

*Exxon Valdez* Oil Spill Trustee Council



DRAFT Work Plan for  
Restoration, Research and Monitoring Projects

Fiscal Year 2017

Revised September 15, 2016

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EVOSTC Restoration, Research and Monitoring Projects

Draft FY17 Work Plan

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*Exxon Valdez* Oil Spill Trustee Council

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ADOL: <http://doa.alaska.gov/dop/eeo/>

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**PLEASE COMMENT**

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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:** 4210 University Drive  
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Attn: Draft Fiscal Year 2017 Work Plan

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1-800-478-7745  
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Public comments on any drafts of the Work Plan are due to the Council office by **Monday, October 3** in advance of the Council's Nov. 3rd meeting.

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## FY17 Proposal Funding Recommendations

*The funding described in this document is for EVOSTC Restoration, Research, and Monitoring Projects. Please note that the funding amounts in this document are approximate. The Work Plan is a working document and may be revised as needed throughout the fiscal year.*

Page	Project Number	Principal Investigator	Project Title	FY17 Requested	FY17 Funding Amount Recommended				Trustee Council
					Science Panel	Science Coordinator	PAC	Executive Director	
6	17120100	EVOS Admin	EVOS Administration	\$2,138,604	Not Applicable	Not Applicable		\$2,138,604	
7	17100853	Kaler	Pigeon Guillemot Restoration Project	\$149,778	\$149,778	\$149,778			
14	15150113	O'Doherty	Kenai Peninsula Aquatic Ecosystem Restoration Project	\$2,725,000	Not Applicable	Not Applicable		\$2,725,000	
16	17170116	Miranda	ADNR/DPOR - Habitat Restoration & Protection	\$3,453,393	Not Applicable	Not Applicable		\$2,214,444	
19	17120111	Pegau	PWS Herring Program - see table on page 2	\$1,252,900	\$1,252,900	\$1,252,900			
48	17120114	Lindeberg	Long-Term Monitoring Program - see table on page 3	\$2,278,750	\$2,069,050	\$2,069,050			
84	17120113	Janzen	Data Management for Long-Term Programs	\$218,000	\$218,000	\$218,000			
88	17170117	Nixon/Michel	Lingering Oil – Monitoring & removal rate	\$265,900	\$0	\$0			
90	17170117	Whitehead	Lingering Oil – Immunological Compromise of Fish	\$217,968	\$217,968	\$217,968			
96	17170118	Quinn	Cross Program Publication: Humpback Whale/Herring in PWS	\$54,035	\$0	\$0			
<b>TOTAL REQUESTED, RECOMMENDED &amp; APPROVED</b>				<b>\$12,754,328</b>	<b>\$3,907,696</b>	<b>\$3,907,696</b>		<b>\$7,078,048</b>	

### Herring Research and Monitoring Program Projects

*The funding described in this document is for EVOSTC Restoration, Research, and Monitoring Projects. Please note that the funding amounts in this document are approximate.*

*The Work Plan is a working document and may be revised as needed throughout the fiscal year.*

***\*The total for these projects can be found above under 17120111-Pegau***

Page	Project Number	Principal Investigator	Project Title	FY17 Requested	FY17 Approved	Science Panel	Science Coord.	PAC	Executive Director	Trustee Council
24	17120111-A	Pegau	Herring Program- Coordination & Logistics	\$138,400		Fund	Fund			
27	17120111-B	Bishop	Herring Program - Annual Herring Migration Cycle	\$381,900		Fund	Fund			
30	17120111-C	Branch	Herring Program - Modeling and stock assessment	\$124,300		Fund	Fund			
34	17170111-D	Gorman	Herring Program - Reproductive Maturity among Age Cohorts	\$170,000		Fund	Fund			
37	17120111-E	Hershberger	Herring Program – Herring Disease Program II	\$197,800		Fund	Fund			
40	17120111-F	Moffitt	Herring Program – ASL Study & Aerial Milt Surveys	\$166,300		Fund	Fund			
44	17120111-G	Rand	Herring Program - Adult Pacific Herring Acoustic Surveys	\$74,200		Fund	Fund			

### Long-Term Monitoring Program Projects

*The funding described in this document is for EVOSTC Restoration, Research, and Monitoring Projects. Please note that the funding amounts in this document are approximate. The Work Plan is a working document and may be revised as needed throughout the fiscal year.*

***\*The total for these projects can be found above under 17120114-Lindeberg***

Page	Project Number	Principal Investigator	Project Title	FY17 Requested	FY17 Approved	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
51	17120114-A	Lindeberg	LTM Program - Science Coordination and Synthesis	\$226,800		Fund	Fund			
53	17120114-B	Hoffman	LTM Program - Administration	\$277,100		Fund	Fund			
55	17120114-C	Arimitsu	LTM Program - Forage Fish Distribution, Abundance, and Body Condition	\$198,800		Fund Reduced (-\$40,000)	Fund Reduced (-\$40,000)			
60	17120114-D	Batten	LTM Program - Continuous Plankton Recorders	\$76,500		Fund	Fund			
62	17120114-E	Bishop	LTM Program - Seabird Abundance in Fall and Winter	\$90,100		Fund	Fund			
65	17120114-G	Campbell	LTM Program - Oceanographic Conditions in PWS	\$218,700		Fund	Fund			
67	17120114-H	Coletti	LTM Program - Nearshore ecosystems the Gulf of AK	\$401,900		Fund	Fund			
69	17120114-I	Danielson	LTM Program - GAK1 Monitoring	\$146,800		Fund	Fund			
71	17120114-J	Doroff	LTM Program - Oceanographic Monitoring in Cook Inlet/Kachemak Bay	\$169,700		Do Not Fund	Do Not Fund			
74	17120114-L	Hopcroft	LTM Program - Seward Line Monitoring	\$132,700		Fund	Fund			



<b>Page</b>	<b>Project Number</b>	<b>Principal Investigator</b>	<b>Project Title</b>	<b>FY17 Requested</b>	<b>FY17 Approved</b>	<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
76	17120114-M	Kuletz	LTM Program - PWS Marine Bird Surveys	\$24,900		Fund	Fund			
78	17120114-N	Matkin	LTM Program -Long-term killer whale monitoring	\$152,800		Fund	Fund			
80	17120114-O	Moran	LTM Program - Humpback Whale Predation on Herring	\$161,900		Fund	Fund			

## **Project (not in a Program) Descriptions**

**Project Number:** 17120100

**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:**

<b>FY17</b>
<b>\$2,138,604</b>

**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 Protection Program
- Trustee Agency Project Management & Federal Funds Transfer
- Trustee Agency Funding
- Alaska Resources Library & Information Services (ARLIS)

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.

**FY17 Funding Recommendations:**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
Not Applicable	Not Applicable		Fund	

**Project Number:** 17100853

**Project Title:** Pigeon Guillemot Restoration Research in Prince William Sound

**Primary Investigator(s):** Robb Kaler

**PI Affiliation:** USFWS

**Project Manager:** USFWS

**EVOSTC Funding Authorized To Date: \$1,881,297**

<b>FY07-16</b>
\$1,881,297

**Additional EVOSTC Funding Requested: \$274,486**

<b>FY17</b>	<b>FY18</b>
\$149,778	\$124,708

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,155,783**

**Funding From Non-EVOSTC Sources:**

<b>FY14</b>	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>FY18</b>	<b>Total Non-EVOSTC Funding</b>
\$391,280	\$ 371,280	\$317,580	\$313,580	\$312,580	\$ 1,707,300

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 4/6/16, budget updated 8/24/16.*

This project is providing an opportunity to restore the population of Pigeon Guillemots (*Cepphus columba*) in Prince William Sound, Alaska, which had fallen by more than 90% at the Naked Island Group since 1989. A restoration plan for Pigeon Guillemots in PWS was prepared to address the species' lack of population recovery following injury by the 1989 Exxon Valdez oil spill. Predation on nests and adults by mink is now the primary limiting factor for guillemot reproductive success and population recovery at the most important historical nesting site for guillemots in PWS (i.e., the Naked Island group). Mink on the Naked Island group are descended in part from fur farm stock and arrived on the island group during the 1980s. The goal of the project is to remove all mink from the Pigeon Guillemot nesting areas and allow for recovery to occur. **FY17 is the 4th year of the 5-year project.** We trapped for the first time in the winter and spring of 2014, at which time 76 mink were killed. During the 2015 trapping season 23 mink were killed in localized areas. During the 2016 trapping season seven mink were killed. Five were trapped on Peak Island and two were trapped on Naked Island, no mink were trapped on Storey Island. While we believe few mink remain in the pigeon guillemot nesting areas, we will trap again in 2017. After 2017, we will conduct a reduced trapping effort to monitor whether mink are extirpated from the nesting areas. Counts of pigeon guillemots at Peak, Naked and Storey Islands have doubled in two years; 74 birds in 2014, 95 birds in 2015, and 155 birds in 2016! Numbers of pigeon guillemots counted at control islands did not have a similar increase. We did not expect to see this large of increase in birds this quickly. We surveyed for breeding guillemots and found the number of nests had more than tripled since 2014; 11 nests in 2014, 30 nests in 2015, and

39 nests in 2016. Colonies are starting to form with up to 8 nests in one area. Productivity during the chick stage was high, around 80%, indicating that the adults could find enough food for their chicks. This is especially good given that the black-legged kittiwakes and glaucous-winged gulls had complete reproductive failure in the Sound in 2016.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

We have no additional comments for this project.

