

*Exxon Valdez Oil Spill Trustee Council*



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

Fiscal Year 2018

*Revised October 16, 2017*

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EVOSTC Restoration, Research and Monitoring Projects

Draft FY18 Work Plan

Prepared by:

*Exxon Valdez* Oil Spill Trustee Council

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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:

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## FY18 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. Please contact the EVOSTC office if you would like exact funding amounts.*

Page	Project Number	Principal Investigator	Project Title	FY18 Requested	FY18 Funding Amount Recommended				Trustee Council
					Science Panel	Science Coordinator	PAC	Executive Director	
6	18180100	EVOSTC Admin	EVOSTC Annual Budget	\$2,261,585	Not Applicable	Not Applicable	\$2,261,585	\$2,261,585	\$
7	18100853	Kaler	Pigeon Guillemot Restoration Project	\$173,438	\$173,438	\$173,438	\$173,438	\$173,438	\$
14	17170116	Miranda	ADNR/DPOR - Habitat Restoration & Protection Reauthorization	\$327,000	Not Applicable	Not Applicable	\$327,000	\$327,000	\$
17	18120111	Pegau	PWS Herring Program - see table on page 2	\$1,578,800	\$1,578,800*	\$1,578,800*	\$1,578,800*	\$1,578,800*	\$
66	18120114	Lindeberg	Long-Term Monitoring Program – see table on page 3	\$2,574,860	\$2,574,860	\$2,574,860	\$2,574,860	\$2,574,860	\$
110	18120113	Janzen	Data Management for Long-Term Programs	\$218,000	\$218,000	\$218,000	\$218,000	\$218,000	\$
116	18170115	Whitehead	Lingering Oil – Immunological Compromise of Fish	\$492,750	\$492,750	\$492,750	\$492,750	\$492,750	\$
<b>TOTAL REQUESTED, RECOMMENDED &amp; APPROVED</b>				<b>\$7,626,433</b>	<b>\$5,037,848</b>	<b>\$5,037,848</b>	<b>\$7, 626,433</b>	<b>\$7, 626,433</b>	<b>\$</b>

*\*Indicates this review group recommends a Fund Contingent for Project #18170111-D Gorman*

### 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. Please contact the EVOSTC office if you would like exact funding amounts.*

***\*The total for these projects can be found under 18120111-Pegau on the page one chart***

Page	Project Number	Principal Investigator	Project Title	FY18 Requested	FY18 Approved	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
22	18120111-A	Pegau	Herring Program-Coordination & Logistics	\$270,200	\$	Fund	Fund	Fund	Fund	
25	18120111-B	Bishop	Herring Program - Annual Herring Migration Cycle	\$379,500	\$	Fund	Fund	Fund	Fund	
28	18120111-C	Branch	Herring Program - Modeling and stock assessment	\$288,300	\$	Fund	Fund	Fund	Fund	
34	18170111-D	Gorman	Herring Program - Reproductive Maturity among Age Cohorts	\$172,000	\$	Fund Contingent	Fund Contingent	Fund Contingent	Fund Contingent	
53	18120111-E	Hershberger	Herring Program – Herring Disease Program II	\$228,900	\$	Fund	Fund	Fund	Fund	
56	18160111-F	Haight	Herring Program – ASL Study & Aerial Milt Surveys	\$166,300	\$	Fund	Fund	Fund	Fund	
61	18120111-G	Rand	Herring Program - Adult Pacific Herring Acoustic Surveys	\$73,800	\$	Fund	Fund	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. Please contact the EVOSTC office if you would like exact funding amounts.*

***\*The total for these projects can be found under 17120114-Lindeberg on the page one chart***

Page	Project Number	Principal Investigator	Project Title	FY18 Requested	FY18 Approved	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
69	18120114-A	Lindeberg	LTM Program - Science Coordination and Synthesis	\$227,600	\$	Fund	Fund	Fund	Fund	
72	18120114-B	Hoffman	LTM Program - Administration	\$282,400	\$	Fund	Fund	Fund	Fund	
75	18120114-C	Arimitsu	LTM Program - Forage Fish Distribution, Abundance, and Body Condition	\$229,800	\$	Fund	Fund	Fund	Fund	
79	18120114-D	Batten	LTM Program - Continuous Plankton Recorders	\$78,800	\$	Fund	Fund	Fund	Fund	
81	18120114-E	Bishop	LTM Program - Seabird Abundance in Fall and Winter	\$92,700	\$	Fund	Fund	Fund	Fund	
84	18120114-G	Campbell	LTM Program - Oceanographic Conditions in PWS	\$223,400	\$	Fund	Fund	Fund	Fund	
87	18120114-H	Coletti	LTM Program - Nearshore ecosystems the Gulf of AK	\$452,700	\$	Fund	Fund	Fund	Fund	
90	18120114-I	Danielson	LTM Program - GAK1 Monitoring	\$148,400	\$	Fund	Fund	Fund	Fund	
93	18120114-J	Holderied & Shepherd	LTM Program - Oceanographic Monitoring in Cook Inlet/Kachemak Bay	\$174,400	\$	Fund	Fund	Fund	Fund	
97	18120114-L	Hopcroft	LTM Program - Seward Line Monitoring	\$136,100	\$	Fund	Fund	Fund	Fund	



<b>Page</b>	<b>Project Number</b>	<b>Principal Investigator</b>	<b>Project Title</b>	<b>FY18 Requested</b>	<b>FY18 Approved</b>	<b>Science Panel</b>	<b>Science Coordinator</b>	<b>PAC</b>	<b>Executive Director</b>	<b>Trustee Council</b>
100	18120114-M	Kuletz	LTM Program - PWS Marine Bird Surveys	\$222,200	\$	Fund	Fund	Fund	Fund	
103	18120114-N	Matkin	LTM Program -Long-term killer whale monitoring	\$151,300	\$	Fund	Fund	Fund	Fund	
106	18120114-O	Moran & Straley	LTM Program - Humpback Whale Predation on Herring	\$155,000	\$	Fund	Fund	Fund	Fund	

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

**Project Number:** 18180100

**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:**

FY18
\$2,261,585

**Abstract:**

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

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

**FY18 Funding Recommendations:**

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

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Project Number:** 18100853

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

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

**PI Affiliation:** USFWS

**Project Manager:** USFWS

**EVOSTC Funding Requested FY17-21: \$274,486**

FY17	FY18	FY19	FY20	FY21
Auth: \$149,778	\$173,438*	\$0	\$0	\$0

*Requests include 9% GA.*

\*As noted in prior proposals, the field season and trapping effort was originally proposed to be reduced by 50% compared to FY16. However, given that this is the last year of the 5-year project a full trapping season in FY18 is proposed to ensure that there are no mink in the nesting areas; USDA-FS requests \$13,623.9 for permit cost for working on Naked Island.

**Funding From Non-EVOSTC Sources FY 17-21: \$627,160**

First line is from National Fish and Wildlife Foundation Grant, Second line is USFWS in-kind support

FY17	FY18	FY19	FY20	FY21
\$215,580	\$215,580	\$0	\$0	\$0
\$98,000	\$98,000	\$0	\$0	\$0

**Total Past EVOSTC Funding Authorized (FY07-17): \$2,031,075**

**Total EVOSTC Funding Authorized (FY07-17) and Requested (FY18-21): \$2,155,783**

**Total Non-EVOSTC Funding (FY07-21): \$1,707,300**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 4/16/17, budget updated 8/24/17.*  
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. **FY18 is the 5<sup>th</sup> 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. During the 2017 field season we caught no mink, but we had snow for the first time in 4 years and we saw mink tracks. While we believe few mink remain in the

pigeon guillemot nesting areas, we will trap again in 2018. Counts of pigeon guillemots at Peak, Naked and Story Islands has more than doubled since 2014; 69 birds in 2014, 95 birds in 2015, 151 birds in 2016 and 169 in 2017! Numbers of pigeon guillemots counted at control islands did not have an 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 quadrupled since 2014; 11 nests in 2014, 30 nests in 2015, 39 nests in 2016 and 52 in 2017. Colonies are starting to form with up to 10 nests in one area. Productivity during the chick stage was high, around 80%, indicating that the adults could find enough food for their chicks.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel approves of the additional funding requested for a full field season to remove all mink from 70% of the shoreline where PIGU nested or currently nest. Again, the panel is very pleased with how quickly the population is increasing. As noted in past work plans, unless expanded trapping is permitted, the observed success will likely be temporary. A subsequent increase in the mink population resulting from only a partial eradication will probably, again, decimate the PIGU population over time. As noted in last year’s work plan, population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions regarding predator controls.

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments– FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Science Panel Comments – FY17**

**Date: September 2016**

We have no additional comments for this project.

**Date: May 2016**

This project has continued to demonstrate marked progress toward the recovery of a historically important PIGU nesting site on Naked Island and the Panel is supportive of continued funding. The Panel has noted in past work plans that, unless expanded trapping is permitted, this success may only be temporary with mink remaining in other areas of the island. Ultimately, lacking a program to fully eradicate mink from this island, redistribution of a rebounding mink population would be expected to once again cause a PIGU population decline over the long term. Population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions regarding predator controls.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**FY16 Funding Recommendations:**

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

**Science Panel Comments – FY16**

**Date: September 2015**

Trapping of mink to promote restoration of pigeon guillemots is already a remarkable success story, well ahead of expected time frames for recovery. The project is well along to remove all mink from PIGU nesting sites, and a positive PIGU population response has already been observed.

Documentation of population trends of predator and prey over the full 5-year course of this project will make for an excellent case study. However, over the long term, the question is whether this success will be temporary or sustained, given that mink remain on other parts of the islands. The PIs have made estimates of PIGU population doubling times as a result of mink eradication from nesting sites. Additionally, it would be informative to estimate mink population trends in the absence of an ongoing trapping program after the conclusion of this project. Ultimately, lacking a program to fully eradicate mink from these islands, redistribution of a rebounding mink population would be expected to once again cause a PIGU population decline over the long term. Population projections of both predator and prey may be useful to evaluate the merits and timeliness of future management agency decisions about predator controls.

**Science Coordinator, Executive Director Comments – FY16**

**Date: September 2015**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY16**

**Date: September 2015**

There are no project specific comments.

**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 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

Science Panel	Science Coordinator	PAC	Executive Director
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:** 17170116

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

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

**PI Affiliation:** ADNR

**Project Manager:**

ADNR

**EVOSTC Funding Requested FY17-21: \$2,214,444**

FY17	FY18	FY19	FY20	FY21
Auth: \$2,214,444	Reauth: \$327,000	\$0	\$0	\$0

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY 17-21: \$1,600,000**

FY17	FY18	FY19	FY20	FY21
\$1,600,000	\$0	\$	\$	\$

**Total Past EVOSTC Funding Authorized (FY17): \$2,214,444**

**Total EVOSTC Funding Authorized (FY17) and Reauthorized (FY18-21): \$2,214,444**

**Total Non-EVOSTC Funding FY17-21: \$1,600,000**

**Abstract:**

In Fall 2016, the Department of Natural Resources, Division of Parks and Outdoor Recreation (DNR-DPOR) submitted six projects for funding under the *Exxon Valdez* Oil Spill (EVOS) Restoration Program. **The Council approved funding for projects 2-6. As noted in 2016, reauthorization of Project 1 is needed due to the multi-year nature of the work and schedule for application for potential Federal ATAP funding. Thus, the request is for Project 1 of 6:**

**Project 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**

**The projects that were approved Fall 2016:**

Project 2: KRSMA: Eagle Rock Riverbank Protection – Total project cost \$410,450 | Total recommended by ED for funding (with GA): \$447,391

Project 3: Crooked Creek State Recreation Site Riverbank Restoration– Total project cost \$445,900 | Total recommended by ED for funding (with GA): \$486,031

Project 4: KRSMA: Kenai River Ranch Riverbank Restoration – Total project cost \$166,200 | Total recommended by ED for funding (with GA): \$181,158

Project 5: KRSMA: Pipeline Crossing Riverbank Restoration – Total project cost \$282,450 | Total recommended by ED for funding (with GA): \$307,871

Project 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.

**FY18 Funding Recommendations:**

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

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**Executive Director Comments – FY17**

**Date: September 2016**

There are no project specific comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Herring Research and  
Monitoring Program Project Descriptions**

**Project Number:** 18120111

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

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

**PI Affiliation:** PWSSC

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$6,617,500**

FY17	FY18	FY19	FY20	FY21
Auth: \$1,252,900	\$1,578,800*, <sup>a</sup>	\$1,478,900*, <sup>a</sup>	\$1,403,100*, <sup>a</sup>	\$903,700*

*Requests include 9% GA.*

\*Plasma sample processing for disease work to be included in the revised ASA model has increased in FY 18-21 by \$24.5K (See Herschberger, pg. 44). <sup>a</sup>Post-doc salary to be included for FY18-20 for synthesis of data between the Herring Research and Monitoring and Gulf Watch Alaska programs over the last five years (See Branch, pg. 28).

**Funding From Non-EVOSTC Sources FY 17-21: \$790,000**

FY17	FY18	FY19	FY20	FY21
\$157,200	\$159,700	\$160,700	\$162,700	\$149,700

**Total Past EVOSTC Funding Authorized (FY12-17): \$7,491,243**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$12,855,743**

**Total Non-EVOSTC Funding (FY12-21): \$944,731**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 7/31/17.*

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.

The program is made up of seven projects; Modeling and Stock Assessment of Prince William Sound Herring; Surveys and Age, Sex, and Size Collection and Processing; Adult Pacific Herring Acoustic Surveys; Herring Disease Program; Studies of Reproductive Maturity among Age Cohorts of Pacific Herring; Annual Herring Migration Cycle; and HRM Coordination.

Through these projects we expect to address areas of interest outlined within the herring research and monitoring section of the original 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.

**FY18 Funding Recommendations:**

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

*\*Indicates this review group recommends a Fund Contingent for Project #18170111-D Gorman*

**Science Panel Comments – FY18**

**Date: September 2017**

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

*PI Response (10/11/2017)*

*As the program lead I will review the proposals to ensure they have the hypotheses, goals, and highlights as requested.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

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

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

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

There was one aspect of the revised proposal that elicited some concerns: the brevity of scientific context and rationale for the herring program, as a whole. We acknowledge that this is a demanding request: it is difficult enough to provide such context for individual proposals, let alone a collection of proposals such as the integrated herring program. Nevertheless the Panel would like to have seen more attention provided to explaining how the composite set of proposals addressed basic scientific issues. The two general hypotheses listed in the opening pages of the Herring program (i) bottom-up forcing and (ii) age-specific migration are fine, but there are many other fundamental questions in the literature that are germane to the projects in the herring program. For example, within the initial overview of the herring proposals, there is scant reference to the potential impacts of climate change, as a factor that could affect herring or the research efforts directed at herring. We note, however that this specific issue is mentioned specifically in two projects. The Panel was somewhat reassured, however, when we heard directly from Dr. Pegau during a telephone conversation when he indicated that he shares some of this perspective but is constrained by time and assistance. There is some promise that the additional of a post-doc position may provide some assistance in this regard.

**Date: May 2016**

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

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

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



These three hypotheses are copied below (in Italic font):

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

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

Under the project called "HRM Coordination" there is general text referring to a post-doc position that reads as follows (in Italic font) with sentences numbered.

*(1) The focus of the postdoctoral research will be to examine connections between herring recruitment and condition with the physical and biological environmental conditions. (2) We will be seeking proposals for the postdoctoral position in which the specifics of the approach will be described. (3). The intent is to address the hypothesis: Herring recruitment is driven by bottom up forcing and the total population level is determined by disease and predation. (4) The postdoctoral position is proposed to as a method that allows a focused effort on using historical data to test this hypothesis. (5) Testing this hypothesis is expected to inform the population modeling effort in a manner that improves the predictive capacity of the modeling. (6) The improved model would then lead to resource managers having a better understanding of potential changes in the population.*

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

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

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

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

#### **Science Coordinator Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

I concur with the Science Panel’s comments.

