

FY14 PROGRAM PROJECT PROPOSAL FORM

Project Title: Data Management Support for the EVOSTC Long Term Monitoring Program

Project Period: Feb 1st 2014 to Jan 31st 2015

Primary Investigator(s): Rob Bochenek, Axiom Consulting & Design

Abstract: This project supplies the EVOS Long Term Monitoring (LTM) effort with critical data management support to assist study teams in efficiently meeting their objectives and ensuring data produced or consolidated through the effort is organized, documented and available to be utilized by a wide array of technical and non technical users. This effort leverages, coordinates and cost shares with a series of existing data management projects which are parallel in scope to the data management needs of the long term monitoring program. In the first two years, this project would focus on providing informatics support to streamline the transfer of information between various study teams and isolate and standardize historic data sets in the general spill affected area for use in retrospective analysis, synthesis and model development. These efforts would continue into year three through five but efforts would also focus on developing management and outreach applications for the data and data products produced from the LTM program.

Estimated Budget:

EVOSTC Funding Requested:

FY12	FY13	FY14	FY15	FY16	TOTAL
130,800	130,800	22,500	23,300	24,000	331,400

(Funding requested must include 9% GA)

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL

Date: August 6th 2013

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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 the data management component of the PWS Herring Research and Monitoring 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.

Managing oceanographic data is particularly challenging due to the variety of data collection protocols and the vast range of oceanographic variables studied. Data may derive from automated real-time sensors, remote sensing satellite/observational platforms, field/cruise observations, model outputs, and various other sources. Variables can range from mesoscale ocean dynamics to microscale zooplankton counts. The resulting datasets are packaged and stored in advanced formats, and describe a wide spectrum of scientific observations and metrics. Due to the complexity of the data, developing data management strategies to securely organize and disseminate information is also technically challenging. Distilling the underlying information into usable products for various user groups requires a cohesive, end-to-end approach in addition to a fundamental understanding of the needs and requirements of the user groups and stakeholders.

Data management activities for oceanographic information occur in isolated, physically distributed agencies, leading to low cross-agency utilization of data. Technical barriers, complex data formats, a lack of standardization and missing metadata have limited access to data and made the utilization of available scientific information cumbersome and daunting. As a consequence, existing data is underutilized and often has not undergone quality assurance.

B. Summary of Project to Date (if applicable)

During the first few months of the EVOS PWS Herring Program Data Management project investigators have been focused on establishing protocols for data transfer, metadata requirements and initiating the data salvage effort. Investigators have been meeting and planning with Matt Jones to coordinate future activities. PIs have participated in several PI meetings and are coordinating activities between the Herring and LTM programs. In addition, the AOOS ocean workspace has been rolled out to PIs and their user and group profiles have been created. Several training seminars have been held via webinars and PIs are beginning to use the system to organize and consolidate their project level data. Software

engineers at Axiom have also been working to support workspace, resolving bugs and implementing new functionality in response to user feedback. The PWS Herring Portal has been updated with available herring data from ADF&G and expanded with additional regional datasets of relevance to the PWS Herring Program.

II. PROJECT DESIGN

A. Objectives

- 1) Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.
- 2) Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.
- 3) Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

The specific objectives of this proposed effort will directly support the overall objectives of the combined PWS Herring Research and Monitoring proposal which are listed below.

- 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.

Providing a framework for efficiently managing data produced or consolidated by this effort will enable the information to be used to improve the ASA model, inform and facilitate the planned synthesis efforts, address assumptions in the current measurements and develop new approaches to monitoring. Data management activities are critical for the overall success of the IHRP program in addition to the integration of data sets and information transfer between study groups and research team leads.

B. Procedural and Scientific Methods

Objective 1. Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.

AOOS data management staff will work with EVOS IHRP investigators to assess the types of data which will be collected during sampling efforts, assess Standard Operating Procedures (SOPs) for data collection to create metadata templates in addition to gauging general data management needs of PIs. This assessment is critical to identify the data management needs and the types of tools needed by researchers to increase their abilities to manage their data in an automated, standard fashion.

