FY12 INVITATION
PROPOSAL SUMMARY PAGE

Project Title: A high temporal and spatial resolution study to validate the separate herring condition monitoring program.

Project Period: federal fiscal years of 2012 to 2014 (October 1, 2011 – September 30, 2014)

Primary Investigator(s): Thomas C. Kline, Jr., Ph. D., Prince William Sound Science Center
Ron Heintz, Ph. D., National Oceanic and Atmospheric Administration (NOAA) Alaska Fisheries Science Center (AFSC) Auke Bay Laboratories (ABL)

Study Location: Prince William Sound

Abstract:

Described here is a single process study project that is a part of an integrative program that will enhance the current monitoring efforts, and examine aspects of particular life stages to allow better modeling of Prince William Sound herring populations. The long-term goal of the program is to improve predictive models of herring stocks through observations and research. The herring monitoring program is necessarily of coarse temporal and spatial resolution with just two observations per year at narrowly defined sampling sites spread around the large area comprising Prince William Sound. Data interpretation requires a greater context to impart greater meaning. In the case of temporal variation of herring condition it would be useful to know (1) how sensitive the herring overwinter mortality model is to starting time, and (2) the timing of recovery from winter starvation. In the case of spatial variation of herring condition it would be useful to know how sensitive the herring overwinter mortality model is to immigration and emigration from areas immediately adjacent to where herring are sampled at the time of our November and March surveys.

Fine-scale temporal and spatial variability at designated herring monitoring sites has never been characterized and therefore remains a data gap with potential ramifications for interpreting observed variation of herring condition that is part of the herring monitoring program as well as the aforementioned modeling. This will be addressed by sampling at Simpson Bay, which has been a key monitoring site for juvenile herring since the 1990's. Energy content and RNA/DNA will be measured monthly from September 2011 until June 2012 to assess fine-scale temporal variability. Fine-scale spatial variability will be assessed by sampling in November and March five separate sub-areas of a more extensive Simpson Bay than what is typically done during surveys. The results of the analysis will be contributed to the herring synthesis effort that will take place in FY14.

Estimated Budget:
EVOSTC Funding Requested:
To PWSSC: 174.2K (FY12), 77.3K (FY13), 20.4K (FY14)
To NOAA:
Non-EVOSTC Funds to be used:
(breakdown by fiscal year)

Date: 1 June 2011

(NOT TO EXCEED ONE PAGE)

PROJECT PLAN

I. NEED FOR THE PROJECT
A. Statement of Problem

Robust Pacific herring (*Clupea pallasii*) populations, suitable for exploitation by commercial fisheries, are typically sustained by periodic recruitment of strong year classes into the adult spawning population. However, the Prince William Sound (PWS) herring population has not had a strong recruitment class since 1989, when the Exxon Valdez Oil Spill (EVOS) occurred. In the EVOS settlement herring were identified as an injured resource and they remain listed as an unrecovered species by the EVOS Trustee Council (EVOSTC). Understanding why herring have not recovered in Prince William Sound requires understanding potential bottlenecks in the herring life cycle. The identification of the limiting conditions to herring recovery requires a series of focused process studies combined with monitoring of the natural conditions that affect herring survival.

Described here is a single project that is a part of an integrative program that will enhance the current monitoring efforts of the Alaska Department of Fish and Game (ADF&G), and examine aspects of particular life stages to allow better modeling of herring populations. The long-term goal of the program is to improve predictive models of herring stocks through observations and research. While we do not anticipate that there will be a major change in our modeling ability in the next five years, we expect that the combination of monitoring and focused process studies will provide incremental changes over the next twenty years and result in a much better understanding of herring populations by the end of the program.

The herring monitoring program is necessarily of coarse temporal and spatial resolution with just two observations per year at narrowly defined sampling sites spread around the large area comprising Prince William Sound (PWS). Data interpretation requires a greater context to impart greater meaning. In the case of temporal variation of herring condition it would be useful to know (1) how sensitive the herring overwinter mortality model is to starting time, and (2) the timing of recovery from winter starvation. The latter is important since the overwinter mortality model predicts that as little as 1 % of the November population would survive to May given a continuation of starvation after March (Kline 2011). PWS herring as late as May have been in very poor condition (Norcross et al. 2001). In the case of spatial variation of herring condition it would be useful to know how sensitive the herring overwinter mortality model is to immigration and emigration from areas immediately adjacent to where herring are sampled at the time of our November and March surveys. The herring population sampled at a given time at a sampling site is defined by the swath of water sampled by the device(s) used (e.g., a net), which is very small compared to the size of the habitat and thus may not be reflective of the local herring population.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

