1. Program Number: *See,* Reporting Policy at III (D) (1).

18120113

2. Program Title: *See,* Reporting Policy at III (D) (2).

Data Management Program

3. Program Lead Name(s): *See,* Reporting Policy at III (D) (3).

Dr. Carol Janzen

4. Time Period Covered by the Summary: *See,* Reporting Policy at III (D) (4).

February 1, 2018- January 31, 2019

5. Date of Summary: *See,* Reporting Policy at III (D) (5).

March 2019

6. Program Website (if applicable): *See,* Reporting Policy at III (D) (6).

AOOS Gulf of Alaska Data Portal: http://portal.aoos.org/gulf-of-alaska.php

7. Overview of Work Performed during the Reporting Period: *See,* Reporting Policy at III (D) (7).

The goal of this program is to provide critical data management support to Exxon Valdez Oil Spill Trustee Council's Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) program investigators in order to assist study teams in efficiently meeting their objectives and ensuring data collected or consolidated through the effort is organized, documented, and available for their use and for future use by the larger scientific community. To meet this goal, the data management program leveraged the extensive cyberinfrastructure and data management capacities of both the Alaska Ocean Observing System (AOOS) and it technical partner, Axiom Data Science, utilizing the existing, collaborative relationships with program PIs to ensure continuity in the data collected across efforts. The goals of the program are achieved with the following objectives:

Objective 1. Initiate data management services and oversight for GWA and HRM Program data-related activities.

Objective 2. Continue to standardize and provide access to datasets from the first five-year GWA and HRM efforts for continuity and integration.

Objective 3. Facilitate, monitor, and evaluate regular data submissions and metadata generation in the Research Workspace.

Objective 4. Provide, maintain, and modify technical infrastructure for user groups to access information produced or processed by the GWA and HRM Programs.

Objective 5. Publish and promote data collected by the GWA and HRM Programs, making it available for research, management, and general audiences.

Objective 6. Execute management, user feedback, and internal and external communications related to GWA and HRM data and data products.

Objective 7. Verify data and metadata completeness and final transfer at the term completion.

The FY18 Workplan focused on Objectives 1,3,4,5 and 6. Objective 2 is now complete. The Data Management program prioritized data preservation and accessibility to the scientific and resource management communities by supporting data submission and organization, metadata generation, and data transfer among study teams. The data curation process is designed to meet the requirements of the EVOSTC, including the transfer of GWA and HRM Program data to the EVOSTC storage resources at the completion of this funding term. To this end, Axiom

data analysts and domain experts reviewed metadata and data structure formats produced from GWA and HRM data collection activities and advised study team members in best practices for short-term and long-term data formats. Axiom software engineers enhanced existing web-based tools to improve the discoverability of GWA and HRM project-level data. One such improvement is now the ability to search and filter EVOSTC-funded datasets by space, time, parameter and taxonomy, both privately within the project and externally after the data have been shared with the public.

The following activities sorted by Objective were accomplished during the FY18 period.

OBJECTIVE 1. *Initiate data management services and oversight for EVOSTC GWA and HRM Program data-related activities.*

Using information generated from data management meetings with the GWA and HRM project PIs in FY17, an inventory of data expected to be generated by project sampling efforts was created. This inventory is maintained annually, and lists the expected datasets and metadata to be produced by each project. This inventory allows the Data Management team to track projects that might have delays and can help remediate any issues directly with the project PIs as they arise, and is being used to track data and metadata progress throughout the life of the project. This inventory is also reported to the Project Leads and included in annual reports and workplans. The data inventory and data submission status are further described in Objective 3.

Data management procedures from FY17 are still in use. These procedures continue to be available to all PIs through the Research Workspace.

OBJECTIVE 3. *Facilitate, monitor, and evaluate regular data submissions and metadata generation in the Workspace.*

Throughout the FY18 period, oversight of timely and organized data, metadata documentation, and other program documents to the Research Workspace occurred using a combination of data management personnel and technical infrastructure. Program-specific metadata templates for the PIs that include boilerplate information for fields that must contain program-wide metadata (e.g. access constraints, use constraints, and programmatic contact information) have proven successful at making metadata creation less cumbersome for PIs while providing time saving steps and standardizing the metadata across programs. Metadata templates are in the Research Workspace.

The data inventory (Objective 1) tracks data and metadata submissions to the Workspace against data that were expected to be generated through the GWA and HRM program terms. Following data submissions in FY18, Axiom audited the organization of the data by ensuring the types of data submitted were appropriate for long-term preservation and consistent conventions were used for naming files. Additionally, Axiom conducted quality control checks for accuracy and consistency of the metadata. These audits informed a list of issues in the data submissions and associated metadata, which required remedy before the dataset was considered final and ready for publication.

