FY16 PROPOSAL SUMMARY PAGE
Continuing, Multi-Year Projects

Project Title: PWS Herring Program – Herring Condition Monitoring

Project Period: February 1, 2016 – January 31, 2017

Primary Investigator(s): Ron Heintz, NOAA Auke Bay Laboratory, 17109 Pt. Lena Loop Road, Juneau, AK 99801, ron.heintz@noaa.gov and Kristen B. Gorman, Prince William Sound Science Center, 300 Breakwater Ave, PO Box 705, Cordova, AK 99574, kgorman@pwssc.org

Study Location: Prince William Sound

Project Website (if applicable): http://pwssc.org/research/fish/pacific-herring/

Abstract*: Outlined here is a single herring monitoring project that is a part of an integrative program that will enhance the current herring 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.

This project will be continuing the development of an overwinter herring mortality model that began with an ongoing monitoring project initiated in 2007, and incorporates results from Prince William Sound herring research dating as far back as the 1990's. Accordingly, herring are sampled in November and the following March (Objectives 1 and 2). The model runs by applying herring condition observations made before and after winter (Objective 3). Proposed sampling will commence in November 2012 and end in March 2016. A future project is expected to continue the time series beginning in November 2016. The purpose of the time series is to relate overwinter mortality to herring recruitment.

Additionally, this project will be furthering the development of an overwinter herring mortality model with additional data types including proximate composition, RNA/DNA, and diet (Objective 6), as well energy levels per se. The goal is to use physiological indicators to realistically modify the daily energy loss rate in the overwintering model. The results of model improvement will be tested using the March data model validation approach that began in 2007.

We will no longer be assessing competitive effects of other juvenile fishes on condition of age-0 herring using stable isotope analysis as noted in previous proposals (Objective 4). Our experience with the sampling program is that we were unable to target the sample sizes need for other species to make this a realistic goal. This aspect of the project was not conducted in 2015 and will not be conducted in 2016.

In 2015, we examined the relationship between age-0 herring length and scale growth (Objective 5) using existing data collected as part of this program, in order to better interpret long-term scale data held by Alaska Department of Fish and Game within the context of energetics. This project will not continue in 2016 as the analysis was completed successfully.

Estimated Budget:

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

FY12	FY13	FY14	FY15	FY16	TOTAL
0	**$231.0K**	**$238.6K**	**$251.6K**	**$253.9K**	**$975.0K**

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
0	**0**	**0**	**0**	**$46.7K**	**0**

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

Date: August 12, 2015

I. EXECUTIVE SUMMARY

Please provide a summary of the project including key hypotheses and overall goals, as submitted in your original proposal. If there are additional highlights that you would like to include since you submitted your annual report, please include them here. Also, please list any publications that have been submitted and/or accepted since you submitted your annual report.

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.

Studies conducted since the 1990's suggest that age-0 PWS herring begin winter deficient in energy, which leads to significant overwinter mortality. Starvation was confirmed by using RNA/DNA as a physiological indicator. It is hypothesized that when these constraints are relaxed, first winter survival is much greater and this leads to enhanced recruitment. Specific objectives for the Herring Condition Monitoring (HCM) project follow:

Objective 1. Monitor juvenile herring condition by sampling in November.

Objective 2. Monitor juvenile herring condition by sampling in March.

Objective 3. Apply resultant observations from Objectives 1 and 2 to continue refining an overwintering mortality model with the addition of physiological indicators.

Objective 4. Assess competitive interactions with fishes using stable isotope analyses (objective not continued in 2015 or 2016).

Objective 5. Examine relationships between age-0 herring scale growth and body length (objective new in 2015 and not continuing in 2016).

Objective 6. Monitor seasonal changes in juvenile herring diets (November vs. March) and examine relationship between diet and herring condition (continuing objective although not specifically defined in previous proposals).

The Science Panel expressed a concern last year about the need to replace Dr. Kline. Dr. Gorman took over the project right after that proposal was written. During the past year all backlog of samples have been processed. The PWSSC and NOAA efforts have been collaborating and worked together on the synthesis effort. That effort identified a couple potential paper topics examining the connections between the condition and environmental conditions. The collaboration with the oceanographers working for Gulf Watch Alaska have been established.

Dr. Gorman has also been able to begin a collaboration with the disease project to examine the condition of herring with ichthyophonus. This collaboration is based on field measurements and looks at the potential transmission of ichthyophonus through offal.