The proposed program addresses the goals and priorities outlined in the 1994 Restoration Plan (http://www.evostc.state.ak.us/Universal/Documents/Publications/IHRP%20DRAFT%20-%20July%202010.pdf) and in the FY 2012 invitation for proposals. In particular our program addresses the need to "Conduct research to find out why Pacific herring are not recovering" and "Monitor recovery", listed on page 48 of the 1994 Restoration Plan. It will lead to the development of new tools to improve herring management. The latter will be accomplished by providing the information needed to develop or test biological and physical models of herring growth.

In November 2006, a Herring Steering Committee was formed and tasked with developing a focused Restoration Program that identifies strategies to address recovery and restoration of herring, recognizing that activities in the program must span an ecologically relevant time frame that accounts for herring population dynamics and life history attributes. A draft Integrated Herring Restoration Program (IHRP) was completed in the fall of 2008 and was further refined in July of 2010. The main goal of the program is to determine what, if anything, can be done to successfully recover the Pacific herring in PWS. In order to determine what steps can be taken, the program examines the factors limiting recovery of herring in PWS, identifies and evaluates potential recovery options, and recommends a course of action for achieving restoration.

Based on the recommendations of the IHRP the Trustee Council has stated in the FY12 request for proposals that they have chosen Restoration Option #2, Enhanced Monitoring, as the focus for their research interests. The program ~~described below~~ aims to meet the goals of this option by utilizing a combination of monitoring efforts to provide more information about the existing stock and process studies to elucidate aspects of the herring life cycle necessary to move us towards an analytical modeling approach. This particular project falls into the process study category.

II. PROJECT DESIGN

A. Objectives

We have sought input for the design of the first five year proposal from scientists with ADF&G, NOAA, the current PWS herring survey program, and other institutions. Based on that input we have arrived at the following objectives for the first five-year period.

1) *Provide information to improve input to the age-structure-analysis (ASA) model, or test assumptions within the ASA model.* The ASA model is currently used by ADF&G for estimating herring biomass (Hulson et al. 2008). The proposed monitoring efforts are designed to address this objective by either expanding the data available for the existing ASA model or by providing information about factors that determine the size of recruitment events.

2) *Inform the required synthesis effort.* Proper completion of a detailed synthesis means being able to access and manipulate different sources of data and information. We are proposing projects that make data available to all researchers.

3) *Address assumptions in the current measurements.* Many of the existing studies are based on historical or logistical constraints. We are proposing research necessary to put the existing measurements into context spatially and temporally. This effort will allow the design of the most accurate and efficient monitoring program.

4) *Develop new approaches to monitoring.* With technological advances we have the potential to improve our monitoring programs so they require less effort or reduce the need to collect fish.

Because we are at the beginning of a twenty-year effort, we want to maximize the value of any data collected. The objectives listed above are designed to ensure that research and monitoring efforts within the expected twenty-year program are most effective. The programs addressing the objectives provide the information necessary to evaluate existing efforts while continuing to move towards our long-term goal.

Objectives specific to this project:

1. Expanded area Simpson Bay sampling in November 2011 and March 2012
2. Sample Simpson Bay monthly from September 2011 to June 2012

B. Procedural and Scientific Methods

We will sample at a single bay, Simpson Bay. However, the spatial scope of what is considered Simpson Bay will be expanded during the November and March sampling periods. The scope of this expansion (Fig. 1) is based on a combination of where herring have been previously sampled and where herring have been observed acoustically (R. Thorne. Pers. comm.).

Sampling to increase spatial resolution (objective 1): For this project we will augment current monitoring samples by sampling Simpson Bay as an aggregate of five sub-areas within the designated expanded bay area during November and March (Fig. 1). This entails dividing the designated expanded Simpson Bay into five sub-areas and sampling systematically within each area rather than just one location (the expansion per se is thus for four additional Simpson sites).

Sampling to increase temporal resolution (objective 2): For this project we will augment current November and March monitoring by also sampling Simpson Bay in September, October, December, January, April, May, and June as we are presently doing (sampling limited to either sub-areas 1 or 2 in Fig. 1 according to greatest fish abundance). The target minimum sample size at each time is 100 herring for energetics and 50 fish for RNA/DNA.

