave in the GOA. We look forward to further collaboration with Gulf Watch in the future.

PAC Comments – 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 – FY20

Date: October 2019

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

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY19

Date: September 2018

The Science Panel greatly appreciates the detailed responses by the PI to the Science Coordinator's questions. We acknowledge the importance of this follow-up project and determining if and when the mink might return. This information will add to what we already know about fox predation on seabirds. Furthermore, the utility of this method of culling mink improves our ability to conserve and restore pigeon guillemots and other ground-nesting seabirds. We continue to be impressed with the results of the first five years of this project, one of the few in which active restoration was observed in a surprisingly short amount of time. We also recognize that it will not cost much more to conduct the black-legged kittiwake monitoring ($7.5K) and believe this would cost-effectively add forage fish availability information to this project and knowledge of seabird ecology in PWS.

Science Coordinator Comments – FY19

Date: September 2018

Determining if mink are truly absent from the islands is important but also when or if mink might return and what numbers will the start having an effect on PIGU populations again. Furthermore, I was gratified to hear the strong PAC support for this project, including the BLKI monitoring at the PAC meeting. I have several questions for the PIs:

PIs propose to search for evidence in mink in PIGU breeding areas through 3 years of winter/spring monitoring using bait stations, camera traps and track surveys focused on 10 previously high-density mink areas to determine the need for continued management of mink. Is this sufficient compared to monitoring 70% of the coastline? How will mink movement be accounted for?

PI Response 9.6.18
We trapped for two months each year for five years at the Naked Island group and found 11 areas (10 accessible) with 2 Km or less shoreline where 5 to 10 mink were trapped. During our 5-year effort, 68% (72 of 106) of mink were caught in these 11 areas, from which we interpret that these areas provide preferred habitat. Further support for our interpretation includes the ADF&G American Mink info page (http://www.adfg.alaska.gov/index.cfm?adfg=americanmink.printerfriendly) which reports mink are found in close association with water, preferring saltwater beaches, riparian habitats of lakeshores, marshes, and stream banks, with coastal mink selecting shallow vegetated slopes and tidal slopes with protection from wave action. As much of the Naked Island group coastline is composed of steep cliffs with little riparian, marshes or streambank habitat, focusing our efforts on the 10 proposed areas is a reasonable approach. Additionally, based on patterns observed from our trapping efforts, once a male mink was removed from a territory, another male quickly moved in. Many of the females were also captured in these high mink density areas. If mink remain at the Naked Island group, or if new mink arrive (highly unlikely; please see additional comments below under PIGU population model question), we surmise that they would select territories in preferred habitats, which are these 11 areas. We feel that our plan is sufficient to capture evidence of mink coming into the pigeon guillemot nesting areas. Based on the patterns observed during pre-mink trapping using bait stations and cameras, as well as patterns of movements of males as fewer females were present during the trapping effort, we are confident that our approach using bait stations, cameras, and track surveys will detect mink if they are present.

PIs propose to monitor relative food availability by conducting BLKI productivity surveys for 5 years and using productivity as an index for food availability. PIs also state that "the forage fish project (Arimitsu and Piatt; 19120114-C) and Middleton Island seabird research led by Dr. Scott Hatch (Institute for Seabird Research and Conservation) will provide background on forage fish availability in the northern Gulf of Alaska and PWS region." Isn't this sufficient for providing information on forage fish availability?

PI Response 9.6.18
Obtaining PWS-wide forage fish population/biomass estimate was not feasible given the funding available so Drs. Yumi Arimitsu and John Piatt's forage fish project shifted directions for 2017-2021 to integrate directly with the humpback whale study (Moran and Straley, Gulf Watch Project 1912011-O). The forage fish monitoring now focuses survey efforts during the fall (September/October) and at areas with high densities of fall whale observations (Montague Strait, Bainbridge Passage, Bligh Island). Owing to these different sampling times (July versus late September/early October), we are not confident the forage fish study will provide sufficient information during the July PIGU chick rearing period. Regarding BLKI monitoring at Middleton Island led by Dr. Scott Hatch (Institute for

Seabird Research and Conservation), we agree it will provide background on forage fish availability in the northern Gulf of Alaska, but Middleton Island is 100 Km from Hinchinbrook Entrance and most kittiwakes from Middleton do not forage in PWS during the chick rearing period.