To facilitate timely data submission and corrections or updates to metadata, Axiom met with each individual PI at the November 2018 PI meeting to review and revise the specific data management plan for their project and the current data and metadata progress. Based on previous experiences, one-on-one meetings are an effective way to address individual metadata authoring questions, create accountability for data submissions, and strengthen relationships between PIs and Data Management staff. During these meetings, any organizational, data format, or metadata documentation issues were discussed between Axiom staff and PIs, with clear direction on what changes were necessary to ensure the data are publication-ready.

An updated inventory (March 31, 2019) of expected and submitted data to the Research Workspace and Gulf of Alaska Data Portal can be found in Table 3 (Section 9.c). Table 4 contains summary statistics of data submission as March 31, 2019 (Section 9.c). In most cases, projects are meeting or exceeding expectations for data sharing. Some projects are typically delayed annually due to late-in-year sampling schedules, longer sample processing times, and data processing delays, but are compliant and being updated when ready using the Research Workspace.

During FY18, the Data Management team worked with GWA and HRM program PIs to finalize and publish any remaining lagged datasets from the prior funding effort (2012-2016). These are datasets that typically have longer processing time, thus were delayed and not part of the initial 2012-2016 data archive. In FY17, all outstanding 2012-2016 datasets were finalized, added to the Research Workspace and made available through the Gulf of Alaska Data Portal. In early September 2018, these data were appended to the existing archived data packages in the DataONE Member Node for those respective projects, including the Environmental Drivers: Continuous Plankton Recorders, Environmental Drivers: Seward Line, Environmental Drivers: Oceanographic Monitoring in Cook Inlet and Kachemak Bay, and the Adult Herring Biomass Surveys projects. Additionally, minor metadata revisions were made to the DataONE archived resources for five additional datasets. The original update to the 2012-2016 data packages and metadata was scheduled to be completed by quarter 1 (Q1) of FY18. Due to delays caused by capacity issues at DataONE, the completion date for this task was pushed to August 2018 (Q3) and was the only FY18 workplan milestone delay in FY18. A list of the updated archived dataset citations can be found in Table 1 below.

Table 1. A list of the GWA and HRM archived datasets that were updated in the DataONE repository during the FY18 reporting period.

Angela Doroff, Kris Holderied, Katrina Hoffman, and Molly McCammon. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Zooplankton Data, 2012-2016, Gulf Watch Alaska Environmental Drivers Component. Research Workspace. 10.24431/rw1k21g, version: 262a47ff-bed8-452b-a87b-a9f733bed0f3.
Angela Doroff, Kris Holderied, Molly McCammon, and Katrina Hoffman. Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Water Quality, Meteorological, and Nutrient Data collected by the National Estuarine Research Reserve System's System-wide Monitoring Program (NERRS SWMP), 2012-2016, Gulf Watch Alaska Environmental Drivers Component. Research Workspace. 10.24431/rw1k21f, version: 17b18387-5a16-4d9a-a404-31ac040fdffd.
Mary Anne Bishop, John Eiler, and Scott Pegau. Tracking Seasonal Movements of Adult Pacific Herring in Prince William Sound, 2012-2016, EVOS Herring Program. Ocean Tracking Array Expansion 2016. urn:node:RW. 10.24431/rw1k21i, version: d8340265-89d1-43fc-bbec-7bc2cb414b16.
Kathy Kuletz, Katrina Hoffman, Molly McCammon, and Russell Hopcroft. Seward Line and Lower Cook Inlet Marine Bird Survey Data, 2006-2016, Gulf Watch Alaska Pelagic Component. Research Workspace. 10.24431/rw1k21l, version:0571fa8f-bfa1-4c4b-959b-e80c1e072fc6.
Robert Kaler, Kathy Kuletz, Kris Holderied, Molly McCammon, and Katrina Hoffman. Prince William Sound Marine Bird Surveys, July 2012 to 2016, Gulf Watch Alaska Pelagic Component. Research Workspace. 10.24431/rw1k21k, version:b1d9148c-4a45-41a8-856d-da8585a8907d.
Sharon Wildes, Hanhvan Nguyen, Jeff Guyon, Sharon Wildes - NOAA Federal, and Scott Pegau. Genetic Stock Structure of Herring in Prince William Sound, 2012-2015, EVOS Herring Program. urn:node:RW. 10.24431/rw1k21j, version: d44aeae1-8c12-428f-b1c0-26555e46eb81.

