PROPOSAL SIGNATURE FORM

THIS FORM MUST BE SIGNED BY THE PROPOSED PRINCIPAL INVESTIGATOR AND SUBMITTED ALONG WITH THE PROPOSAL. If the proposal has more than one investigator, this form must be signed by at least one of the investigators, and that investigator will ensure that Trustee Council requirements are followed. Proposals will not be reviewed until this signed form is received by the Trustee Council Office.

By submission of this proposal, I agree to abide by the Trustee Council's data policy (Trustee Council Data Policy*, adopted March 17, 2008) and reporting requirements (Procedures for the Preparation and Distribution of Reports**, adopted June 27, 2007).

PROJECT TITLE:	**Measuring Interannual Variability in the Herring's Forage Base from the Gulf of Alaska – submitted under the BAA**
Printed Name of PI	**Alexander Bychkov**
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Printed Name of PI	**Sonia Batten**
Email:	**soba@sahfos.ac.uk**
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Signature of PI:	 Date: **31st March 2009**

* www.evostc.state.ak.us/Policies/data.cfm
** www.evostc.state.ak.us/Policies/reporting.cfm

FY10 INVITATION
PROPOSAL SUMMARY PAGE

Project Title: Measuring Interannual Variability in the Herring's Forage Base from the Gulf of Alaska – submitted under the BAAa

Project Period: Oct 1 2009 – Apr 15 2013

Primary Investigator(s): Alex Bychkov, North Pacific Marine Science Organisation (PICES). Sonia Batten, Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

Study Location: Shelf waters SW of PWS, Cook Inlet, northern Gulf of Alaska

Abstract:
Herring from Prince William Sound feed on zooplankton, some originating within the Sound and some from the Gulf of Alaska (GOA) introduced to PWS via a variety of processes. Additionally, adult herring almost certainly forage outside of the Sound, feeding on zooplankton over the wider Alaskan shelf. Understanding the sources of variability in the herring forage base is essential to efforts to understand the herring recovery process and to address basic resource management questions. Direct measurements inside PWS do not explain how the interannual variation in ocean food sources creates interannual variability in PWS zooplankton, nor when changes in ocean zooplankton are to be seen inside PWS. A ten-year time series of seasonal zooplankton data from the Alaskan shelf and northern oceanic GOA has been maintained through support from a variety of agencies including the EVOS TC. The Continuous Plankton Recorder (CPR) survey is a cost-effective, ship-of-opportunity based sampling program that includes community involvement and has a proven track record. The existing time series shows considerable interannual variation in GOA zooplankton abundance and is essential baseline data to underpin herring restoration efforts. EVOS TC support is now requested to maintain the sampling in this region at the current resolution while we examine the linkages between PWS and GOA zooplankton.

Estimated Budget:
EVOS Funding Requested *(must include 9% GA)*

FY10	FY11	FY12	FY13	Total
$61,900	$63,600	$65,100	$15,000	$205,600

Non-EVOS Funds to be used:

FY10	FY11	FY12	FY13	Total
$100,000	$100,000	$100,000	$50,000	$350,000

(NOT TO EXCEED ONE PAGE)

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

The draft Integrated Herring Restoration Program (IHRP) states that the goal of the program is to '*determine what, if anything can be done to successfully recover Pacific herring in PWS from the effects of the Exxon Valdez Oil Spill'*. The IHRP recognizes that "*Each step in the PWS herring population life cycle and the concomitant interaction with either food or predator could be the "bottleneck" point or limiting factor(s) prohibiting their recovery"*. It is thus essential that data on prey availability and variability continue to be collected to provide this context. The environment in which all stages of the herring population live needs to be considered before other effects (disease or genetic stock structure for example) can be fully evaluated. Pacific herring are a planktivorous fish with juveniles and adults feeding opportunistically on a variety of plankton (Blaxter, 1985). As adults they spend a significant portion of their life cycle foraging outside of their spawning and nursery grounds in Prince William Sound (PWS). It is not known exactly where adult herring spend the summer, but it is likely to extend over the continental shelf south west of PWS; concentrations have been found in the SW passes to the Gulf of Alaska (Norcross et al., 2001). Other east Pacific herring populations such as those in northern BC, San Francisco Bay and Bristol Bay stocks have been shown to move into deeper waters to feed (Hay, 2007).

Furthermore, water is transported into PWS from the Gulf of Alaska introducing oceanic zooplankton prey to the neritic habitats used by herring (Norcross et al., 2001). The IHRP recognizes that "*the amount of transfer between PWS and the Gulf of Alaska (in terms of both water properties and plankton) can impact the ecosystem within the sound"*. PWS receives significant oceanic zooplankton subsidies (Cooney et al., 2001). Work by Kline (2008) has shown that oceanic zooplankton subsidies enhanced the survival of juvenile pink salmon from PWS and are believed to be important to PWS herring (Kline, pers. comm.). While it is possible to measure oceanic carbon in the food web of PWS, direct measurements inside PWS do not explain how the interannual variation in ocean food sources creates interannual variability in PWS zooplankton, nor when changes in ocean zooplankton are to be seen inside PWS. Correlations between the offshore and PWS zooplankton may be complex so that the ocean carbon signal in PWS in any one year is the result of unequal effects from several years of GOA inputs. Seasonal winds and currents drive downwelling on the shelf for much of the year which brings offshore water and plankton onto the shelf. We are also now realizing the importance of mesoscale eddies which occur all around the southern Alaskan shelf and exchange shelf and offshore water (and organisms), inextricably linking these two regions (e.g. Okkonen et al., 2003; Ladd et al., 2005). Mesoscale eddies may drive inputs of zooplankton into PWS (Kline, pers. comm.) and eddy intensity is dependent on climatic variables. A time series of oceanic zooplankton is essential to understanding the relationships between PWS and the wider GOA.

Understanding changes in herring food supply from year to year, whether a shift in distribution, community composition or timing of zooplankton abundance could help understand the fluctuations in the population and in turn support management of this resource. Brown (2003) found evidence of bottom-up environmental forcing of PWS herring population size with adult

growth varying in phase with zooplankton production and climate trends. Marty et al. (2003) report that poor body condition in Pacific Herring is one risk factor for disease.