I appreciate the leveraging of other data and equipment from the GWA projects and using a less costly method of BLKI productivity monitoring as a proxy but I'm concerned that this may not be appropriate or as useful as we would like it to be. The PI's rational is that there is 35 years of data that shows strong evidence that BLKI productivity in PWS is directly linked to food availability and provides good indices of "good", "moderate", and "poor" years regarding food availability for seabirds in PWS. BLKI do well when sand lance, herring and capelin are present, previous studies also show that PIGU have higher nesting success when the same lipid-rich forage fish are available.

The assumption is that high BLKI productivity = good food availability for PIGU. And BLKI are coastal and offshore pelagic foragers? And PIGU typically forage in nearshore benthic environments (Golet et al. 2002). They eat sand lance, herring and smelt but also demersal fish such as gadid, sculpins, and blennies. Are BLKI an appropriate indicator of food availability for PIGU?

PI Response 8.6.18
As you mentioned, PIGUs have higher nesting success with lipid rich forage fish are available, as do BLKI. BLKI are the only indicator available, they are not perfect but they would add information to help interpret the PIGU population trends.

How would the BLKI productivity monitoring be used to interpret PIGU observations?
So, if PIGU populations on Naked Island group continue to increase and BLKI productivity is high, then you would infer that this increase is due to the absence of mink and good food availability?

PI Response 8.6.18
Yes

But if what if BLKI productivity is low? Then the increase in PIGU populations would be due to only the absence of mink? And this would indicate that PIGU are finding enough to eat but something different than BLKI?

PI Response 8.6.18
If BLKI productivity is low and PIGU populations increase, there are two reasons regarding food: (i) Since the PIGU population is very low compared to carrying capacity it takes less total food to be successful and will change as the PIGU population increases; (ii) The PIGU can and do feed on demersal fish, but as has been pointed out, they can do better when high-lipid forage fish are abundant. There is another scenario that may happen, which is of concern. The PIGU remain stable (like 2018) or decline. If we have the BLKI data and they are doing well, then we suspect it is not a food issue, but something else. If the BLKI are doing poorly, then we might suggest the reason for the PIGU not increasing despite being well below carrying capacity is lack of food. We think this scenario is a strong reason to monitor the BLKI, especially since the PIGU did not go up this year.

PIGU Population Model: this addresses the SP's comments from 2017 (see Science Panel comments – from FY18). Question – can mink emigrate from other areas? Does this need to be taken into account in the model?

PI Response 9.6.18
We believe it is highly unlikely that mink will immigrate to the Naked Island group. While mink are native to mainland PWS and inhabit other larger islands in PWS (e.g., Knight, Hinchinbrook, Hawkins, Bainbridge, Latouche, and Elrington islands) they never swam to the Naked Island group, Smith Islands, Seal Island, or Montague Island. Looking at a map of PWS one observes that all these islands are in the middle of PWS several miles from other islands and the mainland. In 1951 the USFWS gave ADF&G money to introduce mink to Montague Island to increase trapping opportunity in PWS. The origin of mink to the Naked Island group followed two fox farms at the island group that were active from about 1900 to 1940. Following the end of fox farming on the islands, a family homesteaded and continue to have an in-holding and house on Peak Island. In the 1970s, one of the family's sons living in Cordova decided he wanted to trap mink at the Naked Island group and started live-trapping mink from other islands, taking one or two a year out to the island group. The mink population did not increase quickly so the son continued to release mink for about 10 years. After extensive trapping in PWS we know that the first mink caught in an area is likely to be a male, because males travel more defending their territory. We suspect that the son kept catching males and brought them to the Naked Island group and finally he caught a female. By 1998 the mink population had increased enough that there was 60% PIGU nest predation. We trapped 106 mink off the island so the population level was likely about 100. We expect that they increased from a few to about 100 in about 15 years. Given this evidence we do not feel is it necessary to include immigration or emigration into the population models.