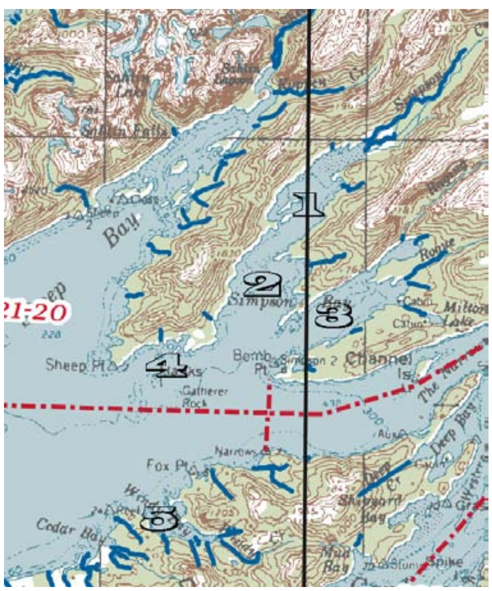

Figure 1. Map of Simpson Bay and surrounding waters showing five sampling areas.

The experimental design of the ongoing monitoring, i.e., sampling during November and March is a good match with respect to the experimental results used to develop the overwinter mortality model (Kline and Campbell 2011). The overwinter mortality model is based, in part, on a laboratory energy loss experiment that was conducted from 1 December to 25 January (Paul and Paul 1998). Therefore, measuring initial conditions during November is a good match. As well, one Paul and Paul (1998) experiment ended on 1 April, a good match to our field observations made in late March.

The energy value of herring that died during laboratory experiments ranged by 0.8 kJ/g wet mass (Paul and Paul 1998). The monthly (30 days) energy loss rate is very similar at 0.7 kJ/g wet mass suggesting this is a good sampling interval for the planned process study. If for example we sampled at twice per month, the expected energy loss would be ~ 0.3 kJ/g wet mass, much less than this range. Furthermore, with sampling trips possibly taking up to 10 days to complete from planned starting dates due to weather, there could be less than 10 days between samples, resulting in negligible change in measured energy.

Short-term (time intervals of months) increases in fish density previously observed at herring sampling sites suggest the possibility of localized migration (Table 1 in Stokesbury et al. 2002). For example, an undetected movement of the herring population to just outside/inside a given sampling bay prior to a survey would mimic a population loss/gain. If the condition of groups of herring within a bay was heterogeneous such short movements could result in a false apparent change in condition. For example, only those fish with higher condition might have migrated out. To test for this effect during our process study, we will sample more extensively during November and March during the process study year (late summer 2011 to spring 2012). The more extensive area comprising Simpson Bay will be sub-divided into five parts with one part corresponding to existing sampling. Therefore only the four additional parts need to be sampled as part of this study. To assess possible effect on the mortality model, the top 20% (the approximate present survival rate between November and March as well as between March and April) of each of the five sub-areas will be compared. Therefore at least 100 herring need to be sampled yielding 20 for this comparison. The mortality model will be run for each of the five sub-areas. The five outcomes will be compared with the five observed March distributions using ANOVA. At the end of the project we will make any necessary recommendations for altering sampling within a bay so as to achieve better representation.

Measurements of energy density can be misleading if the relative concentrations of lipid and protein remain constant when growth resumes. This would translate as a constant energy density leading the mortality model to overestimate mortality due to starvation. Monitoring growth would provide a more direct measure of the onset of feeding. Use of RNA/DNA as an indicator of feeding can be used to indicate the onset of feeding (Sewall et al. 2011). Moreover, RNA/DNA responds more quickly to changes in nutritional status than energy density. Similarly, RNA/DNA could be used to indicate when feeding ceases in fall. When feeding ceases, energy density will remain elevated until fish deplete glycogen reserves and sufficient lipid is catabolized relative to protein to effect a change in energy density. Thus, reliance on energy density can underestimate the period in which feeding ceases. By combining RNA/DNA and energy density analysis the mortality model can provide better estimates of potential mortality.

C. Data Analysis and Statistical Methods

Other than tests specific to the experimental design aspects unique to this project (section B), the data analysis and statistical methods are the same as described in the accompanying Herring Condition Monitoring project. Energy measurement techniques will be done consistent with previous Prince William Sound herring studies dating as far back as the 1990's (Kline and Campbell 2011).