#### **Executive Director Comments – FY17**

**Date: September 2016**

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

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

**Date: September 2016**

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

**Project Number:** 18120111-A

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

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

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

**EVOSTC Funding Requested FY17-21:** \$1,039,400

FY17	FY18	FY19	FY20	FY21
Auth: \$138,400	\$270,200	\$284,100	\$256,100	\$90,700

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21:** \$136,100

FY17	FY18	FY19	FY20	FY21
\$26,000	\$26,600	\$27,200	\$28,000	\$28,300

**Total Past EVOSTC Funding Authorized (FY12-17):** \$2,078,500

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$2,979,500

**Total Non-EVOSTC Funding (FY12-21):** \$247,800

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 7/31/17.*

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 Data Management 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 is funded for three years. The focus area of the research was chosen 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.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

*PI Response (10/11/2017) Thank you*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

The Panel 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: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120111-B

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

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

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

**EVOSTC Funding Requested FY17-21: \$1,231,100**

FY17	FY18	FY19	FY20	FY21
Auth: \$381,900	\$379,500	\$268,300	\$201,400	\$0

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$60,000**

FY17	FY18	FY19	FY20	FY21
\$15,000	\$415,000	\$15,000	\$15,000	\$0

**Total Past EVOSTC Funding Authorized (FY12-17): \$654,500**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,503,700**

**Total Non-EVOSTC Funding (FY12-21): \$475,500**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17*

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. During spring 2017 we tagged 125 herring at Port Gravina in northeast Prince William Sound. For FY18 we will expand our efforts to two tagging sites and tag a total of 210 herring.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18****Date: September 2017**

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

*PI Response (10/11/2017) Thank you*

**Science Coordinator Comments – FY18****Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

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

**Date: May 2016**

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

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

A different comment on tagging reflects comments made during our call with Scott Pegau who indicated that recent genetics work showed significant differences between PWS herring and those of Kodiak. Less clear was whether there were any genetic differences found within PWS. Based on previously published work, the Panel thought that the likelihood of genetic differences among herring within PWS to be very small – but, on the other hand, if such differences were found then it would be sensible to ensure that tagging was conducted on each of any potential different stocks or sub-stocks. Perhaps a review of fish genetic research done by the 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: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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



**Project Number:** 18120111-C

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

**Primary Investigator(s):** Trevor Branch

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

**EVOSTC Funding Requested FY17-21:** \$1,161,800

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

*Requests include 9% GA.*

\*Post-doc salary to be included for FY18-20 for critical synthesis of data between the HRM and GWA programs over the last five years.

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

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

**Total Past EVOSTC Funding Authorized (FY12-17):** \$551,400

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$1,588,900

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

**Abstract:**

*\*This abstract is excerpted from the PI's Revised Proposal, dated 9/11/17.*

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.

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.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

The BASA is a logical extension of the preceding ASA assessment model for PWS herring, and may be of use to fishery managers as a model intended to determine such quantities as the stock abundance relative to the stock size threshold for opening a fishery. Some aspects of the BASA model pose difficulties for the examination of environmental relationships. The Panel does not consider the present BASA to be an adequate operating model for purposes of Management Strategy Evaluation (MSE). EVOSTC research needs would be better met by implementing the following changes to the BASA model to aid in identifying critical population processes and environmental influences on PWS herring:

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

*PI Response (10/11/2017)*

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

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

(predation) and comparison with trends in predator abundance.

*PI Response (10/11/2017)*

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

- C. Consider constructing a similar BASA model for the Sitka fishery. To the extent that Sitka shares previously-identified large-scale environmental influences with PWS (Williams & Quinn 2000), combined models will increase statistical power. Conversely, if this pattern of correlation no longer applies in recent years, comparing models should help isolate the important differences or changes in the PWS system relative to Sitka. A long-term Sitka assessment may possibly allow the time-series gap in PWS assessments (no assessments 1957-1971) to be filled on the basis of correlated recruitment patterns.

*PI Response (10/11/2017)*

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

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

*PI Response (10/11/2017)*

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

The Panel whole-heartedly supports the request to use the CPPG funding (total \$150K) toward 1.5 years of salary for another postdoc (David McGowan) to conduct synthesis work via modeling project with Trevor Branch. However, herring program needs to request an additional \$150K for the

remaining 1.5 years (part of FY19 and FY20) needed to create a three-year synthesis, which would provide the minimum time needed for achieve appropriate synthesis.

*PI Response (10/11/2017)*

*We are excited to start work with David McGowan.*

References:

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

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

The 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.

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

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

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

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

The Panel endorses this task.

*(3) Continued collection and expansion of catch, biomass, and recruitment time series from all herring populations around the world to place the lack of recovery of PWS herring into context given patterns of change in herring populations around the world.*

The Panel is puzzled and perhaps ambivalent about this. This seems like a worthy task but the implications for PWS seem remote. Providing that this task is not a big-ticket item, it does not present any issues, although it is not clear why this needs to be shown as a distinct task, when it could have been conducted sub-rosa.

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

The Panel strongly endorses this task.

*(5) A management strategy evaluation to test alternative harvest control rules for managing the fishery in the future, given realistic variability in productivity over time, and the possibility that the population has moved into a low productivity regime. Ecological, economic and social factors would be considered in the MSE.*

The Panel does not foresee the resumption of active herring fisheries in PWS anytime in the near future. Therefore while this task may have eventual worth, it belongs closer to the back-burner than the front.

*(6) Simulations to evaluate which data sources are the most useful in assessing future herring biomass, based on an MSE of the impact of each form of data on the accuracy of the BASA model.*

We recommend caution. While it may be sensible to proceed with data evaluation, it also is essential to have a concurrent examination of the efficacy and integrity of some of the key databases used in the assessment model. In particular the factors that might affect the time series of acoustics data have not been well explained in any document to date. Similar comments might be made about some other types of data used in the assessment model (see comments made in response to the Moffitt and Gorman proposals).

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

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18170111-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 Requested FY17-21: \$850,000**

FY17	FY18	FY19	FY20	FY21
Auth: \$170,000	\$172,000	\$165,100	\$169,600	\$173,300

*Requests include 9% GA.*

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

FY12-17	FY18	FY19	FY20	FY21
\$0	\$0	\$0	\$0	\$0

**Total Past EVOSTC Funding Authorized (FY12-17): \$170,000**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,020,000**

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

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 7/26/17*

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 (ASA) 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 across seasons, 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 work 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.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel appreciates the PI’s work and effort during FY17 and understands that if the fish are not present, they can’t be caught. The Panel whole-heartedly endorses the histology component to its full capacity. The Panel also strongly suggests recording gonad weights to determine age of maturity.

**Updated Science Panel and Science Coordinator comments (10/16/2017):**

The Panel thanks the PI for her responses to the Panel’s concerns and comments. After reading the most recent response dated September 25, 2017 the Panel’s recommendation remains fund contingent for FY18 on the submission of a more thoroughly revised proposal, with recommendations to fund in future years dependent on results and progress in this coming year.

The Panel is pleased to see that the main focus for FY18 has been changed to Objective 1 (addressing direct measures of female and male maturity). The Panel emphasizes that any scale work should focus on methods and validation of the approach as it applies to PWS herring.

Although a bit brief, the Panel appreciates the inclusion of the FY17 highlights and updates. This section will become part of future proposal forms for all projects and used to evaluate progress in the preceding year and plans for the upcoming year.

The Panel found the additional description of sampling plans using hydroacoustics and jigging techniques, as well as exploring use of “ships of opportunity” in winter to be helpful. The Panel will look to see that sampling difficulties in FY17 are resolved in FY18.

The Panel still has some concerns. The Panel notes that the proposal revisions are quite modest and appear to have been prepared with minimal effort to address their comments. The Panel’s assessment is that relative to other proposals, especially those in the LTM, this proposal remains weak and the revised proposal appears to be set on the same original course. The Panel and Science Coordinator note the lack of attention paid to details: there are quite a few grammatical errors, including incomplete sentences, the proposal number is still incorrect and not all comments were addressed (see below).

With respect to references made to Heinz and Vollenweider as personal communications and the reference to an AMSS poster, the Panel recommends that their final report should be cited – at least to the extent that information to be cited can be found in the final report by Vollenweider et al. (2017) as preliminary results reported as personal communications or symposium posters often change in the final analysis.

The Panel’s comments about project milestones were not addressed:

“At present the project milestones mainly include field collections and sending off histology samples. In the revised proposal, please include timelines for other project milestones (e.g. data analysis, conference attendance) for each project component. It is important for all of us to be able to track progress on the



objectives to assess any course corrections that may be necessary with each new annual proposal.”

The Panel requests a revised proposal to include specific, measurable milestones by which to judge project progress and success. For instance, next year the Panel will be looking for some results of data analyses associated with Objective 1 to track project progress and the merits for additional funding beyond FY18. It is imperative that tangible, measurable milestones are presented by which project success can be evaluated, at least in terms of Objective 1 next year. The Panel does not find it sufficient to simply state how many fish were caught and how many samples were sent to a third-party lab for analysis. Examples of these milestones are also given in the proposal form:

**B. Measurable Project Tasks for FY18**

Specify, by each quarter of each fiscal year, when critical project tasks (for example, sample collection, data analysis, manuscript submittal, etc.) will be completed, as submitted in your original proposal. Please identify any substantive changes and the reason for the changes.

Overall, the Panel expects more scientific rigor with more attention paid to the broad scientific literature related to this project and greater use of existing databases, especially bio-sampling databases that provide information (i.e., catch dates, locations, growth rates, etc.).

The Panel and Science Coordinator acknowledge and commend your productive scientific publication record and your ability to collaborate effectively with other researchers. We recognize and thank you for your dedication. We look forward to receiving your revised proposal.

**Below at the end of the FY18 comments, for those interested, is the discussion between the Panel and PI regarding various technical issues the Panel and Science Coordinator requested be resolved before any approved funding is released.**

**Date: September 2017**

I concur with the Science Panel’s comments. I greatly appreciate Panel’s suggestions and the PI’s responses to the Panel’s concerns.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

I concur with the recommendations of the Science Panel, Science Coordinator and Public Advisory Committee. I appreciate the Science Panel’s detailed comments and the PI’s responsiveness.

**EVOSTC FY18**

**SCIENCE PANEL COMMENTS AND RECOMMENDATIONS FOLLOWING FROM THE RESPONSE TO REVIEWER COMMENTS**

**PROJECT TITLE**

Herring Research and Monitoring Program: Studies of Reproductive Maturity among Age Cohorts of Pacific Herring (*Clupea pallasii*) in Prince William Sound, Alaska

PROJECT NUMBER  
18170111-D

PRIMARY INVESTIGATOR AND AFFILIATION  
Kristen B. Gorman, Prince William Sound Science Center (PWSSC), P.O. Box 705, Cordova, AK 99574

DATE PI RESPONSE SUBMITTED  
September 13, 2017, September 25, 2017

DATE SCIENCE PANEL REPLY SUBMITTED  
September 15, 2017

Note from the Science Coordinator:

In an effort to keep this as organized as possible, initial Science Panel comments are under the header “**SCIENCE PANEL COMMENTS (9.11.17)**”. First round of PI comments are *italics* under the header “**PI RESPONSE (9.13.17)**”. Science Panel follow-up comments are under the header “**SCIENCE PANEL COMMENTS (9.15.17)**”. Line numbers referenced can be found in the document preceding this one. Second round of PI comments are *italics* under the header “**PI RESPONSE (9.25.17)**”.

#### SCIENCE PANEL COMMENTS (9.11.17)

In general the science panel endorses work to estimate the age at maturity but the panel notes the following:

- Some reconsideration of the approaches may be warranted, especially those involving the use of scales for retrospective analyses. (See comments on methods, below).
- There may be some implicit biological assumptions about the connection between herring distributions and age-specific maturation that warrant more explanation – and perhaps re-consideration relative to work that has occurred in other Pacific herring populations. (See comments on methods, below).
- There is no mention of direct measures of maturity, using simple, inexpensive and accurate estimation by simply weighing gonads, or other, direct measures that might be considered.

Of the four objectives listed in the proposal, three involve the use of scales. To date, and as the proposal points out, the use of scale measurements, as criteria of *past* maturation, has yet to be demonstrably successful for Pacific herring. Therefore, we advise that parts of the proposed work, as presented, appear risky. The Science Panel is concerned about the emphasis on scales, and the probable success of this approach, for two reasons.

**Reason One.** Similar approaches were tried in BC and failed. Regrettably there is no report on such failed projects but the reasons for failure were related to the degrees of error associated with scale measurements of retrospective growth. Scale measurements can be crude. By the time Pacific herring have reached age 2 (24 months), most are roughly 15 cm long. Fully mature herring (mainly ages 5-10+) may reach 30 cm but few reach such a length (allowing for differences in definitions of length (‘standard’ versus ‘fork’ versus ‘total’). The point is that most herring, prior to maturity have already achieved half or more of their final total length (or L-infinity) and scale growth are near-exact replicas of past growth (i.e., one-scale per myomere and the growth of the scale ‘edge’ (BTW not ‘layer’) occurs in an anterior direction between the focus and the outer annulus. The proposed scale measurement requires a careful measure between tiny segments of the scales: between the focus, and each subsequent annulus. In theory this is simple. In practice it can be messy. First, the precise location of the focus point (which is also the point closest to the exposed edge of the scale – or non-readable part) can be difficult to determine, perhaps because of scale wear. Then each subsequent measure may have some fuzziness to the estimate because it can be difficult to estimate the exact point of each annulus. The vital measures are between the second and third annulus and the third and fourth annulus, which at most, would only be a small part of most scales, especially on the oldest fish. Therefore, it would be vital to ensure that such measurements were as accurate as possible. One recommendation would be to *take multiple independent measurements from different scales from the same fish*, to determine the relative amount of error associated with measurement versus the natural variation in actual retrospective age-specific (or annulus-specific) growth. Unless this was done there would be little assurance that the measurements were valid estimators of past growth. There are many potential artifact-inducing processes (i) scale source or scale locations (small differences in location can have large impacts on inter-annulus measurements); (ii) time of year of collection when the scales are still growing (affecting measures of scale edge and age-specific estimates of total body length). Note that scales may continue to grow, even during winter periods when nutrition may be limited, which is mainly seen as a distortion of the annulus); and (iii) year-specific effects. Scale-readers have noted that scales can be difficult to read in some years or for some cohorts, perhaps reflecting unique oceanographic or trophic conditions. Finally, we know that herring resorb calcium and perhaps other minerals from their scales, as they expand

their gonads prior to spawning. Such a resorption of material is part of the rationale for this proposed work (i.e., an impact of maturation on somatic growth) but it is also part of the potential source of error.

**Reason Two.** A second reason for recommending caution, is that PWS herring are not generally as long-lived as the Norwegian Spring-Spawning (NSS) herring (that can live for 20 years or longer), or even as long as Pacific herring in the Bering Sea that can live well into their teens. In such longer-lived herring there may be a higher likelihood of delayed age at maturity ('right-shifted' ogive) relative to smaller, shorter-lived herring.

#### **PI RESPONSE (9.13.12)**

*As the panel notes there are four objectives to the research and three include mention of working with scales. The objectives of the proposed research follow:*

- 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.*
- 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. These objectives address the hypotheses in the proposal and are meant to build upon each other. What is not clear from the wording is that this study relies on histology as the primary measure of ovary maturity in female Pacific herring. The project is designed to use histology to discern proportions of mature and immature herring per age cohort, which is something the earlier pilot study by Vollenweider et al. (EVOS Final Report 13120111-J, 2017) did not report. We include work on scales from fish collected in PWS, mainly because the earlier pilot study suffered from low sample sizes of wild caught fish. They were unable to demonstrate a connection between histology and scale growth based on their low sample sizes for wild caught fish during their study (our second objective). Importantly, the pilot study by Vollenweider et al. (EVOS Final Report 13120111-J, 2017) suggested that it may be possible to use scale growth to discriminate spawners from non-spawners using the larger sample sizes available from the ADF&G scale library.*

*However, it would now be interesting to extend the retrospective analysis using the ADF&G scale library to ask if there is evidence of a shift in age at maturity that follows the ASA model output. The model suggests a change in maturity function between two time periods (before and after 1996). This is a component of the project that had not been proposed, but could replace Objective 3 in the proposal. Our fourth objective uses both histology and scale measurements to look for inter-annual changes in maturity. If this can be achieved it can be used to validate the ASA model output of maturity. This follows the conclusions of Vollenweider et al. (EVOS Final Report 13120111-J, 2017) that future efforts examine inter-annual variability in the proportions of mature herring among age cohorts.*

#### **SCIENCE PANEL COMMENTS (9.15.17)**

*LINES 79-83: It is good to have this point clarified, although we still advise that even simple visual assessments of gonads, and gonad weights, can be informative. We also advise that estimation of age-at-maturity should also apply both to males and females. Please revise the proposal to include these analyses.*

#### **PI RESPONSE (9.25.17)**

*I agree that simple visual assessment of gonads and gonad weights can be informative. Therefore, in the original proposal (FY17) and noted on the response dated 9.13.17 (FY18 proposal), it is stated that data are taken to develop a GSI:*

*From Procedural and Scientific Methods (FY17 proposal): All fish within these ages [3+ - 5+] will be measured for length (mm) and wet weight (g). Gonads will be dissected from the body and a gonadosomatic index (GSI) will be developed by weighing the gonad separately where  $GSI = (\text{ovary weight}/\text{whole wet weight}) * 100$ .*

*From PI Response (9.13.17): For all collections, including spring 2017, we examined age using scale information, and maturity is examined primarily using histology. However, during lab processing, we obtain information to develop a GSI index including fish length, weight, and gonad weight, as well as the Hjort criteria.*

*The Hjort criteria were not identified in the original FY17 proposal and was added during spring 2017 processing as this is the criteria used by ADF&G. This is updated in the FY18 proposal.*

*Thank you for clarifying that the age at maturity analysis should apply to both males and females. The original FY17 proposal focused only on females and did not propose to assess maturity of males, and because the FY17 proposal was funded, in spring 2017 I did not obtain data on gonad weights and Hjort criteria for males. The requested change to assess GSI and Hjort criteria in males will be updated in the FY18 proposal edits.*

LINES 83-89: At best, the intention of using archived scales to retrospectively estimate age-at-maturity is speculative and should be conducted cautiously. We still see this as having a low likelihood of success. Therefore, it would be in the best interests of everyone to conduct such investigations as an “expendable appendage” to the main thrust of the research, which would focus on direct estimates of maturity, using histology or other approaches.