**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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Committee Comments – FY17**

**Date:**

**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.

**FY15 Funding Recommendations:**

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

**Science Panel Comments – FY15****Date: September 2014**

The Panel notes that the proposal is strong and well written and provides a level of detail that allows for constructive review. We do note the high cost of the mink trapping effort in relation to the number culled in FY14. We are concerned about the effectiveness of the project and its ability to achieve its goals in the long term given that eradication of mink will not be allowed.

**Science Coordinator, PAC, Executive Director Comments – FY15****Date: September and October 2014**

We concur with the Science Panel.

**FY14 Funding Recommendations:**

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

**Science Panel Comments – FY14****Date: September 2013**

The panel recommends funding of this proposal. The panel notes that the proposal is strong and well-written and provides a level of detail that allows for constructive review. The panel does acknowledge that culling could be a temporary or on-going solution and a “money sink,” if continued into future years and that it is a substantial commitment to fund and monitor over time. However, it is active restoration, which is rare among submitted proposals, and it is an interesting scientific experiment.

**Science Coordinator Comments – FY14****Date: September 2013**

I concur with the science panel regarding the scientific merit of the proposal. I also echo the concerns of the Panel this is likely a temporary solution and a full cull would be needed to increase the population by the numbers cited in the proposal. Dr. Irons stated in his final report for Phase 1 of this project (Page 12):

*“... because even a single mink can devastate a guillemot colony (U.S. Fish and Wildlife, unpubl. data), culling is unlikely to significantly reduce the level of guillemot nest predation or facilitate population recovery.”*

Has something changed since the report was accepted that a limited cull would now be considered useful? I also have several questions regarding the design of the project including: If the number of birds increases, are there any plans to determine if the increase was from the predator removal or other factors? The plan includes monitoring the population on Smith Island as a control which is currently mink-free. However, there is no monitoring plan discussed in the proposal. Will Smith Island be surveyed at the same time and frequency as Naked Island? The proposal states that ADFG is only willing to consider a limited cull at this time. If a complete removal is found to be necessary, would a permit to complete this work be possible or denied due to the mixed genetic stock of the mink on the Island?

At this time, I feel that the Council should postpone a funding decision until a final Environmental Assessment is provided by the PI and the question above regarding the limited cull is answered.

**Public Advisory Committee – FY14****Date: October 2013**

The October 2013 PAC meeting was cancelled due to the federal government shutdown. Abstracts were submitted to the PAC; no individual comments were received.

**Executive Director Comments – FY14****Date: September 2013**

I concur with the Science Panel and support the concerns of the Science Coordinator. Due to the

prospect of matching funds if this proposal is funded at this time and the opportunity for active restoration, I recommend funding, conditioned upon completion of the EA to the satisfaction of EVOSTC Executive Director and the coordinating agencies (USFWS, APHIS, ADFG, USFS).

**FY12 FUNDING RECOMMENDATIONS**

Date	Science Panel	Science Coordinator	PAC	Executive Director
June/July 2011	Fund	No consensus	No comments	No consensus

**Science Panel Comments – FY12**

**Date: June 2011**

This proposal has been previously submitted to the EVOS Trustee Council and reviewed by the Science Panel.

Support for the work was strong among the Science Panel members. One concern that arose pertained to the question of whether the mink found today on Naked and nearby Islands in the Naked group are descendants of the animals introduced artificially or whether these are fully native mink with an intact natural genome. That question has now been answered with DNA analysis revealing a mixed genome, not reflecting a pure native stock. This answer would appear to satisfy the question of whether these mink are natural (no) and to allow the extermination to move forward, if supportable scientifically by the Science Panel and Trustee staff and if politically and financially acceptable to the Trustee Council.

Here we will provide a review of the adequacy of the science. First, it is noteworthy that PIGUs are the only bird species still listed as Not Recovering after EVOS. Second, the importance of Naked Island and its potential recovery to this species is evident – the Naked Island group held about 25% of the PIGU population in PWS prior to the spill despite representing only 2 % of the PWS shoreline. Third, the inference that mink represent the impediment to PIGU recovery on Naked is strong, based especially on comparison Smith Island where mink are absent and PIGU survival is good. Fourth, the contention that strong recovery of PIGUs on Naked would lead to spread and re-colonization of other suitable sites in PWS is a reasonable expectation, so restoration on Naked pays a wider dividend of recovery elsewhere in PWS. Fifth, we know that the introduced foxes are now gone from Naked so that isn't the problem. Sixth, the alternatives analysis is compelling in showing that no other restoration option would work and that eradication is the only solution. For example, providing more of the now reduced lipid-rich prey would be useless, resulting in feeding mink better not in enhancing PIGU survival and abundance. Culling would be a half-step and require costly intervention forever, and thus can be rejected as a viable restoration option. Seventh, elimination of predatory mammals on islands is a well-established practice to enhance ground-nesting seabirds and other birds. Consequently, this proposal makes good sense scientifically and addresses an ongoing restoration failure of importance. The only questions involve the costs and the potential use of dogs, if trapping fails to get every last mink in the eradication process. The costs are 2.4 Million or 1.3 Million if a National Wildlife Foundation match is obtained. We concur that these cost estimates are reasonable because a 3-5 year time frame is needed to complete the removal. So while high, the expenditures are likely justified. The use of dogs in the removal of mink seems to possibly conflict with animal rights as an



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unacceptably cruel practice.

**Science Coordinator Comments – FY12**

**Date: June 2011**

This proposal is scientifically compelling and builds on four years of work focused on this topic. While the idea of a direct restoration project is appealing, I am concerned that the total project cost is very high in relation to the total number of nests that they project will be added to the island complex.

**Public Advisory Committee Comments – FY12**

**Date: July 2011**

No project specific comments.

**Executive Director Comments – FY12**

**Date: July 2011**

I do not have a recommendation for this project. The project is very compelling because it potentially provides active restoration for an injured species. However, the high cost and speculation regarding the long-term outcome needs to be weighed carefully by the Council.

**FY07 FUNDING RECOMMENDATIONS**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>
Fund reduced	Not reviewed	Not reviewed	Fund reduced

**Science Panel Comments – FY07**

**Date: Fall 2006**

This proposal investigates the efficacy of direct restoration techniques for the pigeon guillemot population in PWS. They will genetically sample mink that reside on Naked Island Archipelago to determine if the population was introduced or native and make recommendations for a recovery plan for pigeon guillemots based on the findings. Pigeon guillemots are one of two non-recovered species and this project represents one of the few restoration based proposals that have been submitted. The genetic sampling of mink and studies examining the relative contribution of mink vs. other predators to pigeon guillemot survival and reproduction are important in evaluating mink removals as a potential restoration activity. However, there is some concern that removal of mink may not be an appropriate restoration activity if the mink are in fact native. Also, food limitation studies may be difficult to interpret with respect to restoration and are perhaps premature. Mink removal may still prove an effective restoration tool even if food quality is poor. Furthermore, given the likely annual variation in food supply, a lack of food in one year may not be a reasonable predictor of future food limitation. We recommend funding the initial year of this proposal and suggest that efforts be made to provide genetic evidence on mink at the end of that year so that reasoned decisions can be made regarding future funding.

**Science Coordinator Comments – FY07****Date: Fall 2006**

The Science Director is on a long-term detail from the FWS and must therefore, recuse herself from making recommendations on FWS proposals. The PI on this proposal is employed by the FWS.

**Public Advisory Committee – FY07****Date: Fall 2006**

Not Reviewed.

**Executive Director Comments – FY07****Date: April 2006**

Salaries and logistics are the major expenses of this proposal. Assuming mink predation on pigeon guillemots, any direct restoration will likely involve controlling the mink population on Naked Island. Before this can be undertaken a determination must be made whether the mink population is indigenous or introduced. Therefore, I only recommend funding the minimum mink capture and genetic testing program necessary to determine where the population is indigenous or introduced. I further recommend local trappers and logistics be utilized in this effort to reduce expense.

**Project Number:** 15150123  
**Project Title:** Kenai Peninsula Aquatic Ecosystem Restoration Project  
**Primary Investigator(s):** Gillian O’Doherty  
**PI Affiliation:** ADFG                      **Project Manager:** ADFG

**EVOSTC Funding Requested: \$8,175,000**

<b>FY15-17</b>
<b>\$8,175,000</b>

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$8,175,000**

**Funding From Non-EVOSTC Sources:**

**Non-EVOSTC Funding for this project is \$3 for every \$1 of EVOSTC investment.**

**Abstract:**

**The Council authorized the full suite of these multi-year projects in March 2015 for \$8.175 (includes GA). As anticipated at that time, a re-authorization of any remaining funds (\$2.725 with GA) remains to complete the projects.**

The Kenai Peninsula Aquatic Ecosystem Restoration Project was funded in 2015 by the Council to help restore physical and biological processes within the Kasilof and Anchor River Watersheds in order to contribute to a productive and biologically diverse ecosystem for the benefit of injured species and services. The project eliminates four barriers to aquatic species passage on the Anchor and Kasilof Rivers and improve access to an estimated 115 miles of important spawning, rearing and migratory habitats which includes the parcels previously acquired with EVOSTC funding.

As noted in March 2015 when the Council approved funding, these are multi-year projects with anticipated Council re-authorization as necessary. Of the original Council authorization, \$5.450 million has been released. The remaining \$2.725 million (includes GA) for the Nikolaevsk Road Barrier and Two Moose Creek projects are included in the Council’s review for re-authorization. Construction is currently expected to be completed ahead of the initially proposed schedule, approved by the Council in March 2015, and all funds are expected to be released during this re-authorization period.