The null hypothesis for the higher spatial resolution sampling is that the five sub-areas of Simpson Bay have the same value for each of the parameters being measured. This will be tested using ANOVA. For example, the whole body energy density should not vary spatially within the greater Simpson Bay. If this is so then small scale migration (within this area) should not be a concern.

The expectation for the monthly observations is that they will follow a consistent pattern over the course of the observation period. An inconsistent pattern would be if the values of a given parameter shifted erratically rather than with a consistent pattern. For example, energy values decreased, then increased, then decreased, etc. Evidence of immigration would be supported by a combination of erratic variation and a systematic relationship among shifting values consistent with two more populations mixing. The differences corresponding to these hypothetical populations would have to be consistent with the differences among the five sub-areas sampled in November and March to suggest shifting around of sub-populations (e.g., the herring residing in each of the five sub-areas at a given time) from nearby.

However, if the de-trended monthly differences exceeded the differences from within the five sub-areas, it would suggest immigration/emigration from a greater space domain than that reflected by the expanded Simpson Bay sampling scheme of this project. If this is the case we may need to adjust the herring monitoring sampling strategy.

D. Description of Study Area

The study area includes all of Prince William Sound (N, E, S, and W boundaries of respectively, ~ 61, -145.5. 60, and -149°). However, most of the projects will focus on the four bays (Zaikof, Whale, Eaglek, and Simpson) that were extensively studied during the Sound Ecosystem Assessment study and PWS Herring Survey program (Figure 2). This allows the work to build upon the historical research completed in those bays. These bays also cover four different quadrants of the Sound. We anticipate a potential build out to include other bays or contraction based on the results from the synthesis. As part of the synthesis effort we will be reviewing the question "What is the appropriate sampling distribution?" as applied to the questions of juvenile herring condition and providing an index of juvenile abundance.

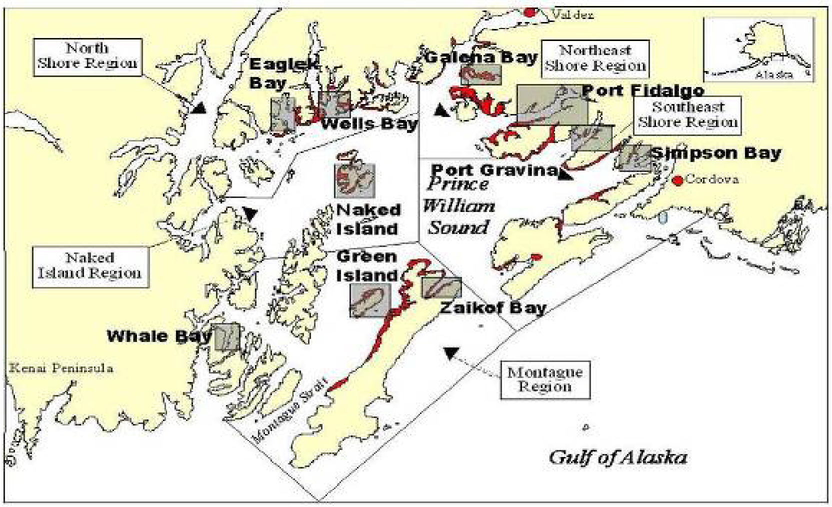

Figure 2. PWS study area, including the four SEA bays (Whale, Zaikof, Eaglek, and Simpson, as well as other bays historically important for juvenile herring.

E. Coordination and Collaboration with Other Efforts

This proposal is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center. Program coordination will primarily be through e-mail and phone communications. Annual meetings are planned in Cordova, tentatively in May, for all investigators to share information between themselves and with the community. These in-person meetings are vital to ensure proper communication among programs.

Dr. Pegau will act as the program team leader and be responsible for ensuring a coordinated and focused research program that leverages other assets whenever possible. He will be responsible for ensuring proper scientific oversight of individual projects and reporting to the EVOSTC. He will lead the development of annual work plans and the synthesis of findings from these programs. He will be responsible for coordinating the efforts of the herring research program with those of the Long-term Monitoring program. He will also be responsible for outreach and public input efforts.

Dr. Pegau currently is the coordinator of the existing EVOSTC funding PWS Herring Survey program. This program consists of ten individual projects that provide a coordinated examination of juvenile herring in Prince William Sound. This proposal is heavily influenced by the early findings from that effort. Dr. Pegau also serves as the Research Program Manager for the Oil Spill Recovery Institute (OSRI). In that capacity he is responsible for developing annual work plans, ensuring proper reporting, making reports available, developing partnerships to leverage funding, and to ensure outreach of OSRI activities. All activities that provide experience delivering the team leader duties outline in the request for proposals.