PAC Comments– FY19

Date: September 2018

The PAC recognized the excellent results from this project, with one member stating that PIGU have been observed in PWS in higher numbers. Several PAC members also strongly supported the kittiwake monitoring as these seabirds have not been doing well either.

Executive Director Comments – FY19

Date: September 2018

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY18

Date: September 2017

The Panel approves of the additional funding requested for a full field season to remove all mink from 70% of the shoreline where PIGU nested or currently nest. Again, the panel is very pleased with how quickly the population is increasing. As noted in past work plans, unless expanded trapping is permitted, the observed success will likely be temporary. A subsequent increase in the mink population resulting from only a partial eradication will probably, again, decimate the PIGU population over time. As noted in last year's work plan, population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions regarding predator controls.

Science Coordinator Comments – FY18

Date: September 2017

I concur with the Science Panel's comments.

PAC Comments– FY18

Date: September 2017

There are no project specific comments.

Executive Director Comments – FY18

Date: September 2017

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee.

FY17 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

FY17 Funding Recommendations:

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Science Panel Comments – FY17

Date: September 2016

We have no additional comments for this project.

Science Panel Comments – FY17

Date: May 2016

This project has continued to demonstrate marked progress toward the recovery of a historically important PIGU nesting site on Naked Island and the Panel is supportive of continued funding. The Panel has noted in past work plans that, unless expanded trapping is permitted, this success may only be temporary with mink remaining in other areas of the island. Ultimately, lacking a program to fully eradicate mink from this island, redistribution of a rebounding mink population would be expected to once again cause a PIGU population decline over the long term. Population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions regarding predator controls.

Science Coordinator Comments – FY17

Date: May and September 2016

I concur with the Science Panel's comments.

Executive Director Comments – FY17

Date: September 2016

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY17

Date: September 2016

The PAC meeting was Sept. 22, 2016 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

FY16 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund	Fund	Fund	Fund

Science Panel Comments – FY16

Date: September 2015

Trapping of mink to promote restoration of pigeon guillemots is already a remarkable success story, well ahead of expected time frames for recovery. The project is well along to remove all mink from PIGU nesting sites, and a positive PIGU population response has already been observed. Documentation of population trends of predator and prey over the full 5-year course of this project will make for an excellent case study. However, over the long term, the question is whether this success will be temporary or sustained, given that mink remain on other parts of the islands. The PIs have made estimates of PIGU population doubling times as a result of mink eradication from nesting sites. Additionally, it would be informative to estimate mink population trends in the absence of an ongoing trapping program after the conclusion of this project. Ultimately, lacking a program to fully eradicate mink from these islands, redistribution of a rebounding mink population would be expected to once again cause a PIGU population decline over the long term. Population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions about predator controls.

Science Coordinator, Executive Director Comments – FY16

Date: September 2015

I concur with the Science Panel's comments.

Public Advisory Committee Comments – FY16

Date: September 2015

There are no project specific comments.