The AOOS data management group is currently developing a web base platform for PIs to manage project level data sets and author metadata. System development is currently supported through internal AOOS funds in addition to dedicated funding from the Prince William Sound Science Center. The AOOS Ocean Workspace will provide a web based platform for PIs to post and share data sets and rapidly author metadata. The system will be enabled with security authentication in order to limit access to IHRP investigators, project managers and administrators. The system will also provide PIs with tools to generate metadata profiles which comply with national standards. Initially, this system will focus on authoring FGDC metadata formats including tools for authoring the biological extension for taxonomic classifications and measurements. The software development phase of this application was initiated in March 2011. An initial beta release/testing of this system will commence in August 2011 with a planned release date of October 1st, 2011. This platform will provide IHRP investigators and project managers with a transparent view of data collection and metadata authoring progress in addition to providing a framework for data integration. It is envisioned that this platform will function as the primary vehicle to facilitate data transfer, metadata generation and archiving for the entire IHRP project data management lifecycle. This proposed effort will provide a user base and focused environment for the expansion and refinement of this project level data management tool.

Objective 2. Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.

This task will involve isolating and standardizing historic data sets deemed necessary for retrospective analysis by EVOS IHRP synthesis efforts. Early in the effort the EVOS IHRP researcher team will be engaged to prioritize sources of relevant data deemed of high value for the synthesis effort. Data will be prioritized by several metrics including length of time series, scientific importance, and quality and precision of the data storage format. All data acquired through efforts of this project will be merged into the AOOS data system for long term archival and access. Many herring related data sets not easily accessible to restoration researchers and managers have been standardized and made available through the actions of the PWS Herring Portal (EVOS Project 070822, 080822 and 090822). This proposed project would expand the geographic and programmatic scope of this work to include datasets in Lower Cook Inlet and potentially Kodiak regions.

Building upon results of the PWS Herring Portal Project, investigators will expand their efforts to additional project level data sets, long term time series produced from sensor platforms, remote sensing/satellite imagery data products, oceanographic/atmospheric/ecological model outputs and relevant GIS data layers. The AOOS data system currently has the capacity to manage all of these data types except for project level data. AOOS will be deploying a project level data management system in the fall of 2011 to address this need. This is the same system referenced in methods of objective 1. Data

analysts preparing and salvaging historic project level datasets will leverage this system to consolidate, centralize and document data resources so that IHRP investigators can access these data as they are discovered, processed and made available for use.

Additionally, data management staff will leverage existing data management efforts and data sets currently under the stewardship of AOOS in this activity. These resources and efforts are detailed more fully in the “Coordination and Collaboration with Other Efforts” section of this proposal. These existing data resources include a wide array of physical and biological data sets in the general spill affected areas. These resources can be reviewed at <http://data.aos.org>.

Potential Data Sources for this Effort

Lower Cook Inlet

The Alaska Department of Fish and Game in Homer (ADF&G-Homer) has flown aerial surveys to assess Pacific herring abundance trends in Lower Cook Inlet (LCI) since 1978 (Otis et al. 1998). An uninterrupted time series (1978-2008) of aerial survey data is available for the Kamishak and Southern (i.e., Kachemak Bay) districts and discontinuous data sets are available for the Outer and Eastern districts. The Outer/Eastern districts are oceanographically downstream of PWS. Embayments along the outer coast of the Kenai Peninsula may function as juvenile rearing areas for herring larvae advected from PWS via Montague Strait. Lower Cook Inlet’s most comprehensive herring data set is for Kamishak Bay, where commercial sac-roe herring harvests occurred from 1974-1979, and from 1985-1998. The fishery is currently closed while the stock rebuilds, but ADF&G continues to fly aerial surveys and conduct vessel surveys to assess herring abundance and ASL composition of the spawning biomass. Through a previous NOAA grant funded project (Otis and Spahn 2003), the great majority of the Kamishak herring data set has already been digitized into a spatial database (ADF&G 2002), which can be readily ingested into the data management system for this project. However, herring survey and ASL data for the Southern, Outer, and Eastern districts of LCI remain spatially disabled and would require staff time to digitize and spatially reference them. Table 1 documents the type and current status of available herring data from LCI.

Kodiak

The Alaska Department of Fish and Game in Kodiak (ADF&G-Kodiak) has been monitoring herring population and fishery parameters since the 1930’s. Herring distribution and abundance trends have been assessed using a combination of aerial and acoustic surveys periodically since the mid-1980’s. Spawn observations have been documented consistently since the 1970’s and herring age, sex, length (ASL) data have been collected annually since 1967. Fishery performance and harvest data have been maintained since the 1970’s and early fishery observations exist back to the 1930’s. Marine mammal sightings and herring disease data are also available for recent years. Most of these valuable, historical data sets exist only in hard copy format and need to be digitized and spatially enabled to realize their full worth. Table 2 documents the type and current status of available herring related data from the Kodiak region.