One of his duties is to ensure proper scientific oversight of the research programs. To accomplish this we will be setting up a four-person scientific oversight panel that will help guide the program and ensure the research is relevant to the long-term goal. The team will consist of people representing Alaska Department of Fish and Game, the National Oceanic and Atmospheric Administration, academia, and the local fishing community. There will be annual Principal Investigator meetings in Cordova each year to provide updates to the oversight panel, improve coordination between projects, and provide outreach and public input opportunities. This meeting will be in the spring so that there is opportunity to provide input on the development of the next year's work plan. In an effort to be proactive in the scientific oversight we sought input on the development of this proposal from ADF&G, NOAA, Cordova District Fishermens United (CDFU), and others. Team development and input on research direction was also sought at the 2011 Alaska Marine Science Symposium.

Coordination with the EVOSTC Long-term Monitoring program is critical to the success of the herring program. The ability to develop a predictive tool using the juvenile condition component requires an understanding of when feeding may occur and hence the need to coordinate with the oceanographic monitoring component. Predation by whales, fish, and birds are also considered potential factors inhibiting the recovery of herring. In that regard we will be looking to the monitoring program for information on the changes in the predator population base. That information will be critical if the herring program chooses to focus on predation during future efforts. The forage fish component and our efforts to develop an index of juvenile herring populations must inform each other. We expect that our hydroacoustic surveys and direct capture efforts will help provide measures of total fish biomass as well as forage fish populations. We will also work together to identify historical data that both programs would benefit from as part of the data management efforts. Throughout the proposal writing effort, the herring and long-term monitoring efforts led by Kris Holderied have been working together to identify how the two programs can inform and complement each other.

Other important programs for coordinating with are the existing PWS herring survey program and existing ADF&G herring research. This program has been developed with input from both of these programs and the focus of this proposal is extending the interpretation of the data from those two programs. The Herring Survey program will still be operating in FY12 and FY13. There are field observations scheduled in FY12 and in FY13 funds are strictly for analysis and report writing. Included in the report writing is a synthesis of previous and current research. This report will be finished in FY13 and be the basis for the synthesis required under this request for proposals.

Lead Principal Investigator Dr. Thomas C. Kline, Jr. will be responsible for the execution of project's energy observations and energy modeling and oversight of the proposed project. Dr. Kline is a world-leader in applying natural stable isotope abundance to fish ecology problems. Dr. Kline has been a research scientist at the Prince William Sound Science Center (PWSSC) since 1995. During this time he has led numerous projects on the oceanography of Prince William Sound and adjacent Gulf of Alaska. He has published dozens of research papers based on the resulting data.

Dr. Kline is currently the principal investigator of the *Exxon Valdez* Oil Spill Trustee Council project 'Prince William Sound Herring Survey: Pacific Herring Energetic Recruitment Factors**'** that is investigating the role of food sources and energy status of herring for recruitment. He was the principal investigator of several previous *Exxon Valdez* Oil Spill Trustee Council projects that had a herring focus. These included Herring Forage Contingency (2007-9), Productivity Dependencies: Stable Isotopes (1998-9), and Sound Ecosystem Assessment: Conforming Food Webs of Fishes with Stable Isotope Tracers (1995-8). Results of these projects have been incorporated into approximately two-dozen scientific publications. The data from the existing project and past projects will synergize with this proposed project.

Co-Principal Investigator Dr. Ron Heintz will be responsible for the execution of the RNA/DNA aspects of the proposed project.
Ron- please add more stuff here

Both investigators are also investigators of ongoing and proposed herring condition monitoring projects that are part of the herring program. This dual role will facilitate near real-time integration of project results with the monitoring program. Both investigators will contribute to programmatic synthesis scheduled to take place in FY14. This synthesis may include suggested changes to the herring monitoring according to depending on outcome.

Table summarizing proposed project tasks (the responsible investigator indicated by initials):

1. (TK) Systematically assess energy levels of age-0 herring per the experimental design.

2. (TK) Model overwintering mortality using data from (1) to evaluate the monitoring experimental design in conjunction with data from (3) through collaborating with Heintz.