The Continuous Plankton Recorder (CPR) transect samples the Alaskan shelf and crosses the slope into the open Gulf of Alaska. Many important species as well as herring forage in the offshore areas for at least some of their life history (salmon, birds and marine mammals for example) so an understanding of the productivity of these shelf and offshore areas is important to understanding and predicting fluctuations in resource abundance. Our sampling transect extends from the inner part of Cook Inlet, onto the open continental shelf, across the shelf break and into the open Gulf of Alaska in a continuous fashion, enabling us to identify how widespread the incidences of high or low plankton are and whether the whole region is responding in a similar way to meteorological variability.

The existing time series of CPR data from the Alaskan shelf is shown in Figure 1. Data have been broken out by season and show the contribution to the biomass by broad taxonomic groups. Considerable seasonal and interannual variability is evident, for example, large copepods are particularly important in late winter and spring but can amount to as little as 14% (2001) or as much as 70% (2003 and 2004). Small copepods tend to dominate the summer biomass but again, their contribution can range from 26% (2006) to more than 80% (1997, 2008). Pteropods are an intermittently important contributor – they can be virtually absent in any one season/year but can make up as much as 40% of the biomass.

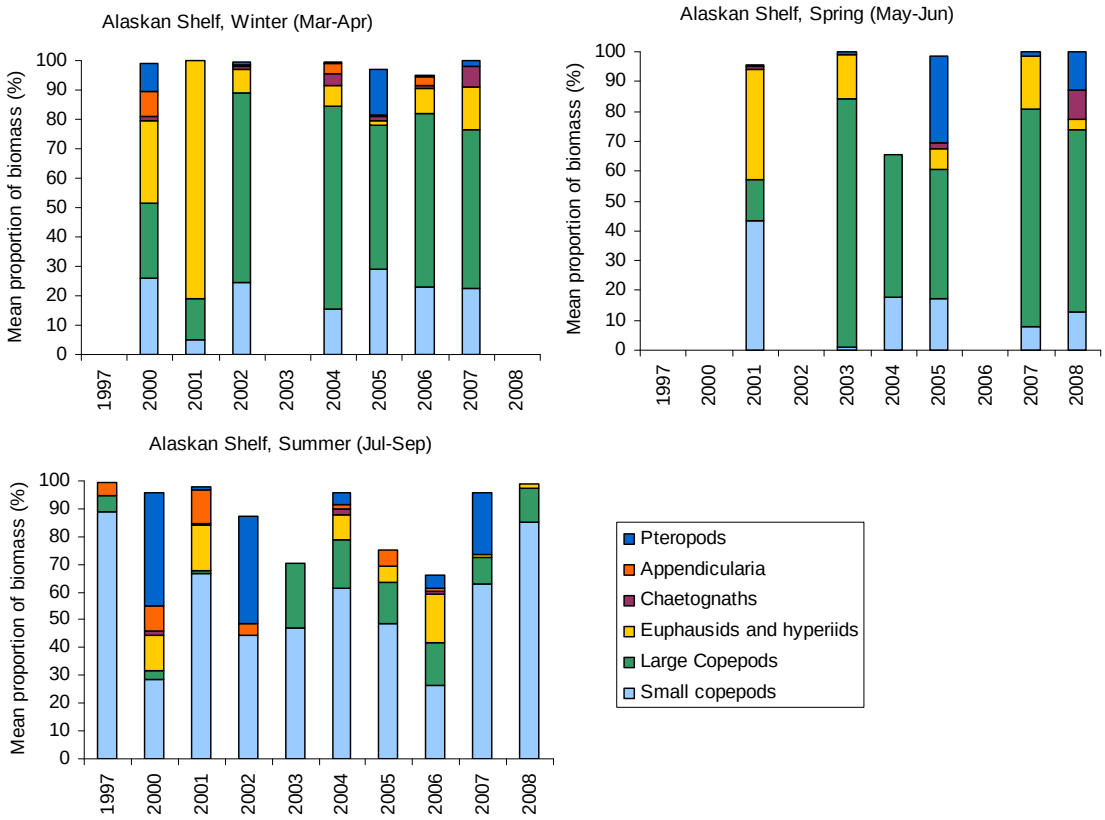

Figure 1. The mean contribution to overall mesozooplankton biomass (dry weight per sample) by major taxonomic groups in each year, by season.

These data can also be further broken down into individual taxa (more than 150 zooplankton taxa are counted) and although not shown, similar data exist for the off-shelf portion of the northern Gulf of Alaska and within Cook Inlet. We will work with other scientists (we have already approached Dr. Kline and Dr. Brown who are enthusiastic) to examine linkages between plankton variables such as these and the forage base for herring within PWS.

The North Pacific Marine Science Organization (PICES) has endorsed the north Pacific CPR project since its inception in 2000. In 2007 PICES initiated a funding consortium that would support the project, through relatively small contributions from agencies with a need for data from all or part of the region. At this time, the Canadian Department of Fisheries and Oceans (DFO) and the North Pacific Research Board (NPRB) have each made commitments for at least the next three years (4 years from the NPRB). The Exxon Valdez Oil Spill Trustee Council has supported the CPR program in the past (projects 030624, 040624 and 070624) and, in fact, was instrumental in its establishment. PICES is now seeking a contribution from the EVOS TC to the funding consortium, at a level much reduced from previous contributions, to enable the collection of Alaskan shelf and northern Gulf of Alaska samples to continue at the current sampling resolution. The Sir Alister Hardy Foundation for Ocean Science (SAHFOS) is supporting ~50% of the program through 2009, so that the time series remains unbroken, but it is the only time that it can do this. Additional funding must be attained to continue sampling the Alaskan region. There are multiple practical reasons to justify EVOS TC support:

- The funding requested is modest and because of the Consortium approach is less than the actual cost of the data collection.
- The project has a proven track record with a high sampling success rate, all past deliverables have been fully met (the final report for the previous support received very favourable reviews) and there is a good publication record in primary scientific literature, so the funding would likely generate a very positive return for the EVOS TC.
- SAHFOS has maintained its links with local technicians at PWSCC and the Horizon shipping company so that ~10% of the requested funding will be returned to the region.
- The EVOS TC has supported the program in the past, and so continued support adds value to this initial contribution and builds a legacy. Additionally, the data have relevance to other species inhabiting the region, since plankton are the base of the oceanic food chain, so the value of the data extends beyond the herring restoration program.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

This proposal fits within the 'Monitoring and Research' program of the Restoration Plan, specifically under the provision '*long-term monitoring of an ecosystem relationship that provides an understanding important for restoration of one or more injured resources*'. This project will provide data on the abundance and variability of herring prey.