Project Number: **21200127**

Project Title: Gulf Watch Ocean Acidification Sampling

Primary Investigator(s): Jeff Hetrick, Rob Campbell, Steve Baird, Wiley Evans

PI Affiliation: Alutiiq Pride Shellfish Facility, PWSSC, KBNERR, Hakai Institute

Project Manager: NOAA

EVOSTC Funding Requested FY17-21: $68,600

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	Auth: $34,300	$34,300

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY17-20): $34,300

Total EVOSTC Funding Authorized (FY07-20) and Requested (FY21): $68,600

Total Non-EVOSTC Funding (FY17-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/17/20, budget updated 8/17/20.*

The Chugach Regional Resources Commission (CRRC) operates the Alutiiq Pride Shellfish Hatchery (APSH) and the Alaska Ocean Acidification Laboratory in Seward, Alaska. This project would incorporate ocean acidification sampling into the Gulf Watch Program currently funded by *Exxon Valdez* Oil Spill (EVOS) Trustee Council (TC). The Gulf Watch program, through its routine sampling, would add the collection of ocean acidification samples to several of its sampling sites. This would add to the current data set from these sites and offer a broader understanding of ocean acidification in the Prince William Sound and Lower Cook Inlet. The Prince William Sound Science Center (PWSCC) and the Kachemak Bay National Estuarine Research Reserve (KBNERR) are current partners in the Gulf Watch program and routinely conduct marine (vessel) sampling transects on a time series. The cost to sample and process ocean acidification samples ($34,323 per year) would be the only additional cost to the PWSCC and KBNERR existing programs and would go directly to CRRC.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
Fund with Reservation	Fund	Fund	Fund	Fund

Science Panel Comments – FY21

Date: September 2020

The Science Panel has reservations/concerns about this proposal. The proposal is not well prepared and raises more questions than it answers. The SP re-examined last year's proposal that provided more information. If this project were to continue in the next Invitation, the methods need to be described in sufficient detail. The project should indicate how it integrates with the Alaska Ocean Acidification Network (AOAN) administered by the Alaska Ocean Observing System (AOOS). The proposal provides little information upon which to conduct a review. For instance, the current proposal lacks a description of the spatial and temporal plan, if there is one, for collecting samples and their justification. The distribution and timing of OA in Alaskan coastal waters is affected by oceanography and weather patterns. Thus, there are opportunities to sample through changes in conditions to establish the situations that lead to OA in coastal waters. Such an understanding could lead to some predictive ability about future OA events. In addition, it is important that data comply with the Data Management Program and should be easily available. Data do not appear to be available on the Alutiiq Pride Shellfish Hatchery website. Are they available through AOAN/AOOS? Despite these criticisms, the SP remains supportive of the rationale for this project. On close inspection some additional concerns were raised about the lack of clear articulation of chemical analytical methods and justification of these methods based on established, peer reviewed science (the appendix provided was insufficient). We look forward to seeing these methods clarified.

Science Director Comments – FY21

Date: September 2020

I concur with the Science Panel.

PAC Comments – FY21

Date: October 2020

The PAC meeting will be held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

I concur with the Science Panel, Science Director, and PAC.

FY20 Funding Recommendations:

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

Science Panel Comments – FY20

Date: September 2019

This project is straightforward, low-cost and important in understanding climate change. Interannual and seasonal trends may be examined. Why is BIA funding being discontinued?

PI Response (9.27.19)
The BIA funding was for a "Landscape Conservation" grant which provided funding for two years. The grant program was only available for two years. BIA has held the grant up as a template for successful projects. CRRC has chosen to fund our Community Sampling program through internal funds and our E.P.A. Indian General Assistance Program (IGAP) water quality program.

Science Director Comments – FY20

Date: September 2019

The costs are relatively low, given that the request for funding is for processing of samples and 1-month FTE director salary for oversight of the project. The PIs have extensive experience with collecting and analyzing ocean acidification data, and the Ocean Acidification and Research lab is located in the Alutiiq Shellfish Pride Hatchery (ASPH) which has been operating since 2012 and processing water samples for 12 partners throughout Alaska with results in .001% accuracy. Alaska Ocean Observing System already manages and houses data from the ASPH lab; thus the familiarity with the data will make for streamlined data management by the TC-funded Data Management Program. The PI should note that the TC-funded Data Management Program will be providing services for managing all TC-funded projects. As written, the proposal does not include when data will be posted and available online. If this project is funded, the PIs will work with the Data Management Program Team to submit data according to their timelines.