PWS-ADF&G

The Alaska Department of Fish and Game in Cordova (ADF&G-Cordova) has flown aerial surveys in Prince William Sound since 1973. Population trends were initially monitored with aerial surveys to estimate biomass and the linear extent of beach used for spawning (Brady 1987), and have continued almost without interruption. Age, sex, and size data has been collected from most fisheries and spawning aggregations since 1973 (e.g., Baker et al. 1991; Biggs et al. 1992). Dive surveys to estimate spawning biomass began with feasibility studies in 1983 and 1984 and continued in 1988-1992 and

1994-1997 (e.g., Willette et al. 1999). In 1993, ADF&G in cooperation with the Prince William Sound Science Center began fall acoustics surveys. Spring (March/April) acoustics surveys have been conducted during 1995-2009. Age structured models have been used since 1993 to estimate historical population parameters and project future biomass, recruitment, and abundance (Funk 1994). Disease assessments (1993-2002) indicate viral hemorrhagic septicemia virus (VHSV) and associated ulcers were related to population declines in 1993/1994 and 1998; and *Ichthyophonus hoferi* was related to a population decline in 2001 (Marty et al. 2004). Additional disease sampling to index the prevalence of VHSV and *I. hoferi* (2003-2006) and measure the prevalence (2006-2009) have been funded by the Department of Fish and Game and the EVOS Trustee Council. Previous funding by the EVOS Trustee Council has allowed the digitizing and publishing of the majority of the aerial survey linear extent of spawn and biomass data; and age, sex, and size in addition to the commercial harvest data. (<http://dev.axiomalaska.com/pwsherringportal/>) and digitizing most of the commercial harvest and spawn deposition survey data. Table 3 documents the type and current status of available herring related data from the PWS region.

PWS-PWSSC

The Prince William Sound Science Center (PWSSC) has been collecting biological and physical measurements in Prince William Sound which are critical to understanding herring population dynamics back to the early 1990s. The data includes herring acoustic data (e.g., Thomas and Thorne 2003), herring nursery bay and larger PWS oceanographic conditions, zooplankton abundance, herring energetic, and seabird predation datasets for juvenile and adult herring. The data at PWSSC must be standardized, documented and up scaled into a geospatial database. Table 4 documents the type and current status of available herring related data from the PWS region stewarded by the Prince William Sound Science Center.

Objective 3. Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

The ultimate goal of this project is to provide services to assist in the organization, documentation and structuring of data collected and made available via EVOS IHRP project activities so that it can be transferred efficiently to long term data archive and storage centers and made available for future use by researchers and other user groups. This task will leverage the AOOS cyber infrastructure, long term funding and other active data management projects being undertaken by that organization. Data sets produced from the integrated research effort will be served to users by extending existing data access, analysis and visualization interfaces currently supported and under development by the AOOS data management team.

Figure 1 below provides screen captures of existing AOOS data portals which provide access to data management systems that manage sensors, models/remote sensing and GIS data layers. These portals can be accessed off the AOOS website at <http://data.aos.org/>.