**PI RESPONSE (9.25.17)**

*The use of archived scales, although proposed as part of the 5 year project, is not something that would be accomplished in FY18 as both FY17 and FY18 are focused on the successful seasonal collection of fish and obtaining initial data on age at maturity using histology, and direct measurement of gonad weights and the Hjort criteria. The specifics on any retrospective analysis would be outlined in future annual proposals for this project, thus it is understood that this aspect of the project would only proceed with further input from the SP.*

LINES 91-99: While we appreciate the thought and detail related to the listing of the four detailed objectives or hypotheses, we also suggest that there is a risk of getting too far ahead of the anticipated results. It might be clearer and simpler to stick with the main objective and hypothesis: estimation of the age of maturity.

**PI RESPONSE (9.25.17)**

*I understand the SP’s concern that the research not get ahead of anticipated results as the original objectives outlined in FY17 all built upon each other. The main objective will be highlighted in the FY18 proposal edits.*

**PI RESPONSE (9.13.12)**

*LINES 22-54: Regarding “Reason One”. I appreciate the detailed comments by the reviewer, as they are legitimate concerns. In response, there has been past work to determine the precision of scale growth measurements for PWS Pacific herring, see Moffitt (EVOS Final Report 13120111-N, 2017), specifically the results from the Precision Test reported in Table 3. Moffitt tested the precision of scale measurements by randomly selecting 101 scales from fish aged 4, 5, and 6 to measure a second time. The reader was not informed that these scales had been measured previously to reduce the possibility of a different process being followed for the second measurements. Results show that 91-96% of the variation in scale growth was detected by second reads of the scales, which suggests a high accuracy of reading scale growth. Further, based on ADF&G protocols, the scales taken for growth measurements are better when taken from specific areas of the fish (see Moffitt EVOS Final Report 13120111-N, 2017, Figure 1), which this project is doing and would reduce issues related to “small differences in location can have large impacts on inter-annulus measurements”. Without a doubt the proportional error increases with age, which may explain the result of Vollenweider et al. (EVOS Final Report 13120111-J, 2017) where they found increasing evidence of skip spawning at age-6.*

*Previous unpublished work by ADF&G led them to have a preferred area on the fish to collect scales. This is in large part due to wanting to collect scales from an area that tends to have the best quality scales for reading, but also ensures uniform measures of scale growth that may be lost by collecting scales from multiple locations on a single fish as suggested. We have no issue with collecting multiple scales from a single fish to look at growth variability. We actually collected multiple scales from our samples in 2017 so we can easily do this test, but suggest the work of Moffitt (2017) addresses the ability to consistently read scales with precision.*

**SCIENCE PANEL COMMENTS (9.15.17)**

It is gratifying to see that issues or measurement error had already been considered. A simple statement in the proposal would have been useful. Please add this information into the revised proposal for the purposes of clarity.

**PI RESPONSE (9.25.17)**

*The information regarding measurement error will be updated in the FY18 proposal edits.*

**PI RESPONSE (9.13.12)**

*LINES 56-60: Regarding “Reason two”. I am not entirely sure how this comment applies. Yes, there are different maturation functions in different populations, but there still is a maturation function that is important for use with the PWS ASA model to expand from the spawning population to the actual population. We note that there are even major differences in the estimated maturity between PWS and Sitka.*

**SCIENCE PANEL COMMENTS (9.15.17)**

We agree that this does not seem to apply at this time. Thank you for the reply.

**PI RESPONSE (9.25.17)**

*No response.*

**SCIENCE PANEL COMMENTS (9.11.17)**

The proposed scale work should be re-examined and de-emphasized relative to other approaches to estimating age-at-maturity. A specific prerequisite task would be to determine the relative error related to scale measurements of annuli. To do this samples should be taken where there are multiple scales per fish (~10) so the degree of error related to retrospective annulus-specific growth can be estimated.

**PI RESPONSE (9.13.12)**

*As noted above the precision of the approach was tested by Moffitt (2017), but in a different manner. In the spring 2017 collections, several scales per individual female were collected and this approach will be retained in subsequent sampling. Thus, it would be possible to determine the relative error related to scale measurements of annuli.*

**SCIENCE PANEL COMMENTS (9.15.17)**

As stated above, it is re-assuring to see that you took this issue into consideration. A simple statement in the proposal would have been useful. Please revise the proposal to include these analyses.

**PI RESPONSE (9.25.17)**

*Again, the information regarding measurement error will be updated in the FY18 proposal edits.*

**SCIENCE PANEL COMMENTS (9.11.17)**

Comments and questions related to the proposal heading: **“Changes to Project Design”**  
(proposal text in quotations)

“In spring 2017, we were able to successfully collect herring from the spawning population in adequate sample sizes across all age cohorts of interest.”

Did you examine both age and maturity – by visual analyses for maturation state – or simply take weights of gonads? If not, why not? This is the simplest, least expensive, and most accurate way to detect (and confirm) that herring are, or are not, sexually maturing.

**PI RESPONSE (9.13.12)**

*Yes, we scored the ovaries based on the criteria reported in Hay 1985 “The Hjort maturity scale for Pacific herring” as this is the criteria used by ADF&G. For all collections, including spring 2017, we examined age using scale information, and maturity is examined primarily using histology. However, during lab processing, we obtain information to develop a GSI index including fish length, weight, and gonad weight, as well as the Hjort criteria.*

**SCIENCE PANEL COMMENTS (9.15.17)**

It is good to learn that there was a substantial effort made in the spawning season of 2017 to assess maturity by direct measures and assessments of gonads. A preliminary overview or summary of the work, plus any results, would have helped to clarify the proposal for 2018 work. If possible, please present preliminary analyses or summary of the work from FY17 (tables and/or figures) in the revised proposal. For future proposals, preliminary analyses of the data will be appreciated.

Additionally, in the statement above you state that the intention is to collect samples from “all age cohorts of interest”. What ages would these be? The reason for asking is that it appears (from the tabular data provided at the end of this document) that the main ages of interest could be age 2 (between 24-36 months of age) and age 3 (between 36 and 48 months of age). If there is a shifting maturity ogive in PWS then we suggest that researchers may be well advised to consider inclusion of samples from younger, smaller fish, collected later in the spawning season and from over-wintering aggregations. We highly suggest that this be incorporated into the revised proposal, provided that this is logistically possible.

**PI RESPONSE (9.25.17)**

*It is understood that the SP would like to see preliminary results in future proposals. Please note, that although we processed fish from the spring 2017 collection, we do not have histology results yet for these fish. I have updated the FY18 proposal with information on the spring 2017 collection results.*

All age cohorts of interest are 3+ to 5+ as described in the original FY17 and the hypotheses in FY18 proposal. The suggestion of including age 2 fish is a good idea. In reality, we process in the lab all fish collected, so if we get age 2 fish they will be processed, but in terms of relevance to the ASA model, the ages of interest to the model are ages 3-5, as noted in the FY17 and FY18 proposals.

#### **SCIENCE PANEL COMMENTS (9.11.17)**

Re: “However, we were unable to collect herring from the non-spawning population during spring due to limited logistics, i.e., ship time or flights in regions of PWS where fish in non-spawning populations might occur.”

It is not clear what is meant by the ‘non-spawning population’ in the spring. Where would you be looking? How would they be captured? (See the notes summarizing the issues for BC herring). If you intend to use histology, then samples of herring at any date can be used, from mid-summer (when early oogenesis begins) to late winter. Ideally, you probably would want to look at some time between the late fall and early winter – or October to March. There are merits to sampling the portion of the herring population that does not migrate to nearshore areas for spawning. Fish that are not mature in the current year may not undertake these migrations. Thus, if you only sample the fish that spawn, the proportion of mature fish at age will be significantly biased for the younger ages.

#### **PI RESPONSE (9.13.12)**

The reason for wanting to sample fish in the spring that are not part of the spawning population is the exact reason identified, “if you only sample the fish that spawn, the proportion of mature fish at age will be significantly biased for the younger ages”. We would like to obtain samples from fish that are not part of the spawning population in the spring. The location of these fish remains unknown. The difficulty in the non-spawning fish led to the seasonal sampling proposed that is consistent with this recommendation.

#### **SCIENCE PANEL COMMENTS (9.15.17)**

The response statement indicates a distinct difference in perspective between the researcher and some of the SP reviewers. In one sense, this is not a problem, because heterogeneity of opinion is valuable – but only if it is clear to all that there is such heterogeneity. In this case, the response statements above reveal that there is a belief (preferably called a ‘hypothesis’) that there is a component of the ‘non-spawning’ population that exists somewhere in an unknown location (see underlined sentence above). The alternate hypothesis is that if such a non-spawning component exists, it would be mainly composed of small, young fish (mainly age two’s - between 24-36 months) and perhaps some age three’s (between 36 and 48 months). There may also be some age one’s (between 12-24 months). Part of the ‘alternate hypothesis’ (as opposed to the researcher’s hypothesis) is that such small, young fish may only be spatially disjunct during the spawning season. At other times of the year, they may well be in roughly the same locations as the spawning (or sexually maturing) component of the population. Probably ALL groups may be in the same general vicinity during the over-wintering aggregations, that supported the fisheries during the reduction fishery era.

There is a concern that the proposed research intends to look for herring in new locations – a form of ‘prospecting’ that, depending on the context, can be risky (see the PI response statement above LINES 233-234: “*The difficulty in the non-spawning fish led to the seasonal sampling proposed that is consistent with this recommendation.* “). However, and importantly, the intention of seasonal sampling, especially outside of the spawning period is a really good suggestion, and such an approach, when coupled by analyses of maturity (by size and age and sex) could be very useful and informative approach. Please include this approach in the revised proposal.

#### **PI RESPONSE (9.25.17)**

*The issue of seasonal sampling was included in the original FY17 proposal. Reviewer comments about the FY17 proposal highlighted the importance of temporal and spatial structuring:*

From FY17 Reviewer Comments: 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 (see again AUTHOR RESPONSE 1).

*This approach will be included in the revised FY18 proposal.*

#### **SCIENCE PANEL COMMENTS (9.11.17)**

“In mid-June 2017 during our summer sampling event, although we had adequate ship time and aerial survey support, we were unable to collect adult herring at many locations scouted throughout PWS. We may need to revisit our knowledge of adult herring distribution during this time period to better direct sampling activities in order to be successful. In addition, the mid-water trawl used by PWSSC would benefit from the use of a trawl master so that real-time information could be obtained

on net depth during trawls in order to fish more efficiently. PWSSC does have equipment that would help us collect real time information on the mid-water trawl and we will consider the possibility of requesting additional ship time to calibrate and test this equipment.”

While testing and calibration of trawl equipment is probably a good idea, does it need to be part of this project? It runs the risk of modifying the work to be more of an exercise in a study of gear configurations, OR, a study of herring distributions (horizontal and vertical). Such work might be warranted but it deviates from the main thrust of the proposal – unless you prefer to adjust the proposal to include such work. As it stands now, the requirement of this trawl survey calibration work, as a pre-requisite, is unclear.

**PI RESPONSE (9.13.12)**

The proposal is not advocating for a calibration of trawl equipment. Simply, that having an efficient capture method would expedite the sampling of fish and cut down on the ship and staff time needed to conduct the project. When the project was designed it was recognized that it may be difficult to capture fish outside of the spawning period and thus the original proposal suggested that modifications to the approach may be necessary in the first two years. As we complete this first year we will examine what changes in approach may be necessary and what techniques are most likely to lead to success of the project.

**SCIENCE PANEL COMMENTS (9.15.17)**

Thank you for this clarification. Please add a brief explanation in the revised proposal for clarity.

**PI RESPONSE (9.25.17)**

*This information will be included in the revised FY18 proposal.*

**SCIENCE PANEL COMMENTS (9.11.17)**

“Another issue we ran into this season is that the vessel we run the trawl from also seines in PWS, and therefore, the timing of our collections is driven by the availability of the ship, which doesn’t allow us to explore other timing in the summer to collect herring. Therefore, we may need to consider alternative approaches for catching fish, such as chartering with a gillnet vessel and using a gillnet to catch herring. Gillnet vessel likely have greater availability throughout the summer.”

The difficulties encountered to sample herring in the first year do not appear to bode well toward meeting your first objective, which is to evaluate seasonal timing for accurate maturity/spawning status from spring, summer, and fall. From the FY 18 proposal, it is not clear what new information on herring distributions or alternative sampling opportunities will allow this project to collect samples to meet this objective. Such sampling difficulties will also compromise the other three objectives. Thus, it appears risky to build a 5-year research project on a presumption that you can collect samples from PWS where and when you want. Methods for getting the required samples are clearly a prerequisite for this work. As indicated in our comments on this proposal in May 2016, the Science Panel again had discussions about the need for a five-year proposal. It seems to us that it should not require more than a year, or two, to collect specimens and evaluate the utility of scales as indicators of past maturity.

**PI RESPONSE (9.13.12)**

*Finding and collecting Pacific herring outside the spawning event is a difficult task even in populations that have not been reduced to extremely low levels. Part of our effort in year 1 (2017) is to determine what methods work to obtain samples, both in the field and in the lab. The summer 2017 collection was constrained by the timing the vessel with trawl gear was able to work given its fishing schedule. We cannot simply load this trawl on other vessels due to the specs of the stanchions. For the fall 2017 collection, we are aiming to collect fish as part of the Gulf Watch Alaska forage fish and whale survey and we anticipate having more success at finding herring given what we know from the telemetry work and the seasonal presence of herring in PWS. However, given the extremely low numbers of herring in PWS currently, we may again suffer from not being able to find fish. We can only try and see what we are able to accomplish.*

*By no means is it our intent to have a five year project dedicated to learning how to capture fish, but we recognized that we might have to try different approaches in the first two years to achieve the captures that we want. The idea of the 5-year program was to have at least three years of collections that could be used for looking at inter-annual changes in maturity.*

**SCIENCE PANEL COMMENTS (9.15.17)**

The difficulties in collecting appropriate samples, especially in the context of other cooperative and collaborative research is understood. We also continue to recommend that the researcher pays special attention to small, young herring collected either in the winter months (in winter aggregations) or by trying to collect herring later in the spawning period, especially April and May. As requested earlier, please include this in the revised proposal.

### PI RESPONSE (9.25.17)

*This information will be included in the revised FY18 proposal.*

### SCIENCE PANEL COMMENTS (9.11.17)

The question of the age of sexual maturation for BC herring was an issue for decades. As the proposal points out, it is an important parameter for stock assessments. Uncertainty arises because the youngest and smallest herring can seem under-represented in the age composition of samples, especially from commercial fisheries samples collected during the roe fishery. Probably similar issues occur in PWS, although there does not appear to have been a detailed description or analysis of this issue.

An example of an under-represented maturing (age 3) cohort occurs in northern BC where the frequency of age 4 herring may exceed the frequency of age 3 herring. A simple explanation for this, and one adopted by the DFO assessment biologists for years, was that some substantial part of the age 3 cohort, in most (or all years) did not mature. In contrast, in southern waters, the age 3 cohort, in most years, was more abundant than the age 4 cohort – so the assumption made there was that most of the age 3 cohort was maturing.

In short, there was an *assumption* that the maturation ogive varied between the north and the south. This was an assumption we challenged for several reasons:

(1) we usually see a partial, or sometimes near-complete geographic separation of cohorts on spawning grounds, with larger, older herring spawning earliest and smaller, younger herring spawning later (similar trends occur in other species – it is more of a norm than an oddity). We also note that in the roe fishery, most of the catches, and the biological sampling, occurs in the early part of the season, and inadvertently but selectively target, older, larger fish.

(2) Herring sampling by DFO in BC has examined over two million herring for size, age and sex since the 1940s and in almost all there are one or two estimates of mature (a visual ‘Hjort’ maturity scale) and a gonad weight. These herring have been collected over the entire coast, in all areas, seasons and by different types of gear. Various types of spatial and temporal analyses have shown evidence of strong and weak cohorts, changes in spatial distribution, changes in size-at-age, etc. There is evidence of spatial distinction between maturing and non-maturing herring, but the instances of non-maturing fish are almost exclusively samples of mainly age-2 herring or juvenile schools, mainly age 1. **There are no clear examples of large numbers of immature age-3, or age-4 herring after November.** There are, however, many instances of immature age-2 herring. Thus, attempts to sample non-spawning age 3 and 4 herring in PWS may be futile.