3. (RH) Systematically assess RNA/DNA of age-0 herring per the experimental design.

4. (RH) Collaborate with Kline per (2).

5. Both P.I.'s will contribute to the synthesis effort in 2013 and workshop in 2014.

As part of the integrated herring program, this project will be interacting with virtually all other aspects of the program. Personnel from multiple projects will be working in cooperation. This project will furnish one field technician for field sampling. This technician will be expected to cooperate with other projects during this sampling. For example, Dr. Kline's current technician has been simultaneously collecting, sorting, and preparing samples for multiple investigators such as Dr. Hershberger disease samples as part of research cruise duties. Field sampling is being conducted on shared research vessels, with funding for charter time outside the scope of this project. Vessel needs are summarized below.

Table summarizing project specific vessel needs

• Seven days, one each in September, October, December, January, April, May, and June to sample Simpson Bay

• Approximately three days each in November and March formed by expanding the on-going monitoring cruises

• Capability to sample age-0 herring and process samples on board.

III. SCHEDULE
A. Project Milestones

Objective 1. Expanded area Simpson Bay sampling in November 2011 and March 2012.
Sampling to be met by March 2012, analysis by March 2013, incorporation into project synthesis by October 2013, and incorporated into herring program by March 2014

Objective 2. Sample Simpson Bay monthly from September 2011 to June 2012
Sampling to be met by June 2012, analysis by June 2013, incorporation into synthesis by October 2013, and incorporated into herring program by March 2014

B. Measurable Project Tasks

FY12 1st Quarter (October 1, 11 to December 31, 11)
October Begin high temporal resolution sampling
November High spatial resolution sampling cruise

FY12 2nd Quarter
January Annual Marine Science Symposium
March High spatial resolution sampling cruise

FY12 3rd Quarter
May Annual PI meeting
June Submit FY13 work plan for review
June End high temporal resolution sampling

FY12 4th Quarter
August Submit annual report

FY13 1st Quarter (October 1, 12 to December 31, 12)

FY13 2nd Quarter
January Annual Marine Science Symposium

FY13 3rd Quarter
May Annual PI meeting
June Laboratory analysis of samples completed
June Submit FY14 work plan for review

FY13 4th Quarter
August Submit annual report

FY14 1st Quarter (October 1, 13 to December 31, 13)
October Data analysis completed
October Contribute to synthesis for EVOS science council

FY14 2nd Quarter
January Annual Marine Science Symposium
Winter Contribute to EVOS sponsored workshop with Herring and Long-term monitoring programs

FY14 3rd Quarter
May Annual PI meeting

FY14 4th Quarter
August Submit Final report

References Cited

Kline, T.C., Jr. and R.W. Campbell. 2010. Prince William Sound Herring Forage Contingency, *Exxon Valdez* Oil Spill Restoration Project Final Report (Project 070811). Prince William Sound Science Center, P.O. Box 705, Cordova, AK 99574.

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Norcross, B.L., E.D. Brown, R.J. Foy, M. Frandsen, S. Gay, T.C. Kline, Jr., D.M. Mason, E.V. Patrick, A.J. Paul, and K.D.E. Stokesbury. 2001. A synthesis of the early life history and ecology of juvenile Pacific herring in Prince William Sound, Alaska. Fish. Oceanogr. 10 (Suppl. 1):42-57.

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Sewall, F. R. Heintz, and J.J. Vollenweider. 2011. Growth and changes in body composition over winter in YOY Pacific herring (*Clupea pallasii*) from PWS. Book of Abstracts, Alaska Marine Science Symposium, 17-21 January 2011. North Pacific Research Board. Anchorage, Alaska. 196p.

Stokesbury, K.D.E. J. Kirsch, E.V. Patrick and B. Norcross. 2002. Natural mortality estimates of juvenile Pacific herring (*Clupea pallasi*) in Prince William Sound, Alaska. Can. J. Fish. Aquat. Sci. 59: 416–423.

Budget Justification

Project:

A high temporal and spatial resolution study to validate the separate herring condition monitoring program

P.I.: T. Kline

Personnel

Dr. T. C. Kline, Lead Principal Investigator (P.I.). The Lead P.I.'s job and therefore responsibility is the administration of the project including report writing, supervision of personnel, and interpretation of the results. The purpose of these activities is dictated by the funding agency (e.g., report writing) and the needs of the research (e.g., data interpretation). Accordingly, the P.I. expects to dedicate 3 months of his time to this project in FY12; 3 months in FY13, and 1.2 months in FY14.