PI response (9.27.19)
All of our data from processed samples, when finalized, is available to our partners on google docs. Our continuous monitoring program is part of IPACOA which AOOS is a part of and that data is available zero time. Our discrete sampling program data is shared with our partners and they can choose to make it public if they choose. I'm sure we can accommodate any data reporting requirements from EVOSTC.

PAC Comments – 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 – FY20

Date: October 2019

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

Project Number: **21210128**

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

Primary Investigator(s): Tuula Hollmen, Elizabeth Labunski et al.

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

EVOSTC Funding Requested FY17-21: $278,600

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$278,600

Requests include 9% GA.

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

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$100,300

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

Total EVOSTC Funding Authorized (FY17-20) and Requested (FY21): $278,600

Total Non-EVOSTC Funding (FY17-21): $100,300

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 10/2/20, budget updated 8/31/20.*

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

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

population size, trends in distribution, and trends in relative abundance in the Kenai Peninsula coast study area.

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

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
NA	NA	NA	NA	Fund*

*This project proposal is the revised proposal that resulted in the integration of project proposals 20200128 and 20200130. Please see FY20 Draft Work Plan for comments for project proposals 20200128 and 20200130. Funding was approved in FY20 for the revised proposal contingent on upon the integration of proposals 20200128 and 20200130 and addressing external and agency reviewers', and Science Panel's concerns and comments as determined by the Science Director, in coordination with Trustees. Fiscal year start for this project is FY21.

Science Panel Comments – FY21

Date: September 2020

Although this proposal was funded by the Council at the February 2020 meeting, we have comments and suggestions that will help the PIs best meet their objectives.

First, the SP seeks clarification on the objectives of this project. On page 2 and 5 objectives for murrelets include estimating population size, whereas the objectives for PIGU mention relative population sizes. The SP suspects that all population size estimates are relative population size estimates as it does not appear that the PIs are extending their observations to the unobserved birds in the area. This should be clarified. Also, the SP wonders about your plan to switch sampling protocols in Kachemak Bay from the one used in all previous surveys there to a different protocol that would be used in Kenai Fjords and Resurrection Bay. Will that compromise your ability to compare your new Kachemak Bay results to those from prior years? Can you undertake a calibration of the two protocols before you switch?

The SP did not see the figures embedded in the text of the proposal (they were missing altogether) and requests that the PI embed figures within the text in the place where they are first referenced in order to facilitate review.

Science Director comments: This was an oversight on my part. I approved the request to submit the figures as an Appendix and did not ask the PIs to embed into the final proposal.

PI Response (10.2.20)
Distance sampling methods are used to estimate population size. In Resurrection Bay, distance sampling methods were not used during early years of the survey. Therefore, in any analysis that

involves those years, we will apply detection functions developed in later years to estimate abundance, or estimate trends in relative abundance. We have clarified these approaches in the proposal. For the Kachemak Bay component of this study, we modified our sampling protocols to correspond to those of the Resurrection Bay component to ensure comparable results between projects. We believe our distance sampling approach will provide a common and robust survey methodology to generate population estimates. To integrate prior survey data, we will conduct analysis using distance sampling methods, as distance data was collected in the past surveys but never used to generate population estimates. Therefore, both past and proposed survey data will be calibrated by the use of distance sampling methods to generate population, not index, estimates.