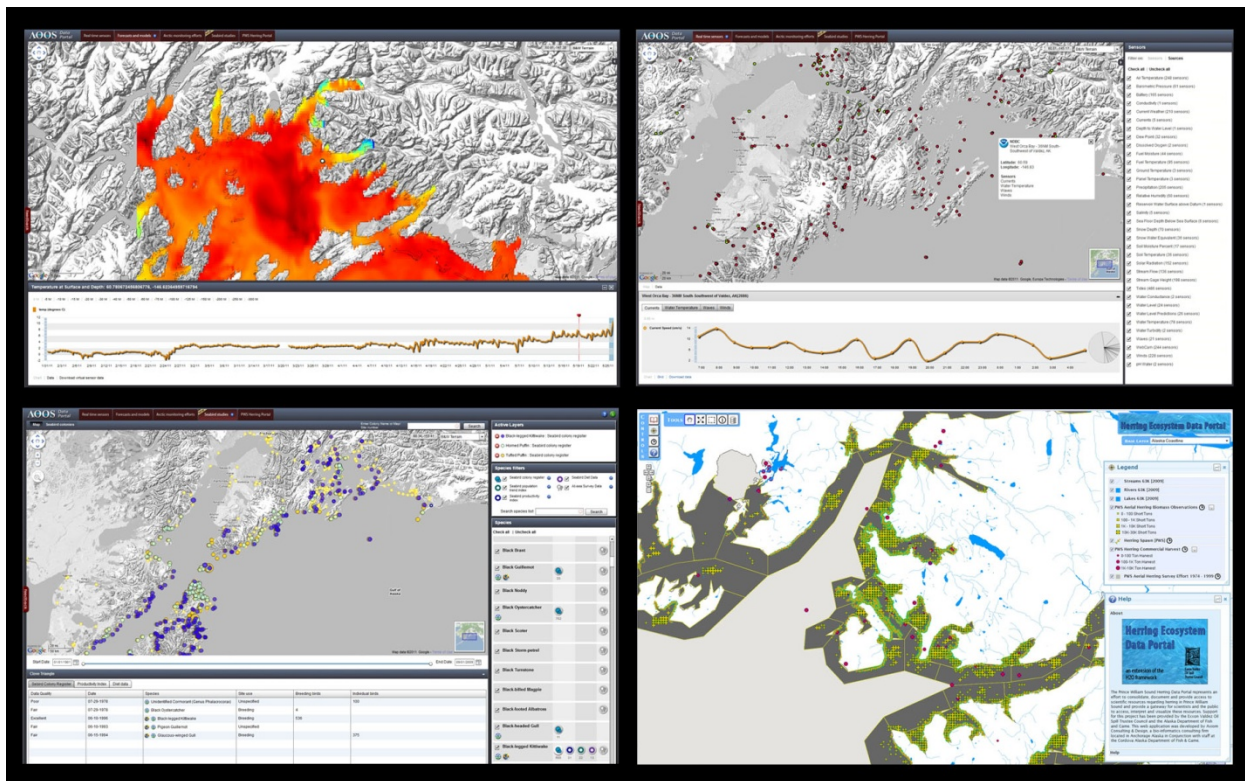


Figure 1. Screenshots of existing AOOS data management and visualization systems which are available at <http://data.aaos.org>. At the top left is a screenshot of the AOOS model explorer displaying a ROMS circulation model of Prince William Sound and an ocean temperature point source time series extraction near Port Fidalgo. On the top right of the figure is a screen capture of the AOOS real time sensor portal. On the bottom of the figure from the left to right are screenshots of the North Pacific Seabird Portal and the PWS Herring Portal.

C. Data Analysis and Statistical Methods

The overarching strategic plan for the AOOS data system involves implementing an end-to-end technological solution which allows data and information to be channeled and distilled into user-friendly products while simultaneously enabling the underlying data to be assimilated and used by the emerging external data assembly systems. The following diagram (Figure 2) details the four logical technical tiers of the approach. At the base (Tier 1) of the pyramid lie the source data produced by researchers, instruments, models, and remote sensing platforms which are stored as files or loaded within geospatial databases. Interoperability systems (Tier 2), such as Web Map Services (WMS) and Web Coverage Services (WCS), are then implemented and connected to these underlying data sources. The asset catalogue (Tier 3) connects to internal interoperability systems in addition to known external sources of interoperable data and populates a database describing the dimensional characteristics (space, time, measured parameter, and taxonomy) of each data resource. Also in this third tier are web services which provide access to the descriptive information contained in the asset catalogue database so that applications can more easily utilize data from multiple sources, formats, and types. The final technical level (Tier 4) is composed of the web based applications and tools which provide users access to data and products. Users sit at the top of the pyramid with all underlying systems working together to create a powerful and intuitive user experience. The intended result is the facilitation of rapid data discovery,

improved data access, understanding, and the development of knowledge about the physical and biological marine environment.