The Restoration Plan recognizes that components of the ecosystem are inextricably linked and that it is very difficult to understand the dynamics of one species studied in isolation. The first policy of the Plan adopts the 'Ecosystem Approach' and states '*Monitoring and Research activities require more than resource-specific investigations to understand the factors affecting*

recovery from the oil spill. Restoration issues are complex, and research must often take a long-term approach to understand the physical and biological interactions that affect an injured resource or service, and may be constraining its recovery. The results of these efforts could have important implications for restoration, for how fish and wildlife resources are managed, and for the communities and people who depend upon the injured resources.' This proposal will provide data on the base of the marine food chain, the plankton, and provide an additional three years of data to add to the time series of zooplankton observations on the Alaskan shelf, which are necessary to characterize the inter-annual variability in plankton abundance. It will improve our understanding of this variability and our ability to correlate abundances of herring and their prey, especially at times of increased variability and changing conditions.

II. PROJECT DESIGN

This project follows a tried and tested approach; the Continuous Plankton Recorder (CPR) has been deployed from ships-of-opportunity in the North Pacific on a routine basis since March 2000. It collects biological data on a transect operated by Horizon Shipping running from Cook Inlet across the Gulf of Alaska to Puget Sound.

We are seeking a contribution to the funding consortium to support an additional three years of sampling on the transect (6 times per year, ~monthly through spring and summer) and because all aspects of the sampling have been going smoothly, we are not suggesting any changes to the current sampling regime. Cooperation from Horizon Shipping has been excellent; officers and crew of the *Horizon Kodiak* have maintained the towing gear and carried out necessary repairs over the past 5 years to enable monthly deployments. The ship's route is extremely consistent from month to month (Fig 2), which makes comparisons between months and years relatively straightforward. Staff at Prince William Sound Community College were trained in 2003 in CPR servicing and have indicated their willingness to continue the servicing and downloading of samples and so we propose to continue with all existing arrangements. A second complementary transect that crosses the Gulf of Alaska from east to west passing through Unimak Pass is also funded by the CPR Consortium and while data analysis often integrates data from both transects to address wider issues, an EVOS contribution will ensure the continuation of the north-south transect at the current sampling resolution.

A. Objectives

The principle objective of this proposal is to continue the acquisition of plankton data on a transect from Cook Inlet to Tacoma (Fig 2) to determine zooplankton abundance and variability, which is the forage base for PWS herring. Sampling will be carried out 6 times, approximately monthly between March and September 2010 and again in 2011 and 2012, to cover the period of zooplankton productivity in the spring and summer period. This will provide 9 continuous years of seasonal sampling on this transect, 13 years from the northern Gulf of Alaska, covering a period of high frequency changes in the phase of the dominant climate signal, the Pacific Decadal Oscillation. Information on prey variability is one component of understanding herring recruitment variability.

We will also continue to analyse a sub-set of samples rapidly and make those results available on the project web site (www.pices.int) within 3 months of sample collection.

We will collaborate with scientists working within PWS to examine the linkages between CPR data and the forage base for herring within PWS.

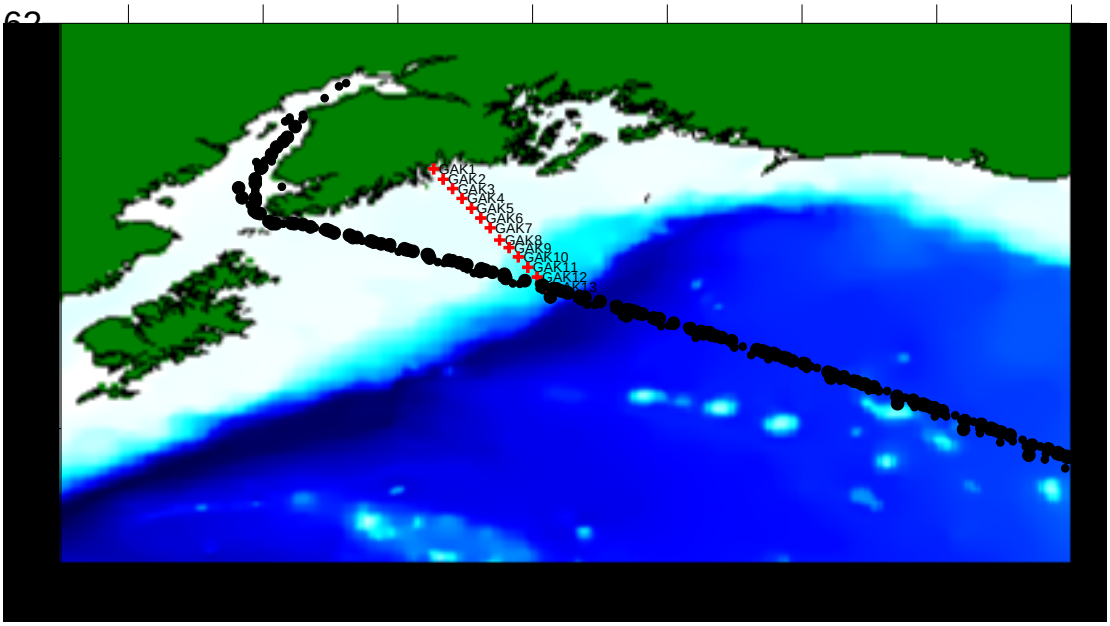

Figure 2. The location of the transect. All previous transect positions are shown and they overlap almost entirely. The Seward Line stations are also shown, in red.