This project is managed by the Alaska Department of Fish and Game, in collaboration with AKDOT, USFWS, NOAA, ADOT, Kenai Watershed Forum and other organizations involved on the project team.

**For information on the individual projects and updates on the current work, please see the full proposals in your meeting materials.**

**FY17 Funding Recommendations:**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
Not Applicable	Not Applicable		Fund	

**Science Panel Comments – FY17**

**Date:**

Not applicable

**Science Coordinator Comments – FY17**

**Date:**

Not applicable

**Executive Director Comments – FY17**

**Date: September 2016**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Committee Comments – FY17**

**Date:**

**Project Number:** 17170116

**Project Title:** ADNR/DPOR Riverbed Habitat Restoration & Protection

**Primary Investigator(s):** Rys Miranda

**PI Affiliation:** ADNR **Project Manager:** ADNR

**EVOSTC Funding Requested: \$3,453,393**

FY17	FY18	FY19	FY20	FY21
\$3,453,393	\$0	\$0	\$0	\$0

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$1,600,000	\$0	\$0	\$0	\$0	\$1,600,000

**Abstract:**

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

The Department of Natural Resources, Division of Parks and Outdoor Recreation (DNR-DPOR) is submitting six projects for funding under the Exxon Valdez Oil Spill (EVOS) Restoration Program. Listed in order of descending priority, the six projects are:

1. Kenai River Special Management Area (KRSMA): Kenai River Flats Riverbank Protection, Phase I – Total project cost: \$1,436,650 | Total recommended by ED for funding (with GA): \$327,000
2. KRSMA: Eagle Rock Riverbank Protection – Total project cost \$410,450 | Total recommended by ED for funding (with GA): \$447,391
3. Crooked Creek State Recreation Site Riverbank Restoration– Total project cost \$445,900 | Total recommended by ED for funding (with GA): \$486,031
4. KRSMA: Kenai River Ranch Riverbank Restoration – Total project cost \$166,200 | Total recommended by ED for funding (with GA): \$181,158
5. KRSMA: Pipeline Crossing Riverbank Restoration – Total project cost \$282,450 | Total recommended by ED for funding (with GA): \$307,871
6. Anchor River State Recreation Area Riverbank Protection – Total project cost \$426,600 | Total recommended by ED for funding (with GA): \$464,994

These six projects address fish habitat restoration and protection of spill area ecosystems that support numerous species affected by EVOS. The primary goal of each project is to restore fish habitats that have been adversely impacted by human activity and to provide continuing habitat protection into the future. These projects restore and protect fish habitats that have been and continue to be adversely

impacted by human activities and will limit future access so that those restored areas will be protected while still accommodating human activities, such as recreational use. These projects are very similar in character, scope, and objective as the previous EVOSTC- funded project "Kenai River Habitat Restoration and Recreational Enhancement Project" (Restoration Project 96180/99180), which was performed during the late 1990s. Additionally, these projects are also aligned with DNR-DPOR management documents or development plans such as the Kenai River Comprehensive Management Plan.

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date:**

Not applicable

**Science Coordinator Comments – FY17**

**Date:**

Not applicable

**Executive Director Comments – FY17**

**Date: September 2016**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Committee Comments – FY17**

**Date:**

**Herring Research and  
Monitoring Program Project Descriptions**

**Project Number:** 17120111

**Project Title:** Herring Research and Monitoring Program

**Primary Investigator(s):** W. Scott Pegau

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

**EVOSTC Funding Authorized To Date: \$6,328,343**

FY12-16	FY12-16 Non-EVOSTC Funding
\$6,328,343	\$154,731

**Additional EVOSTC Funding Requested: \$6,022,300**

FY17	FY18	FY19	FY20	FY21
\$1,252,900	\$1,390,800	\$1,292,700	\$1,215,100	\$870,800

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$12,350,643**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$157,200	\$159,700	\$160,700	\$162,700	\$149,700	\$790,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16.*  
This proposal addresses the Herring Research and Monitoring section of the EVOSTC FY17-21 Invitation for Proposals.  
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.

We are proposing a program made up of eight projects; Modeling and Stock Assessment of Prince William Sound Herring; Surveys and Age, Sex, and Size Collection and Processing; Adult Pacific Herring Acoustic Surveys; Juvenile Pacific Herring Aerial Surveys; Herring Disease Program; Studies of Reproductive Maturity among Age Cohorts of Pacific Herring; Annual Herring Migration Cycle; HRM Coordination; and Remote, Non-invasive Target Discrimination of Herring of Various Age-classes.

Through these projects we expect to address areas of interest numbers 2, 3, 4, 5, 6, 7, and 9 outlined within the herring research and monitoring section of the invitation for proposals. The modeling



project and a postdoctoral fellow in the coordination project are envisioned as two integrating projects that use data and information from all of the others. The postdoc will also work with the Gulf Watch Alaska and Data Management programs. The primary beneficiaries of our efforts are expected to be Alaska Department of Fish and Game and Prince William Sound herring fishermen.

Dr. Pegau will serve as the program lead to ensure the proper coordination within the program, with other EVOS-funded programs, and as a point person for communications with the EVOSTC. An independent scientific oversight group exists that will provide feedback on the program.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund Reduced	Fund Reduced			
Sept 2016	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 PDF position may provide some assistance in this regard.

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**

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**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:**

**Public Advisory Committee Comments – FY17**

**Date:**

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**Trustee Council Comments – FY17**

**Date:**

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**Project Number:** 17120111-A

**Project Title:** Herring Program – Program Coordination

**Primary Investigator(s):** Scott Pegau

**PI Affiliation:** PWSSC

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$1,940,113**

<b>FY12-16</b>	<b>Non-EVOSTC Funding FY12-16</b>
\$1,940,113	\$111,700

**Additional EVOSTC Funding Requested: \$1,039,400**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$138,400</b>	\$270,200	\$284,100	\$256,100	\$90,700

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,979,513**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$26,000</b>	\$26,600	\$27,200	\$28,000	\$28,300	\$136,100

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16.*

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 to analyze the relationships between herring stocks 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.*

The proposed approach follows that used during the Prince William Sound Herring Survey and initial HRM programs. Coordination will primarily be through e-mail and teleconference. The management team of GWA and the lead of DM will be included in the emails to HRM PIs to ensure they are aware of our activities. We also plan joint PI meetings and community involvement activities.

The postdoctoral researcher will be recruited in year one and has an expected duration of slightly over two years. The focus area of the research is to overlap with the activities of both HRM and GWA

programs.

Outreach efforts will be focused on providing up-to-date information on the projects and their findings. Community involvement includes regular communications with stakeholders, such as the herring division of the Cordova District Fishermen United and Alaska Department of Fish and Game to stay aware of their findings and observations. We also are planning listening sessions in two of the villages to seek additional local and traditional ecological knowledge.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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 work load 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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17160111-B

**Project Title:** Herring Program - Annual Herring Migration Cycle

**Primary Investigator(s):** Mary Anne Bishop

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

**EVOSTC Funding Authorized To Date: \$272,600**

<b>FY16</b>
\$272,600

**Additional EVOSTC Funding Requested: \$1,231,000**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$381,900</b>	\$379,500	\$268,300	\$201,400	\$0

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,503,600**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$415,000</b>	\$415,000	\$415,000	\$415,000	\$0	\$1,660,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16*

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 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 if herring were seasonally leaving PWS and migrating into the GoA. With funding from EVOS in FY16, we will improve our ability to detect movements between PWS and the GoA by deploying additional acoustic receivers at the Ocean Tracking Network 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 Gulf of Alaska. For this project, we will tag 125 herring in FY17 at Port Gravina in northeast PWS. For FY18 and FY19, we will expand our efforts to two tagging sites, Port Gravina and Montague Island, tagging a total of 210 herring each year.



**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

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

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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 Seebis 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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120111-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 Authorized To Date: \$427,083**

<b>FY12-16</b>
\$427,083

**Additional EVOSTC Funding Requested: \$673,200**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$124,300</b>	\$124,800	\$135,300	\$139,900	\$673,200

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,099,183**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16.*

Prince William Sound (PWS) herring collapsed shortly after the Exxon Valdez oil spill, and has yet to recover. Here, we proposed a 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, with the following key products:

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 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.
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.
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.
4. An initial exploration of factors that may be used to predict herring recruitment, including oceanography, climate, competition, and predation.
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.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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.*

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17170111-D

**Project Title:** Herring Program - Studies of Reproductive Maturity among Age Cohorts of Pacific Herring in Prince William Sound, Alaska

**Primary Investigator(s):** Kristen Gorman

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

**EVOSTC Funding Authorized To Date: \$0**

<b>FY12-16</b>
\$0

**Additional EVOSTC Funding Requested: \$850,000**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$170,000</b>	\$172,000	\$165,100	\$169,600	\$173,300

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$850,000**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16.*

To address the lack of recovery of Pacific herring (*Clupea pallasii*) in Prince William Sound (PWS), Alaska, research by the Herring Research and Monitoring (HRM) Program has been focused on improving predictive models of PWS herring stocks through observations and research. To this end, the goal of the project described here is to improve the HRM program's updated (Bayesian) PWS herring Age-Structured Assessment model's ability to more accurately predict the total population's biomass by empirically assessing reproductive maturity among age cohorts. Currently, the age at maturity function in the ASA model is not based on empirical data. An improved understanding of age at maturity will allow for more accurate estimates of the total population biomass, which is central to the management of this fishery. The objectives of the studies proposed here are fourfold: 1) assess the seasonal timing (spring, summer, and fall) that allows for accurate determination of both previously spawned and maturing female herring based on ovary histology to determine maturation states; 2) couple histology results with annual scale growth information at the individual level, within specific age cohorts, to understand if scale growth patterns reflect reproductive investment; 3) assess whether annual scale growth patterns can be used to infer age at maturity at the individual level across age cohorts given results from objectives 1 and 2, and 4) assess inter-annual variability in age at maturity based on coupled histology and scale growth over a five-year period by focused, increased sampling during the optimal seasonal period given results from objectives 1-3. The proposed approach will advance preliminary worked conducted previously by HRM investigators by testing the appropriate

sampling time of wild PWS herring for ovary characteristics, as opposed to lab-based studies, and increasing sample sizes for more powerful analyses. Studies proposed here address a key demographic parameter, therefore, this research will not only contribute to the management of PWS herring, but also to a more general understanding of herring demography. As world-wide herring populations encounter more variable environmental conditions in the future, basic knowledge of herring demography and ecology will be invaluable.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

We appreciate that the PI responded thoroughly to Panel comments and felt that the responses dealt effectively with some of our concerns. The proposal, and responses to questions made in the Panel review, made good use of the international scientific literature. We recognize a dilemma faced by this PI, however, that is trying attempting to build on results of past EVOSTC-funded work (by other PI’s in earlier projects), that do not yet have accessible reports.