By about November, nearly all sexually maturing herring can be distinguished visibly using a Hjort maturity scale, or by a gonad weight. Maturity of herring from samples taken earlier, in September or October can be determined by simple measurements of oocytes – using the criterion that developing (vitellogenic) oocytes will be greater than 150 microns. Again, using such criteria, there is no evidence of any large, geographically distinct abundance of immature herring. Usually the incoming age-3 cohort is the most numerous (by number) and comprises a substantial part of the total spawning biomass (~20-50%). Consider, for a moment that this observation were incorrect that, say, half of the age-3 cohort were immature and somehow, not accessible to our any of the DFO sampling to date. That would require large abundances of herring, constituting thousands of tons of herring that have somehow gone unnoticed for decades! If there were a large group of such fish that were routinely residing elsewhere, and which as somehow never been part of the sampling, it is very unlikely that they would have continually avoided detection, after tens of thousands of samples. Nevertheless, there is still some reluctance by some people working in assessments to accept the conclusion that most age-3 herring are mature and they want to push the maturity ogive to the left.

(3) What is the impact of error in the estimate of age-specific maturity – by assuming that there is a large non-spawning component of age-3 herring? One concern is that an assessment model may assume that there is some undetected, premature, biomass. Probably, in most instances this would tend to inflate biomass estimates, and lead to less risk-averse recommendations.

### PI RESPONSE (9.13.12)

*We appreciate the panel sharing this information. ADF&G and the HRM program are aware of the issues associated with separation of age classes during spawning and are striving to ensure the sampling for age-structure is appropriate to capture the full spawning population. Sadly, with the recent collapse of the herring population the age structure no longer has many fish over the age of 5. We will be looking for the separation of age classes as the population hopefully recovers.*

*We too have an assumption that there is a difference in maturation between PWS and Sitka. At this point the assumption is based on the ASA model suggesting different maturation. It is through the work that we proposed that we hope to have a model independent approach to the question of maturity. The model results suggest that there are immature age-3 and age-4*



fish in PWS and this is what we are trying to confirm. These results are a result of changes in the proportion of fish in the stock from a brood year that is explained by new fish recruiting to the spawning population. The results from BC obviously suggest an earlier maturation than we expect in PWS. At the same time the maturation function used in PWS expects much more mature age-3 fish than the model in Sitka suggests.

In your third point about the impact of the error, it can be large as the model suggests that nearly half of the fish at age-3 have not recruited to the spawning stock. This again emphasizes the importance of being able to find a mechanism that provides a measure of the maturity of each age class and how that may change over time.

Additionally, I would like to review the context and timeline of this project. This project was originally proposed in 2016 to EVOS FY17-FY21 invitation for proposals. A pilot project was initiated on PWS herring age at maturity in the previous funding cycle, FY12-16, led by J.J. Vollenweider at NOAA Auke Bay Labs. The results of this pilot project were not available when the original proposal for FY17-FY21 was written, so I did my best to build from the pilot project's ideas and focus on increasing sample sizes from field collected fish as this was the primary weakness of the pilot study. The proposal to the FY17-FY21 invitation was funded and we have since conducted 2 of 3 proposed collections for the first year of study (2017), with the 3<sup>rd</sup> collection occurring next week (Sept 17-24, 2017). We have not yet received histology results back from the lab for fish collected in spring 2017. Therefore, with the FY18 proposal, the entire project was kept exactly the same, which is the project that was funded in FY17.

### **SCIENCE PANEL COMMENTS (9.15.17)**

Thank you for the clarifications. We understand that sometimes there is limited time to absorb and build on related work (such as that by Vollenweider) but such connections are essential.

Below, we offer some related points.

On inter-project (and proposal) integration, there may be opportunities to include results from other projects. For example, it is clear that disease can be widespread in some years, and may impose metabolic costs on some fish, perhaps resulting in slower growth, impacts on maturity, etc. In BC there are infrequent but continuing instances of fish with only one gonad developing, and this could affect energy allocation between the gonads and soma. Further, there can be instances of disease and pathology, in older fish that may interrupt sexual maturation. If examined by scales, would this appear to be an example of 'skipped spawning'? The recent fatty acid work found different signatures among herring from different locations in PWS, and a number of previous reports have noted area-specific differences in growth rate. Therefore such variation could impact retrospective analyses from scales, and also might impact estimates of real-time age-specific maturity.

### **PI RESPONSE (9.25.17)**

*Integrating the results from other projects is most definitely of interest to the PI.*

We encourage the PI to make use of the bio-sampling database as an indicator of past age-specific maturation. We also would encourage the researchers to use any of their results to *challenge* output from the ASA model regarding age-specific maturity. We suggest that there are presumptions about age-specific maturity that may actually reflect age-specific catchability or availability. This could arise because of sampling bias related to the later spawning of younger fish. Please look at the tables and figures at the end of this document that show a rough and simple analysis of PWS bio-sampling data from 1973-2014. It shows two key things: (1) looking at >200,000 specimens in all collections, age 3 herring dominate in May and age 2 (probably about 30 months of age) in November; (2) of about 8000 herring specimens where gonad weights were measured, virtually all had GSI estimates that are consistent with sexual maturation – in both sexes. Note also that no samples were available in May – which could be very revealing OR that no GSI estimates were taken from small, young fish in November. Such samples may be very revealing.

Specifically, consider re-thinking maturity ogives to put more emphasis on younger smaller fish, of both sexes. In this regard we are strongly supportive of your intentions to sample at different times of the year. This approach, which could result in a left-shift of the presumed maturity ogive, could have very important implications for all aspects of PWS herring.

If there is one main point from all the our comments, it is that the PI should emphasize direct estimates of age-specific maturation and proceed cautiously, and in a limited way with scale work especially when directed at retrospective estimates of maturation. To the extent that scale work is pursued, it should not occur at the cost of direct estimation from gonad analysis.

We recommend a revised proposal that prioritizes direct estimation of maturity. Work on scale-based inferences about maturity should be staged, beginning with validation. In other words, we are looking for a convincing demonstration that the method works and will pass muster with the scientific community. Failing this, other scale-based objectives should be dropped from future efforts. At present the project milestones mainly include field collections and sending off histology

samples. In the revised proposal, please include timelines for other project milestones (e.g. data analysis, conference attendance) for each project component. It is important for all of us to be able to track progress on the objectives to assess any course corrections that may be necessary with each new annual proposal.

#### **PI RESPONSE (9.25.17)**

*It is understood that the SP would like the proposal to focus primarily on direct measures of maturity, this was included in the original FY17 proposal that was funded as histology, GSI and now Hjort criteria are used for direct estimation of maturity with the later two measures especially important for males as an addition to the project.*

#### **SCIENCE PANEL COMMENTS (9.11.17)**

Some potentially useful references (most relevant in bold):

**Hay, D.E. and P.B. McCarter. 1999. Age of sexual maturation and recruitment in Pacific herring. Canadian Stock Assessment (CSAS) Research Document 99/175. 39p.**

**Hay, D.E., D.N. Outram, B.A. McKeown, and M. Hurlburt. 1987. Ovarian development and oocyte diameter as maturation criteria in Pacific herring (*Clupea harengus pallasii*). Can. J. Fish. Aquat. Sci. 44: 1496-1502.**

**Hay, D.E. and Outram, D.N. 1981. Assessing and monitoring maturity and gonad development in Pacific herring. Can. Tech. Rep. Fish. Aquat. Sci. 998: 31p.**

Gillis, D.J., B.A. McKeown, and D.E. Hay. 1990. Ultrastructural observations on the ovary and eggs, and the development of egg adhesion in Pacific herring (*Clupea harengus pallasii*). Can. J. Fish. Aquat. Sci. 47: 1495-1504.

Gillis, D.J., B.A. McKeown, and D.E. Hay. 1990. Physiological and histological aspects of late oocyte provisioning, ovulation, and fertilization in Pacific herring (*Clupea harengus pallasii*). Can. J. Fish. Aquat. Sci. 47: 1505-1512.

Hay, D.E. and J.R. Brett. 1988. Maturation and fecundity of Pacific herring: an experimental study with comparisons to natural populations. Can. J. Fish. Aquat. Sci. 45: 399-406.

Hay, D.E., J.R. Brett, E. Bilinski, E.M. Donaldson, D.T. Smith, G.A. Hunter and A. Solmie. 1988. Experimental impoundments of pre-spawning Pacific herring: effects of feeding and density on maturation, growth and proximate analysis. Can. J. Fish. Aquat. Sci. 45: 388-398.

Hay, D.E., Outram, D.N., Shimozawa, A.C. and Stubbington, K.L. 1980. Data record from a study of gonad maturation of Pacific herring. Can. Data. Rep. Fish. Aquat. Sci. 209: 57p.

#### **PI RESPONSE (9.13.12)**

Thank you very much for these references. ADF&G and we have been using the Hay (1985) paper as our primary reference for maturation and these expand the information greatly. We will also continue to follow the results coming from the Institute of Marine Research in Norway.

#### **SCIENCE PANEL COMMENTS (9.15.17)**

Suggested SP reply. We also thank you for your rapid and detailed reply. We hope you consider our comments that are intended to be constructive. We wish you success with your work

#### **SCIENCE PANEL COMMENTS (9.15.17)**

Rough analyses of sampling and age-of maturity from PWS biosampling database, 1973-2014.

Two tables and one figure, using data extracted from an Excel sheet on the EVOSTC or Axiom websites. This analysis was made to respond to proposed research on age-at-maturity in PWS. These analyses may have errors and have not been used elsewhere and would not be used anywhere else without first securing permission from the agencies involved.

Note, these analyses were conducted without reference to the 'birthdate' of PWS herring: specifically when does a herring change from being classified as age 3 to an age 4? If it is at the turn of the year (January 1) then some of the age classifications in the following text may require revision, especially those later months of the year.

#### **PI RESPONSE (9.25.17)**

*From the HRM perspective we use an April 1 birthday because of spawn timing and the end of the winter annulus. The aging is going to become important since we are now trying to collect adults in September and hopefully later in the year. We have a query out to Steve Moffitt about this issue, who lead the herring work while he was in Cordova regarding ageing of adult PWS fish. For SE fish, we asked Sherri Dressel and Detlef Buettner, Detlef responded, "A fish that hatched in May is age zero in September. When the growth for the season ends – one could say roughly in October -the summer growth is counted and turns the fish to age 1 on October 1<sup>st</sup>. An age 4 fish caught in the spring, will not show any new summer growth at all (three annuli and plus growth from the previous summer). But by October 1<sup>st</sup>, the whole summer growth of the same year is now counted (scales from the fish look the same on October 1 as in April of the next year) and the fish will turn age 5".*

Table 1. Numbers of fish collected by age and by month and by different types of gear, in Prince William Sound, 1973-2014. The numbers of age 3 and 4 fish are highlighted. Note that the relative numbers vary, by month and gear type. Of particular interest is the difference in relative frequency between April (the month when most samples are collected and the approximate time of most spawning) and May, when the relative frequency of age 3 fish increases.

**Results for January**

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	3	0	0	0	3
2	0	0	0	0	0	0	0	80	0	0	0	80
3	0	0	0	0	0	0	0	196	0	0	0	196
4	0	0	0	0	0	0	0	440	0	0	0	440
5	0	0	0	0	0	0	0	242	0	0	0	242
6	0	0	0	0	0	0	0	116	0	0	0	116
7	0	0	0	0	0	0	0	49	0	0	0	49
8	0	0	0	0	0	0	0	20	0	0	0	20
9	0	0	0	0	0	0	0	15	0	0	0	15
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	1	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	3	0	0	0	3
15	0	0	0	0	0	0	0	1	0	0	0	1
Missing	0	0	0	0	0	0	0	107	0	0	0	*
All	0	0	0	0	0	0	0	1166	0	0	*	1166

**Results for February**

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	6	0	0	0	6
3	0	0	0	0	0	0	0	47	0	0	0	47
4	0	0	0	0	0	0	0	126	0	0	0	126
5	0	0	0	3	0	0	0	144	0	0	0	147
6	0	0	0	1	0	0	0	94	0	0	0	95
7	0	0	0	5	0	0	0	42	0	0	0	47
8	0	0	0	5	0	0	0	11	0	0	0	16
9	0	0	0	0	0	0	0	7	0	0	0	7
10	0	0	0	0	0	0	0	1	0	0	0	1
11	0	0	0	0	0	0	0	2	0	0	0	2
12	0	0	0	1	0	0	0	0	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	0	0	3	0	0	0	70	0	0	0	*
All	0	0	0	15	0	0	0	480	0	0	*	495

**Results for March**

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	596	6	0	0	602
2	0	0	110	0	0	0	0	4817	639	0	0	5566
3	0	0	494	0	0	0	0	7638	255	25	23	8412
4	0	0	357	0	0	0	0	6933	121	38	314	7449
5	0	0	247	0	0	0	0	3516	150	7	516	3920
6	0	0	245	0	0	0	0	2218	49	1	135	2513
7	1	0	884	0	0	0	0	1026	5	1	240	1917
8	0	0	218	0	0	0	0	951	6	0	145	1175
9	0	0	42	0	0	0	0	636	20	0	106	698
10	0	0	20	0	0	0	0	341	3	0	31	364
11	0	0	12	0	0	0	0	121	2	0	5	135
12	0	0	5	0	0	0	0	50	0	0	1	55
13	0	0	1	0	0	0	0	32	0	0	0	33
14	0	0	0	0	0	0	0	14	0	0	0	14
15	0	0	0	0	0	0	0	4	0	0	0	4
Missing	0	0	37	0	0	0	0	1604	448	451	27	*
All	1	0	2635	0	0	0	0	28894	1256	72	*	32858

**Results for APRIL**

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	766	0	0	0	766
2	0	3	98	1	2	0	1	2090	6	1	7	2202
3	0	686	4326	126	166	1	2	15186	1355	166	260	22014
4	0	591	6137	28	394	16	18	20985	2401	215	841	30785
5	0	1316	3564	357	1439	7	28	15802	2897	54	1189	25464
6	0	1183	2411	19	2419	27	41	12384	2052	14	324	20550
7	0	383	1336	6	1974	54	23	11892	1641	8	571	17317
8	0	96	1084	20	1654	90	1	6242	867	10	603	10064
9	0	80	1075	46	1071	81	3	3131	417	1	584	5905
10	0	157	341	2	526	9	3	1391	127	0	219	2556
11	0	19	202	0	108	7	5	801	94	0	23	1236
12	0	5	195	0	53	2	2	217	32	0	7	506
13	0	0	50	0	18	0	0	71	5	0	1	144
14	0	0	18	0	7	0	0	20	1	0	1	46
15	0	0	11	0	0	0	0	6	0	0	0	17
Missing	0	303	323	14	970	8	15	4042	819	41	174	*
All	0	4519	20848	605	9831	294	127	90984	11895	469	*	139572

Results for May

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	1	0	0	0	0	0	0	0	0	1
2	0	2	6	0	2	0	0	15	0	0	0	25
3	0	417	1081	0	35	0	0	301	0	0	0	1834
4	0	62	413	0	29	0	0	348	0	0	0	852
5	0	18	181	0	67	0	0	358	0	0	0	624
6	0	36	436	0	184	0	0	163	0	0	0	819
7	0	30	22	0	75	0	0	196	0	0	0	323
8	0	4	34	0	5	0	0	46	0	0	0	89
9	0	2	10	0	1	0	0	61	0	0	0	74
10	0	1	10	0	6	0	0	18	0	0	0	35
11	0	1	3	0	2	0	0	14	0	0	0	20
12	0	0	2	0	0	0	0	0	0	0	0	2
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	27	51	0	34	0	0	138	0	0	0	*
All	0	573	2199	0	406	0	0	1520	0	0	*	4698

Results for June

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	968	0	0	0	968
2	0	0	0	0	0	1	0	790	0	0	0	791
3	0	0	0	0	0	7	0	356	0	0	0	363
4	0	0	0	0	0	7	0	115	0	0	0	122
5	0	0	0	0	0	4	0	90	0	0	0	94
6	0	0	0	0	0	0	0	99	0	0	0	99
7	0	0	0	0	0	0	0	37	0	0	0	37
8	0	0	0	0	0	0	0	11	0	0	0	11
9	0	0	0	0	0	0	0	2	0	0	0	2
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	0	0	0	0	1	0	495	0	0	0	*
All	0	0	0	0	0	19	0	2468	0	0	*	2487

Results for September

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	2	0	0	0	0	0	46	0	0	0	48
3	0	24	0	0	0	0	0	386	0	0	0	410
4	0	41	0	0	0	0	0	275	0	0	0	316
5	0	29	0	0	0	0	0	255	0	0	0	284
6	0	16	0	0	0	0	0	129	0	0	0	145
7	0	2	0	0	0	0	0	59	0	0	0	61
8	0	3	0	0	0	0	0	27	0	0	0	30
9	0	0	0	0	0	0	0	8	0	0	0	8
10	0	0	0	0	0	0	0	3	0	0	0	3
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	1	0	0	0	1
14	0	0	0	0	0	0	0	1	0	0	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	3	0	0	0	0	0	90	0	0	0	*
All	0	117	0	0	0	0	0	1190	0	0	*	1307