B. Procedural and Scientific Methods

Standard CPR methodology

The collection and processing of CPR samples and issues of quantitativeness are detailed in Batten et al. (2003) and Richardson et al (2006) and have been described in previous proposals. Methods are summarised here:

The CPR is deployed from the stern of the vessel once it has cleared Port (or when the Captain deems it is safe to do so), normally travelling from south (Tacoma) to North (Anchorage) and is towed behind the vessel on a fixed length cable so that it samples the surface mixed layer at a depth of about 7m. Water enters the front of the CPR, passes along a tunnel and through a silk filtering mesh (with a mesh size of 270μm) which retains the plankton and allows the water to exit at the back of the machine. The movement of the CPR through the water turns an external propeller which, via a drive shaft and gear-box, moves the filtering mesh across the tunnel. As the filtering mesh leaves the tunnel it is covered by a second band of mesh so that the plankton are sandwiched between these two layers, which then wind on into a storage chamber containing preservative. At the end of the tow the machine is returned to the laboratory and the mesh is cut into separate samples (each representing 18.5 km of tow and about $3m^3$ of seawater) which are randomly apportioned amongst the analysts for plankton analysis.

The first step is the assessment of phytoplankton colour (the greenness of the sample) which is a representation of the total phytoplankton biomass and includes the organisms that are too fragile to survive the sampling process intact but which leave an impression on the mesh. Hard-shelled phytoplankton are then semi-quantitatively determined under a microscope by viewing 20 fields of view and recording the presence of all the different taxa in each field. Small zooplankton are identified and counted into categories of abundance from a subsample (1/50 of the sample) whilst all zooplankton larger than about 2mm are counted with no sub-sampling. Identification is carried out to the highest practicable taxonomic level and is a compromise between speed of analysis and scientific interest. Since copepods make up the vast majority of the zooplankton most copepods are identified to species level whilst rarer groups are identified to a lower level. Although CPR sampling is continuous, the midpoint of the sample is used to label it with latitude, longitude, time and date. All of the samples are archived after analysis so that they can be re-examined at any time.

The CPR is a relatively simple, rugged piece of oceanographic equipment. It can withstand being deployed from large ships moving at speeds of >20 knots and over 90% of tows successfully record plankton. A high level of expertise is needed to carry out the taxonomic analysis but SAHFOS has an excellent team of analysts, some members with over 30 years of experience.

All samples collected from the Alaskan shelf will be processed to maximize the spatial resolution possible, and every fourth oceanic sample will be processed to allow a comparison between open ocean and shelf conditions. Summary indices such as 'mesozooplankton biomass' and 'total diatom abundance'are routinely calculated from the abundance data. Transects are also overlaid on satellite altimetry images to identify mesoscale features, such as eddies that were sampled by the transect.

C. Data Analysis and Statistical Methods

Previous proposals have already described the statistical validity of this approach and demonstrated that the sampling frequency and spacing is suitable to characterize seasonal, interannual and spatial variability at the mesoscale. Further information can be found in Batten et al., (2003) and previous funded EVOS TC proposals, but since our proposed sampling and processing protocols are unchanged and have been previously approved we have not repeated them here.

D. Description of Study Area

The project will sample waters on a transect from the Straits of Juan de Fuca outside of Puget Sound (48.45°N, 125°W, Captain's discretion) across the Gulf of Alaska to Cook Inlet and Anchorage. Sampling will end at about 60ºN, 151.9°W (at Captain's discretion). See Figure 2 for a map of the transect. Ship tracks vary minimally from month to month.

E. Coordination and Collaboration with Other Efforts

The work outlined in this project forms part of a larger CPR survey in the North Pacific. The ultimate goal is to have a variety of Agencies and groups contributing to the costs of the survey,

each receiving the benefits of the entire survey for a relatively small individual cost. At this time, long term commitments from the Canadian Department of Fisheries and Oceans and the North Pacific Research Board are in place, so that some sampling can be carried out at least through 2013.

Collaboration with Dr. Kline at the Prince William Sound Science Centre has been discussed. Their work on stable isotope analysis has shown that a significant proportion of PWS zooplankton has an oceanic origin, and Dr. Kline has a hypothesis that mesoscale eddies may facilitate the exchange between PWS and the open Gulf of Alaska. We will work with Dr. Kline's group to compare the CPR time series with zooplankton data within PWS. Correlations are not likely to be simplistic; the ocean carbon signal in PWS in any one year may be the sum of unequal effects from several years of GOA inputs. However, CPR data can be used to determine where particular zooplankton taxa are in relation to mesoscale eddies (e.g. Batten and Crawford, 2005). By combining time series and examining linkages we will make progress in understanding how the PWS forage base for herring relates to the shelf and oceanic regions of the Gulf of Alaska.

Dr. Evelyn Brown has expressed support for this project and has said '*A key factor in understanding recruitment processes for Pacific herring that will ultimately lead to rehabilitating the PWS herring population centers around feeding during the early life history stages (larvae and juvenile). The distribution and diet of these life stages is vastly different than in the adults and is unfortunately poorly understood. As a result, there is a paucity of information available about effects of variable zooplankton production on larvae and juvenile herring and that information is expensive to collect. If a relationship exists between plankton production in the Gulf of Alaska or great PWS and the plankton along the larval drift and within the juvenile nursery bays, than the cost of examining food as a limitation for herring recruitment could be reduced. Sampling along the distribution ranges of the early life stages could be reduced to validating a GOA-PWS-Herring nursery site zooplankton production model.'*

We will of course participate in the annual herring team meeting and provide data or other plankton indices to team members as required.

III. SCHEDULE

Objective 1. Sample collection on the transect from Cook Inlet to Puget Sound will begin in March 2010 and continue approximately monthly through to August/September 2010 (6 transects will be sampled). This schedule will be repeated in 2011 and 2012. All shelf samples will be processed and every 4th oceanic sample.

Objective 2. A subset of samples (25%) will be processed within 3 months of collection at the Institute of Ocean Sciences (DFO, Canada) and results from this processing (e.g. estimated mesozooplankton biomass and comparisons with data from previous years) will be published on the project web site.

Objective 3. Collaborate with other researchers. This will begin as soon as funding is approved and will initially focus on past data comparisons. As data from the proposed work

become available we will incorporate it into our studies and so this objective will be addressed throughout the project in an on-going fashion.