**Date: May 2016**

The four objectives are:

- (1) assess the seasonal timing (spring, summer, and fall) that allows for accurate determination of both previously spawned and maturing female herring based on ovary histology to determine maturation states;
- (2) couple histology results with annual scale growth information at the individual level, within specific age cohorts, to understand if scale growth patterns reflect reproductive investment;
- (3) assess whether annual scale growth patterns can be used to infer age at maturity at the individual level across age cohorts given results from objectives 1 and 2; and
- (4) assess inter-annual variability in age at maturity based on coupled histology and scale growth over a five-year period by focused, increased sampling during the optimal seasonal period given results from objectives 1-3.

This is an ambitious project and the Panel endorses the intentions of the proposed work, but not necessarily all of the details. First, and most importantly, the Panel strongly endorses the objective of determining an ‘empirical’ estimate of ‘age-at-maturity’. It is widely recognized that spawning herring often show spatial and temporal segregation during spawning, with larger, older fish spawning early and smaller, younger fish spawning later. This is well documented for herring and for many other spring-spawning fish species. Ignoring this, by assuming that the age structure of samples taken



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during spawning represents the population at large can lead to serious errors in age-structured assessments. Therefore to the extent that this proposal recognized that issue, the Panel is strongly supportive. To this end the Panel recommends the measurement of gonad size, and the estimation of a gonosomatic index, as the basis for estimating maturity of individuals. Collection of size data will also allow estimation of size-at-maturity, which may be important, as well.

The Panel also reiterates comments made on the age-structured model here about the likelihood that there is temporal and spatial structuring of herring with respect to size- and age-at-maturity. Estimation of age-at-maturity should keep such temporal and spatial structuring in mind when considering sampling protocols and data analysis.

Objectives 2-4 of this proposal are concerned with herring scales and the assumption that growth increments (or some other feature of scales) can provide a meaningful estimate of the age-of-maturation of a herring. If this were possible, the Panel agrees that such a measure would be useful, providing the criteria were rigorous and repeatable. However, the Panel has several concerns. One is that this proposal makes no mention of similar work that was recently conducted, and supported by the EVOSTC, by NOAA staff. Namely, is there evidence that this approach will work? This comment applies especially to the proposed study on scales, as potential indicators of age-of-maturity, and ovarian histology objectives. Insufficient information was provided to allow the Panel to evaluate the chances for success of this portion of the proposal. It is essential that this proposal shows that the proposed work will build on existing results and knowledge. Absent some basis for this approach, the Panel is rather dubious of the chances for its success. The second concern is that there are a number of publications on herring and clupeid maturation, and criteria used for assessing maturation. The revised proposal should make it clear that the PI is aware of this work, and when appropriate, build on the existing knowledge base. Finally, the Panel does not understand why this work is proposed for five years. It should not require more than a year, or two, to evaluate the utility of scales as indicators of past maturity. The proposal should be revised accordingly.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17**

**Date:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120111-E

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

**Primary Investigator(s):** Paul Hershberger

**PI Affiliation:** USGS

**Project Manager:** USGS

**EVOSTC Funding Authorized To Date: \$1,999,882**

FY07-11	FY12-16
\$1,128,100	\$871,782

**Additional EVOSTC Funding Requested: \$1,059,800**

FY17	FY18	FY19	FY20	FY21
\$197,800	\$204,400	\$212,200	\$218,800	\$226,600

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$3,059,682**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$61,700	\$63,600	\$64,000	\$65,200	\$66,900	\$321,400

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/12/16.*

Using an approach that involves a combination of field- and laboratory-based studies, we propose to investigate fish health factors that may be contributing to the failed recovery of Pacific herring populations in Prince William Sound. Field studies will provide infection and disease prevalence data that will inform the ASA model, serological data that will indicate the prior exposure history and future susceptibility of herring to VHS, and diet information that will provide insights into the unusually high prevalence of *Ichthyophonus* that occurs in juvenile herring from Cordova Harbor. Laboratory studies will validate the newly-developed plaque neutralization assay as a quantifiable measure of herd immunity, provide further understanding of disease cofactors including temperature and salinity, investigate the possibility of an invertebrate host for *Ichthyophonus*, and assess the virulence of other endemic pathogens to Pacific herring. Information from the field and laboratory studies will be integrated into the current ASA model, a novel ASA-type model that is based on the immune status of herring age cohorts, and a novel mixture-cure simulation model for VHS. The Herring Disease Program (HDP) is embedded within the Herring Research and Monitoring Program, and the success of the HDP relies heavily on contributions from companion projects with Principle Investigators including Steve Moffitt (platform for the collection of pathogen prevalence data), Dr. Kristen Gorman (collection of juvenile Pacific herring from Cordova Harbor), Dr. Trevor Branch (incorporation of pathogen and resistance information in to the ASA models). Additionally, this project relies on contributions from Principle Investigators in the Long Term Monitoring Program (Dr. Rob Campbell – zooplankton collections).

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

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

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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™ 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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17160111-F

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

**Primary Investigator(s):** Steve Moffitt

**PI Affiliation:** ADFG

**Project Manager:** ADFG

**EVOSTC Funding Authorized To Date: \$60,000**

<b>FY16</b>
\$60,000

**Additional EVOSTC Funding Requested: \$831,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$166,300</b>	\$166,300	\$166,300	\$166,300	\$166,300

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$891,500**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$54,000</b>	\$54,000	\$54,000	\$54,000	\$54,000	\$270,000

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/12/16.*

This proposed project will conduct 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. This proposed project will also provide a research platform (R/V Solstice) for an adult herring acoustics survey and disease sample collection and processing. Finally, this proposed project will collect 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 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 will be help to 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.

**FY17 Funding Recommendations:**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
Fund	Fund			

**FY17 Funding Recommendations:**

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

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**



**Project Number:** 17120111-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 Authorized To Date: \$333,976**

<b>FY12-16</b>
\$333,976

**Additional EVOSTC Funding Requested: \$337,400**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$74,200</b>	\$73,800	\$61,300	\$63,100	\$64,900

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$671,376**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/12/16.*

We propose 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. Here we propose to continue this sampling for the next 5 years. **Our main goal for this proposed project 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.**

Prince William Sound herring stock biomass estimates from hydroacoustic surveys provide a measure of the stock abundance for use in the ASA model that is the forecasting tool used for management. Prior to 2001, the hydroacoustic surveys were conducted exclusively by the Prince William Sound Science Center (PWSSC). Since 2001, the effort has been shared between PWSSC and the Cordova office of Alaska Department of Fish and Game (ADF&G). While the ADF&G considers the hydroacoustic surveys to be critical (Steve Moffitt, pers. comm.) the lack of a commercial herring fishery in PWS since 1998 has reduced management priorities for herring. Thus the PWSSC contribution has become critically important for the long-term, especially if a future fishery appears only a remote possibility. With the level of effort available over the past several years, PWSSC and ADF&G individually have achieved herring biomass estimates with a precision of about ±30%. 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 accurate estimates of the total herring spawning biomass in PWS and provide an alert to changes in biomass in these two different regions. Beginning in FY2017 and continuing through 2021, hydroacoustic surveys will be conducted in spring (March-April) to assess adult spawning biomass. This project will use the ADF&G data from direct sampling for age, sex and length in the estimates of biomass. The estimate will then be provided to the modeling project.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

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

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Long-Term Monitoring Program  
Project Descriptions**

**Project Number:** 17120114

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

**Primary Investigator(s):** Mandy Lindeberg

**PI Affiliation:** NOAA

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$13,826,625**

<b>FY12-16</b>	<b>FY12-16 Non-EVOSTC Funding</b>
\$13,826,625	\$8,985,000

**Additional EVOSTC Funding Requested: \$12,044,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$2,278,750</b>	\$2,574,930	\$2,351,230	\$2,496,920	\$2,342,680

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$25,871,125**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
\$1,671,000	\$1,712,000	\$1,658,000	\$1,677,000	\$1,622,000	\$8,340,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

This program proposal directly addresses the Exxon Valdez Oil Spill (EVOS) Trustee Council's (EVOSTC's) focus area, long-term monitoring of marine conditions and injured resources. We are proposing to continue the successful Gulf Watch Alaska (GWA) long-term monitoring program into the next 5 year period, FY 2017-21. The overarching goal of the GWA program is to continue 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. The organization of GWA includes: three monitoring components (environmental drivers, pelagic, 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 (GOA).
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

(HRM) programs, as well as other Trustee program focus areas including the data management program, lingering oil and potential cross-program publishing groups.