Results for October

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
0	0	0	0	0	0	0	0	390	0	0	0	390
1	0	0	0	0	0	0	0	643	0	95	45	738
2	0	116	0	0	0	0	0	1113	0	856	292	2085
3	0	110	0	0	0	0	0	1143	0	78	115	1331
4	0	165	0	0	0	0	0	3051	0	55	354	3271
5	0	139	0	0	0	0	0	1261	0	30	25	1430
6	0	76	0	0	0	0	0	601	0	62	14	739
7	0	42	0	0	0	0	0	306	0	5	6	353
8	0	11	0	0	0	0	0	237	0	2	10	250
9	0	2	0	0	0	0	0	76	0	1	3	79
10	0	1	0	0	0	0	0	9	0	1	2	11
11	0	0	0	0	0	0	0	2	0	1	0	3
12	0	0	0	0	0	0	0	1	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	1	0	0	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	28	0	0	0	0	0	320	0	158	34	*
All	0	662	0	0	0	0	0	8834	0	1186	*	10682

Results for November

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
0	0	0	0	0	0	0	0	454	0	0	1	454
1	0	0	0	0	0	0	0	1313	0	35	42	1348
2	0	0	0	0	0	0	0	3994	0	162	401	4156
3	0	0	0	0	0	0	0	2247	0	43	25	2290
4	0	0	0	0	0	0	0	1379	0	158	22	1537
5	0	0	0	0	0	0	0	918	0	46	6	964
6	0	0	0	0	0	0	0	694	0	118	6	812
7	0	0	0	0	0	0	0	198	0	1	0	199
8	0	0	0	0	0	0	0	225	0	6	2	231
9	0	0	0	0	0	0	0	100	0	5	0	105
10	0	0	0	0	0	0	0	36	0	9	0	45
11	0	0	0	0	0	0	0	20	0	0	0	20
12	0	0	0	0	0	0	0	20	0	0	0	20
13	0	0	0	0	0	0	0	2	0	0	0	2
14	0	0	0	0	0	0	0	1	0	0	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	0	0	0	0	0	0	1592	0	28	4	*
All	0	0	0	0	0	0	0	11601	0	583	*	12184

Results for December

AGE	*	Beach_Seine	Cast_Net	Dip_Net	Gillnet	Hand_picked	Jig	Purse_Seine	Purse_Seine_Trawl	Trawl	Missing	All
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	120	0	0	0	120
3	0	0	0	0	0	0	0	315	0	0	0	315
4	0	0	0	0	0	0	0	302	0	0	0	302
5	0	0	0	0	0	0	0	83	0	0	0	83
6	0	0	0	0	0	0	0	35	0	0	0	35
7	0	0	0	0	0	0	0	17	0	0	0	17
8	0	0	0	0	0	0	0	2	0	0	0	2
9	0	0	0	0	0	0	0	1	0	0	0	1
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	1	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Missing	0	0	0	0	0	0	0	52	0	0	0	*
All	0	0	0	0	0	0	0	876	0	0	*	876

Table 2. Numbers of fish with gonad weights (and therefore GSI estimates) sorted by year, month and sex. The samples are from all gear types. Note that most samples were taken between February and April, except for some in 1994, collected in October and November.

**Results for SEX = 1 (Male)**

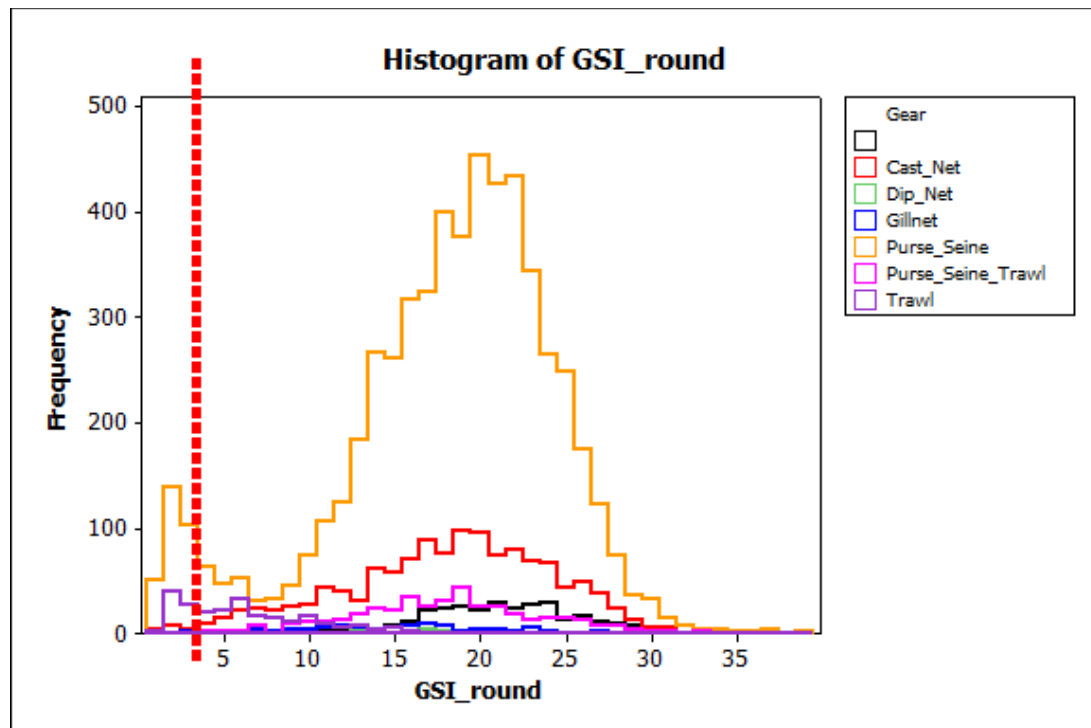
	February	March	April	October	November	All
1983	0	0	0	0	0	0
1994	0	0	0	44	233	277
1995	0	0	414	0	0	414
1996	0	0	351	0	0	351
1997	0	97	579	0	0	676
1998	0	145	57	0	0	202
1999	0	0	91	0	0	91
2001	0	100	101	0	0	201
2002	0	151	50	0	0	201
2003	0	251	0	0	0	251
2004	0	100	0	0	0	100
2005	0	50	50	0	0	100
2006	0	52	50	0	0	102
2007	0	52	49	0	0	101
2008	0	0	202	0	0	202
2009	0	0	151	0	0	151
2010	0	98	0	0	0	98
2011	0	0	98	0	0	98
2012	7	50	100	0	0	157
2013	0	0	47	0	0	47
2014	0	49	51	0	0	100
<b>All</b>	<b>7</b>	<b>1195</b>	<b>2441</b>	<b>44</b>	<b>233</b>	<b>3920</b>

Cell Contents: Count

	February	March	April	October	November	All
1983	0	0	56	0	0	56
1994	0	0	0	128	218	346
1995	0	0	402	0	0	402
1996	0	0	341	0	0	341
1997	0	100	588	0	0	688
1998	0	150	61	0	0	211
1999	0	0	99	0	0	99
2001	0	100	99	0	0	199
2002	0	148	50	0	0	198
2003	0	249	0	0	0	249
2004	0	100	0	0	0	100
2005	0	50	50	0	0	100
2006	0	48	50	0	0	98
2007	0	50	51	0	0	101
2008	0	0	197	0	0	197
2009	0	0	148	0	0	148
2010	0	97	0	0	0	97
2011	0	0	100	0	0	100
2012	11	50	100	0	0	161
2013	0	0	53	0	0	53
2014	0	51	49	0	0	100
<b>All</b>	<b>11</b>	<b>1193</b>	<b>2494</b>	<b>128</b>	<b>218</b>	<b>4044</b>

Cell Contents: Count

Figure 1. Histogram of the GSI (gonosomatic index) by gear type for all of the observations of GSI shown in Table 2 (3920 males and 4044 females). Note that the dotted red line, at a GSI of 3, is a rough guide to maturity: any fish with a GSI greater than three has developing gonads. Even fish with lower GSI's may be maturing and the lower mode (less than three) represents fish collected in November when gonads of ALL fish were small. However, even in November most had GSI scores that were diagnostic of fish in the early stages of maturation.



**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

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 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: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120111-E

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

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

**PI Affiliation:** USGS

**Project Manager:** USGS

**EVOSTC Funding Requested FY17-21: \$1,166,400**

FY17	FY18	FY19	FY20	FY21
Auth: \$197,800	\$228,900*	\$236,700*	\$243,400*	\$259,600*

*Requests include 9% GA.*

\*Plasma sample processing for disease work to be included in the revised ASA model has increased in FY 18-21 by \$24.5K.

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

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

**Total Past EVOSTC Funding Authorized (FY12-17): \$1,069,600**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$2,038,200**

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

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 7/16/17*

We will investigate fish health factors that may be contributing to the failed recovery of Pacific herring populations in Prince William Sound. Field samples will provide infection and disease prevalence data from Prince William Sound and Sitka Sound that will inform the age-structured analysis (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.

**FY18 Funding Recommendations:**

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

**Date: September 2017**

The Panel is pleased with the results, supports the additional funding requested, and finds the request to be reasonable and justified. Would it be beneficial (and cost-effective) for the Post-Doc (Maya

Groner) to help with this project without compromising her proposed research plan? If it can be managed, the Panel feels that this involvement would benefit both the new post-doc and this project.

*PI Response (10/11/2017)*

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel's comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

- Several of the Objectives were from the previous 5-year proposal and there was not a clear rationale why these were nearly identical to the previous proposal. While an extension of the

- earlier objectives makes sense, inadequate descriptions of previous accomplishments and
- application of these accomplishments will advance the knowledge of disease in PWS herring in the coming 5 years.
    - Pathogen-free herring have already been established to the Science Panel’s knowledge. The proposal should explain how these fish will be used in studies, not how they are cultured. The Panel feels it is critical that disease free populations should be established for PWS and a Sitka or Kodiak/Cook inlet. That is, genetically distinct populations that may have differing disease susceptibilities.
    - The plaque neutralization assay data were already presented. The proposal should explain how these data will be employed in the coming 5 years.
  - The past proposal indicated that there was to be a comparative study of herring populations from SE Alaska, including populations that are now established as genetically different from PWS fish. These include Sitka and Cook Inlet or Kodiak populations. Puget Sound populations may have different life histories and demographics so geographical comparisons may be less relevant than data from other Alaskan populations. At the Synthesis Symposium in Anchorage 2 years ago, a discussion of the immunity and exposure differences of populations was prominent but this approach is not described clearly in this proposal. Taking into account the very recent discovery of the unique genetic character of PWS herring, this comparative population susceptibility to disease becomes a high priority to the Science Panel.

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

(\*\*<https://pag.confex.com/pag/xxiv/webprogram/Paper21716.html>)

**Science Coordinator Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Date: May 2016**

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

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18160111-F

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

**Primary Investigator(s):** Stormy Haught

**PI Affiliation:** ADFG

**Project Manager:** ADFG

**EVOSTC Funding Requested FY17-21: \$831,500**

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

*Requests include 9% GA.*

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

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

**Total Past EVOSTC Funding Authorized (FY12-17): \$226,300**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$891,500**

**Total Non-EVOSTC Funding (FY12-21): \$321,487**

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 7/26/17.*

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 been collected since the early 1970s and are an essential part of the age-structured model used by the Alaska Department of Fish and Game to estimate the historical and future biomass for fisheries management. Acoustics surveys have been conducted consistently since 1995 and the age-structured model is also tuned to acoustics biomass estimates. This project will 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.

**FY18 Funding Recommendations:**

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

## Science Panel Comments – FY18

**Date: September 2017**

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

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

*PI Response (10/11/2017)*

*The text is Prince William Sound centric because it explains the history of the data collection that this proposal continues.*

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

*There has been work examining the spawning characteristics, but none of it has been published yet. Dick Thorne was working on a manuscript detailing the shifts in timing and location of spawning in relation to predation pressure by whales, and we will have to follow up to determine the status of that effort. We have tried to use water temperature to help predict spawn timing for guiding survey timing. There appears to be a temperature that spawning does not occur below (~14.5C), but overwinter water temperatures have not been a consistent predictor of when spawning will begin. Spawn location, timing, and the relationship to environmental conditions are things appropriate for the analysis that David McGowan has proposed in his postdoc. The required aerial and acoustic survey information exists for that analysis.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

- 1) conduct spring aerial surveys to document milt distribution and biomass;
- 2) document distribution and abundance of sea lions, other marine mammals, and birds associated with herring schools or spawn;
- 3) provide a research platform (R/V Solstice) for an adult herring acoustics survey and disease sample collection and processing; and
- 4) collect and process age, sex, and size samples of herring collected by the acoustics survey, spawning surveys, and disease sampling.

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

Distribution and abundance of sea lions, other marine mammals, and birds. The Panel strongly

endorses this line of inquiry and notes that evaluation of the potential impacts of pinniped predation on herring is an active area of research in other parts of the northeast Pacific. The proposers should familiarize themselves with current research.

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

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

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

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

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



**Science Coordinator Comments – FY17****Date: May and September 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17****Date: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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

*Footnote: This project has gone through several titles and PIs*

*FY12: 12120111-F Buckhorn Juvenile Herring Abundance Index*

*FY13: 13120111-F Buckhorn Juvenile Herring Abundance Index*

*FY14: 14120111-F Buckhorn Juvenile Herring Abundance Index*

*FY15: 15120111-F Buckhorn Juvenile Herring Abundance Index*

*FY16: 16120111-F Rand Juvenile Herring Abundance Index and 16160111-T Moffit ASL Study & Aerial Milt Surveys began*

*FY17: the work in 16120111-F was rolled into 16160111-T to create 17160111-F Moffit ASL Study & Aerial Milt Surveys.*

*FY18: the project has a new PI, correct number is 18160111-F Haught*

**Project Number:** 18120111-G

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

**Primary Investigator(s):** Peter Rand

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

**EVOSTC Funding Requested FY17-21: \$337,300**

FY17	FY18	FY19	FY20	FY21
Auth: \$74,200	\$73,800	\$61,300	\$63,100	\$64,900

*Requests include 9% GA.*

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

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

**Total Past EVOSTC Funding Authorized (FY12-17): \$408,200**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$671,300**

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

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 7/26/17.*

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 age-structured analysis (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 during 2018. Our main goal for this proposed project is to produce a reliable estimate of adult biomass of the spawning population of Pacific herring during 2018 in support of the 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, ADF&G, 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. We propose to carry out this assessment 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.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

*PI Response (10/13/2017)*

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

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

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

**Date: May 2016**

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

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

**Science Coordinator Comments – FY17**

**Date: May 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Long-Term Monitoring Program  
Project Descriptions**

**Project Number:** 18120114

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

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

**PI Affiliation:** NOAA

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$12,049,840**

FY17	FY18	FY19	FY20	FY21
Auth: \$2,278,750	\$2,574,860	\$2,351,260	\$2,502,340	\$2,342,630

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$8,340,000**

FY17	FY18	FY19	FY20	FY21
\$1,671,000	\$1,712,000	\$1,658,000	\$1,677,000	\$1,622,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$16,307,650**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$26,078,740**

**Total Non-EVOSTC Funding (FY12-21): \$17,023,000**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

The Gulf Watch Alaska (GWA) program directly addresses the *Exxon Valdez* Oil Spill Trustee Council's focus area of integrated long-term monitoring of marine conditions and injured resources services. The overarching goal of GWA is to provide sound scientific data and products that inform management agencies and the public of changes in the environment and the impacts of these changes on injured resources. GWA has a consortium of 14 projects organized in the following functional groups: three monitoring components (environmental drivers, pelagic, and nearshore), a program management team, a science review panel, a science coordinating committee, and an outreach steering committee.

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

Recent highlights from the first six years of the GWA program show continued development of program infrastructure and compilation of scientific information for the long-term. Five-year final reports were submitted to the EVOSTC, 45 datasets were published to the public on DataONE, and 19 papers were accepted for a special journal issue of *Deep Sea Research II*.