Mary Anne Bishop, Sean Powers, Scott Pegau, and Mandy Lindeberg. Fish Predation on Juvenile Herring in Prince William Sound, Alaska, 2009-2012, EVOS Prince William Sound Herring Program. Research Workspace. 10.24431/rw1k21h, version: 83746f58-885c-463a-abbf-d251bda37852.
Pete Rand, Michele Buckhorn, Richard Thorne, Gary Thomas, Mary Anne Bishop, et al. Intensive Acoustic Surveys of Juvenile Herring, Prince William Sound, 2013-2014, EVOS Herring Program. Research Workspace. 10.24431/rw1k21e, version: 675fec82-6fb4-47b3-a349-1ec77ebd29b2.
Pete Rand, Michele Buckhorn, Richard Thorne, Gary Thomas, Mary Anne Bishop, et al. Acoustic Juvenile Herring Abundance Data, Prince William Sound, 2012-2015, EVOS Herring Program. Research Workspace. 10.24431/rw1k21d, version: 55e99231-9d15-4b52-b41b-983f2dbea534
Sonia Batten, Kris Holderied, Molly McCammon, and Katrina Hoffman. Continuous Plankton Recorder and Temperature Data, Gulf of Alaska, 2011-2016, Gulf Watch Alaska Environmental Drivers Component. Research Workspace. 10.24431/rw1k21a, version: 1156722c-45bc-4c4e-a33a-6998c2ab84d5.

OBJECTIVE 4. *Provide, maintain, and modify technical infrastructure to ensure access to information produced or processed by the GWA and HRM Programs*.

Scheduled and as-necessary maintenance was made to the data management system infrastructure, including the Research Workspace and the Gulf of Alaska Data Portal, to ensure continuous operation and reliability for the GWA and HRM Program PIs.

The data management team made a significant overhaul to the Gulf of Alaska Data Portal, which is a regional subset of AOOS's statewide Ocean Data Explorer portal. The updated GOA portal gives users access to new features as well as a revamped design to get more out of the AOOS data services. For the redesign, the portal moved to a new framework that is more responsive and adaptable to long time series from stations, as well as being updated with more advanced discovery and sharing capabilities. The portal now offers sophisticated charting abilities, including comparisons between data sources, binning by time, and plotting of climatologies and anomalies. Ocean profiling sensors offer users the ability to interact with depth charts, interpolation by kriging, and 4D interactive charts. An example of the updated GAK1 mooring data display can be seen in Figure 1. A new feature, *Data Views*, allows users to save a collection of data layers and visualize them together for comparison and analysis. Data Views can be customized by individual users and shared among collaborators. This tool allows curated data trends or environmental events to be captured and easily shared among broader audiences, as well as instantly updated when refreshing the data view. An example data view of 'The Blob', a significant warm water event occurring in the Gulf of Alaska during 2013-15, can be interacted with at this link, or viewed in Figure 2 screenshot.