5. Leverage partnerships with outside agencies and groups to integrate data and expand capacity through collaborative efforts.

Highlights from the first five years of the GWA program show significant development of program infrastructure and compilation of scientific information. Internal and external program communication tools were developed, including a program workspace, intranet, website and data portal. Four (soon to be five) years of monitoring data have been collected for the northern GOA ecosystem. A three-year program synthesis report was completed and submitted to the EVOSTC along with numerous peer reviewed journal publications. Outreach highlights include three community outreach events each year, ongoing development of teaching resources for marine science such as virtual field trips, videos of scientists in the field, numerous classrooms visits, and over 200 presentations. Coordination and collaboration with the HRM program and many other research efforts has proven beneficial to all and these collaborations will continue to grow over time.

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**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

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-A

**Project Title:** LTM Program – Program Management I - Program Coordination and Science Synthesis

**Primary Investigator(s):** Mandy Lindeberg

**PI Affiliation:** NOAA

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$708,500**

<b>FY12-16</b>
\$708,500

**Additional EVOSTC Funding Requested: \$1,170,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$226,800</b>	\$227,600	\$229,000	\$237,700	\$249,300

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,872,500**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$69,000</b>	\$69,000	\$69,000	\$69,000	\$69,000	\$345,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

This project is the Program Management Component I of the integrated Long-term Monitoring of Marine Conditions and Injured Resources proposal submitted by Lindeberg et al. (2016) to the Exxon Valdez Oil Spill Trustee Council. This project explicitly provides for program coordination and science synthesis of data collected under the long-term monitoring program, which we refer to as Gulf Watch Alaska (GWA). The GWA Program Management II proposal compliments this proposal and addresses administration, logistics, and outreach. The leadership team of the GWA program (comprised of PM I and II) manage over two dozen principal investigators and collaborators producing a wealth of scientific information on the northern Gulf of Alaska ecosystem and spill-affected area. Program coordination and science synthesis is a key component that improves linkages between monitoring efforts spanning large regional areas (Prince William Sound, Gulf of Alaska shelf, lower Cook Inlet). Program coordination includes facilitating program planning and sharing of information between principal investigators, 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. The GWA program has matured in the first five years and successful management of the program will continue into the next five year increment.



**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:****Public Advisory Committee Comments – FY17****Date:****Trustee Council Comments – FY17****Date:**

**Project Number:** 17120114-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

**EVOSTC Funding Authorized To Date: \$1,418,100**

<b>FY12-16</b>
\$1,418,100

**Additional EVOSTC Funding Requested: \$1,483,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$277,100</b>	\$282,400	\$303,900	\$307,200	\$312,900

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,901,600**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

This project is the administrative and outreach component of the integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services proposal submitted by Lindeberg et al., referred to as Gulf Watch Alaska (GWA). This proposal includes: fiscal management of non-Trustee Agency sub-awards; convening and management of the Outreach Steering Committee; engagement with Exxon Valdez Oil Spill Trustee Council (EVOSTC) staff, Trustees, and Public Advisory Committee members; and travel and logistics support of the Science Review Panel, PI meetings, plus outreach and community involvement activities. The Prince William Sound Science Center (PWSSC) will serve as the fiscal agent for GWA with Hoffman as Administrative Lead. This continues our role as with GWA during FY12–16. Hoffman is also picking up the role of Outreach and Community Involvement Lead for FY17-21. As a member of the Program Management Team, PWSSC contributes to the coordination and management of over two dozen scientists generating monitoring data and synthetic information about the ecosystems and marine conditions within the spill area. PWSSC has extensive fiscal experience with NOAA, through which all non-Trustee Agency funds are distributed; with the various fiscal agents for the non-Trustee Agencies participating in GWA; and with GWA's Trustee Agency principal investigators, for whom we coordinate semi-annual reporting to the National Oceanic and Atmospheric Administration and EVOSTC. We have previously and will continue to support travel and logistics for all Science Review Panel members. PWSSC is also the proposed administrative lead agency

for the HRM program proposal. This arrangement allows for efficient fiscal management of both programs. PWSSC has relationships with members of the Outreach Steering Committee, who will guide the development of products to inform the public and managers about changes in the environment and the impact of said changes on injured resources and services.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-C

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

**Primary Investigator(s):** Mayumi Arimitsu

**PI Affiliation:** USGS

**Project Manager:** USGS

**EVOSTC Funding Authorized To Date: \$967,600**

<b>FY12-16</b>
\$967,600

**Additional EVOSTC Funding Requested: \$1,106,400**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$198,800</b>	\$229,800	\$221,300	\$224,500	\$232,000

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,074,200**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$256,000</b>	\$256,000	\$256,000	\$256,000	\$256,000	\$1,280,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

*New Direction for Forage Fish Studies:* The forage fish proposal will change directions in 2017-2021: we will integrate directly with the humpback whale and marine bird predation studies and apply the methods we have learned in the previous 5 years to provide estimates of forage biomass in the immediate vicinity of predator aggregations. By integrating with these projects, we will sample forage fish in the same locations and times, thus providing valuable prey information for two pelagic predator groups of key value to EVOSTC, governmental and nongovernmental groups and the public while obtaining trend information for our forage fish monitoring program. Obtaining sound-wide forage fish population/biomass estimates is not feasible with the resources available; funds are insufficient to adequately sample the entire area, and the key forage species in PWS differ significantly in their life histories, habitats, and ease of detection (e.g., sand lance are shallow inshore, while euphausiids are usually deep and off shore), making defensible sound-wide holistic estimations impractical. For this reason, the proposed work focuses on smaller geographical areas within Prince William Sound (PWS) and takes advantage of known persistent predator aggregations to locate prey that can then be well monitored over time within reasonable financial resources. Additionally, using predators as samplers of forage fish can provide an important index of changes in prey species composition over time. Thus we will incorporate into the Gulf Watch Alaska (GWA) Pelagic Component a long-term seabird diet data collection program as a cost-effective means to monitor forage fish stocks in the northern Gulf of Alaska.

### *Integrated Predator-Prey Surveys 2017-2021: Humpback Whales, Marine Birds, Forage Fish*

Under the next five year monitoring program, we will integrate two predator studies (Moran/Straley humpback whale and Bishop fall/winter marine birds) with the forage fish study, by operating at the same time and locations, and using the same vessels. In the past, the predator studies have attempted to opportunistically sample and identify the forage, but not quantify the forage biomass on an area/depth/volume basis. By combining logistic resources and expertise, we will identify and estimate the forage biomass at the same locations in which predators are feeding, which will provide comparable information on both predator density and prey availability (species composition, depth distribution, density and biomass). Collectively, we will use two platforms; a larger vessel to support the acoustic forage fish transects and marine bird surveys (see Bishop fall/winter marine bird proposal), and a smaller second vessel to both scout ahead looking for the predator aggregations and to photo ID the whales (see Moran and Straley humpback whale proposal). The integrated survey would be conducted during the fall, providing insight into predator-prey interactions at a crucial time when forage fish energy is maximized and while marine birds and humpback whales are provisioning for the upcoming winter.

**Forage fish component:** This proposal covers the forage fish component of the integrated study. The forage fish survey will focus on prey availability, distribution relative to the predators and geography, energy density, and water column depth using primarily hydroacoustic methods developed in the previous 5-year study. Ground truthing (sampling by fishing) is an important secondary component to confirm species identity and size for acoustic estimates of biomass, provide samples for other analyses (e.g., diet, stable isotopes, energy content), and will provide critical information on the size distribution of the forage. Experience indicates that herring and euphausiids are the primary forage in the areas of predator aggregation, although capelin, juvenile pollock and other forage species are found there as well. Net sampling and other methods will allow us to collect samples of all these species.

Survey areas will encompass the known historical locations of the feeding aggregations of predators (Figure 1), and we will also conduct adaptive sampling if predators are found in unexpected locations. Marine bird observations (see Bishop marine bird project proposal) will be recorded concurrently with acoustic transects, while humpback whale distribution and abundance will be assessed from a smaller vessel concurrently in the same area (see Moran and Straley humpback whale project proposal). The simultaneous surveys of three component projects will reduce vessel cost for overall while combining sampling efforts with spatial and temporal consistency. Combined efforts by GWA's pelagic component humpback whale, marine bird and forage fish principal investigators (PIs) will provide a more comprehensive understanding of the pelagic ecosystem and provide an integrated dataset that facilitates analyses of predator prey relationships within the sampled regions. In addition to a planned research cruise in September/October, the proposed approach may also allow for in-kind contributions from National Oceanic and Atmospheric Administration (NOAA) for vessel charter and an additional survey in March, when humpback whales are returning from their migrations to feed and when we can assess the impact of severe winter conditions on forage fish. The NOAA funds will be applied for and awarded on an annual basis, and a March NOAA cruise, if awarded, would be an added value to the GWA Pelagic monitoring program.

### *Long-term Data on Predator Diets*

Forage fish monitoring using predators as samplers is a proven and cost-effective approach in marine

ecosystem research (Hatch & Sanger 1992, Roseneau & Byrd 1997, Thayer et al. 2008). Concordance in trends of key forage species have been observed between GWA studies in PWS and seabird diet sampling at Middleton. Long-term seabird diet data from Middleton Island can provide a useful index of long-term trends in PWS. Given Middleton Island’s location near the continental shelf edge, the data obtained also reflect interannual variability in both pelagic (deep ocean) and neritic (continental shelf) habitats (Hatch 2013). Furthermore, the Middleton Island seabird diet dataset is the longest continuous dataset on forage fish in the region. Since the project is no longer directly supported by the U.S. Geological Survey after the retirement of the lead PI (i.e., Scott Hatch, Institute for Seabird Research and Conservation [ISRC]) future funding for the program is highly uncertain. Therefore, we propose to support the field effort required to continue this important dataset within the GWA forage fish monitoring program.