II. COORDINATION AND COLLABORATION

A. Within the Program

Provide a list and clearly describe the present functional and operational relationships with other program projects. This includes any coordination that has taken or will take place and what form the coordination will take (shared field sites or researchers, research platforms, sample collection, data management, equipment purchases, etc.).

The HCM project is structured to be part of a collaborative programmatic effort being led by the Prince William Sound Science Center (PWSSC), the Prince William Sound Herring Research and Monitoring (PWS HRM) program supported by EVOSTC. The PWS HRM program also includes monitoring of disease, as well as studies of adult and juvenile biomass using acoustic techniques. As part of the PWS HRM, the HCM project interacts with virtually all other aspects of the program and personnel from multiple projects work in cooperation. For example, the HCM project will furnish one field technician for field sampling. Previous herring technicians have been simultaneously collecting, sorting, and preparing samples for multiple investigators such as Dr. Hershberger's disease program as part of research cruise duties. Field sampling is being conducted on shared research vessels, with funding for vessel charter time outside the scope of this project. We further rely on environmental data provided by the Gulf Watch Alaska program. Additionally, local fishermen associated with Cordova District Fishermen United, which is a component of the larger PWS HRM program's logistics, collects spring herring samples. Further, in 2015 forage fish work conducted by Gulf Watch Alaska (an EVOS-funded program led by Mayumi Arimitsu) provided samples collected from PWS for disease and body condition estimates of juvenile herring to compare with HCM's work on disease and energetics during spring 2015.

B. With Other Council-funded Projects
None

C. With Trustee or Management Agencies
The HCM project is an ongoing collaboration between PWSSC and NOAA. Bomb calorimetry and preparation of samples for stable isotope analyses are conducted at PWSSC under the supervision of project PI, Kristen Gorman. Proximate composition, RNA/DNA, and dietary analyses are conducted at NOAA's Auke Bay laboratory under the supervision of project PI, Ron Heintz. The proposal for 2015 also included a new collaboration between PWSSC and ADF&G in Cordova to conduct scale analyses. Steve Moffitt, Fisheries Biologist III with ADF&G in Cordova, collaborated on this component of the proposal by provided services for herring scale analysis and access to long-term herring scale datasets. This project, however, will not continue in 2016 as it was completed in 2015.

III. PROJECT DESIGN – PLAN FOR FY16

A. Objectives for FY16
The following were listed in the 2015 proposal, which includes the originally submitted objectives.

Objective 1. Monitor juvenile herring condition by sampling in November.

Objective 2. Monitor juvenile herring condition by sampling in March.

Objective 3. Apply resultant observations from Objectives 1 and 2 to continue refining an overwintering mortality model with the addition of physiological indicators.

Objective 4. Monitor seasonal changes in juvenile herring diets (November vs. March) and examine relationship between diet and herring condition (continuing objective although not specifically defined in previous proposals).

Methods
Juvenile herring are caught in November of each year from a series of bays throughout PWS primarily using a trawl net, however gillnets and cast nets are also used in order to assess size selection by each gear type. In the field, a subset of fish are sampled for disease work in collaboration with Paul Hershberger's work as part of the HRM program. Fish are then allocated to condition monitoring at PWSSC and also diet studies conducted by Ron Heintz and Fletcher Sewall at NOAA in Juneau. Fish that are allocated for PWSSC are all measured and dried in the lab, with approximately 50 fish per bay and gear type prepared for stable isotope analyses at U Alaska – Fairbanks Stable Isotope Facility. Approximately 20 fish per bay are sent to Auke Bay labs for processing. Approximately 10% of the fish prepared for stable isotope analysis are also processed via bomb calorimetry to ground-truth estimates from the isotope approach. During the spring, Cordova fisherman catch juvenile herring using gillnet gear from the same suite of bays as fish caught in the fall. Again, approximately 50 fish per bay are processed for isotope analysis and 10% of these are processed using bomb calorimetry.

B. Changes to Project Design

There are no major changes planned for the design of the HCM project within the scope of energetic sampling and application to the overwinter herring mortality model (**Objectives 1-4**).

We discontinued work aimed at assessing competitive interactions between age-0 herring and other fishes (**Prior Objective 4**) in 2015. Further, in 2015 we pursued a new project that examined age-0

herring growth using scale data as a predictor of age-0 herring body size (**Prior Objective 5**). This project was completed in 2015 and will not be continued in 2016. The scale growth work was the only aspect of the project that received comments by the Science Panel in September 2014 during the 2015 proposal. There was some concern that scales from juvenile fish would be too fragile to work with, however, this project was successfully conducted, results form this work are being included in a manuscript in preparation by Pegau and Batton.