The SP understands that the "productivity" metric of ratio of hatch year to non-hatch year birds may be broadly used, yet the SP still has concerns about the way in which the PIs may be interpreting this ratio-- a high ratio may or may not be indicative of population growth for many reasons and the assumptions associated with the interpretation of these ratios need to be clearly articulated. As previously requested, the PIs elaborated on other factors that may influence the numbers of adults encountered, thereby skewing the ratio. Given all the caveats, the SP remains skeptical that the measures presented allow the PIs to accomplish objective #4 regarding measuring "productivity" and it remains unclear why then the PIs consider the HY:AHY ratio a reliable measure of productivity. The SP encourages the PIs to justify the use of HY:AHY ratio as a measure of productivity and not just because this is what has been done in the past. The SP understands that there are no estimators of productivity of these enigmatic birds. Both murrelet species are arguably the least known of the seabirds in Alaska, including in a large proportion of the Spill Area. Have the PIs given any thought to other alternative ways to measure productivity more reliably? It may be that the objective #4 needs to be reworded from "productivity" to what the ratio is actually measuring.

PI Response (10.2.20)
We have reworded Objective 4 in the Kenai Coast component to: Estimate juvenile densities and age ratios as an index of productivity. We have also clarified in the proposal that our objective is focused on estimating juvenile densities, and that in addition we will also calculate age ratios as an index of productivity relative to the local population. We acknowledge uncertainties associated with age-ratio data, and have clarified factors influencing the interpretation of this index in the revised proposal.
In the Kachemak Bay component we also have clarified our objective to focus on estimating juvenile densities and spatial variation in density (Objective 2). We will primarily use distance sampling to estimate the number and spatial variation of juvenile murrelet density (birds/km^2). This will allow to understand if there are 'hotspots' for juvenile abundance and if these areas are similar to past surveys. We also proposed to increase our systematic sampling transects to include potential murrelet 'hotspots' areas in Kachemak Bay as compared to past surveys. By adapting our survey effort to the distribution properties of juvenile murrelets in Kachemak Bay, we will improve estimates of juvenile murrelet density and better describe their habitat use.

Science Director Comments – FY21

Date: September 2020

This revised integrated proposal is much improved. The PIs adequately addressed the external reviewers' and Science Panel's comments and concerns. This project will provide critical information to assist the Council with updating the Injured Resources and Services status for murrelets and pigeon guillemots, species for which recovery objectives have not been met or recovery status is unknown. I concur with the Science Panel on their comments and suggestions.

PAC Comments – FY21

Date: October 2020
The PAC meeting will be held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020
Any specific comments will be added to the Work Plan after the PAC meeting on 13 October 2020

Habitat Enhancement Project Descriptions

Project Number: **20180119**

Project Title: ADNR/DPOR Outreach Project

Primary Investigator(s): Rys Miranda, Shawna Popvici

PI Affiliation: ADNR/DPOR **Project Manager:** EVOSTC

EVOSTC Funding Requested FY17-21: $151,700

FY17	FY18	FY19	FY20	FY21
$0	Auth: $102,600	Reauth: $102,600	$49,100	Reauth: $49,100

Requests include 9% GA.

Funding From Non-EVOSTC Sources FY 17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY17-19): $102,600

Total EVOSTC Funding Authorized (FY17-19) and Reauthorized (FY20-21): $151,700

Total Non-EVOSTC Funding FY17-21: $0

Abstract:

**This abstract is excerpted from the PI's Proposal, date 8/23/19, budget updated 8/23/19.*

The EVOS Outreach and Education project proposal is for the purpose to continue the work the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC, or the Council) has requested which includes interpretation and public outreach services within the *Exxon Valdez* oil spill area, on EVOSTC parcels, and/or on DPOR managed lands. This project will work to enhance EVOSTC's public outreach by informing and educating the public about the *Exxon Valdez* oil spill event, its lasting impacts to the State of Alaska, and its achievements to mitigate those impacts on spill-affected habitats, species, and services. Thus, new interpretive materials created will tell the story of the *Exxon Valdez* oil spill, the Council, and the habitat conservation, enhancement, and/or restoration projects that have taken place or are taking place at the identified sites. Final tasks will be identified by the EVOSTC office.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
NA	NA	Fund	Fund	Fund

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

No comments.