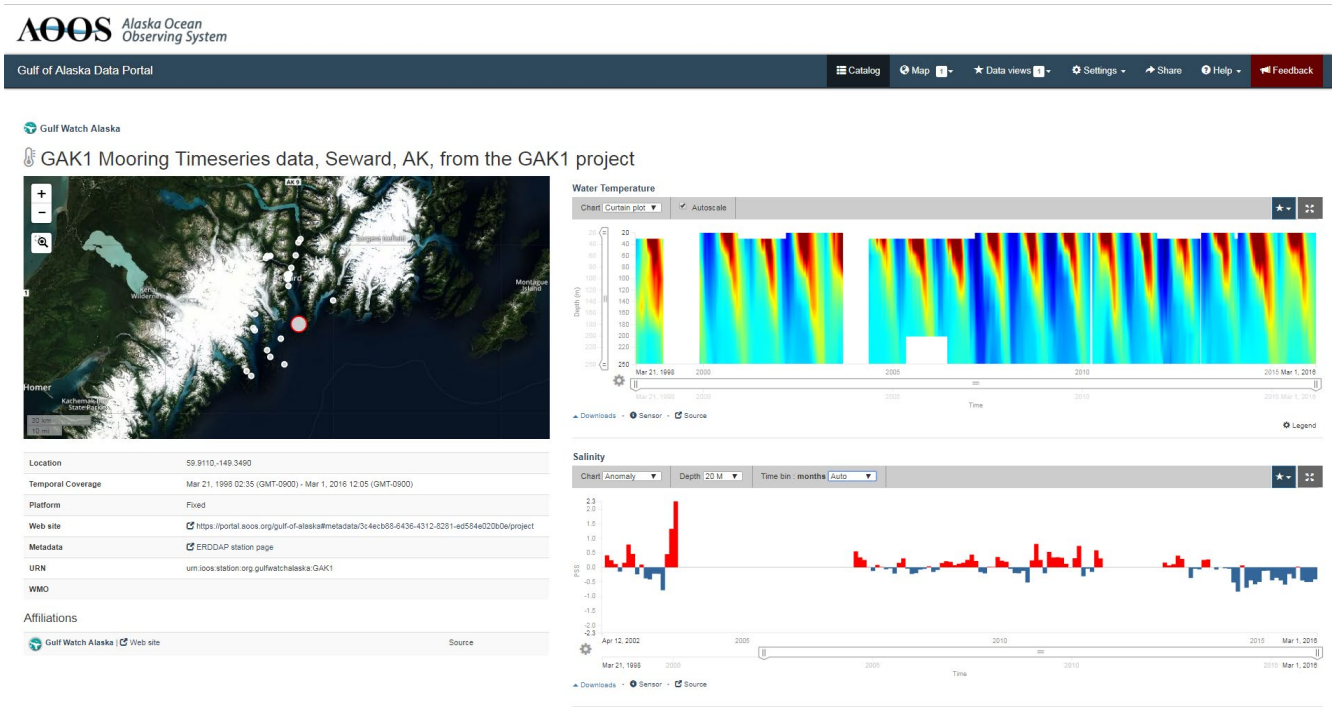


Figure 1. A screenshot of the GAK1 mooring time series data, along with interactive data charts available through the GOA Data Portal (interactive link).