IV. SCHEDULE

A. Project Milestones for FY 16

Objective 1. Monitor juvenile herring condition by sampling in November.
Fieldwork to be accomplished by November 2016
Laboratory work to be accomplished by March 2017

Objective 2. Monitor juvenile herring condition by sampling in March.
Fieldwork to be accomplished by March 2016
Laboratory work to be accomplished by November 2016

Objective 3. Apply resultant observations from Objectives 1 and 2 to continue refining an overwintering mortality model with the addition of physiological indicators.
Analyses to be accomplished by November 2016 with data collected in November 2016 and March 2016.

Objective 4. Monitor seasonal changes in juvenile herring diets (November vs. March) and examine relationship between diet and herring condition.
Laboratory work to be accomplished by July 2017, for fieldwork samples collected in March and November 2016.

B. Measurable Project Tasks for FY 15

FY 16, 1st quarter (February 1, 2016 - April 31, 2016)

February – April 2015:	*Ongoing laboratory work for samples collected in November 2015 and March 2016*
March 2015:	*2016 Sampling*

FY 16, 2nd quarter (May 1, 2016-July 30, 2016)

May – July 2016:	*Ongoing laboratory work for samples collected in March 2016*

FY 16, 3rd quarter (August 1, 2016 – October 31, 2016)

August – October 2016:	*Ongoing laboratory work for samples collected in March 2016* *Application of data collected in November 2015 and March 2016 to overwinter mortality model.*

FY 16, 4th quarter (November 1, 2016- January 31, 2017)

November – January 2017:	*Ongoing laboratory work for samples collected in November 2016*
November 2016:	*2016 Sampling*

V. PROJECT PERSONNEL – CHANGES AND UPDATES

Ron Heintz will continue as PI with this program.

Kristen Gorman is a new PI at the Prince William Sound Science who is now leading projects previously coordinated by Dr. Tom Kline including the current Herring Condition Monitoring project. Kristen holds a PhD from Simon Fraser University, Vancouver BC, which she earned in January 2015.

Fletcher Sewall is a PhD candidate researching juvenile herring survival and recruitment who contributes to the project components associated with the NOAA Auke Bay Laboratory and within the purview of Ron Heintz, including sample processing, data analysis, and drafting reports and manuscripts.

Kristen B. Gorman
CV Short

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P.O. Box 705
Cordova, Alaska 99574

Email: kgorman@pwssc.org
Tel: 907-242-5800 ext. 239
Fax: 907-424-5820

Professional Preparation

2015: Simon Fraser University, Faculty of Science; Ph.D. Major: Ecology and Evolutionary Biology.
2005: Simon Fraser University, Faculty of Science; M.Sc. Major: Ecology and Evolutionary Biology.
1996: Dickinson College, Carlisle, PA, USA; B.S. Major: Biology.

Appointments

2014: Research Ecologist, Prince William Sound Science Center, Cordova, AK.
2008: Ph.D. Candidate, Department of Biological Sciences, Simon Fraser University, Burnaby, BC.
2005: Research Assistant, Polar Oceans Research Group, Sheridan, MT.
2002: M.Sc. Candidate, Department of Biological Sciences, Simon Fraser University, Burnaby, BC.
1999: Wildlife Field Technician, Oregon State University, Corvallis, OR.
1997: Wildlife Field Technician, University of Wisconsin, Madison, WI.

Selected Publications

Gorman, K.B., T.D. Williams, and W.R. Fraser. 2014. Ecological sexual dimorphism and environmental variability within a community of Antarctic penguins (genus *Pygoscelis*). *PLoS ONE* 9(3): e90081.

Crossin, G.T., P.N. Trathan, R.A. Phillips, **K.B. Gorman,** A. Dawson, K.Q. Sakamoto, and T.D. Williams. 2012. Variation in baseline corticosterone predicts foraging behaviour and parental care in macaroni penguins. *The American Naturalist* 180(1):E31-E41.

Bestelmeyer, B.T., A.M. Ellison, W.R. Fraser, **K.B. Gorman**, S.J. Holbrook, C.M. Laney, M.D. Ohman, D.P.C. Peters, F.C. Pillsbury, A. Rassweiler, R. Schmitt, and S. Sharma. 2011. Analysis of abrupt transitions in ecological systems. *Ecosphere* 2(12):art129.