FY20 Funding Recommendations (February 2020):

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

FY20 Funding Recommendations (October 2019):

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

PAC Comments – FY20

Date: February 2020

No comments.

Executive Director Comments – FY20

Date: February 2020

No comments.

PAC Comments – 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 – FY20

Date: October 2019

During 2018-2019 ADNR created excellent outreach products focusing on education about the spill, highlighting the Council's restoration activities. These interpretive panels/informational kiosks, films and presentations provide helpful information about varied recreational and fishing areas that have been preserved or enhanced by the Council for public use and access.

FY19 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Not Applicable	Not Applicable	Fund	Fund	Fund

PAC Comments – FY19

Date: September 2018

The PAC feels that this project provides excellent outreach. One PAC member is especially pleased with the use of interpretive panels and the fact that they give credit to the EVOSTC for this restoration work.

Executive Director Comments – FY19

Date: September 2018

No comments.

FY18 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Not Applicable	Not Applicable	Fund	Fund	Fund

PAC Comments – FY18

Date: April 2018

No comments.

Executive Director Comments – FY18

Date: April 2018

No comments.

Project Number: **20200135**

Project Title: Kenai River Special Management Area: Eagle Rock Facility Improvements

Primary Investigator(s): Rys Miranda

PI Affiliation: ADNR **Project Manager:** ADFG

EVOSTC Funding Requested FY17-21: $6,419,000

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$6,419,000	Reauth: $6,419,000

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

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

Total EVOSTC Funding Authorized (FY07-19) and Requested (FY20-21): $6,419,000

Total Non-EVOSTC Funding (FY17-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 8/20/19, budget updated 8/20/19.*

This project will develop the Bookey Parcel to augment the existing Eagle Rock Unit of the Kenai River Special Management Area. Improvements at the Bookey Parcel seeks to improve safety and habitat. The department is committed to providing safe access to recreational opportunities at its park units. Currently, parking at the existing Eagle Rock facility is very limited compared to the demand and overflows into a ditch line at the other side of the Kenai Spur Highway. Additionally, access into the facility is through a residential neighborhood. This project will remedy those two major issues by (1) constructing a 60-stall parking facility at the Bookey Parcel, suitable for truck with trailer design vehicle, and (2) constructing an access road directly off of Kenai Spur Highway, through the Bookey Parcel, and into Eagle Rock, completely bypassing the residential neighborhood.
In addition to the safety improvements, this project will also protect habitat and improve managed access to the parcel's Kenai River frontage. Habitat protection will come in the form of elevated light-penetrating walkways and stairs to keep foot traffic off of sensitive riparian vegetation while maintaining access. Floating docks will also be constructed to help shield the riverbank from erosive boat-induced wave action. This project will benefit the injured resources Dolly Varden, Sockeye Salmon, and Pink Salmon and the injured services Recreation and Tourism.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
NA	NA	Fund	Fund	Fund

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

No comments.

FY20 Funding Recommendations:

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Not Applicable	Not Applicable	Not Reviewed	Defer to TC	Fund

PAC Comments – 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 – FY20

Date: October 2019

Defer to TC

Project Number: **21210129**

Project Title: Standardized, High-Resolution, Geospatial Wetlands and Hydrography Data Across the EVOS Region

Primary Investigator(s): Sydney Thielke

PI Affiliation: USFWS **Project Manager:** USFWS

EVOSTC Funding Requested FY17-21: $3,870,000

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$3,870,000

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY17-20): $0

Total EVOSTC Funding Authorized (FY07-20) and Requested (FY21): $3,870,000

Total Non-EVOSTC Funding (FY17-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 10/1/20, budget updated 10/1/20.*