Our plans for FY18 have not changed and include continuing the legacy of our LTM datasets and expanding our knowledge of the GOA ecosystem and its changing conditions.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

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

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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



### **Science Panel Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

### **Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel's comments.

### **Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel's comments.

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

**Date: September 2016**

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

**Project Number:** 18120114-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 Requested FY17-21:** \$1,170,500

FY17	FY18	FY19	FY20	FY21
Auth: \$226,800	\$227,600	\$229,000	\$237,700	\$249,300

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21:** \$345,000

FY17	FY18	FY19	FY20	FY21
\$69,000	\$69,000	\$69,000	\$69,000	\$69,000

**Total Past EVOSTC Funding Authorized (FY12-17):** \$935,300

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$1,879,000

**Total Non-EVOSTC Funding (FY12-21):** \$410,000

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

The Program Management I project provides program coordination and science synthesis of data for the EVOSTC's integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services program, referred to as Gulf Watch Alaska (GWA). The leadership team of the GWA program manages 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 to rely on effective program and science coordination into the next five-year increment. Major accomplishments of program management and science coordination in FY17 included coordinating completion, review, and submission of FY12-16 GWA final reports, completion of the Deep-Sea Research II GWA special issue (19 papers), and inauguration of the second 5-yr period of GWA for the program management team. Inauguration included orientation of new personnel, evaluating successes and challenges of first 5-yrs and identifying improvements and efficiencies for the second 5-yr period. During FY18, key directions of program coordination and science synthesis will include improving efficiencies and facilitating program reporting requirements for PIs, identifying GWA

indicators from each project to contribute to annual ecosystem status and oil spill recovery assessments, standardizing reporting, and identifying main cross-program science synthesis products for GWA, HRM, and other Gulf of Alaska investigations. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

*PI Response (10/11/2017):*

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

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

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

<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	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

**Science Panel Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-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 Requested FY17-21:** \$1,476,900

FY17	FY18	FY19	FY20	FY21
Auth: \$277,100	\$282,400	\$303,900	\$300,600	\$312,900

*Requests include 9% GA.*

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

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

**Total Past EVOSTC Funding Authorized (FY12-17):** \$1,695,300

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$2,895,100

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

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

This project is the administrative and outreach component of the integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services program referred to as Gulf Watch Alaska (GWA). PWSSC serves as the fiscal agent for non-Trustee Agency recipients of GWA funds with Hoffman as Administrative Lead. This continues Hoffman's role, as with GWA during FY12–16. Hoffman is also serving as Outreach and Community Involvement Lead for FY17-21, a new role as compared to the previous five years. As a Program Management Team member, Hoffman 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 the National Oceanic and Atmospheric Administration (NOAA), and is the party through which all non-Trustee Agency funds are distributed. PWSSC issues and manages contracts for subawards to the various non-Trustee Agencies participating in GWA, for whom we also coordinate semi-annual reporting to NOAA. PWSSC also works with Trustee Agency principal investigators, with whom we coordinate reporting to the EVOSTC. PWSSC ensures regular program engagement with EVOSTC staff, Trustees, and Public Advisory Committee members. We coordinate logistics for annual PI meetings for all GWA participants and make telecommunications available for remotely-connected meetings. We support travel and logistics for all GWA Science Review Panel members. We will convene the Outreach Steering Committee, which 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. PWSSC is also the administrative lead agency for the Herring Research and Monitoring program, allowing for efficient fiscal management of and reporting for both programs. We are not

proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

*PI Response (10/11/2017):*

*See response in section above for project 18120114-A.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel's comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-C

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

**Primary Investigator(s):** Mayumi Arimitsu & John Piatt

**PI Affiliation:** USGS

**Project Manager:** USGS

**EVOSTC Funding Requested FY17-21: \$1,106,400**

FY17	FY18	FY19	FY20	FY21
Auth: \$198,800	\$229,800	\$221,300	\$224,500	\$232,000

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$1,280,000**

FY17	FY18	FY19	FY20	FY21
\$256,000	\$256,000	\$256,000	\$256,000	\$256,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$1,166,400**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$2,074,000**

**Total Non-EVOSTC Funding (FY12-21): \$2,119,000**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

Identifying drivers of change in forage fish populations is key to understanding recovery potential for piscivorous species injured by the Exxon Valdez oil spill. Forage fish are small pelagic schooling fish such as capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes personatus*), Pacific herring (*Clupea pallasii*), and juvenile walleye pollock (*Gadus chalcogrammus*) that are important in marine ecosystems because they are primary food resources for marine predators. Krill (*Euphausiidae*) are also important prey taxa sampled in this study. The goals of the Gulf Watch Alaska (GWA) forage fish monitoring project are to provide information on the population trends of forage species in the Gulf of Alaska (GOA) and to better understand how underlying predator-prey interactions influence recovering species and pelagic ecology within Prince William Sound (PWS). In FY18 we will conduct acoustic-trawl surveys for forage fish during an integrated predator-prey survey in PWS during fall (Sept/Oct), and conduct seabird diet sampling at Middleton Island during spring/summer (Apr – Aug). Forage fish indices from seabirds on Middleton Island provide the critical mid-trophic level link to spring/summer lower and upper trophic levels studied during GWA Environmental Drivers cruises in the GOA. The FY18 sampling activities will continue newly initiated predator prey studies (FY17-FY21) and ensure the continuity of long-term datasets that will collectively provide an important contribution to knowledge of ecosystem function. Furthermore, our continued sampling will provide insight into how forage fish populations respond to the persistence of or recovery from the recent Pacific marine heat wave. Expansion of environmental drivers sampling (National Science Foundation Long-term Ecological Research) to the GOA shelf area adjacent to Middleton Island provides additional linkages to



GWA forage fish studies and lower trophic level processes. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

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

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

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

**Date: May 2016**

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

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

**Science Coordinator Comments – FY17**

**Date: September 2016**

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

**Date: May 2016**

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

**Executive Director Comments – FY17**

**Date: September 2016**

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

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-D

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

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

**PI Affiliation:** SAHFOS

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$406,200**

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

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$801,600**

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

**Total Past EVOSTC Funding Authorized (FY12-17): \$356,000**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$680,300**

**Total Non-EVOSTC Funding (FY12-21): \$1,394,100**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

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 17 year record of taxonomically resolved, seasonal, near-surface zooplankton and large phytoplankton abundance over a wide spatial scale. Sampling takes place approximately monthly, six times per year, usually between April and September. Outputs from the project include indices of plankton abundance (e.g., large diatom abundances, estimated zooplankton biomass), seasonal cycles (phenology of key groups) and community composition (e.g., appearance of warm water species, change in dominance by some groups). Variability in any, or all, of these indices might be expected to flow-through to higher trophic levels such as herring, salmon, birds and mammals that forage across the region, some which have been impacted by the *Exxon Valdez* oil spill. Recent results show that inter-annual 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. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel has no project specific comments.

**Science Coordinator Comments – FY18****Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

The Panel has no project specific comments.

**Date: May 2016**

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

**Science Coordinator Comments – FY17****Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17****Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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

**Project Number:** 18120114-E

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

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

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

**EVOSTC Funding Requested FY17-21: \$478,800**

FY17	FY18	FY19	FY20	FY21
Auth: \$90,100	\$92,700	\$95,700	\$98,600	\$101,700

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$265,000**

FY17	FY18	FY19	FY20	FY21
\$53,000	\$53,000	\$53,000	\$53,000	\$53,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$471,000**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$859,700**

**Total Non-EVOSTC Funding (FY12-21): \$511,500**

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/23/17.*

The fall-winter marine bird surveys in Prince William Sound (PWS) will continue to build upon a 10-year time series of marine bird abundance and habitat associations (2007-2017) and are further integrated with forage fish assessments of prey availability and humpback whale prey consumption and population monitoring. All three projects will share logistics, timing, and location of sampling. Marine bird surveys occur onboard research vessels conducting oceanographic, fisheries, or marine mammal surveys, thereby increasing opportunities for cross-project collaboration and reducing project costs. We use established protocols employed by all other Gulf Watch Alaska marine bird survey efforts (Kachemak Bay/Cook Inlet, Seward Line/Gulf of Alaska, PWS summer). For FY18, we have identified four fall-winter marine bird cruises: PWS Science Center Ocean Tracking Network maintenance cruise (February), Gulf Watch Alaska Pelagic Integrated Predator Prey Surveys (September), Alaska Department of Fish and Game spot shrimp survey (October), and a NOAA pollock cruise (November).

Of the marine birds that overwinter in PWS, nine species were initially injured by the *Exxon Valdez* oil spill, including three species that have not yet recovered or 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. 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.

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. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

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

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

*PI Response (10/11/17):*

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

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

<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	N/A	N/A	N/A
Sept 2016	Fund	Fund	Fund	Fund	Fund

**Science Panel Comments – FY17****Date: September 2016**

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

**Date: May 2016**

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

**Science Coordinator Comments – FY17****Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17****Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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



**Project Number:** 18120114-G

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

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

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

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

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

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$1,425,000**

FY17	FY18	FY19	FY20	FY21
\$300,000	\$300,000	\$275,000	\$275,000	\$275,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$1,260,300**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$2,183,900**

**Total Non-EVOSTC Funding (FY12-21): \$1,774,900**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

This project will continue physical and biological measurements 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-based surveys of PWS will be conducted to maintain ongoing time series observations of physical (temperature, salinity, turbidity), biogeochemical (nitrate, phosphate, silicate, dissolved oxygen), and biological (chlorophyll-a concentration, zooplankton abundance and composition) parameters in several parts of PWS. Sampling sites include central PWS, the entrances (Hinchinbrook Entrance and Montague Strait), and four priority bays that were part of the *Exxon Valdez* Oil Spill Trustee Council- (EVOSTC)-funded Sound Ecosystem Assessment (SEA) project in the 1990s and the ongoing Herring Research and Monitoring project.

Additionally, an autonomous profiling mooring will be deployed each year in central PWS to provide high frequency (at least daily) depth-specific measurements of the surface layer that will be telemetered out in near real-time. The profiler will include measurements that complement the survey activities (temperature, salinity, oxygen, nitrate, chlorophyll-a, turbidity). An *in situ* plankton camera is under development and will be used to enumerate zooplankton, large phytoplankton and other particles, with some taxonomic discrimination.

FY17 spring and early summer observations in PWS indicate the spring bloom was about on time, the surface layer water temperature was 1-2 °C above average, but still showing negative anomalies below the surface layer. Some warm water zooplankton (southern species) are still present. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18****Date: September 2017**

The Panel believes the PI is conducting important work that supports the goals of the EVOSTC. The Panel was happy to see that there are peer-reviewed publications in press and encourages the PI to keep publishing.

**Science Coordinator Comments – FY18****Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

The Panel has no project specific comments.

**Date: May 2016**

The Panel acknowledges the value of continued time series of physical, chemical, and biological primary production data to provide the basis for analyses of how changing environmental conditions are affecting the higher trophic level animals of the PWS and other spill-affected regions of the Northern Gulf of Alaska.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-H

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

**Primary Investigator(s):** Heather Coletti, Dan Esler, Brenda Konar, Katrin Iken

**PI Affiliation:** NPS, USGS, NOAA **Project Manager:** USGS

**EVOSTC Funding Requested FY17-21: \$2,071,000**

FY17	FY18	FY19	FY20	FY21
Auth: \$401,900	\$452,700	\$411,400	\$402,300	\$402,800

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$2,014,000**

FY17	FY18	FY19	FY20	FY21
\$410,000	\$410,000	\$410,000	\$392,000	\$392,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$1,961,800**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$3,630,900**

**Total Non-EVOSTC Funding (FY12-21): \$3,502,000**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

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 injured by the 1989 *Exxon Valdez* oil spill (EVOS). The monitoring design includes spatial, temporal and ecological features that support inference regarding drivers of change. Application of this monitoring design to date include assessment of change in sea otter populations in relation to EVOS recovery and density dependent factors as well as the assessment of the relative roles of static versus dynamic environmental drivers in structuring benthic communities. Continued monitoring will lead to a better understanding of variation in the nearshore ecosystem across the GOA and a more thorough evaluation of the status of spill-injured resources. This information will be critical for anticipating and responding to ongoing and future perturbations in the region, as well as providing for global contrasts. In 2018 we propose to continue sampling in Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park, and Western Prince William Sound following previously established methods. Monitoring metrics include marine invertebrates, macroalgae, sea grasses, birds, mammals, and physical parameters such as temperature. In addition to taxon-specific metrics, monitoring includes recognized important ecological relations such as predator-prey dynamics, measures of nearshore ecosystem productivity, and contamination. Preliminary FY17 observations indicate low sea star densities across all four regions, while nearshore bird surveys of common murre distributions have returned to pre die-off states. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel appreciates the amount of data being collected on multiple nearshore sites. There is not a clear integration with oceanographic studies, but there is enough substance to make this a meaningful, stand- alone nearshore ecosystem project. The Panel is very pleased with their productivity and integration of students into the studies.

*PI Response (10/11/2017):*

*The nearshore component greatly appreciates the Science Panel's support of our progress towards an integrated nearshore program. There have been recent discussions to use oceanographic data, initially temperature, across all components to examine linkages between offshore and nearshore systems. We anticipate that analyses of temperature data will be our first step in integrating other oceanographic processes to pelagic and coastal systems for the GWA program.*

The Panel would like to see more of the synoptic surveys, what they are finding or not finding temporally and on a spatial scale. A question from the Panel for the PIs to ponder: Have egg-eating seabirds/waterfowl changed their distribution in regards to location in time and space to herring spawning?

*PI Response (10/11/2017):*

*Several PIs in the nearshore program did publish a paper in Ecosphere (<http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1489/full>) that examined temporal trends in sea otter abundance, energy recovery rates, and demographics at varying spatial scales. However, based on the design of the nearshore component, an exercise examining trends across space and time could be done for a variety of species. We are meeting as a component prior to the PI meeting in November to examine data trends to date and develop product ideas for the next 1-3 years within the nearshore component. Specific to the Science Panel's question about changing seabird/waterfowl distribution, we have set aside time for cross-component bird data integration and synthesis discussions at the PI meeting in November. All parties will have data summaries to discuss and determine how we may be able to look at trends over time, and changes in distribution, and integration with data from other components, including environmental drivers.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel's comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

The Panel wished to draw attention of the PIs to similar recent declines in mussels in the Gulf of Maine in the Atlantic. No action is required by the PIs, but they might find parallel research on a similar problem interesting. A paper by Sorte et al. in Global Change Biology would be once place to look: Sorte, C. J. B., Davidson, V. E., Franklin, M. C., Benes, K. M., Doellman, M. M., Etter, R. J., Hannigan, R. E., Lubchenco, J. and Menge, B. A. (2016), Long-term declines in an intertidal foundation species parallel shifts in community composition. Glob Change Biol. doi:10.1111/gcb.13425

**Date: May 2016**

The Panel has no project specific comments.

**Science Coordinator Comments – FY17****Date: May and September 2016**

I have no project specific comments.

**Executive Director Comments – FY17****Date: September 2016**

I concur with the Science Panel’s comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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

**Project Number:** 18120114-I

**Project Title:** LTM Program – Long-term Monitoring of Oceanographic Conditions in the Alaska Coastal Current from Hydrographic Station GAK-1

**Primary Investigator(s):** Seth Danielson

**PI Affiliation:** UAF

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21:** \$680,800

FY17	FY18	FY19	FY20	FY21
Auth: \$146,800	\$148,400	\$132,600	\$125,600	\$127,400

*Requests include 9% GA.*

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

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

**Total Past EVOSTC Funding Authorized (FY12-17):** \$726,100

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$1,260,100

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

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

This project 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 casts and a mooring outfitted with seven temperature/conductivity recorders distributed throughout the water column and a fluorometer at 20 m depth. The project monitors five important Alaska Coastal Current (ACC) ecosystem parameters that quantify and help us understand hourly to seasonal, interannual, and multi-decadal period variability in: 1) temperature and salinity throughout the 250 m-deep water column, 2) near surface stratification, 3) surface pressure fluctuations, 4) fluorescence as an index of phytoplankton biomass, and 5) along-shelf transport in the ACC. All of these parameters are basic descriptors that characterize the workings of the inner shelf and the ACC, an important habitat and migratory corridor for organisms inhabiting the northern Gulf of Alaska, including Prince William Sound and resources injured by the *Exxon Valdez* oil spill. We are aware of 69 publications utilizing data collected at station GAK-1, and since 2000 the citation list has grown by nearly three publications per year. Topics covered by these publications range from physical oceanography and climate through trophic (including commercial fisheries) level components and ecosystem analyses. Recent water temperatures have returned to average in the upper 100 m, but warmer than average water remains below 100 m. A newly awarded National Science Foundation Long-term Ecological Research program (awarded to GWA PIs R. Hopcroft and S. Danielson) will leverage and compliment this and other environmental drivers sampling within GWA. We are not proposing any major changes to this project in FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18****Date: September 2017**

This is an important long-term data collection project that needs to continue. The Panel supports the research and welcomes the news of the Long-Term Ecological Research (National Science Foundation) funding awarded to the PIs, which will insure the stability of gathering long-term data while expanding the scope of the project. PIs are using graduate students productively.

**Science Coordinator Comments – FY18****Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

The Panel has no project specific comments.

**Date: May 2016**

This long-term data set provides critical information to both Programs and to researchers beyond the Programs. The resultant data are heavily used. The Panel supports the continued funding of this work. The Panel also awaits seeing new analyses that integrate these environmental variables into the changing abundances of members of the food webs of importance.