B. Measurable Project Tasks

FY 10, 1st quarter (October 1, 2009-December 31, 2009)
October: Project funding approved by Trustee Council

FY 10, 2nd quarter (January 1, 2010-March 31, 2010)
January: Attend Annual Science Symposium
February: Shipping of CPR from UK to Horizon Kodiak
March: First transect sampled, first servicing at PWSCC

FY 10, 3rd quarter (April 1, 2010-June 30, 2010)
April Begin sample processing (ongoing hereafter)
April-June Three transects sampled
June First results from 2010 sampling on website (ongoing hereafter)

FY 10, 4th quarter (July 1, 2010-September 30, 2010)
July-Sept Two transects sampled, CPR shipped back to UK

FY 11, 1st quarter (October 1, 2010-December 31, 2010)
December: Final transect data posted on website

FY 11, 2nd quarter (January 1, 2011-March 31, 2011)
January: Attend Annual Science Symposium and give presentation
February: Shipping of CPR from UK to Horizon Kodiak
March: First transect sampled, first servicing at PWSCC

FY 11, 3rd quarter (April 1, 2011-June 30, 2011)
April Begin sample processing (ongoing hereafter)
April-June Three transects sampled
June First results from 2011 sampling on website (ongoing hereafter)

FY 11, 4th quarter (July 1, 2011-September 30, 2011)
July-Sept Two transects sampled, CPR shipped back to UK

FY 12, 1st quarter (October 1, 2011-December 31, 2011)
December: Final transect data posted on website

FY 12, 2nd quarter (January 1, 2012-March 31, 2012)
January: Attend Annual Science Symposium and give presentation
February: Shipping of CPR from UK to Horizon Kodiak
March: First transect sampled, first servicing at PWSCC

FY 12, 3rd quarter (April 1, 2012-June 30, 2012)
April Begin sample processing (ongoing hereafter)
April-June Three transects sampled
June First results from 2011 sampling on website (ongoing hereafter)

FY 12, 4th quarter (July 1, 2012-September 30, 2012)
July-Sept Two transects sampled, CPR shipped back to UK

FY 13, 1st quarter (October 1, 2012-December 31, 2012)
December: Final transect data available

FY 13, 2nd quarter (January 1, 2013-March 31, 2013)
January: Attend Annual Science Symposium and give presentation
January-March Complete sample processing

FY 13, 3rd quarter (April 1 2013-June 30 2013)
April Submit final report

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Qualifications

1972	B.S./M.S. in Chemistry (with Honour), Moscow State University, Moscow, Russia
1978	Ph.D. in Analytical Chemistry, Institute Geochemistry & Analytical Chemistry, Russian Academy of Sciences, Moscow, Russia

Career History

1999-present	Executive Secretary, North Pacific Marine Science Organization (PICES)
1996-1999	Assistant Executive Secretary, North Pacific Marine Science Organization (PICES)
1991-1996	Head, Climate Chemistry Laboratory, Pacific Oceanological Institute, Far-Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia
1990	Visiting Scientist, Center for Ocean Climate Chemistry, Institute of Ocean Sciences, Fisheries & Oceans Canada, Sidney, British Columbia, Canada
1978-1990	Research Scientist, Senior Research Scientist, Leading Research Scientist, Pacific Oceanological Institute, Far-Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia

Professional Services

2001-2003	Chairman, North Pacific Synthesis Group, Joint Global Ocean Flux Study (JGOFS), International Geosphere-Biosphere Program (IGBP)
1997-2001	Co-Chairman, North Pacific Task Team, Joint Global Ocean Flux Study (JGOFS), International Geosphere-Biosphere Program (IGBP)
1996-2003	Member, Scientific Steering Committee, Joint Global Ocean Flux Study (JGOFS), International Geosphere-Biosphere Program (IGBP)
1995-1996	Member, Physical Oceanography and Climate Committee, North Pacific Marine Science Organization (PICES)
1994-1997	Honorary Research Associate, Department of Earth & Ocean Sciences, University of British Columbia, Vancouver, B.C., Canada
1994-1996	Member, National Oceanographic Committee of Russian Federation

Cooperative Scientific Research Programs

1989-1995	Co-leader, joint Canada/Russia/USA International North Pacific Ocean Climate (INPOC) Program
1990-1994	Co-leader, joint Russia/USA Geochemistry of Marine Sediments (GEMS) Program
1992	Chief scientist, joint Canada/Russia/USA WOCE cruise
1992-1993	Co-leader, joint ROC/Russia Kuroshio Edge Exchange Processes and Marginal Seas Study (KEEP-MASS)

Five Recent Relevant Publications

2007	Guest Editor (with A. Peña and S. Bograd), special issue of *Progress in Oceanography* on "Time series of the Northeast pacific" (Vol. 75, No. 2)
2006	Guest Editor (with W. Sydeman, R. Brodeur, C. Grimes and S. McKinnell), special issue of *Deep-Sea Research II* on "Top predator "hot spots" in the North Pacific" (Vol. 53, Nos. 3-4)

2004 Guest Editor (with T. Saino, C.T. Chen and P. Harrison), special issue of *Journal of Oceanography* on "JGOFS North Pacific Synthesis" (Vol. 60, No. 1)
Guest Editor (with S. McKinnell, K.-R. Kim and M. Terazaki), special issue of *Progress in Oceanography* on "Recent progress in studies of the Japan/East Sea ecosystem" (Vol. 61, Nos. 2-4)

2003 Guest Editor (with A. Peña), special issue of *Progress in Oceanography* on "Plankton size classes, functional groups and ecosystem dynamics" dedicated to the memory of the late Prof. Michael M. Mullin (Vol. 57, Nos. 3-4)

Collaborators on projects/ publications in last 4 years

Steven Bograd, Southwest Fisheries Science Center, NMFS, NOAA, U.S.A.
Richard Brodeur, Oregon State University, Hatfield Marine Science Center, U.S.A.
Chen-Tung Arthur Chen, National Sun Yat-Sen University, China-Taipei
Churchill Grimes, Southwest Fisheries Science Center, NMFS, NOAA, U.S.A.
Paul Harrison, AMCE Program, Hong Kong University of Science and Technology, Hong Kong
Kyung-Ryul Kim, School of Earth and Environmental Sciences, Seoul National University, Korea
Skip McKinnell, PICES Secretariat, North Pacific Marine Science Organization (PICES)
Angelica Peña, Institute of Ocean Sciences, Fisheries and Oceans Canada
William Sydeman, Farallones Institute, U.S.A.
Toshiro Saino, Global Warming Observational Research Program, JAMSTEC, Japan

Resume: Sonia Dawn Batten Ph.D.