Gorman, K.B., D. Esler, P.L. Flint, and T.D. Williams. 2008. Nutrient reserve dynamics during egg production by female Greater Scaup (*Aythya marila*): relationships with timing of reproduction. *Auk* 125(2):384-394.

Gorman, K.B., P.L. Flint, D. Esler, and T.D. Williams. 2007. Ovarian follicle dynamics of female

Greater Scaup during egg production. *Journal of Field Ornithology* 78(1):64-73.

Other Relevant Publications

Schofield, O., H. Ducklow, K. Bernard, S. Doney, D. Patterson-Fraser, **K.B. Gorman**, D. Martinson, M. Meredith, G. Saba, S. Stammerjohn, D. Steinberg, and W. Fraser. Penguin biogeography along the West Antarctic Peninsula: Testing the canyon hypothesis with Palmer LTER observations. *Submitted Apr 2013*.

Crossin, G.T., A. Dawson, R.A. Phillips, P.N. Trathan, **K.B. Gorman**, S. Adlard, and T.D. Williams. 2012. Seasonal patterns of prolactin and corticosterone secretion in an Antarctic seabird that moults during reproduction. *General and Comparative Endocrinology* 175(1):74-81.

Badzinski, S.A., P.L. Flint, **K.B. Gorman**, and S.S. Petrie. 2009. Relationships between hepatic trace element concentrations, reproductive status, and body condition of female greater scaup. *Environmental Pollution* 157(6):1886-1893.

Gorman, K.B., D. Esler, R.L. Walzem, and T.D. Williams. 2009. Plasma yolk precursor dynamics during egg production by female Greater Scaup *(Aythya marila*): characterization and indices of reproductive state. *Physiological and Biochemical Zoology* 82(4):372-381.

Gorman, K.B. and T.D. Williams. 2005. Correlated evolution of maternally derived yolk testosterone and early developmental traits in passerine birds. *Biology Letters* 1(4):461-464.

Synergistic Activities

- Peer-review of manuscripts for *Biology Letters* (4), *Journal of Animal Ecology* (1), *Journal of Avian Biology* (1), *Marine Ecology Progress Series* (4), *Physiological and Biochemical Zoology* (1), *Polar Biology* (2), *Waterbirds* (1).
- Association of Polar Early Career Scientists (APECS) Council Member, Research Activities and Education/Outreach Committees (September 2012-2013).
- Graduate student representative to the US Long-Term Ecological Research (LTER) Network for Palmer Station, Antarctica LTER program (September 2010-September 2012).
- Co-organizer for *Les Ecologistes* Seminar Series, Department of Biological Sciences, Simon Fraser University (2010-2011).

Collaborators

S Badzinski (Bird Studies Canada), B Bestelmeyer (New Mexico State U), J Blum (Polar Oceans Res. Group), G Crossin (Dalhousie U), S Doney (Woods Hole), A Dawson (C. Ecol Hydrol, NERC), H Ducklow (Marine Biological Lab), A Ellison (Harvard U), E Erdmann (U Wisconsin Madison), D Esler (Simon Fraser U), P Flint (AK-USGS), W Fraser (Polar Oceans Res Group), M Hipfner (Canadian Wildlife Service), S Holbrook (UC Santa Barbara), P Horne (Polar Oceans Res Group), J Joy (Simon Fraser U), S Laney (U Texas El Paso), H Lucas (Polar Oceans Res. Group), D Martinson (Lamont-Doherty), M Meredith (Brit Ant Surv), M Ohman (SCRIPPS), D Patterson-Fraser (Polar Oceans Res. Group), D Peters (New Mexico State U), S Petrie (Bird Studies Canada), B Pickering (Polar Oceans Res. Group), R Phillips (BAS), F Pillsbury New Mexico State U), A Rassweiler (UC Santa Barbara), K Sakamoto (Hokkaido U), O Schofield (Rutgers U), S Sharma (U Wisconsin Madison), S Stammerjohn (Inst Arctic Alpine Res), D Steinberg (VIMS), P Trathan (BAS), R Vos (Simon Fraser U), R Walzem (Texas A&M), T Williams (Simon Fraser U).