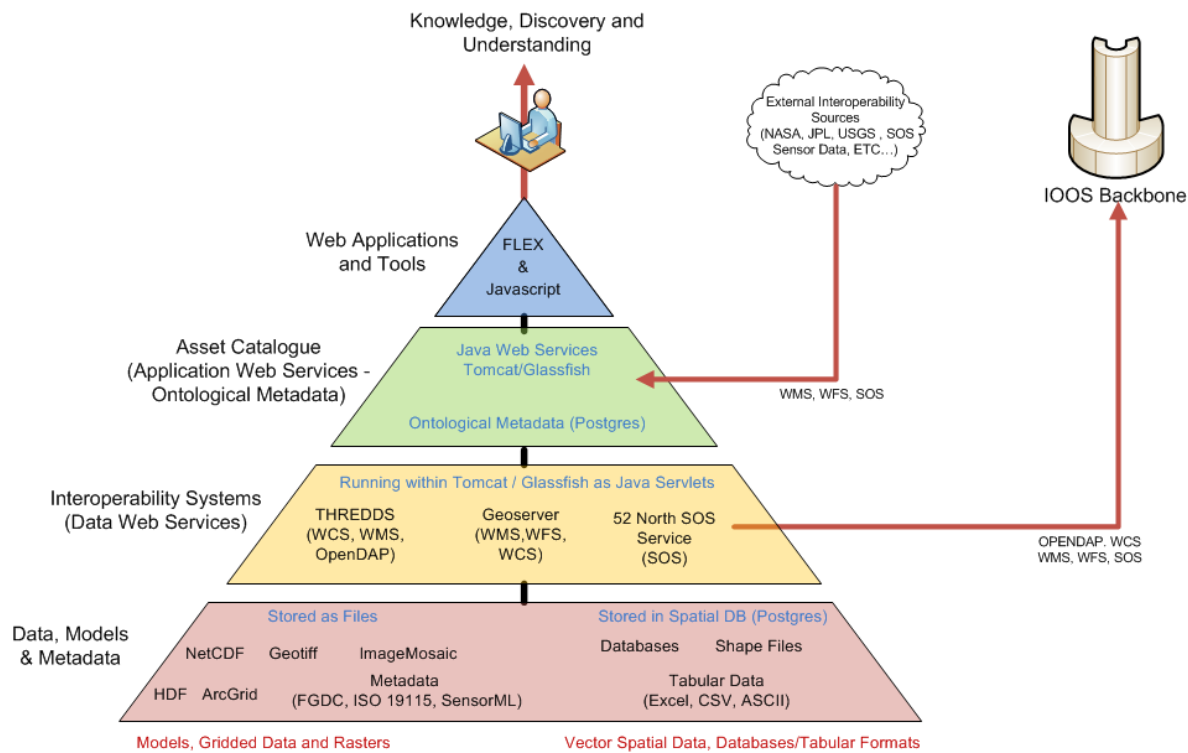


Figure 2. Data knowledge pyramid detailing the flow of data through logical technology tiers so that it can be consumed by users to enable discovery and understanding about the ocean environment.

Tiers are discussed in technical detail below.

- Tier 1 (Data, Models and Metadata)** – At the base of the proposed data management framework are the datasets, metadata, and model outputs that provide the foundation for applications and user tools. These resources can be stored either in native formats or spatially enabled databases. The decision to choose one method over the other is dictated by the requirements of the interoperability system which will be serving the data. Data which has a tabular or vector form (Shapefiles, databases, Excel spreadsheets, comma separated values (CSV) text files, etc.) will be loaded into a PostgreSQL database and spatially indexed. GeoServer, an open source geospatial data server, will then connect to the PostgreSQL database and serve the data via WFS and WMS protocols. Imagery, raster, and model data will be stored in a file server in their native file formats. THREDDs and/or ncWMS will be used to serve NetCDF and HDF files which may contain two, three, four or higher dimensional gridded datasets. GeoServer or other OGC compliant mapping servers will be utilized to serve GeoTIFF, ArcGrid, ImageMosaic and other two dimensional imagery/raster data.
- Tier 2 (Interoperability Systems)** – Various interoperability servers (GeoServer, THREDDs, ncWMS, 52 North SOS, etc.) will be implemented on top of source data. By design, these servers will expose a powerful set of interfaces for other computing systems and humans to extract, query, and visualize the underlying source data. These systems will facilitate all aspects of data delivery to users in addition to providing the muscle for the machine-to-machine data transfer to national data assembly systems as required. Because these systems have been developed using the Java programming language, they will run within a servlet container such as Tomcat or Glassfish.

- **Tier 3 (Asset Catalogue, Ontological Metadata and Services)** – The asset catalogue provides a description of known internal and external available data resources, access protocols for these resources (interoperability services, raw file download, etc.), and directives on how to ultimately utilize these data resources in applications. Because documentation and access methods vary widely between data sources, a system which catalogs data sources and reconciles these inconsistencies must be implemented if the data are to be used in an efficient manner.

In addition to managing information about data availability and access methods, the asset catalogue will also contain an ontology that maps source data descriptions and metadata to a common set of internally stored terms with strict definitions. This mapping will allow users to easily locate related sets of information without having explicit knowledge of the internal naming conventions of each data-providing agency. The development of an internal ontology will also enable future endeavors to connect the asset catalogue to global ontologies in the semantic web. The following dimensions are to be stored in the database for mapping the heterogeneous characteristics of source data to common metrics:

- **Source** – Service URLs and methods of interaction for these services.
- **Data formats and return types** – Data format returned by the service and how data can be equated between various formats.
- **Space (x, y, z)** – Spatial dimensions of dataset (1D, 2D, 3D). Upper and lower spatial bounds (bounding box or cube) stored in common projection (EPSG 4326).
- **Time (t)** – For data resources with a time component: document time span, whether time corresponds to a single moment or if it is representative of a time period. If data is in discrete periods, document individual available periods.
- **Taxonomy** – Taxonomic data mapped to International Taxonomic Information System (ITIS) codes.
- **Parameter** – Parameter(s) and units in the data resource and how they map to internally defined universal terms. For example: Datasets SST, AVHRR, and Sea_Surface all contain parameters that map to internal universal term Sea Surface Temperature.