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**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 Long-Term Monitoring 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:**

#### **Public Advisory Committee Comments – FY17**

**Date:**

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**Trustee Council Comments – FY17**

**Date:**



**Project Number:** 17120114-D

**Project Title:** LTM Program - Continuous Plankton Recorders

**Primary Investigator(s):** Sonia Batten

**PI Affiliation:** SAHFOS

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$1,283,700**

FY02-FY11	FY12-16
\$984,300	\$299,400

**Additional EVOSTC Funding Requested: \$400,800**

FY17	FY18	FY19	FY20	FY21
\$76,500	\$78,800	\$81,200	\$78,200	\$86,100

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,684,500**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$183,700	\$183,900	\$186,300	\$188,300	\$190,300	\$932,500

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

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 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. Recent results show that interannual variability in plankton dynamics is high and plankton responded clearly and rapidly to the recent warm conditions, with changes evident in abundance, composition and timing.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

<b>Date</b>	<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-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 Authorized To Date: \$380,900**

<b>FY12-16</b>
\$380,900

**Additional EVOSTC Funding Requested: \$478,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$90,100</b>	\$92,700	\$95,700	\$98,600	\$101,300

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$859,500**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$53,000</b>	\$53,000	\$53,000	\$53,000	\$53,000	\$265,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

The fall-winter marine bird surveys will continue to build upon the previous years of monitoring marine bird abundance and habitat associations (2007-2016), but will be upgraded by means of further integration with companion studies of humpback monitoring and forage fish assessments of prey availability. All three components will share logistics, sample timing, and location of sampling and monitoring. Of the marine birds that overwinter in Prince William Sound (PWS), nine species were initially injured by the Exxon Valdez oil spill, including three species that have not yet recovered or their recovery is unknown (pigeon guillemot, marbled murrelet, and Kittlitz's murrelet). Fall through winter are critical periods for survival as food tends to be relatively scarce or inaccessible, the climate more extreme, light levels and day length reduced, and water temperatures colder. By monitoring marine birds during fall and winter we will improve our predictive models of species abundance and distribution across PWS in relation to biological and physical environmental factors. Furthermore, continued monitoring will help determine marine bird vulnerability to future perturbations and environmental change, including oil spills. Our long-term monitoring has shown that the nonbreeding season cannot be characterized as a single time period when describing marine bird distribution and suggests that multiple surveys are required to quantify wintering populations and understand changes in marine bird distribution. The project utilizes established U.S. Fish and Wildlife Service survey protocols adapted for GPS-integrated data entry. Surveys are conducted onboard research vessels already conducting oceanographic, fisheries, or marine mammal surveys, thereby increasing

opportunities for cross-project collaboration and reducing project costs. For 2017-2021 we have identified four cruises a year for marine bird surveys: Gulf Watch Alaska Pelagic Integrated Predator Prey Surveys (September/October, March- funding dependent), Alaska Department of Fish and Game spot shrimp survey (October), and PWS Science Center Ocean Tracking Network maintenance cruise (February). Our participation in the Gulf Watch Alaska Pelagic Integrated Predator Prey Surveys will allow us to identify and estimate the forage biomass at the same locations in which marine birds and humpback whales are feeding, which will provide comparable information on both predator density and prey availability.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

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**Trustee Council Comments – FY17**

**Date:**

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**Project Number:** 17120114-G

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

**Primary Investigator(s):** Robert Campbell

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

**EVOSTC Funding Authorized To Date: \$1,041,600**

<b>FY12-16</b>
\$1,041,600

**Additional EVOSTC Funding Requested: \$1,142,300**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$218,700</b>	\$223,400	\$228,300	\$233,300	\$238,500

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,183,900**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$300,000</b>	\$300,000	\$275,000	\$275,000	\$275,000	\$1,425,000

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/24/16.*

This project will continue physical and biological measurements that may be used to assess trends in the marine environment and bottom-up impacts on the marine ecosystems of Prince William Sound (PWS). Regular (~6 per year) vessel 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: in central PWS, at the entrances (Hinchinbrook Entrance and Montague Strait), and at four priority bays that were part of the Exxon Valdez Oil Spill Trustee Council- (EVOSTC)-funded Sound Ecosystem Assessment (SEA) project in the 90’s and the ongoing Herring Research and Monitoring project.

Additionally, an autonomous profiling mooring will be deployed each year in central Prince William Sound to provide high frequency (~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-development in situ plankton camera will also enumerate zooplankton, large phytoplankton and other particles, with some taxonomic discrimination.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-H

**Project Title:** LTM Program –Nearshore Ecosystems in the Gulf of Alaska

**Primary Investigator(s):** Heather Coletti

**PI Affiliation:** NPS

**Project Manager:** USGS

**EVOSTC Funding Authorized To Date: \$1,559,905**

<b>FY12-16</b>
\$1,559,905

**Additional EVOSTC Funding Requested: \$2,071,000**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$401,900</b>	\$452,700	\$411,400	\$401,200	\$402,800

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$3,630,905**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$410,000</b>	\$410,000	\$410,000	\$392,000	\$392,000	\$2,014,000

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/24/16.*

Nearshore monitoring in the Gulf of Alaska (GOA) provides ongoing evaluation of the status and trend of more than 200 species, including many of those recovering from the 1989 Exxon Valdez oil spill (EVOS). The monitoring design includes spatial, temporal and ecological features that support inference regarding drivers of change through testing of alternative hypotheses. Examples of the application of the monitoring design include assessment of change in sea otter populations related to EVOS recovery and density dependent factors; and assessment of the relative roles of static versus dynamic drivers in structuring benthic communities. Continued monitoring will allow for a better understanding of variation in the nearshore ecosystems across the GOA and a more thorough evaluation of the status of spill injured resources. This information will be critical for anticipating and responding to ongoing and future perturbations in the region, as well as providing for global contrast.

**FY17 Funding Recommendations:**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
Fund	Fund			



**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:****Public Advisory Committee Comments – FY17****Date:****Trustee Council Comments – FY17****Date:**

**Project Number:** 17120114-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 Authorized To Date: \$524,200**

<b>FY12-16</b>
\$524,200

**Additional EVOSTC Funding Requested: \$680,800**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$146,800</b>	\$148,400	\$132,600	\$125,600	\$127,400

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,205,000**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

This program continues a 45-year time series of temperature and salinity measurements at hydrographic station GAK-1. The data set, which began in 1970, now consists of quasi-monthly conductivity-temperature versus depth (CTD) 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, inter-annual 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
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 (GOA), including Prince William Sound (PWS). We are aware of 69 publications utilizing data collected at station GAK-1 and since 2000 the citation list has grown by nearly three publications per year. GAK-1

data are cited within at least eight student Masters theses and Doctoral dissertations, peer-reviewed papers, and both State of Alaska and federal agency reports. The topics covered by these publications range from physical oceanography and climate through lower- and upper-trophic (including commercial fisheries) level components and ecosystem analyses.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-J

**Project Title:** LTM Program – Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay

**Primary Investigator(s):** Angela Doroff

**PI Affiliation:** UAF

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$778,300**

<b>FY12-16</b>
\$778,300

**Additional EVOSTC Funding Requested: \$796,500**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$169,700</b>	\$174,400	\$183,400	\$135,700	\$133,300

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,574,800**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$205,000</b>	\$213,000	\$215,000	\$217,000	\$194,000	\$1,044,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

The lower Cook Inlet/Kachemak Bay (CIKB) oceanographic monitoring project, in conjunction with other Gulf Watch Alaska (GWA) Environmental Drivers (ED) projects, assesses the effects of oceanographic variability on nearshore and pelagic species injured by the *Exxon Valdez* Oil Spill. We currently have oceanographic data from a 6-year time-series within CIKB and 15-year record of continuous nearshore water quality station observations in Kachemak Bay. Oceanographic monitoring in this area is important because variables important to biological production change at different time and space scales, including water temperature, stratification, fresh water runoff, the strength and position of the Alaska Coastal Current, regional modes of climate variability and nutrient conditions (changes within season, seasonally, and inter-annually). During the first five years of cross-program synthesis in the ED group, we began to quantify the spatial and temporal trends and variability in oceanographic conditions for CIKB, Prince William Sound (PWS) and the Gulf of Alaska shelf; we found that temporal patterns are quasi-synchronous at longer time scales overall but asynchronous at shorter times and finer space scales in the estuary. Based on FY12-16 observations (and to refine coordination with other GWA projects) we propose to increase sampling frequency along the estuary gradient and add nutrient monitoring in the eastern portion of our study area, with an associated reduction in spatial coverage across Cook Inlet. Ship-based oceanographic surveys are proposed monthly, seasonally, and annually in CIKB, with conductivity-temperature-depth casts (including fluorescence, turbidity, and dissolved oxygen), phytoplankton, and zooplankton collected along

repeated transects. These data will be augmented with continuous oceanographic measurements recorded at Kachemak Bay National Estuarine Research Reserve oceanographic stations in Seldovia harbor, Homer harbor, and at a Bear Cove mooring. This proposal fills data gaps in the monitoring not currently being met by ED monitoring of the Seward Line (spring/fall only) or the Continuous Plankton Recorder (April-October) in the northern part of the Gulf of Alaska and will provide context for shorter time scales of variability relevant to ecosystem-level monitoring in GWA. By sampling in both estuaries (PWS and CIKB), we strengthen the ability of the GWA program to evaluate local (within estuary) and remote (shelf, North Pacific) climate forcing effects on nearshore ecosystems.