Graduate Advisors (PhD)

Simon Fraser University: T. Williams, W. Fraser (Polar Oceans Res Group), D. Esler, R. Ydenberg

CURRICULUM VITAE

Fletcher Sewall
NOAA Auke Bay Laboratories, 17109 Pt. Lena Loop Rd
Juneau, AK 99801
Tel.: (907) 789 – 6024, E-mail: fletcher.sewall@noaa.gov

EDUCATION

- PhD candidate, Fisheries Oceanography 2010 – present
  University of Alaska Fairbanks
- Master of Applied Science, Marine Ecology and Fisheries Biology 2005
  James Cook University, Australia.
- Bachelor of Science, Psychology 1993
  University of Alaska Anchorage

PROFESSIONAL EXPERIENCE

Chemical/Biological Laboratory Assistant. 12/15/2005 – present NOAA-NMFS Auke Bay Laboratories Recruitment Energetics & Coastal Assessment program (independent contractor).

Eight years of research-related experience including manuscript preparation, data analyses, chemical laboratory analyses, and fieldwork in support of NOAA fisheries research at the Auke Bay Laboratories.

Publications and presentations

- Principal investigator/lead author of study concerning use of nucleic acid ratios and lipid content as indicators of winter performance of juvenile Pacific herring. In preparation for submission to peer-reviewed scientific journal. [Sewall, Heintz, and Vollenweider. In review. Value of growth and energy storage as predictors of winter survival of YOY herring in Prince William Sound.]
- Principal investigator/lead author of study concerning proximate composition and fatty acid analysis of fish embryos and larvae. Published findings in peer-reviewed scientific journal. [Sewall & Rodgveller 2009, Changes in body composition and fatty acid profile during embryogenesis of quillback rockfish (*Sebastes maliger*), Fishery Bulletin 107(2): 207-220.]
- Developing poster presentations of research findings. Alaska Marine Science Symposium, 2009 – 2014.
- Presenting research findings. Prince William Sound Herring Survey principal investigators meetings, 2011 – 2014.
- Collaborating with scientists from Auke Bay Labs and other state, federal, university, and private agencies to develop research proposals and to synthesize research findings for dissemination.

Chemical and biological laboratory analysis

- Familiarity and experience with sample preparation and extraction procedures for analysis of hydrocarbons in marine tissue and sediment samples, including use of column chromatography and high performance liquid chromatography (HPLC).
- Cleaning and maintaining laboratory glassware, analytical instruments, and other chemistry laboratory equipment to a high standard that ensures contaminant-free use in multiple applications, including fatty acid analysis and trace hydrocarbon analysis.
- Performing lipid analysis on juvenile and adult fish, marine mammal, and invertebrate samples by modified method of Folch et al (1957): extracting lipids from homogenized tissue samples using accelerated solvent extractor (ASE) and other equipment described in the analytical chemistry protocols for Auke Bay Labs lipid analysis; determining masses of lipid extracts using gravimetric analysis.
- Using microscale laboratory techniques to extract lipids from larval fish and small tissue samples and analysing using spectrophotometry with sulphophosphovanillin (SPV) reagent.
- Preparing lipid samples for fatty acid analysis by carrying out acid-catalyzed transesterification of fatty acids in lipid extracts.
- Familiarity and experience with operation of gas chromatograph-mass spectrometer (GC-MS) for fatty acid quantification in marine tissue samples.
- Determining concentrations of nucleic acids and RNA/DNA ratios in larval fish and in muscle tissues of juvenile and adult fish by protocols of Calderone et al (2001), using a microplate fluorescence spectrophotometer and ethidium bromide.

- Verifying that sample results from chemical processing are within acceptable statistical bounds for quality assurance, including reproducibility of results, comparability to standard reference materials, and minimal contaminant levels.
- Collaborating with senior chemist in ongoing refinement of standard operating procedures and quality assurance criteria for analytical chemistry processes.
- Preparing a variety of types and size ranges of sample organisms and tissues for analyses, including: using preservative solutions for small invertebrate organisms, anaesthetizing fish, and homogenizing sample tissues through physical mixing by mortar/pestle, electric tissue homogenizer, and sonification equipment.
- Organizing, storing and processing biological samples in accordance with processing needs to maintain sample integrity, including use of supercold (-80 °C) freezing, liquid nitrogen, nitrogen gas flushing of storage containers, and BHT antioxidant.
- Generating biological data on a variety of fish species at different life stages, including: lengths of adult and larval fish; wet and dry tissue masses of adult, larval, and embryonic fish; size and maturity stage of gonads; fish stomach contents; bioelectrical impedance analysis (BIA) data.
- Dissecting juvenile and adult fish and preparing samples for pathological analyses, including collecting peripheral blood smears, and aseptic removal of heart, kidneys, spleen and liver.