Web services written in the Java programming language will be developed to connect to the asset catalogue and provide applications with access to the underlying descriptions of all known data sources. Because the asset catalogue contains a structured ontological definition of data sources and maps all known data sources to a common definition, applications can be developed which connect users to vast arrays of data through simple but powerful interfaces. The following is a list of example functionality that is possible utilizing this methodology:

- Users can load multiple data layers (potentially existing in different physical locations and being served by different systems) onto a single web based map. Users can also filter all layers simultaneously by time or request spatial and temporal subsamples of data that can be pulled from multiple sources and automatically packaged into a single download.
 - All real time sensor feeds can be accessed and visualized on a single uniform user interface by parameter even though the sources of the sensor feeds may exist in a wide array of formats and service protocols.
 - Users can query the asset catalogue to discover which data is available for an area, time period, parameter, and species.
- **Tier 4 (User Applications)** – Users interface with web based applications that bring together combinations of underlying data and allow users to make discoveries, improve understanding, and develop knowledge through visualization and data access. These types of applications would most likely

be interactive map based data portals. Applications will also be developed which provide specific targeted functionality. These focused applications could include marine spatial planning tools, emergency response applications, and educational/outreach portals. Developed tools are designed to meet user needs and thus require user input into their initial design and periodic feedback to direct functional improvements for future design iterations.

D. Description of Study Area

The majority of this project will involve consolidating existing data, metadata, and other electronic resources related to herring in Spill Affected Area. Specific areas of focus include those areas in PWS, Lower Cook Inlet, and Kodiak where herring fisheries currently do, or historically did occur. The north, east, south, and west bounding coordinates of this area are 59.767, -145.837, 61.834, and -154.334

E. Coordination and Collaboration with Other Efforts

This proposal is part of the integrated “PWS Herring Research and Monitoring” proposal submitted by the Prince William Sound Science Center to the Exxon Valdez Oil Spill Trustee Council. It includes the collaboration and coordination described there for work within the herring research group and with the Long-Term Monitoring proposal submitted by the Alaska Ocean Observing System. This project is also highly coupled with the proposed data management component of the EVOS Long Term Monitoring program.

AOOS brings a significant level of leveraged resources, infrastructure, regional data management projects and partnerships to this proposed effort. The data management effort for the LTM and herring projects could not be accomplished for the budgeted amount by a team without these leveraged resources.

1. AOOS – (500k to AOOS DM) Alaska oceanographic data management effort. Supports open source, standards based data system that serves up and archives real-time sensor feeds, models & remote sensing applications, GIS data layers, and historical datasets. Data system developed on interoperability concepts and meets NOAA Integrated Ocean Observing System standards and protocols for streaming data feeds to national data assimilation sensors. Data Management Committee chaired by Dr. Phil Mundy provides ongoing advice, prioritization and direction to the team at Axiom Consulting & Design. AOOS board is made up of federal and state agencies, and major marine research institutions in the state that have committed to data sharing. The AOOS board has committed to supporting a statewide data system for as long as AOOS exists. Federal funding is stable, although we would like to see it increase. In the event AOOS was to end, all data and data products would be transferred to the University of Alaska.
2. PWSSC – PWSSC Data Management Project (\$50K to AOOS DM).– Project involves the creation of a prototype data management system for use by PWSSC staff to manage, track, document via metadata and visualize oceanographic and biological data being collected at the center. Project will utilize a stack of open source technologies and protocols with the overall goal of creating a packaged solution for research organizations to better manage and document their data resources. This project is to function as the pilot application for the AOOS project level data management system.