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Do Not Fund	Do Not Fund			
Sept 2016	Do Not Fund	Do Not 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 murre, 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

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-L

**Project Title:** LTM Program – Seward Line Monitoring

**Primary Investigator(s):** Russell Hopcroft

**PI Affiliation:** UAF

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$470,200**

<b>FY12-16</b>
\$470,200

**Additional EVOSTC Funding Requested: \$697,900**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$132,700</b>	\$136,100	\$139,500	\$143,000	\$146,600

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,168,100**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$297,000</b>	\$311,000	\$314,800	\$319,000	\$323,500	\$1,565,300

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/24/16.*

Long times-series are required for scientists to tease out pattern and causation in the presence of substantial year-to-year variability. For the 5 year period beginning in 2017, we propose continued 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.

**FY17 Funding Recommendations:**

<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
Fund	Fund			

**FY17 Funding Recommendations:**

<b>Date</b>	<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**



**Project Number:** 17120114-M

**Project Title:** LTM Program –PWS Marine Bird Population Trends

**Primary Investigator(s):** Kathy Kuletz

**PI Affiliation:** USFWS

**Project Manager:** USFWS

**EVOSTC Funding Authorized To Date: \$681,700**

<b>FY12-16</b>
\$681,700

**Additional EVOSTC Funding Requested: \$519,100**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$24,900</b>	\$222,200	\$24,900	\$222,200	\$24,900

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$ 1,200,800**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$23,000</b>	\$56,000	\$23,000	\$56,000	\$22,000	\$180,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

We propose to conduct small boat-based surveys to monitor abundance of marine birds in Prince William Sound (PWS), Alaska, during July 2018 and July 2020. Historical data include fourteen surveys spanning 1989 to 2014 (a fifteenth survey will be conducted in July 2016) and have been used to monitor population trends for marine birds in PWS following the 1989 Exxon Valdez oil spill (EVOS). Continued long-term monitoring of marine birds in PWS and synthesis of the data are needed to determine recovery of marine bird populations injured by the spill, as well as evaluate the possible effects of climate variability and climate change on these populations. Data collected from 1989 to 2014 indicated that pigeon guillemots (*Cepphus columba*) and Brachyramphus murrelets had declined in the oiled areas of PWS. Furthermore, declines were observed of offshore-associated plantivorous and piscivorous genera of marine birds suggesting that changes have likely occurred in the pelagic food webs of PWS. Continuation of boat-based marine bird surveys in PWS will (i) build upon an important data set for long-term monitoring of population recovery of marine bird species following the EVOS, and (ii) provide managers and researchers with a tool to track impacts of climate variability and climate change on important groups of marine predators. Marine bird surveys compliment the benthic monitoring and forage fish monitoring aspects (including Middleton Island proposed project) of the Long-term Monitoring Project by providing a population trend index useful for interpreting marine ecosystem patterns observed in PWS.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:****Public Advisory Committee Comments – FY17****Date:****Trustee Council Comments – FY17****Date:**

**Project Number:** 17120114-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 Authorized To Date: \$536,100**

<b>FY12-16</b>
\$536,100

**Additional EVOSTC Funding Requested: \$725,900**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$152,800</b>	\$151,300	\$142,100	\$140,300	\$139,500

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,262,000**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$25,000</b>	\$25,000	\$25,000	\$25,000	\$25,000	\$125,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

The proposed project is a continuation of the photo-identification based long term killer whale monitoring program that was initiated in 1984 in Prince William Sound (PWS). 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 groups of whales suffered serious losses at the time of the oil spill and have not recovered at projected rates. Monitoring of all the major pods and their population dynamics, feeding ecology, movements, range, and contaminant levels will help determine their vulnerability to future perturbations and environmental change, including oil spills. The project uses various techniques, as possible and in addition to the core photoidentification monitoring and annual skin and biopsy sampling. These include observations of predation and sampling of prey, remote acoustic monitoring to identify important habitat and seasonal use patterns, time depth tags to investigate feeding ecology, and photographic drones to examine morphometrics, relocating whales for feeding studies. It continues examination of feeding habits prey sampling coupled with innovative chemical techniques. The study will continue to monitor delineate and monitor important habitat and variations in pod specific use patterns using observation as well as non-invasive remote acoustic monitoring. We will continue to examine the role of both fish eating and mammal eating killer whales in the near-shore ecosystem and their interaction with prey species. Community based initiatives, educational programs, and programs for tour boat operators will continue to be integrated into the work to help foster restoration by improving public understanding and reducing harassment of the whales.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17120114-O

**Project Title:** LTM Program – Long-term monitoring of humpback whale predation on Pacific herring in Prince William Sound

**Primary Investigator(s):** John Moran

**PI Affiliation:** NOAA

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$591,800**

<b>FY12-16</b>
\$591,800

**Additional EVOSTC Funding Requested: \$777,400**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$161,900</b>	\$155,000	\$157,900	\$154,900	\$147,600

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,369,200**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$146,000</b>	\$146,000	\$146,000	\$146,000	\$146,000	\$730,000

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/24/16.*

**INTEGRATED PREDATOR-PREY SURVEYS 2017-2021: HUMPBACK WHALES, MARINE BIRDS, FORAGE FISH**

Under the next five year monitoring program, we are proposing to integrate predator-prey survey efforts by combining monitoring work from three of the Prince William Sound (PWS) Pelagic Component projects and collaborating with the Herring Research and Monitoring program. We propose to combine the humpback whale, marine bird and forage fish (including euphausiids) projects into a single, integrated predator-prey survey. The integrated survey would be conducted during the fall, providing insight into predator-prey interactions at a crucial time when forage fish energy is maximized while marine birds and humpback whales are provisioning for the upcoming winter. In addition, the survey would estimate the availability, including species composition, density and depth distribution of prey near seasonally predictable predator aggregations in PWS. The survey would include concurrent habitat and nutrient measurements in conjunction with acoustic measurements of nekton biomass and predator density. A midwater trawl (max depth ~ 100 m) will be used to sample acoustic sign and collect samples of forage fish for further analysis (e.g., diet, energy). Marine bird observations will be conducted concurrent with acoustic transects and humpback whale distribution and abundance will be assessed at the same time and area from a smaller vessel. The simultaneous surveys will reduce vessel cost for the three projects while combining expertise with spatial and temporal consistency, allowing a more comprehensive understanding of the pelagic ecosystem. In

addition to a planned research cruise in September/October, the proposed approach may also allow for in-kind contributions from National Oceanic and Atmospheric Administration (NOAA) for vessel charter and an additional survey in March, when humpback whales are returning from their migrations to feed and when we can assess the winter severity on forage fish. The NOAA funds will be applied for and awarded on an annual basis, and a March NOAA cruise, if awarded a second cruise would be an added value to the GWA pelagic monitoring program.

**HUMPBACK WHALES: LONG-TERM MONITORING OF PREDATION ON PACIFIC HERRING IN PRINCE WILLIAM SOUND:**

The humpback whale monitoring project is a component of the integrated fall/winter predator-prey survey. We will continue to evaluate the impact by humpback whales foraging on Pacific herring populations in PWS. Following protocols established during the winters of 2007/08 and 2008/09 (EVOSTC project PJ090804). Prey selection by humpback whales will be determined through acoustic surveys, visual observation, scat analysis and prey sampling. Chemical analysis of skin and blubber biopsy samples will provide a longer term perspective on shifts in prey type (trophic level from stable isotopes) and quality (energy content). These data will be combined in a bioenergetic model that will allow us to assess the impact of recovering humpback whale populations on the PWS ecosystem. By integrating with the forage fish and winter seabird components, we will be able to provide a comprehensive understanding of bottom-up influences and top-down controls on herring abundance.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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:**

**Public Advisory Committee Comments – FY17**

**Date:**

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**Trustee Council Comments – FY17**

**Date:**

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**Data Management Program  
Project Descriptions**



**Project Number:** 17120113

**Project Title:** Data Management Program

**Primary Investigator(s):** Carol Janzen

**PI Affiliation:** AOOS

**Project Manager:** NOAA

**EVOSTC Funding Authorized To Date: \$1,423,642**

<b>FY12-16</b>
\$1,423,642

**Additional EVOSTC Funding Requested: \$1,089,900**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$218,000</b>	\$218,000	\$218,000	\$218,000	\$217,900

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$2,513,542**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$2,705,000</b>	\$2,786,000	\$2,869,000	\$2,955,000	\$3,044,000	\$14,359,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/05/16.*

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 last 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, but also helped inform and improve AOOS' overall data and metadata management, access, and visualization tools. Because of these past investments, the AOOS team and infrastructure are best situated to provide data services to the EVOSTC for the next five years and thus maintain continuity and build upon the ongoing efforts and data management system development. Beginning in 2017, AOOS proposes to continue providing access to these tools and services for which the principal investigators (PIs) of the GWA and HRM Programs depend. Among these, the Ocean Workspace, a web-based data management platform, 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 from the prior funded effort, and allows data to be made promptly and securely available to team members and program administrators. During the spring of 2016, the existing Ocean Workspace will be updated with an enhanced metadata editor designed to help 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. Publishing through AOOS makes the data available to a wide-ranging and established network of resource managers, scientists, and the general public to support decision-making. In addition, the GWA and HRM Program datasets will be ingested into DataONE for long-term preservation, where each dataset will be assigned a digital object identifier (DOI) and made discoverable through other DataONE nodes. Through the AOOS data management system, the significant expertise of the data management staff at 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 five-year effort. 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 to support decision-making related to Spill affected ecosystems.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
Fund	Fund			

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Fund	Fund			
Sept 2016	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 time tables.