Technician (to be named). One technician will be needed to accomplish the laboratory tasks and to lead in field sampling. Accordingly, The technician will be expected to dedicate 6.5 months of time in FY12, and 1.5 months in FY13.

Fringe benefit. It is the PWSSC's usual accounting practice that contributions to employee benefits (social security, retirement, etc.) are treated as direct costs. Workman's compensation for anticipated sea-days varies per year according to the anticipated number of cruise days. Included are anticipated modest benefit cost increases of 3% and 5% each year, respectively for the P.I. and technician, based on recent experience.

Travel

Travel is budgeted each year to attend the Alaska Marine Symposium in Anchorage through an existing project for FY12 and a separate project for FY13 and FY14. Additionally, travel is budgeted to attend project workshops during the synthesis year, FY14 in a separate project. The P.I. will attend and participate in workshops, special symposia, and town meetings at a national conference. The P.I. tentatively plans on attending the 2012 Ocean Sciences Meeting in Salt Lake City and the 2013 Aquatic Sciences Meeting in New Orleans. Symposia sponsored by PICES and AFS may be attended instead of these or in other years according to the details of the symposia content. Symposia registration fees run $300 to $500 and are incorporated as part of the ticket cost in the EVOS budget form. Emphasis will be symposia where methods used by the P.I. or herring are the focus. Air travel is based on the current cost of round-trip, economy airfare. Travel will be by US-flag carriers, if available.

Supplies

Field supplies: Ice, coolers, cast nets, gill nets, floats, lead lines, rope, sampling bags, foul-weather gear, and other items as determined by project needs (such as replacement items). The large number of samples to be collected dictates that about $5000 will be spent in FY12.

Laboratory supplies: LSC vials, vacuum pump oil, chemicals, grinder components, forceps, lab safety equipment and apparel, notebooks, bags, boxes, bulbs, anything else as determined by project needs (such as replacement items). The large number of samples to be collected dictates that about $5000 will be spent in FY12 and $1600 will be needed in FY13.

Office supplies: Paper, folders, pens, pencils, and computer accessories as needed. Experience dictates that about $900 will be spent in FY12 and $500 in FY13. A laptop computer ($3K) to facilitate computer use and data transport to and from workshops. Experience dictates that after two years of daily use a laptop will cease to function or have significant problems and thus in need of replacement. Accordingly a laptop is budgeted for in year 1 of the project, FY12.

Equipment

None

Contractual

It is the practice to charge a per use fee for photocopies, printing, and shipping to a project. The annualized totals for FY12 and FY13 are estimated at $500. There is a base phone fee of $50 per person-month.

PWSSC Network charge (computer-months): The PWSSC presently must levy a $100 per person-month network charge to offset this cost.

Mass Spectrometry Elemental Analysis (EA): This is the actual mass spectrometric analysis of samples, which is outsourced to the UAF Stable Isotope Facility at $25 each.

Lyophilizer usage (LU): This is a PWSSC-mandated cost for the operation of this equipment at $3 each.

EA and LU are based upon analyzing 1400 samples in FY12 and 250 samples in FY13.

Software: word processing, spreadsheet, email, operating system (OS), presentation, scientific graphing, statistical updates as needed (virtually annually) due to OS updates and fixes. Experience dictates that about $500 will be needed per year.

Indirect Costs:

The Prince William Sound Science Center has a federally approved indirect rate of 30% on modified total direct costs (excluding equipment, subawards in excess of $25,000, and tuition). Please contact the financial officer, Penelope Oswalt, for further information.

Budget Justification:

Below is the NOAA budget for the project. Funds are requested for only one year, outlying years are not shown as they incur no cost to the Trustee Council.

FY12

Personnnel:

No funds requested

Travel:

Funds are requested for Heintz and Vollenweider to travel the annual herring meeting in Cordova

Conractual : Request contracts for:

Processing ($15/sample), nucleotide extraction, staining, digestion and fluorometry ($25/sample) collected during the intensive survey project in FY12.
450 samples x $50/sample = $18,000

Data management contract $5,000

Commodities:

Sample collection and preparation : vials, lables, bags
$3.00 per sample x 450 samples = $1350

Nucleic acid isolation : reagents, ethidium bromide, enzymes, multiplates
$6.75 per sample x 450 samples = $3038

Shipping: $600

Equipment:

No funds requested