3. Northern Forum/USFWS Seabird Data System – (\$50K)Project involves the creation and population of a series of new seabird metric databases (diet and productivity) and integrating these new databases with legacy seabird databases (species distribution and abundance at seabird colonies, pelagic species distribution and abundance, USGS seabird monitoring databases and NPRB’s North Pacific Seabird Diet Database). Modern spatially explicit, web based data entry interfaces have and continue to be developed to assist researchers existing in distributed agencies to contribute their historic and current seabird metric data into standard data structures. Project will result in vastly increasing the amount and quality of seabird species distribution, diet and other seabird data available for use in retrospective analysis and management. Though data includes areas around all of Alaska, most available data is located in GOA and PWS.
4. AOOS – 3-year funded partnership (~\$200K to ADF&G) with ADF&G Division of Commercial Fisheries to develop data sharing and transfer to make commercial fisheries data more accessible, and to allow ADF&G researchers greater access to oceanographic data. Project builds upon an effort funded by the Moore foundation to develop improved data management capacity and salmon fishery management tools for the PWS fisheries.
5. AOOS – collaborator with Alaska Data Integration Working Group – an initiative with the Alaska Climate Change Executive Roundtable – to develop protocols for serving up project data to increase data sharing among federal and state agencies.
6. AOOS and NOAA – initiatives to develop data sharing agreements with private sector, including oil & gas companies.
7. Cook Inlet Regional Citizens Advisory Council (27K) – contract with Axiom to develop a data management system for their oceanographic and contaminants data in Cook Inlet.

III. CV’s/RESUMES

CV — Robert Bochenek

Position and Address

Information Architect

Axiom Consulting and Design, 523 W. 8th Ave, Anchorage, AK 99501, USA

Professional Preparation

University of Michigan, Aerospace Engineering, B.S.E., 2001

Appointments

2010 – Present	Technical Lead, Alaska Ocean Observing System, Anchorage, AK
2006 – Present	Information Architect, Axiom Consulting and Design, Anchorage, AK
2003 – 2006	Data Systems Manager, Exxon Valdez Oil Spill Trustee Council (EVOSTC), Anchorage AK, 99504
2001 – 2002	Analyst Programmer, Alaska Department of Fish & Game, Anchorage, AK

Publications

None

Synergistic Activities

- 2012 – Present Funded under the NOAA High Performance Computing program for exploratory research in applying HPC concepts to serving and visualizing gridded multidimensional models and observational data sets
- 2011 – Present Member of the IOOS Sensor Observation Service standardization Committee
- 2010 – Present Member of the Alaska Data integration Working Group (ADIWG) focused on developing frameworks for interchange of scientific information across Alaskan Agencies.
- 2009 - Present Development of the Prince William Sound Data Portal, A tool for scientists, educators and the public to visualize four dimensional fisheries data

Collaborators and Co-Editors

- Broderson, Dayne Geographic Information Network of Alaska (GINA), Fairbanks, AK
- Howard, Katherine Alaska Department of Fish and Game, Anchorage, AK
- Jones, Matt National Center for Ecological Analysis and Synthesis, Santa Barbara, CA
- Krueger, Charles Great lakes Fishery Council, Ann Arbor, MI
- Moffit, Steve Alaska Department of Fish and Game, Anchorage, AK
- Moss, Jamal Alaska Fisheries Science Center, Juneau, AK
- Mueter, Franz University of Alaska, Juneau, AK
- Mundy, Phillip Alaska Fisheries Science Center, Juneau, AK
- Pegau, Scott Oil Spill Recovery Institute, Cordova, AK
- Saupe, Susan Cook Inlet Citizen's Advisory Council, Anchorage, AK
- Smith, Stan United states geological Survey, Anchorage, AK
- Snowden, Derrick Integrated Ocean Observing System, Silver Springs, MD
- Svoboda, Michael Environment Canada, Whitehorse, Canada
- Wiese, Francis North pacific Research Board, Anchorage, AK

CV — Shane R. StClair

Position and Address

Senior Software Engineer
Axiom Consulting and Design, 523 W. 8th Ave, Anchorage, AK 99501, USA

Professional Preparation

University of Alaska Anchorage, Biological Sciences, B.S., 2002

Appointments

- 2008 – Present Senior Software Engineer, Axiom Consulting and Design, Anchorage, AK
- 2006 – 2008 Analyst Programmer, Exxon Valdez Oil Spill Trustee Council, Anchorage, AK
- 2002 – 2006 Research Analyst, Alaska Department of Fish & Game, Anchorage, AK

Publications

- Brannian, L. K., K. R. Kamletz, H. A. Krenz, S. StClair, and C. Lawn. 2006. Development of the Arctic-Yukon-Kuskokwim salmon database management system through June 30, 2006. Alaska Department of Fish and Game, Special Publication No. 06-21, Anchorage.
- Hamner, H. H., S. St Clair, and H. Moore. 2004. An inventory of age, sex and length data for Norton Sound, Kotzebue, and Kuskokwim chum salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A04-06, Anchorage.
- Estensen J. L., S. St Clair. 2003. Pacific herring stocks and fisheries in the Arctic-Yukon-Kuskokwim region of the Bering Sea, Alaska, 2003 and outlook for 2004. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-37, Anchorage.
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- Hamner, H. H., S. Karpovich, S. St. Clair. 2003. Norton Sound salmon information database file inventory and problem review. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-01, Anchorage.