**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-J

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

**Primary Investigator(s):** Kris Holderied and Jessica Shepherd

**PI Affiliation:** NOAA and KBRR **Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$796,500**

FY17	FY18	FY19	FY20	FY21
Auth: \$169,700	\$174,400	\$183,400	\$135,700	\$133,300

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$1,044,000**

FY17	FY18	FY19	FY20	FY21
\$205,000	\$213,000	\$215,000	\$217,000	\$194,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$316,500**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,375,800**

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

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

The Cook Inlet/Kachemak Bay monitoring project provides year-round, high temporal resolution oceanographic and plankton data to assess the effects of seasonal and inter-annual oceanographic variability on nearshore and pelagic species injured by the *Exxon Valdez* Oil Spill. We continue a 6-year time-series of shipboard oceanography surveys along the estuarine gradient from Kachemak Bay into southeast Cook Inlet, as well as a 16-year time series of continuous nearshore water quality station observations in Kachemak Bay. Shipboard surveys are conducted on repeated transects monthly in Kachemak Bay, seasonally in southeast Cook Inlet and annually across the Cook Inlet entrance. Shipboard sampling includes conductivity-temperature-depth casts (including fluorescence, turbidity, and dissolved oxygen), phytoplankton, and zooplankton. The project provides oceanographic data to support Gulf Watch Alaska (GWA) nearshore component monitoring in Kachemak Bay and important environmental driver information downstream of other GWA components. By sampling across Prince William Sound, Cook Inlet and the northern Gulf of Alaska shelf, in connection with other GWA Environmental Drivers component projects, we strengthen the ability of the GWA program to evaluate local (within estuary) and remote (shelf, North Pacific) climate forcing effects on nearshore ecosystems. Recent results show that during 2014-2016: 1) water temperatures were warmer than average throughout the water column and fresher below the pycnocline - consistent with the upper 100m of the water column at GAK1, but different from the lower water column, with warm water possibly contributing to sea star declines observed by the nearshore sampling team; 2) increased blooms of *Alexandrium* phytoplankton species caused paralytic shellfish poisoning events in Kachemak Bay which may have contributed to marine mammal and seabird mortalities; and 3) abundances of

warm water zooplankton species increased relative to 2012-2013. We are not proposing any major changes to this project in FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel was happy to see that the PIs explained how data from this study tie into the decline in sea stars, marine mammal and seabird mortalities and changes in the presence of zooplankton species. The Panel was pleased to see how the funding is being used and how the PIs found connections as previously requested.

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

Date	Science Panel	Science Coordinator	PAC	Executive Director	Trustee Council
May 2016	Do Not Fund	Do Not Fund	N/A	N/A	N/A
Sept 2016	Do Not Fund	Do Not Fund	Do Not Fund	Do Not Fund	Fund

**Science Panel Comments – FY17**

**Date: September 2016**

The Science Panel appreciated the PI’s responses to our comments. The proposal is fundamentally sound. However, our primary concern was not addressed. The proposed research is beyond the core area of interest, and it remains unclear how the study would significantly advance the core mission of EVOSTC and justify a second cycle of \$800,000 in funding.

As noted in a follow-up Panel discussion with the Program Team Leads, the results from the original research proposal in Cook Inlet and Kachemak Bay provided data that may be useful to those interested in this project's study area, and, for example, the proposal may serve those with an interest in harmful algal blooms, bivalve mariculture, invasive species and to EVOSTC PIs currently sampling in PWS but who would be pleased to expand activities to the project area. However, the proposal did not demonstrate actual use of these data by other projects in either the Long-Term Monitoring Program or the Herring Program and it still remains to be seen just how relevant these data will be to EVOSTC.

**Date: May 2016**

The Panel does not recommend funding this project. The investigators propose to modify sampling conducted in 2012-2016 to profile oceanographic variables (water temperature, salinity, nutrients) and plankton from ship and shore in lower Cook Inlet and Kachemak Bay in response to the anomalously warm waters in 2014-2015. The warm-water event was concurrent with harmful algal blooms with consequences for shellfish, otters and 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 production and foraging by fishes, seabirds and marine mammals near lower Cook Inlet and outer in Kachemak Bay in response to changing oceanographic forcing. To compensate for this increased effort, sampling at locations on the northern side of Cook Inlet is proposed to be reduced.

The Panel does not feel that the proposed research is a priority, given the cost and the relative lack of connection to the larger program. Answers to the proposed hypotheses are largely self-evident as stated and seemingly could be tested with data already in hand. A more compelling justification for the proposed research would have been helpful. For instance, hypothesis 1 that lower Cook Inlet is mostly synchronous with PWS suggests that continued oceanographic measurements in Cook Inlet may be redundant. It is not clear that extending a modified version of the previous five years of research via monitoring would significantly advance our understanding of productivity and links to nearshore species, seabirds and marine mammals in the study area, especially given the expense of the project. The proposal also would have benefitted from a robust statement of how the expected outcomes of the proposed research would be integrated with those from the rest of the program. The methods appear to be appropriate; though including a fluorometer with the CTDs to profile chlorophyll fluorescence throughout the water column would have been beneficial.

**Science Coordinator Comments – FY17**

**Date: September 2016**

I concur with the Science Panel's comments. The project offers sound science and is managed by an experienced team but the applicability of the data toward addressing the LTM Program's hypotheses appears weak at best after the first five years of funding.

**Date: May 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17**

**Date: September 2016**

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

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-L

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

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

**PI Affiliation:** UAF

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$697,900**

FY17	FY18	FY19	FY20	FY21
Auth: \$132,700	\$136,100	\$139,500	\$143,000	\$146,600

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$7,180,300**

FY17	FY18	FY19	FY20	FY21
\$1,424,000	\$1,438,000	\$1,411,800	\$1,466,000	\$1,450,500

**Total Past EVOSTC Funding Authorized (FY12-17): \$910,900**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,476,100**

**Total Non-EVOSTC Funding (FY12-21): \$2,717,300**

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/23/17.*

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. We are not proposing any major changes to this project for FY18. Newly acquired funding as one of National Science Foundation’s 30 Long-term Ecological Research (LTER) sites, will allow us to expand sampling on the shelf upstream of Prince William Sound, including near Middleton Island.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

This is an important long-term data collection project that needs to continue. The Panel is enthusiastic about the incorporation of an LTER site to expand the scope of this project. The Panel is pleased to see that sampling will occur around Middleton Island, and that there will be integration with the predator-prey project.

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

The Science Panel appreciates transfer of funds among projects to support additional sampling relevant to the spill area.

**Date: May 2016**

The Science Panel notes that this transect of moorings has value as professed in the proposal for purposes of assessing long-term environmental forcing of the base of the pelagic food chains.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I concur with the Science Panel’s comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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



**Project Number:** 18120114-M

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

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

**PI Affiliation:** USFWS **Project Manager:** USFWS

**EVOSTC Funding Requested FY17-21: \$519,100**

FY17	FY18	FY19	FY20	FY21
Auth: \$24,900	\$222,200	\$24,900	\$222,200	\$24,900

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$180,000**

FY17	FY18	FY19	FY20	FY21
\$23,000	\$56,000	\$23,000	\$56,000	\$22,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$706,500**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,200,700**

**Total Non-EVOSTC Funding (FY12-21): \$392,000**

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/23/17.*

We propose to conduct small boat surveys to monitor abundance of marine birds in Prince William Sound, Alaska, during July 2018 and 2020. Fourteen previous surveys over a 27-year period have monitored population trends of marine birds and mammals in Prince William Sound after the *Exxon Valdez* oil spill. We will use data collected to examine trends from summer to determine whether populations in the oiled zone are increasing, decreasing, or stable. We will also examine overall population trends for the Sound. Continued monitoring of marine birds and synthesis of the data are needed to determine whether populations injured by the spill are recovering. Data collected from 1989 to 2016 indicated that pigeon guillemots (*Cephus columba*) and marbled murrelets (*Brachyramphus marmoratus*) are declining in the oiled areas of Prince William Sound. We have found high inter-annual variation in numbers of some bird species and therefore recommend continuing to conduct surveys every two years. These surveys are the only ongoing means to evaluate the recovery of most of these injured marine bird species. Surveys would also benefit the benthic monitoring and forage fish monitoring projects of the GWA Long-term Monitoring Program as well as the Herring Research and Monitoring project. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

## Science Panel Comments – FY18

**Date: September 2017**

The Panel is pleased with the work the PIs are conducting and impressed with the survey coverage. Would it be worth surveying a subset of sites to monitor annually?

*PI Response (10/11/2017):*

*We agree with the Science Panel that, ideally, we would improve trends analysis by adding surveys to include even numbered years to our current ‘odd year’ July surveys. However, budgetary constraints make such an effort impractical. The additional time and costs would include boat preparation and post-survey maintenance, hiring extra personnel or covering salary of in-house personnel, lodging, per diem, fuel, and additional data control and analyses. Even selecting a much reduced number of transects to survey during even years (by ‘subset of sites’ we presume the panel is referring to transects), the cost of gearing up and operating a survey in Prince William Sound (PWS) is not substantially reduced by reducing the number of transects. A rough estimate of surveys during even years would be \$150-180K per year, in addition to the current \$222K per odd year under the current work plan.*

*If additional funds were added to this project to cover a reduced survey during even years, we would first want to conduct an analysis to determine what level of effort would be statistically robust, and how those transects or regions (sites) should be selected. Such an analysis could be useful for future planning, but would require additional funds for a contract or to cover time for the U.S. Fish and Wildlife Service (USFWS) biometrician.*

*We have some indication of what a reduced level of effort can provide, based on an analysis conducted for USFWS by WEST, Inc. in 2003 (Nielson et al. 2003). In brief, although the effect varied among species, the conclusion was that, on average, the coefficient of variation (CV) would not decrease substantially at 80% of our current effort, but increased substantially after that, which would greatly reduce our ability to detect population trends of < 50%. The report states: “However, for many species with low CVs at 100% of the original sample size (i.e., CV around 0.2 or less), the CV almost doubles when the sampling effort is reduced to 30%.” We add that for species of conservation concern, typically with low or variable numbers, an unusually low or high abundance estimate in any given year will result in much reduced probability of detecting change in the population over time. The report also notes, however, that “... a systematic sample of blocks across habitats will likely provide more precise estimates of species abundance than the stratified random sample.” With additional years of data since 2003, analysis of sampling effort by habitats may help with design of a reduced effort during even years.*

*Alternative to reduced surveying during even years, additional funds for the PWS marine bird surveys could be directed towards ‘winter’ (March) surveys. The March survey had fewer transects than July surveys, but has not been funded since 2010. The species composition of PWS changes substantially between July and March, with nine species or species groups primarily represented only in March (see Table 1 of the WEST, Inc. report); these were waterfowl, seaducks, and grebes. March surveys would provide population estimates and trends for all species during this critical season.*

*Literature Cited:*

*Nielson, R., S. Howlin, L. McDonald. 2003. "Bootstrapping to investigate effects of sample size on variance and bias of estimated species totals for Prince William Sound Marine Bird Surveys". Report by WEST, Inc. to U.S. Fish and Wildlife Service, Anchorage, Alaska, April 28, 2003.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: September 2016**

The Panel has no project specific comments.

**Date: May 2016**

There are no project specific comments.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I have no project specific comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I have no project specific comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-N

**Project Title:** LTM Program – Long-term killer whale monitoring

**Primary Investigator(s):** Craig Matkin

**PI Affiliation:** North Gulf Oceanic **Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$725,900**

FY17	FY18	FY19	FY20	FY21
Auth: \$152,800	\$151,300	\$142,100	\$140,300	\$139,500

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$125,000**

FY17	FY18	FY19	FY20	FY21
\$25,000	\$25,000	\$25,000	\$25,000	\$25,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$688,900**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,262,000**

**Total Non-EVOSTC Funding (FY12-21): \$242,500**

**Abstract:**

*\*This abstract is excerpted from the PI’s Proposal, dated 8/23/17.*

The proposed project is a continuation of the long-term photo-identification based program that has continuously monitored killer whale populations in Prince William Sound since 1984. A primary focus has been on resident killer whales and the recovery of AB pod and the threatened AT1 population of transient killer whales. These two groups of whales suffered serious losses at the time of the oil spill and have not recovered at projected rates. Assessment of population dynamics, feeding ecology, movements, range, and contaminant levels for all major pods in the area will help determine their vulnerability to future perturbations and environmental change, including oil spills. In addition to population dynamics from annual photo-identification, this project uses other techniques to determine the health and trends of the population. These techniques include biopsy/skin sampling to compare genetics between populations, biopsy/blubber to investigate contaminants, fatty acid, and stable isotope profiles, prey sampling of flesh, fish scales, and whale scat to investigate diet, behavioral observation, and remote acoustic monitoring to determine important off-season habitat. We are not proposing any major changes to this project for FY18; however, some opportunistic sampling has been de-emphasized.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel applauds the work being conducted by the PI demonstrating the impact of oil on killer whales depends on whether the group of whales is transient or resident. These results help refine the restoration goal of this species, which might otherwise not capture the genetic differences between pods. These differences suggest unanswered questions about their social activities, which will be further addressed by the PI. The Panel appreciates that the PI does an excellent job regarding outreach.

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18**

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18**

**Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17**

**Date: May and September 2016**

There are no project specific comments.

**Science Coordinator Comments – FY17**

**Date: May and September 2016**

I have no project specific comments.

**Executive Director Comments – FY17**

**Date: September 2016**

I have no project specific comments.

**Public Advisory Committee Comments – FY17**

**Date: September 2016**

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

**Project Number:** 18120114-O

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

**Primary Investigator(s):** John Moran and Jan Straley

**PI Affiliation:** NOAA and UAS      **Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21: \$777,400**

FY17	FY18	FY19	FY20	FY21
Auth: \$161,900	\$155,000	\$157,900	\$154,900	\$147,600

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21: \$730,000**

FY17	FY18	FY19	FY20	FY21
\$146,000	\$146,000	\$146,000	\$146,000	\$146,000

**Total Past EVOSTC Funding Authorized (FY12-17): \$753,800**

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21): \$1,369,300**

**Total Non-EVOSTC Funding (FY12-21): \$955,000**

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

The humpback whale monitoring project is part of the Gulf Watch Alaska pelagic component's integrated fall/winter predator-prey survey. Humpback whale predation has been identified as a significant source of mortality on wintering Pacific herring in Prince William Sound (PWS) and a likely top-down force constraining their recovery. Humpback whales in PWS have a higher percentage of herring in their diet during the winter months and forage longer on wintering herring shoals than their counterparts in Southeast Alaska. Currently, North Pacific humpback whales in the Gulf of Alaska may be experiencing nutritional stress and increased use of inland waters like PWS could result in increased predation on herring. We will continue to evaluate the impact by humpback whales foraging on Pacific herring populations in PWS, following protocols established during 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 fall/winter marine bird components, we will be able to provide a comprehensive understanding of bottom-up influences and top-down controls on the PWS herring population. We are not proposing any major changes to this project for FY18.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel was excited to see the results presented in Figure 1 in the proposal and encourages the PIs to make comparisons to the relevant study conducted by the National Center for Ecological Analysis and Synthesis (NCEAS) working group. Results shown in Figure 1 of the proposal are important and so strikingly incompatible with what was suggested previously by the time series analysis of the NCEAS working group (Ward et al 2017). That working group’s model, of necessity, made some quite restrictive assumptions. Can the PIs look at the NCEAS model, and consider whether the new findings invalidate one or more key conclusions from that synthesis work?

*PI Response (10/11/2017):*

*Thank you for the close review of project 18120114-O’s work plan. Comparisons to Ward et al. (2017) are problematic because these authors depend on summer whale counts from western PWS (Teerlink et al. 2014), while our project focuses on fall/winter and spring time periods when herring form large, dense schools that are most vulnerable to whale predation. Observations of whales and prey when herring are aggregated allow us to study the potential impact of foraging humpback whales on herring as a possible contributor to the lack of herring recovery. The following are three important differences between our approach and the Teerlink et al. (2014) approach to modeling whale predation on herring:*

- 1. The Teerlink et al. (2014) study estimates the number of whales that use PWS in summer, not the number that are present at any given time (for example, 10 whales spending 90 days in the Sound would have the same effect on prey as 900 whales spending one day in the Sound). It is important to know how many whales are feeding on herring for how many days within the Sound and the Ward et al. (2017) paper does not address this.*
- 2. Ward et al. (2017) used whale population estimates from summer surveys, when overall whale abundance is generally low in PWS compared to other seasons. Our work identified adult herring as the preferred prey of humpbacks in PWS, especially when herring are aggregated in the fall, winter, and spring (spawning); thus, whale numbers peaked in the fall and spring, and dropped during the summer months.*
- 3. Neither Ward et al. (2017) nor Teerlink et al. (2014) identify prey consumed by humpback whales.*

Additionally, the Panel is concerned that objective #3 may be overly ambitious and suggests rewording and editing to “predation rate”?

*PI Response (10/11/2017):*

*With regards to objective #3 being overly ambitious and the Science Panel’s suggestion of rewording and editing to “predation rate”? We agree and will change the wording of this objective.*

**Science Coordinator Comments – FY18**

**Date: September 2017**

I concur with the Science Panel’s comments.



**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: May and September 2016**

There are no project specific comments.

**Science Coordinator Comments – FY17****Date: May and September 2016**

I have no project specific comments.