Sir Alister Hardy Foundation for Ocean Science
C/o 4737 Vista View Crescent
Nanaimo, British Columbia, V9V 1N8, Canada
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Qualifications

1990–1994. PhD. Marine Biology. 'Correlative studies of the ecophysiology and community structure of benthic macrofauna' Southampton University, UK.
1987–1990. BSc. Honours Degree in Oceanography with Biology, 2(i). Southampton University, UK

Career History

2000 to present. Half-time Research Fellow. Sir Alister Hardy Foundation for Ocean Science, UK.
2003 and 2004. Temporary Instructor, Malaspina University College, Fisheries and Aquaculture program.
1996–2000. Assistant Director. Sir Alister Hardy Foundation for Ocean Science, UK
1994–1996. Postdoctoral Research Fellow. Sir Alister Hardy Foundation for Ocean Science, UK

During the past 14 years I have been working with the Continuous Plankton Recorder Survey through the Sir Alister Hardy Foundation for Ocean Science, which operates and maintains the multi-decadal, basin-wide database of plankton abundance and distribution from the North Atlantic. Since 2000 I have been based in western Canada, co-ordinating the north Pacific CPR survey. My main research focus has been the mesozooplankton; their distribution, ecology and role in the upper pelagic ecosystem. I have extensive experience of analysing and interpreting CPR data and have worked on several multidisciplinary projects in European waters. I have extensive project management, data analysis and publication/presentation skills through my experience as Assistant Director of SAHFOS and as acting as a PI on numerous research projects (including the current EVOS and NPRB projects in the North Pacific).

Five Recent Relevant Publications

Batten, S.D., and Mackas, D.L. (In Press) Narrowing of the annual peak of *Neocalanus plumchrus* in the oceanic Northeast Pacific. Marine Ecology Progress Series
Mackas, D.L., Batten, S.D., and Trudel, M., (2007) Effects on zooplankton of a warming ocean: recent evidence from the Northeast Pacific. Progress in Oceanography, 75, 223-252
Batten, S.D. and Freeland, H.J. (2007). Plankton populations at the bifurcation of the North Pacific Current. Fisheries Oceanography, 16, 536-646.
Batten, S.D., Hyrenbach, K.D., Sydeman, W.J., Morgan, K.H., Henry, M.F., Yen, P.Y. and Welch, D.W. (2006). Characterising Meso-Marine Ecosystems of the North Pacific. Deep Sea Research II. 53, 270-290.
Batten, S.D and Crawford, W.R. (2005). The influence of coastal origin eddies on oceanic plankton distributions in the eastern Gulf of Alaska. Deep Sea Research II, 52, 991-1009.

Other Significant Publications

Batten, S.D. and Welch, D.W. (2004). Changes in oceanic zooplankton populations in the North-east Pacific associated with the possible climatic regime shift of 1998/1999. Deep Sea Research II, **51**, 863-873.

Batten, S.D., Clarke, R.A., Flinkman, J., Hays, G.C., John, E.H., John, A.W.G., Jonas, T.J., Lindley, J.A., Stevens, D.P., and Walne, A.W. (2003). CPR sampling – The technical background, materials and methods, consistency and comparability. *Progress in Oceanography*, **58**, 193-215.

Collaborators on projects/ publications in last 4 years

Ken Coyle, of Alaska Fairbanks, School of Fisheries and Ocean Sciences
William Crawford, Department of Fisheries and Oceans, Canada
Martin Edwards, SAHFOS
Howard Freeland, Department of Fisheries and Oceans, Canada
Mike Henry, University of British Columbia
David Hyrenbach, University of Washington
Richard Kirby, Marine Biological Association, UK
Alistair Lindley, SAHFOS
David Mackas, Department of Fisheries and Oceans, Canada
Ken Morgan, Canadian Wildlife Service
William Sydeman, Farallones Institute
Marc Trudel, Department of Fisheries and Oceans, Canada
Anthony Walne, SAHFOS
David Welch, Department of Fisheries and Oceans/Kintama Research, Canada
Peggy Yen, Point Reyes Bird Observatory Conservation Science

Budget Justification

The proposal and budget asks for a contribution to the CPR funding consortium for three years to enable sampling and analysis of samples from the northern Gulf of Alaska to be maintained at the current resolution (6 times per year March-September, all shelf samples processed and every 4th oceanic sample). The North Pacific Research Board and Canadian Department of Fisheries and Oceans (DFO) are each contributing to the consortium at a similar level to this request. In addition, a collaborative agreement between SAHFOS and DFO has an in-kind contribution of $59,000 from DFO for FY 2009. This amount has not been included in the proposal budget because the agreement is renewed annually and is not yet in place beyond 2009 but we would expect a similar agreement to exist in each subsequent year with a similar in-kind contribution (for laboratory space, technician support and so on).

Personnel

S. Batten will manage the day to day running of the project, carry out research on the data and complete reports and publications. D. Moore is the DFO technician who will process the samples and carry out some sample analysis. The SAHFOS team of analysts will complete the sample analysis and sample curation. Small amounts of time are allocated for other personnel to liaise with the shipping company (P. Pritchard) and technicians to set up/repair the CPRs at the start/end of the field season. Salaries have been increased by 3% in each year after FY10. FY13 contains only salary time for S. Batten to complete the final report (1 mo). There is no overtime and the salary costs include National Insurance and pension contributions.

Personnel	Time allocated per yr 2010-12	Cost in FY10	Cost in FY11	Cost in FY12	Cost in FY13
S. Batten	1 mo	$7.2k	$7.4k	$7.6k	$7.8k
Doug Moore	1.5 mo	$7.7k	$7.8k	$8.1k	
Technicians - workshop	0.3 mo	$1.5k	$1.5k	$1.6k	
Technicians - analysts	2.5 mo	$12.8k	$13.3k	$13.5k	
P Pritchard	0.1 mo	$0.7k	$0.7k	$0.8k	
Total	5.4 mo	$29.8k	$30.7k	$31.5k	$7.8k

Travel

A proportion of the costs for the PI to attend the annual science meeting in Anchorage is requested (~33%) for FY10-12 and full costs in FY13. $800 in years 2010-2012 and $2200 in FY13.