Synergistic Activities

- 2011 - Present Member of the IOOS Sensor Observation Service standardization committee
- 2011 - Present Developer of IOOS customizations of 52North SOS software and significant contributor to main codebase
- 2011 - Present Maintainer of GeoServer (open source geospatial data server) Excel WFS output plugin
- 2010 - Present Maintainer of Redmine/ChiliProject (open source project management software) Recaptcha anti-spam plugin
- 2009 - Present Contributor to several widely used open source projects including jTDS, OpenScales, Maven Shade, GeoTools
- 2009 - 2012 Developed spatially enabled online data management application for Alaska Dept. of Fish & Game aerial surveys and transferred software to client systems and programmers
- 2008 - Present Developer for global seabird abundance, population health, and diet database in conjunction with USFWS, World Seabird Union, Pacific Seabird Group, and others

Collaborators

- Aime, Andrea GeoSolutions, Reggio, Italy
- Bridger, Eric Gulf of Maine Research Institute, Portland, ME
- Chaouchi, Mohamed Center for Operational Oceanographic Products and Services, Silver Spring, MD
- Deoliveira, Justin OpenGeo, New York, NY
- Dickinson, Ian Epimorphics, Bristol, UK
- Garcia, Mike National Data Buoy Center, John C. Stennis Space Center, MS
- Hollmann, Carsten 52North Initiative for Geospatial Open Source Software, Muenster, Germany

Irons, David	U.S. Fish and Wildlife Service, Anchorage, AK
Jones, Kathleen	Alaska Department of Fish and Game, Juneau, AK
Kaler, Robb	U.S. Fish and Wildlife Service, Anchorage, AK
Kellon, Cathy	Ecotrust, Portland, OR
Kimball, Heath	Alaska Department of Fish and Game, Anchorage, AK
Mayorga, Emilio	Northwest Association of Networked Ocean Observing Systems, Seattle, WA
Moffit, Steve	Alaska Department of Fish and Game, Cordova, AK
Snowden, Derrick	Integrated Ocean Observing System, Silver Springs, MD
Walton, Kelly	Alaska Natural Heritage Program, Anchorage, AK
Welch, Tim	Ecotrust, Portland, OR
Wilcox, Kyle	Applied Science Associates, South Kingstown, RI

IV. SCHEDULE

A. Project Milestones

Objective 1. Provide data management oversight and services for EVOS IHRP project team data centric activities which include data structure optimization, metadata generation, and transfer of data between project teams.

This objective will be addressed throughout the entire span of the project and will follow the annual cycle of field data collection and analysis by principal investigators. Investigators will be engaged before each field season to ensure that preparations have been made to stage data collected by the project so that other members of the IHRP project can access the data produced by project participants.

Objective 2. Consolidate, standardize and provide access to study area data sets that are critical for retrospective analysis, synthesis and model development.

This objective will be met by the fourth quarter of year two of the effort (January 2014).

Objective 3. Integrate all data, metadata and information products produced from this effort into the AOOS data management system for long term storage and public use.

This objective will be addressed throughout the entire span of the project. The AOOS data system is to serve as the vessel to capture all project level data produced through this effort in addition to those datasets salvaged to inform the historic synthesis effort. This task will be ongoing as long as the program is producing or acquiring additional data.

B. Measurable Project Tasks

Y3 1st Quarter (February 1, 14 to April 30, 14)

Winter	EVOS workshop with Herring and Long-term monitoring programs
February	Submit annual report
February	Submit annual financial report

Y3 2nd Quarter (May 1, 14 to July 31, 14)

May	Participate in annual PI meeting
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Y3 3rd Quarter (August 1, 14 to October 31, 14)

August Submit semi-annual report and year 4 work plan

September Oversee transfer of field year 3 data

October Assess year 3 datasets and metadata submitted through Ocean Workspace

Y3 4th Quarter (November 1, 14 to January 31, 15)

January Annual Marine Science Symposium

V. BUDGET

Budget Form (Attached)

Please complete the budget form for each proposed year of the project.