**Executive Director Comments – FY17****Date: September 2016**

I have no project specific comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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

**Data Management Program  
Project Descriptions**

**Project Number:** 18120113

**Project Title:** Data Management Program

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

**PI Affiliation:** AOOS

**Project Manager:** NOAA

**EVOSTC Funding Requested FY17-21:** \$1,090,000

FY17	FY18	FY19	FY20	FY21
Auth: \$218,000	\$218,000	\$218,000	\$218,000	\$218,000

*Requests include 9% GA.*

**Funding From Non-EVOSTC Sources FY17-21:** \$14,359,000

FY17	FY18	FY19	FY20	FY21
\$2,705,000	\$2,786,000	\$2,869,000	\$2,955,000	\$3,044,000

**Total Past EVOSTC Funding Authorized (FY12-17):** \$3,471,200

**Total EVOSTC Funding Authorized (FY12-17) and Requested (FY18-21):** \$4,343,200

**Total Non-EVOSTC Funding (FY12-21):** \$16,695,200

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

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. Through these efforts, AOOS will continue to provide access to these tools and services for which the principal investigators (PIs) of the GWA and HRM Programs depend. Among these, the Research Workspace (an enhanced version of the former web-based data management platform, the Ocean Workspace) will be maintained and supported to upload, organize, and document data, as well as to facilitate program administration. This platform is familiar to GWA and HRM PIs 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.

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18**

**Date: September 2017**

The Panel greatly appreciates the PI’s efforts on this project. The coordination between the data management program and the HRM and LTM Programs has greatly improved. The proposal was well written and organized.

Can the PI confirm that data will be available and not require specially approved access to get to the data?

*PI Response (10/13/2017):*

*The process for making data from the EVOS Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) programs publicly available is as follows. Project PIs upload preliminary and final datasets to the Research Workspace within one year of collection for sharing among collaborators. PIs maintain ownership of the data they have submitted to the Research Workspace; therefore, they have access to data from the 2012-16 and 2017-21 funding cycles without needing special permissions. Once data are finalized (e.g., within one year of data collection, in most cases) data are published from the Research Workspace to the AOOS Gulf of Alaska (GOA) data portal.*

*All data published to the GOA portal are accessible by the public with no restrictions or specially approved access. In the portal, these data are discoverable alongside the publicly-available final data from the 2012-2016 GWA and HRM projects. These data are further made available to the public through the Research Workspace DataONE member node, a preservation-oriented data repository that is openly accessible to the public. The DataONE archives, similar to the GOA portal, will continue to be updated with final data from the 2017 to 2021 funding cycle.*

*To navigate to the public-facing data in the GOA portal:*

- 1. Visit the AOOS website (<http://data.aos.org>) and select the Gulf of Alaska portal (image below), or navigate directly to the portal at <http://portal.aos.org/gulf-of-alaska>.*
- 2. To view data, click on Data Layer Catalog*
- 3. From the catalog labels on the left hand side, select the Gulf Watch or Herring Projects*
- 4. Click on the project you want to open from the list.*
- 5. To view data files, click ‘Project Data’ in the upper right (top image below). Browse the files and click those you want to download*

Are the ADFG herring data sets available on the DataOne portal? If not, they should be made accessible.

*PI Response (10/13/2017):*

*The ADFG Prince William Sound datasets have been submitted to the Research Workspace for sharing among collaborators. Some of these datasets have been made available to the public through both the GOA data portal and DataONE. An inventory of these datasets and their publication status are shown in the below table.*

**ADFG Herring Surveys, Prince William Sound: aerial survey route, biomass, age sex length, and spawn**  
 EVOS Herring Research Workspace c <https://workspace.aos.org/project/283281/files>

Dataset	Years	Public in GOA portal?	GOA portal link	Archived with DataONE?	DataONE doi link
Aerial herring biomass observations	1973-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a692c-ea24-11e0-b73c-0019b9dae22b">http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a692c-ea24-11e0-b73c-0019b9dae22b</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.16">https://search.dataone.org/#view/df35a.22.16</a>
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a753e-ea24-11e0-a20d-0019b9dae22b">http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a753e-ea24-11e0-a20d-0019b9dae22b</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.17">https://search.dataone.org/#view/df35a.22.17</a>
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/79b1cc76-5ff1f41d7-bb79-3f7e995d6d89">http://portal.aos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/79b1cc76-5ff1f41d7-bb79-3f7e995d6d89</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.18">https://search.dataone.org/#view/df35a.22.18</a>
Aerial survey marine bird observations	2008-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/258864ed-5fe3-4ae1-af41-fee3222612aa/d3964546-4786-11e5-953e-00265529168c">http://portal.aos.org/gulf-of-alaska.php#module-metadata/258864ed-5fe3-4ae1-af41-fee3222612aa/d3964546-4786-11e5-953e-00265529168c</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.19">https://search.dataone.org/#view/df35a.22.19</a>
Aerial survey marine mammal observations	2008-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/00357656-e3b9-4d22-9d03-345fb0b7320">http://portal.aos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/00357656-e3b9-4d22-9d03-345fb0b7320</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.20">https://search.dataone.org/#view/df35a.22.20</a>
Aerial survey sea lion observations	2008-2016	yes; visualized & available for download	<a href="http://portal.aos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/d39650b8-4786-11e5-9543-00265529168c">http://portal.aos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/d39650b8-4786-11e5-9543-00265529168c</a>	yes; 2007-09 only	<a href="https://search.dataone.org/#view/df35a.22.21">https://search.dataone.org/#view/df35a.22.21</a>
Age Sex Length Data	1973-2014	no	-	yes	<a href="https://search.dataone.org/#view/df35b.273.7">https://search.dataone.org/#view/df35b.273.7</a>
Age Sex Length Data	2015-2016	no	-	no	-
PWS Herring Acoustics	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-
PWS Herring Acoustic	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-

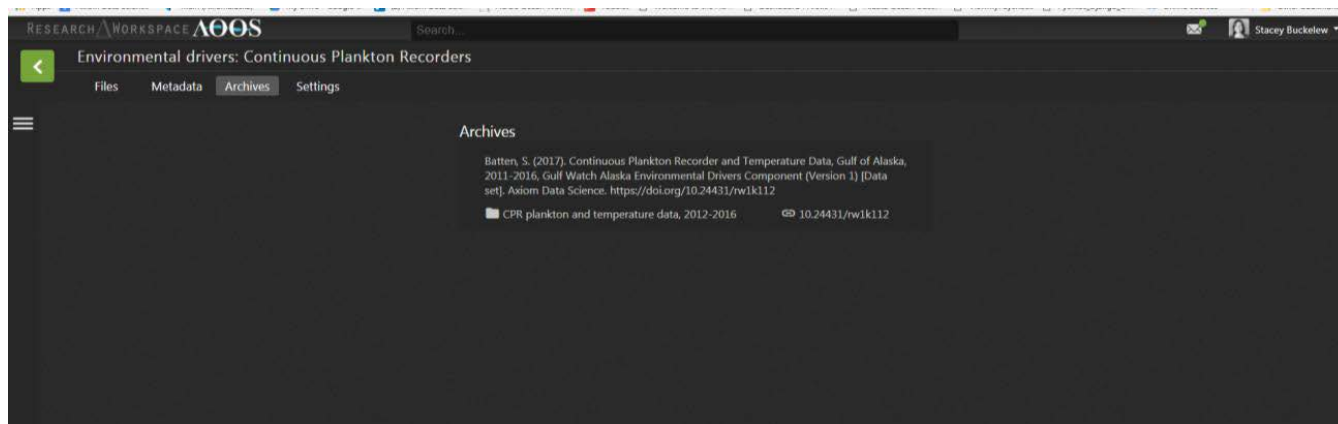
*The data management team is awaiting a final decision from ADFG Commercial Fisheries division about whether to make the remainder of the data available publicly. We will update the EVOSTC and the EVOS Science Panel with this information as soon as we have a response.*

What is the status on linking DataOne to Workspace for all the projects?

*PI Response (10/13/2017):*

*In June 2017, we launched the Research Workspace DataONE1 Member Node, a preservation-oriented data repository serving as the archival home for datasets published from the Research Workspace (news release here). Datasets published from the Research Workspace to the Research Workspace DataONE Member Node are issued a citable digital object identifier (DOI), and are discoverable through DataONE search interfaces alongside datasets and metadata from the other 40+ repositories that make up the DataONE federation. The final data holdings from the 2012-2016 GWA and HRM programs were archived in the Research Workspace DataONE Member Node and are now publicly discoverable and citable through both the AOS Gulf of Alaska data portal<sup>2</sup> and the DataONE Search<sup>3</sup> catalog. These archived resources are linked to any related datasets from the EVOS historical data salvage project (conducted by NCEAS), which are also stored in DataONE. Within the Research Workspace, the GWA and HRM program datasets archived with DataONE are visible under the Archives tab within each project (see below image). Here PIs can view the resource title, DOI, and link to the associated data and*

metadata. Additionally, the DOI is reflected in the Gulf of Alaska data portal, from which any member of the public can navigate from the Gulf of Alaska portal to the archived dataset within DataONE. In future Research Workspace updates, an archive page will be added to the EVOS GWA and HRM campaign which lists the archive dataset citations for the entire program (as opposed to individually by projects), and this list will include links to DataONE.



### Science Coordinator Comments – FY18

**Date: September 2017**

I concur with the Science Panel’s comments. I greatly appreciated the Key Highlights section.

### PAC Comments – FY18

**Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

### Executive Director Comments – FY18

**Date: September 2017**

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

### FY17 Funding Recommendations:

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

### FY17 Funding Recommendations:

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

### Science Panel Comments – FY17

**Date: September 2016**

We appreciate the Team Lead’s thorough responses to our questions and comments. We do not have any additional questions or comments on the revised proposal.

**Date: May 2016**

The Panel appreciates the refocusing of the data management program to better meet the needs of the Programs and the EVOSTC. Making the data collected by the Programs available to other researchers and trust agencies is the primary goal of the data management program. The development and implementation of the data portal in conjunction with the partnership with DataONE in the first five-year program has helped to meet that goal.

The Panel was encouraged to see a more defined data policy that provided clear repercussions for non-compliant PIs. The Panel was gratified to learn that AXIOM has developed or is developing a presumably online training course for PIs on how to construct metadata for their projects, so as to address one cause for slow compliance with data submittal 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 five-year Program unless they submit a special request? Access to both the historical data assembled by NCEAS and data collected by projects in the first five years is critical to the success of both Programs.

The Panel strongly encourages the continued coordination and collaboration with both major Programs (Long-Term Monitoring and Herring Research) in the design and updating of the system.

The Panel was concerned that the Program lead was unable to answer several questions regarding the design of the Program and the PI appeared unfamiliar with the content of the proposal, thus inhibiting a full discussion of the Workspace functionality.

**Science Coordinator Comments – FY17****Date: May and September 2016**

I concur with the Science Panel's comments.

**Executive Director Comments – FY17****Date: September 2016**

I concur with the Science Panel's comments.

**Public Advisory Committee Comments – FY17****Date: September 2016**

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

**Lingering Oil  
Project Descriptions**



**Project Number:** 18170115

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

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

**PI Affiliation:** UC Davis

**Project Manager:** USGS

**EVOSTC Funding Requested FY17-21: \$1,697,628.7**

FY17	FY18	FY19	FY20	FY21
Auth: \$224,703.5	\$492,750.4*	\$420,259.3*	\$319,845.2*	\$240,070.3*

*Requests include 9% GA.*

\* Some components have progressed ahead of schedule necessitating a shift in funding among remaining years.

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

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

**Total Past EVOSTC Funding Authorized (FY17):** \$224,703.5

**Total EVOSTC Funding Authorized (FY17) and Requested (FY18-21):** \$1,697,628.7

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

**Abstract:**

*\*This abstract is excerpted from the PI's Proposal, dated 8/23/17.*

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

**FY18 Funding Recommendations:**

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

**Science Panel Comments – FY18****Date: September 2017**

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

**Science Coordinator Comments – FY18****Date: September 2017**

I concur with the Science Panel’s comments.

**PAC Comments – FY18****Date: September 2017**

The PAC meeting was 28 September 2017 and fund recommendations are included in the table above. Any project-specific comments from that meeting will be added to the Work Plan when the comments are finalized in the meeting notes.

**Executive Director Comments – FY18****Date: September 2017**

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

**FY17 Funding Recommendations:**

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

**Science Panel Comments – FY17****Date: September 2016**

This innovative proposal complements the Herring Research and Monitoring Program by conducting a retrospective (pre-spill to present) analysis of genome diversity and the potential impacts of oil exposure on immune deficiency, as well as an assessment of the ability of current genetic diversity to cope with ongoing disease issues. The current Herring Program is focused primarily on stock assessments and current factors affecting the lack of recovery (e.g., whale predation, disease monitoring, and recruitment issues). The Science Panel is supportive of the proposal because of the potential to answer important questions about the cause of the herring population crash as well as important genetic factors that may inhibit recovery. Notably, this project combines genome

(Whitehead) and disease (Hershberger) expertise, and makes use of valuable genetic samples archived by ADFG pre-spill to present. The Panel is quite enthusiastic about this new approach and opportunity to assess the evidence for mechanistic ties between oil and herring immune deficiency by bringing genomic expertise to bear on herring disease issues. The PI has an excellent track record of productivity and expertise. A major strength of the proposal is the utilization of fish tissues samples that have been archived for almost 30 years at ADFG. This work draws upon ADFG's existing tissue collection, in combination with advanced genomic techniques, to provide a unique (and possibly unparalleled) view into the population, genetic and evolutionary history of Alaskan herring before, during and after the oiling event. This unique opportunity to utilize ADFG samples, collected and archived across decades, will facilitate a novel approach to the pressing problem of lack of herring recovery and result in valuable information regarding the PWS herring genome.

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

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

**General Comments:**

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

This proposal has an unprecedented capacity to apply novel, highly technical research on Alaskan herring genomics to actually test the hypothesis that exposure to oil during the egg (or embryo) and early larval stages has led to a decrease in the genetic capacity of PWS herring to resist naturally-occurring, endemic disease organisms. This retrospective genome determination from archived

genetics samples would determine if present-day PWS herring would be detectably different than their ancestors residing in PWS prior to the spill, and from other Alaskan herring populations. The proposal consists of several tests. One would be based on a time-series analyses of archived samples of herring collected and stored annually since the spill to test for change in the frequency of alleles related to disease resistance or susceptibility in PWS versus areas that were not exposed to oil. A related test of differences in disease resistance of PWS herring from other herring would be based on laboratory experiments of reared herring from PWS and two other populations.

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

### **Specific Technical Comments:**

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

1. Add technical detail on pathogen exposure experiments. The Panel had several questions that need clarification. Which pathogens will fish be exposed to? Are these from purified sources that can be used at different times of exposure? Given the population differences and pathogen responses, this is a key detail that needs to be included. Will embryos/larvae from the different populations be tested simultaneously for oil and disease exposure in the lab? If not what assurances will be made that exposure (oil as well as pathogens) conditions are identical across populations? For example, how reproducible is the oiled gravel treatment and the pathogen challenge? What steps will be taken to ensure and verify this reproducibility? What will be the age of embryos at collection? That is, 10-14 day embryos may have a different transcriptome than 5-7 day embryos because they might have been exposed to environmental stressors such as UV, desiccation and salinity changes.
2. Aim 3 needs more details on replication, exposure duration and intensity.
3. Functional annotation of genes. It would be useful to mention existing genomic resources for similar species to assure the Panel that these genes and others of potential relevance can be identified and the genome annotated.
4. Add detail on retrospective population genomics sampling. Please provide information on where fish were sampled and the age classes of collected fishes to clarify how the longitudinal time series will be interpreted. For example, age 3 fish collected in 1993 would not have been exposed to oil, but age 8 would have been. Additional information is needed to ensure that samples were representative of the population at the time of sampling and that sample numbers are sufficiently large and were preserved in such a way that genomic level data can be recovered from the samples.

5. Ignoring alleles with less than 5% frequency. While this makes sense, with N=50 individuals, this means that genotypes with fewer than 3 individuals will be discarded. Depending on the degree of polymorphism, if diverse populations have large numbers of rare genotypes, this could result in many genotypes being ignored. This is a question, especially if disease perhaps maintains diversity via negative frequency dependent selection. It would be helpful if the PI could address this potential issue.
6. Clarify Hershberger's role and budget needs. There appears to be considerably more effort from Hershberger than indicated by the total dollar request. We assume that this is the result of "in-kind" contributions, but it would be good to document the source of those funds so that we can both be assured that they will happen and to account for any leveraging of funds. The Panel noted that this sort of in-kind contribution might be time sensitive and this is another very good reason to support funding the project in this cycle.
7. Add additional detail on the budget. Please clarify budget details for each objective to allow the reviewers and Trustees to know what the cost for each piece of the work would be and to assess what funds from other projects (both those funded by EVOSTC and others) might be being already leveraged in this proposal (see #6).

#### **Science Coordinator Comments – FY17**

**Date: September 2016**

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

#### **Executive Director Comments – FY17**

**Date: September 2016**

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

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

**Date: September 2016**

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

**Cross Program Publication Group  
Project Descriptions**

No Projects Submitted for FY18.