Contractual

Lease of CPRs from SAHFOS is included here. 33% of the costs for 6 tows per year ($1300 per tow in FY10, increasing by 3% in subsequent years) = $2600 in FY10, $2678 in FY11 and $2758 in FY12.

A proportion of the costs for shipping CPRs to and from the port of Tacoma at the start/end of the field season is also included at $1000 per year.

Servicing of the CPRs by Prof Benda at the Prince William Sound Community College is included at $3,900 in FY10 increased by 3% in subsequent years ($4,017 in FY11 and $4,138 in FY12)

A gratuity is given to the ship's crew for each transect sampled and a proportion (33%) included here: $570 in FY10, $587 in FY11, $605 in FY12
A contribution to the maintenance of the project website by PICES is included here at $1000 in each of 2010 to 2012.

Commodities
A proportion (33%) of the costs for shipping samples between PWS and the DFO and SAHFOS lab is included at $300 per year.
33% of the costs of the filtering mesh are included ($210 per mechanism): $1260 in FY10, $1298 in FY11, and $1337 in FY12.
Tow wires and lab consumables are included at $100 and $200 per year respectively.
The costs of printing, binding and mailing the final report are included in FY13 at $300.

Equipment
No new equipment will be purchased, existing microscopes and CPRs will be used.

Indirect costs
45% of the salaries are added as an indirect cost (SAHFOS, DFO and PWSCC personnel costs). This will be split 40% to SAHFOS and 5% retained by PICES. Amounts are: $15,165, $15,623, $16,037 and $3,510 in each year 2010 to 2013 respectively.

Data Management and Quality Assurance/Quality Control Statement

1. This study is designed to collect Continuous Plankton Recorder (CPR) samples along a transect that runs from just outside Puget Sound, WA, across the Gulf of Alaska into Cook Inlet and up to Anchorage, AK. The CPR is towed behind the cargo vessel, the *Horizon Kodiak*, and so the exact location of the sampling is outside our control. However, as Fig 2 (page 7) illustrates the route does not normally vary very much. The only variability appears to be within Cook Inlet when a pilot is taken aboard. Three cassettes, each capable of being towed for 450 nautical miles are used on this transect. In the work proposed here, typically 20 samples are collected from Cook Inlet and the Alaskan shelf and then up to 100 samples are collected from the open north Pacific on each transect. In order to spread the resources over the sampled area and through the seasons all samples collected over the shelf are processed but then every fourth open ocean sample is processed (to give a total of about 45 samples processed per transect). All collected samples, whether processed or not, are archived and can be processed at a later date if necessary. An analysis was undertaken and described in an earlier proposal to verify that this level of coverage was adequate to incorporate the large scale patchiness (on the order of 10s to 100s of kms) which may contribute to observed variability.

2. Although sampling is continuous the towed filtering mesh is divided into discrete samples. A single CPR sample consists of a length of mesh and filtered plankton that represents 18.5 km (10 nautical miles) of tow and $3m^3$ of filtered seawater (assuming 100% efficiency) – the Project Plan gives more methodological details beginning on page 7. The ships log is used to assign the time, date, latitude, and longitude of the midpoint of the sample. Constant speed and direction are assumed between sequential log entries. CPR samples are collected and processed according to a standard set of procedures established by the Atlantic CPR survey run by SAHFOS and which have been unchanged since 1958. SAHFOS is also active in the Scientific Committee on Oceanic Research (SCOR) WG 115 'Standards for the Survey and analysis of Plankton' whose terms of reference include the standardisation of techniques and integration/calibration of data.

3. The samples to be processed are distributed to a team of plankton analysts (based at SAHFOS in the UK and at IOS in British Columbia). Processing at IOS occurs first, to give rapid data, then all the samples are couriered to SAHFOS in the UK where the remaining samples are processed. Distribution is pseudo-random so that adjacent processed samples are never examined by the same person. Taxonomic enumerations are carried out using a high power microscope. Phytoplankton taxa are recorded in a semi-quantitative way (number of fields of view out of 20 across the sample), small zooplankton are enumerated from a 0.02 subsample, large zooplankton are enumerated from the whole sample. Zooplankton abundances are recorded in logarithmic categories of abundance. After processing, adjacent sample counts are compared. Differences of more than two categories require that the sample be re-processed to verify that the difference is real and not human error. It is assumed that all taxonomic enumerations are valid once the QC has been completed. However, some factors could affect how quantitative the samples are. Poor preservation owing to insufficient concentrations of formaldehyde in the CPR storage tank occurs rarely, but can result in difficulty in distinguishing some taxonomic features and organisms may be only identified to a higher taxonomic level. Poor preservation is noted in the database. If the

sampling mesh runs out before the CPR is hauled, or there is a tear or jam in the mesh caused by floating debris, then it is not possible to accurately determine the positions of the samples from the ship's log. Samples are still processed as normal, but are labelled as 'Qualitative'. Data are only used for large area investigations where precise location is not important. Such occurrences are rare and, for example, would still allow the data to be used to construct a seasonal cycle for the Gulf of Alaska, but not to examine the composition of plankton in eddies or other mesoscale features.

4. Not relevant to this proposal

5. The ship arrives in Anchorage after sampling and the sampling mechanisms are unloaded and couriered to Prince William Sound Community College where they are unloaded. The roll of mesh containing plankton is unloaded from the mechanism, wrapped in absorbent lint, sealed in plastic bags and couriered to the IOS, Sidney, British Columbia. Once the ship's log information has been used to determine the positions of the samples they are cut, labelled with a unique identifier consisting of the transect name and number and the numerical sample identifier (e.g. 75AT15 would be the 75th deployment of the CPR on the Anchorage to Tacoma transect and the 15th sample along that deployment). Once microscopic analysis has been completed, the sample is sprayed with additional preservative (a buffered formaldehyde mix which also contains a fungicide and bactericide), it is wrapped in plastic and stored in numerical sequence. Curation of the sample archive is an ongoing part of SAHFOS activities.

6. The data will normally be averaged to provide means of single or aggregated taxa for a given sub-region on a monthly, seasonal or annual basis. Summary indices such as total mesozooplankton abundance or biomass for a subset of the samples (processed rapidly) are posted on the project's website soon after sampling. Comparisons will be made and tested for significance using non-parametric statistics (CPR data generally follow a poisson distribution). Conventional software such as Excel or Systat will be used. Community composition changes will be examined using multi-dimensional scaling (available in Systat) or other ordination techniques.