Data analysis and recordkeeping

- Performing univariate and multivariate statistical analyses on biological, chemical, and bioenergetics data using MS Access database, MS Excel, and Minitab software.
- Maintaining accurate, organized records including sample chain of custody information for extensive sample inventories, biological data, and chemical data, in both paper records and Access database.

Mentorship and training experience

- Training multiple personnel in various analytical chemistry procedures, including sample processing, and cleaning and maintaining scientific instruments.
- Training multiple personnel in sample chain of custody recordkeeping and entry of biochemical and biological data in Access database.
- Coordinating and overseeing completion of chemical and biological processing tasks by contractors to accomplish project objectives within specified timelines.
- Mentoring high school biology students competing in regional Intel Science Fair; advised on study design, implementation, and statistical analysis.
- Judging regional Intel Science Fair projects, involving evaluation of written and oral presentations by high school students, and student interviews.
- Assisting outreach coordinator with Sea Week activities, including conducting age-appropriate activities for pre-school through junior high students.

Wet laboratory animal husbandry

- Assisting with design and set up of equipment for use in wet laboratory experiments, e.g., carbon dioxide-enriched seawater exposure of fish embryos.
- Feeding and maintenance of live marine organisms (fish, invertebrates) in Auke Bay Labs wet laboratory facilities for bioenergetics studies.
- Assisting with maintenance of aquaria and touch tanks for public display, including feeding and care of fish and invertebrate organisms.

Fieldwork

- Collecting and identifying of a variety of Alaskan marine fishes, including forage fishes.
- Conducting fieldwork for obtaining forage fish and invertebrate samples, habitat and environmental data, and marine mammal observations, including: live-aboard marine research cruises of over two weeks' duration, traveling by small plane, transporting equipment by foot over rugged terrain, and working in remote locations in all weather conditions.
- Deploying various types of field equipment for obtaining forage fish and other biological samples and environmental/oceanographic data, including: beach seines, mid-water trawls, hook-and-line, fyke nets, cast nets, plankton nets, Niskin bottles, CTD devices, split-beam echo sounder, rotary laser level/stadia rods, and salinity/temperature/DO/pH meters.

VI. BUDGET

A. Budget Forms

PWSSC - Gorman

Budget Category:	Proposed FY 12	Proposed FY 13	Proposed FY 14	Proposed FY 15	Proposed FY 16	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0.0	$64,700.0	$67,300.0	$70,000.0	$72,800.0	$274,800.0	
Travel	$0.0	$3,000.0	$5,900.0	$5,900.0	$6,100.0	$20,900.0	
Contractual	$0.0	$24,800.0	$25,600.0	$26,300.0	$28,900.0	$105,600.0	
Commodities	$0.0	$7,500.0	$5,000.0	$8,300.0	$6,700.0	$27,500.0	
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Indirect Costs (*will vary by proposer*)	$0	$30,000	$31,200	$33,200	$34,400	$128,800.0	
SUBTOTAL	$0.0	$130,000.0	$135,000.0	$143,700.0	$148,900.0	$557,600.0	$0.0
General Administration (9% of	$0.0	$11,700.0	$12,150.0	$12,933.0	$13,401.0	$50,184.0	N/A
PROJECT TOTAL	$0.0	$141,700.0	$147,150.0	$156,633.0	$162,301.0	$607,784.0	
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

NOAA - Heintz

Budget Category:	Proposed FY 12	Proposed FY 13	Proposed FY 14	Proposed FY 15	Proposed FY 16	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Travel	$0.0	$0.0	$3,900.0	$7,100.0	$4,000.0	$15,000.0	
Contractual	$0.0	$75,000.0	$75,000.0	$75,000.0	$75,000.0	$300,000.0	
Commodities	$0.0	$6,000.0	$5,000.0	$5,000.0	$5,000.0	$21,000.0	
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
SUBTOTAL	$0.0	$81,000.0	$83,900.0	$87,100.0	$84,000.0	$336,000.0	$0.0
General Administration (9% of	$0.0	$7,290.0	$7,551.0	$7,839.0	$7,560.0	$30,240.0	N/A
PROJECT TOTAL	$0.0	$88,290.0	$91,451.0	$94,939.0	$91,560.0	$366,240.0	
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

B. Changes from Original Proposal

None

C. Sources of Additional Funding

NOAA in-kind contributions:		
Source	*Purpose*	*Amount*
NOAA staff salaries	Training and oversight of labor for sample processing, contract writing and administration	$ 44,197.16
NOAA instrument amortization	Use of instruments in sample processing, analytical chemistry	$ 2,485.95
	Total	$ 46,683.11