National Wetlands Inventory and Hydrography Data Set Upgrades in the EVOS Region--Requested funding: $3.87million over three years (includes GA), with all funding requested in the first year in order to execute contracts for data creation. This proposed project would update and standardize existing National Wetlands Inventory (NWI) and National Hydrography Datasets (NHD) across the EVOS Region in digital formats that are consistent with current national NWI and NHD databases. Multiple federal agencies, including USGS, BLM, USFWS, NPS and USFS, along with the State of Alaska and the Chugach Regional Resources Commission, have been engaged on this proposal. The creation of the new data sets would be completed by one or more contractors with expertise in this type of mapping. With the exception of some NHD data created in the past few years, existing NWI and NHD data in the EVOS region are not contemporary or completely unmapped. Much of the data dates back to the 1970s and was created in analog format. The new data sets would contain up to date information on the locations of wetlands, stream hydrology and nearshore habitats and would be made available to researchers and the public upon completion. The data would also provide high-quality, standardized digital information for improved environmental monitoring, agency decision-making related to coastal and intertidal land uses and development, and the management of injured species and their habitats.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
NA	NA	Fund	Fund	Fund*

* This proposal was approved for a funding amount of $1,798,500 (includes GA) at the October 14, 2020 Council meeting.

PAC Comments – FY21

Date: October 2020

The PAC meeting was held on 13 October 2020. Any specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

Executive Director Comments – FY21

Date: October 2020

No comments.

Project Number: **21210130**

Project Title: Alaska SeaLife Center Infrastructure Proposal

Primary Investigator(s): Tara Riemer

PI Affiliation: ASLC **Project Manager:** NOAA

EVOSTC Funding Requested FY17-21: $4,296,800

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$4,296,800

Requests include 9% GA.

Funding from Non-EVOSTC Sources FY 17-21: $0

FY17	FY18	FY19	FY20	FY21
$0	$0	$0	$0	$0

Total Past EVOSTC Funding Authorized (FY17-20): $0

Total EVOSTC Funding Authorized (FY07-20) and Requested (FY21): $4,296,800

Total Non-EVOSTC Funding (FY17-21): $0

Abstract:

**This abstract is excerpted from the PI's Proposal, dated 12/9/19, budget updated 10/22/20.*

The Alaska SeaLife Center is a complex facility that relies on numerous physical and biological systems for the research and care of marine wildlife. ASLC is located directly on the powerful weather-thumping edge of Resurrection Bay, requiring a high level of owner care and management. Operating continually for more than 20 years, critical building systems and infrastructure require increasingly costly maintenance due to operating in a harsh saltwater environment and changes in building codes. Collectively, these projects represent facility improvements vital to the long-term sustainability of the ASLC. Without addressing these needs, the Alaska SeaLife Center will not be able to operate safely for animals, staff and visitors. Our visitor education programs, which translate our research to the public, have given many thousands of local people the opportunity to develop their knowledge of our area, enabling further stewardship of Alaska's marine ecosystems. But ASLC's guests are always eager to learn more, and we have now reached a critical stage in the Center's development. Continuing the success of our research, combined with interactive learning opportunities that promote our ability to educate, inform and inspire action to help conserve species and habitats requires an emphasis on repairs of indoor and outdoor aspects of the habitats, life support systems, and gathering places that make the Center a year-round community resource. Our public spaces are equally important to consider in these endeavors to increase efficiencies and safety measures, so that we may continue the variety of activities that enable the research, rehabilitation of animals, educating our community, and promoting stewardship of Alaska's marine ecosystems. Perhaps most important, expanded infrastructure will support our ability to be an

interface between researchers, communities, regulators, resource managers, students, and educators near and far to continue implementing world-class EVOS-related research and education.

FY21 Funding Recommendations:

Science Panel	Science Director	PAC	Executive Director	Trustee Council
NA	NA	NA	NA	Fund Contingent*

*This proposal was approved for a funding amount of $545,000 (includes GA) by the Trustee Council at the October 14, 2020 meeting contingent upon the PI providing proof of a 50% match within 18 months (July 1, 2022).

PAC Comments – FY21

Date: October 2020

No comments

Executive Director Comments – FY21

Date: October 2020

No comments.