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Budget Category:	Proposed FY 10	Proposed FY 11	Proposed FY 12	Proposed FY 13	TOTAL PROPOSED
Personnel	$29.8	$30.7	$31.5	$7.8	$99.8
Travel	$0.8	$0.8	$0.8	$2.2	$4.6
Contractual	$9.1	$9.3	$9.5	$0.0	$27.9
Commodities	$1.9	$1.9	$1.9	$0.3	$6.0
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect *(will vary by proposer)*	$ 15.2	$15.6	$16.0	$3.5	$50.3
SUBTOTAL	$56.8	$58.3	$59.7	$13.8	$188.6
General Administration (9% of subtotal)	$5.1	$5.2	$5.4	$1.2	$17.0
PROJECT TOTAL	$61.9	$63.6	$65.1	$15.0	$205.6
Other Resources (Cost Share Funds)	$100.0	$100.0	$100.0	$50.0	$350.0

The Canadian Department of Fisheries and Oceans is contributing $50,000 annually to the CPR Consortium until at least 2012. The North Pacific Research Board is also contributing $50,000 per year until at least 2013

FY10 - 13

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4A
NON-TRUSTEE
AGENCY SUMMARY

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
						0.0
S Batten			1.0	7.2		7.2
Doug Moore			1.5	5.1		7.7
Technicians - workshop			0.3	4.9		1.5
Technicians - analysts			2.5	5.1		12.8
P Pritchard			0.1	7.2		0.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.4	29.5	0.0	
					Personnel Total	$29.8

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
PI to attend Annual meeting (33% costs)	0.4	1	4	0.1	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.8

FY10

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Leasing of CPRS (6 tows 33% lease costs)	2.6
Transport of CPRs to and from UK at start/end of field season (33% costs)	1.0
Servicing & setting up of CPRs (inc. repair and shipping) between tows carried out by Prince William Sound Science Centre	3.9
Tow payment to ship (33% costs)	0.6
Website support	1.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$9.1

Commodities Costs: Description	Commodities Sum
Filtering mesh (33% costs)	1.3
Tow wires (33% costs)	0.1
Lab supplies (33% costs)	0.2
Shipping of samples (33% costs)	0.3
Commodities Total	$1.9

FY10

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
			0.0
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
existing CPRs will be used. Lease costs charged above cover replacement/repair		
external bodies	1	
internal mechanisms	4	
Existing microscopes will also be used, (including one purchased in FY03)	7	

FY10

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
EQUIPMENT
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
						0.0
S Batten			1.0	7.4		7.4
Doug Moore			1.5	5.2		7.8
Technicians - workshop			0.3	5.1		1.5
Technicians - analysts			2.5	5.3		13.3
P Pritchard			0.1	7.4		0.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.4	30.4	0.0	
					Personnel Total	$30.7

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
PI to attend Annual meeting (33% costs)	0.4	1	4	0.1	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.8

FY11

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description	Contract Sum
Leasing of CPRS (6 tows 33% lease costs)	2.7
Transport of CPRs to and from UK at start/end of field season (33% costs)	1.0
Servicing & setting up of CPRs (inc. repair and shipping) between tows carried out by Prince William Sound Science Centre	4.0
Tow payment to ship (33% costs)	0.6
Website support	1.0
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$9.3

Commodities Costs: Description	Commodities Sum
Filtering mesh (33% costs)	1.3
Tow wires (33% costs)	0.1
Lab supplies (33% costs)	0.2
Shipping of samples (33% costs)	0.3
Commodities Total	$1.9

FY11

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
existing CPRs will be used. Lease costs charged above cover replacement/repair		
external bodies	1	
internal mechanisms	4	
Existing microscopes will also be used, (including one purchased in FY03)	7	

FY11

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
EQUIPMENT
DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
						0.0
S Batten			1.0	7.6		7.6
Doug Moore			1.5	5.4		8.1
Technicians - workshop			0.3	5.2		1.6
Technicians - analysts			2.5	5.4		13.5
P Pritchard			0.1	7.6		0.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.4	31.2	0.0	
					Personnel Total	$31.5

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
PI to attend Annual meeting (33% costs)	0.4	1	4	0.1	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.8

FY12

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description		Contract Sum
Leasing of CPRS (6 tows 33% lease costs)		2.8
Transport of CPRs to and from UK at start/end of field season (33% costs)		1.0
Servicing & setting up of CPRs (inc. repair and shipping) between tows carried out by Prince William Sound Science Centre		4.1
Tow payment to ship (33% costs)		0.6
Website support		1.0
If a component of the project will be performed under contract, the 4A and 4B forms are required.	**Contractual Total**	$9.5

Commodities Costs: Description		Commodities Sum
Filtering mesh (33% costs)		1.3
Tow wires (33% costs)		0.1
Lab supplies (33% costs)		0.2
Shipping of samples (33% costs)		0.3
	Commodities Total	$1.9

FY12

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
			0.0
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
existing CPRs will be used. Lease costs charged above cover replacement/repair		
external bodies	1	
internal mechanisms	4	
Existing microscopes will also be used, (including one purchased in FY03)	7	

FY12

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B EQUIPMENT DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Personnel Costs:		GS/Range/	Months	Monthly		Personnel
Name	Project Title	Step	Budgeted	Costs	Overtime	Sum
						0.0
Batten			1.0	7.8		7.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	7.8	0.0	
					Personnel Total	$7.8

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
					0.0
PI to attend Annual meeting	1.4	1	4	0.2	2.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.2

FY13

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
PERSONNEL & TRAVEL DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

Contractual Costs: Description		Contract Sum
If a component of the project will be performed under contract, the 4A and 4B forms are required.	**Contractual Total**	$0.0

Commodities Costs: Description	Commodities Sum
Printing and binding of final report	0.3
Commodities Total	$0.3

FY13

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B CONTRACTUAL & COMMODITIES DETAIL

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 10- FY 12

New Equipment Purchases: Description	Number of Units	Unit Price	Equipment Sum
			0.0
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
None		

FY13

Project Title: Interannual variability in herring forage base
Lead PI: Bychkov and Batten

FORM 4B
EQUIPMENT
DETAIL