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

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Lingering Oil  
Project Descriptions**

**Project Number:** 17170117

**Project Title:** Lingering Oil Monitoring and Removal Rate Estimation

**Primary Investigator(s):** Zachary Nixon & Jacqueline Michel

**PI Affiliation:** Research Planning      **Project Manager:** USGS

**EVOSTC Funding Requested: \$362,800**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>
<b>\$265,900</b>	\$96,900	\$0	\$0	\$0

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$362,800**

**Funding From Non-EVOSTC Sources:**

<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>Total Non-EVOSTC Funding</b>
<b>\$0</b>	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

The Exxon Valdez Oil Spill Trustee Counsel (EVOSTC) has funded a number of studies to establish a robust understanding of the locations where lingering subsurface oil (SSO) remains, the limiting factors that prevent oil from biodegrading in situ, as well as the geomorphic and hydrologic factors that control where bulk oil is protected from physical dispersion and persists in the subsurface. However, not much is known about the present rates of bulk natural removal of lingering SSO from those locations where it remains, whether those rates are different from when last estimated a decade ago, or if removal rates differ among sites and why. This proposed study seeks to rigorously monitor lingering SSO persistence, as well as estimate the current removal rate with greater specificity than has been previously attempted. Given that further significant wide-scale remediation is unlikely to occur in the future, an improved understanding of what present bulk removal rates are (26 years post spill), and what controls them, is the only way to estimate how long the remaining subsurface oil will persist in Prince William Sound (PWS) in any quantity. We propose to undertake fieldwork in the summer of 2017 to reoccupy a number of previously investigated sites with observed lingering SSO, and excavate pits in areas where oil was previously observed. This critical change as compared with previous studies will allow us to estimate bulk oil removal rates over the previous 10-15 years with much greater precision and statistical power. We will also collect a set of oiled sediment samples to fingerprint the source of the residual oil, characterize the oil residues as to their degree of weathering, and make comparisons with previous analytical chemistry results. We will lastly examine variability in annual loss rates between pits and sites and compare with the recurrence intervals of storm and other wave energy events that are geomorphically relevant to subsurface oil. If there is a relationship between bulk oil physical loss rates and post-spill frequency and recurrence interval of site-specific geomorphically relevant storm events, then we will use appropriate models to predict long-term future persistence of subsurface oil in PWS in future decades, and model how these rates vary

spatially.

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

This proposal would attempt to assess the rate of oil loss by resampling previously sampled study sites. The panel agrees that continuing periodic sampling of oil loss from the system is important, but we do not think that this proposal is the best way to achieve that objective.

We discussed this extensively and raised several concerns about the utility of the proposed research to the EVOSTC mission. We remain concerned that previous excavation likely changes loss rates relative to undisturbed areas. Hence, the applicability of estimates to loss rates of previously undisturbed areas is not clear. Furthermore, the applicability of these estimates to loss of oil from lower intertidal and subtidal areas is also not clear.

The panel acknowledges the technical competence of the investigators but was not convinced that the proposed research would contribute significantly to this goal.

**Science Coordinator Comments – FY17**

**Date: September 2016**

I concur with the Panel's comments.

**Executive Director Comments – FY17**

**Date:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Project Number:** 17170115

**Project Title:** Immunological Expressions of PAH Exposure in Fish

**Primary Investigator(s):** Andrew Whitehead

**PI Affiliation:** UC, Davis

**Project Manager:** USGS

**EVOSTC Funding Requested: \$1,630,689**

FY17	FY18	FY19	FY20	FY21
\$217,968	\$385,968	\$392,244	\$310,923	\$323,591

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,630,689**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$0	\$0	\$0	\$0	\$0	\$0

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/24/16.*

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 (EVOS) four years previous, and the emergence of disease. We test hypotheses concerning the effects of oil exposure, the effects of disease challenge, and the potential interactive effects of oil exposure and disease challenge, on herring health and fitness. Since oil is exquisitely toxic to developing fish embryos at concentrations that were experienced in PWS following the EVOS, we predict that this exposure presented a significant selective event with the side effect of impaired immune function (as evidenced by our recent studies in killifish) leaving fish susceptible to disease and subsequent decline. Alternatively, the oil spill may not have been a significant selective force, but genetic attributes of the PWS stock may have made them susceptible to disease outbreak. In either scenario (and others), we predict that the collapse resulted in significant erosion of genetic diversity in PWS fish, perhaps particularly in immune system genes, which may be limiting their recovery. We will test these predictions and hypotheses by reconstructing genome-wide genetic change through time (pre-EVOS and pre-collapse, post-EVOS soon after collapse, post-EVOS 10 years post-collapse and contemporary) in PWS fish, and compare this to population genetic change through time in a reference site population. 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.

**FY17 Funding Recommendations:**

Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
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



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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 EVOTC 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:

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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:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**

**Cross Program Publication Group  
Project Descriptions**

**Project Number:** 17170118

**Project Title:** Incorporating New Humpback Whale Data into the Herring Age-structure Stock Assessment Model in Prince William Sound

**Primary Investigator(s):** Terrance Quinn

**PI Affiliation:** UAF

**Project Manager:** NOAA

**EVOSTC Funding Requested: \$54,035**

FY17	FY18	FY19	FY20	FY21
\$54,035	\$0	\$0	\$0	\$0

*Requests include 9% GA.*

**Total EVOSTC Funding (Authorized and Requested): \$1,630,689**

**Funding From Non-EVOSTC Sources:**

FY17	FY18	FY19	FY20	FY21	Total Non-EVOSTC Funding
\$6,000	\$0	\$0	\$0	\$0	\$6,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/31/16.*

The overall goal of our Humpback-Herring Cross-Program Publication Group (CPPG) is to better understand the impact of humpback whales on limiting the recovery of Pacific herring in Prince William Sound and what are the likely trajectories of the herring population into the future at different abundances of humpback whales. The CPPG process will facilitate the progress of this study and take advantage of knowledge from two separate programs.

Our CPPG will be formed from members of the Gulf Watch Alaska (GWA) long-term monitoring program and members of the Herring Research and Monitoring (HRM) program. Members of GWA (Quinn, Moran, Straley) have collected a new time-series of whale mark-recapture data and will provide estimates of abundance. Also members of GWA have previously been involved in age-structured assessment modeling funded by EVOSTC. Members of HRM (Branch) have been involved in collecting age-structured assessment data and constructing a new Bayesian assessment model to provide better estimates of uncertainty, but this model is not yet operational. Our CPPG provides a unified way of incorporating humpback whale data into stock assessment models, and the use of two different models will provide insights through comparison of model results.

The Humpback-Herring CPPG will meet twice, once via video-conference and once at a two-day workshop in Juneau, and have continuous contact via e-mail. Two graduate students of Quinn and Branch will do analyses, run models, and present results based on approaches developed by all members of the group. The methods and results will be written into a manuscript for publication in an open-access journal, with review by members of the Group at key time-points.

The main benefit of funding our Humpback-Herring CPPG is better understanding of the role of humpback whales in limiting the recovery of the herring population in Prince William Sound,

simultaneously in comparison to other factors. This will aid EVOSTC in planning future research and monitoring necessary to understand the dynamics of Pacific herring in Prince William Sound in relation to its ecosystem.

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

The Science Panel agrees that incorporating new time-series data on humpback whales into existing herring stock assessment models to assess the extent to which humpbacks may be limiting herring recovery is a worthy goal. We also support the involvement of two graduate students in proposed work. However, the proposal is vague and does not have sufficient information to fully evaluate the planned modeling. Moreover, the key literature source is a manuscript by Teerlink et al. in prep.

The plan is presumably to decompose age-specific year-on-year survival into components, one of which represents humpback whale predation. If the modeling assumes a linear relationship with whale number (or some other measure of pod size), it will certainly be possible to project the consequences of scenarios with different humpback whale populations, conditional on the validity of the linear relationship. This is a worthwhile, though limited, aim. A more ambitious modeling effort would include exploration of effects of nonlinearities, whose importance is hinted in the “background” section of the proposal that emphasizes the variation in timing of humpback whale migration, and mentions that some whales may forego migration. For example, if migration timing is influenced by density of herring, this could enhance or weaken any regulatory effect on the herring. If the decision whether to migrate is, even partly, a response to past, or anticipated, herring density, this could potentially imply multiple steady states for the herring, a recurring theme in previous work from the HRM group and the hypothesis H1 in the draft proposal – now removed.

One aspect of the broad modeling strategy was unclear. The proposal talks about two models - the Bayesian version (BASA) and its predecessor, stating (P4) that “The use of two different models will provide insight through comparison of model results”. The biological processes modeled in each are identical, so the nature of the new insight is unclear – unless it relates to the different statistical assumptions.

The science Panel thought that the proposed work would have been best included in one of the other submitted proposals. For instance, it would have been reasonable to include the whale estimates as an additional time series in the Branch BASA modeling proposal. The proposal is not sufficiently cross-cutting and novel to be a strong contender for one of the three proposals that will ultimately receive \$50K to meet this goal.

**Science Coordinator Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date:**

**Public Advisory Committee Comments – FY17**

**Date:**

**Trustee Council Comments – FY17**

**Date:**