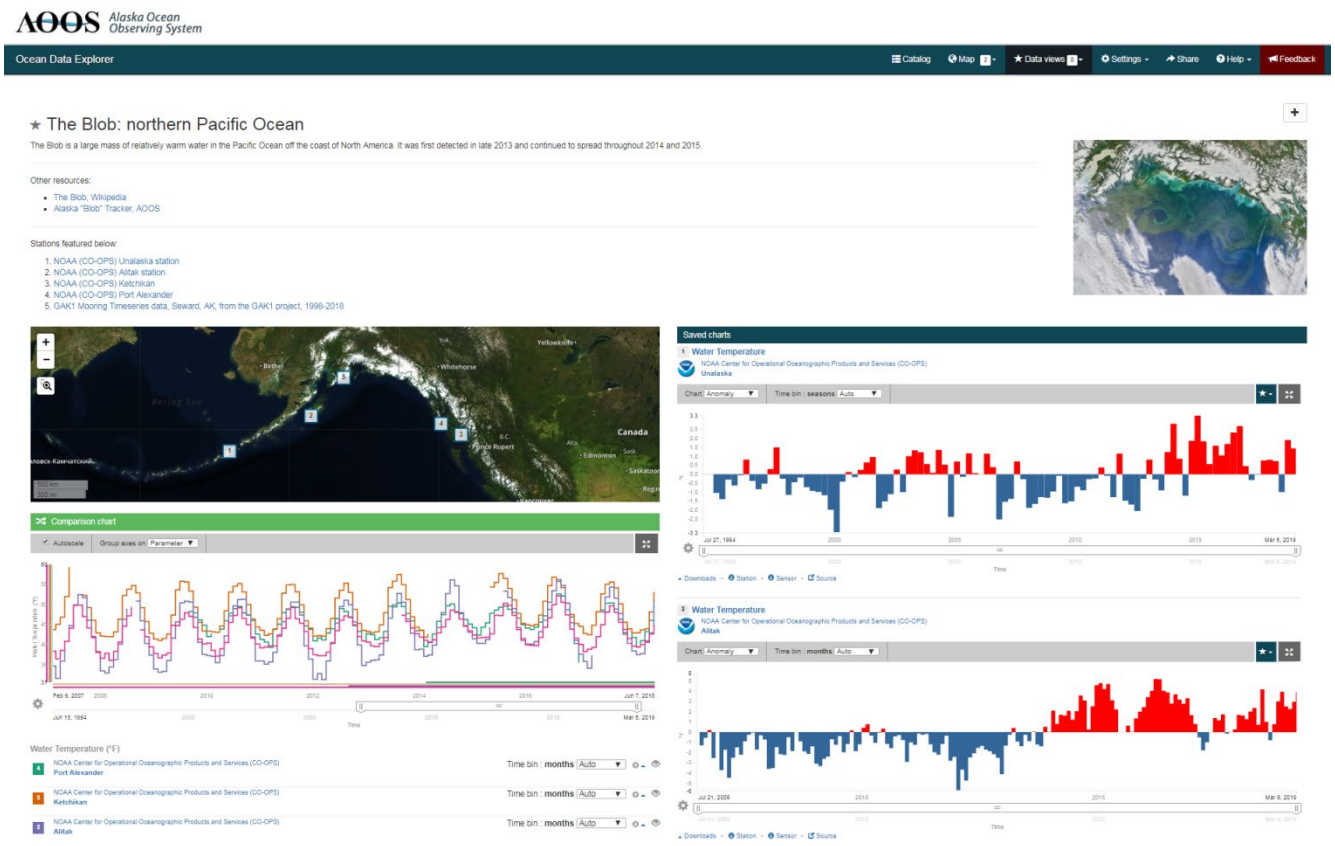


Figure 2. An example data view of 'The Blob', a significant warm water event occurring in the Gulf of Alaska during 2013-15, showing time series data from NOAA and GAK1 moorings (interactive link).

The Research Workspace serves as an internal file sharing and storage tool, where all data files (including the contextual information, raw data, data not currently public, etc.) are housed, and from which these data files can be made public. The Workspace contains individual PI user and group profiles in which data are submitted and shared among project collaborators. Software engineers at Axiom continue to provide support for the Research Workspace, which includes resolving bugs and implementing new functionality in response to user feedback. During this reporting period, the following core enhancements were made to the GWS and HRM Research Workspace campaigns:

- improved DataONE submission process & DOI generation (Figures 3 and 4)
- added initials as default for user profile pictures
- added ability for campaign administrators to assign colors to their campaigns
- added new campaign activity indicators to sidebar
- introduced performance improvements when first loading the page
- added "about" page to campaigns which summarizes activity and total data size
- added tutorial links to help documentation
- added page-specific walkthroughs to guide users through different pages
- upgraded and added additional Jupyter Notebook kernels
- improved Jupyter Notebook performance, including the ability to force-close a notebook
- improved ability to view CSV files without downloading
- added ability to edit Markdown files
- increased zip archive download time by 6x-20x
- added ability to download nested folder structures as zip files
- updated file list to remember user sort preferences

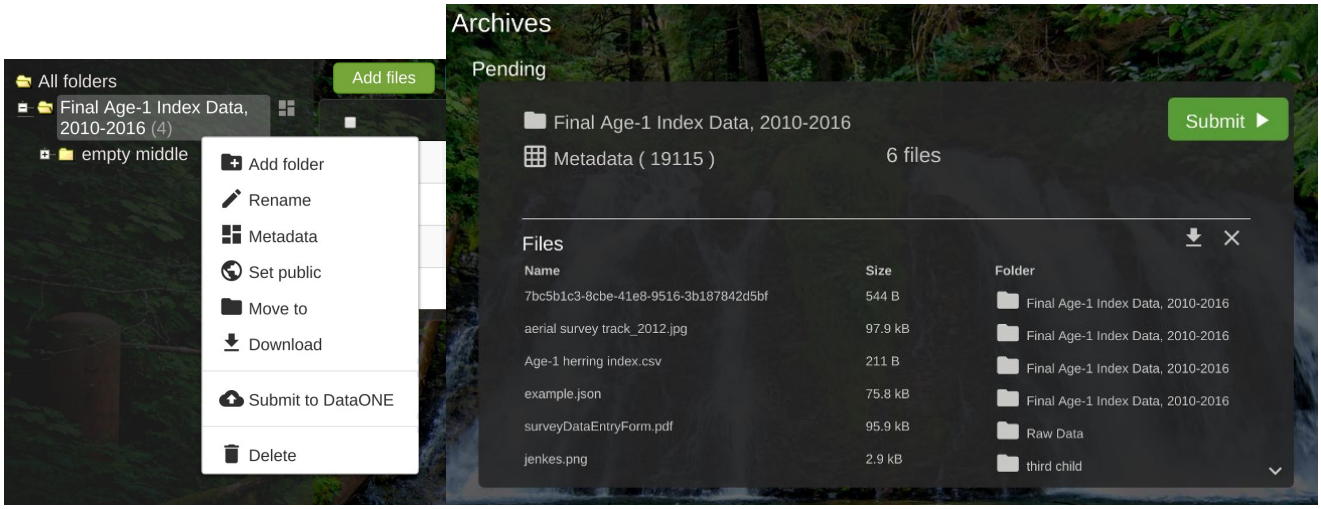


Figure 3. Screenshots of the review process for submitting archives to DataONE.

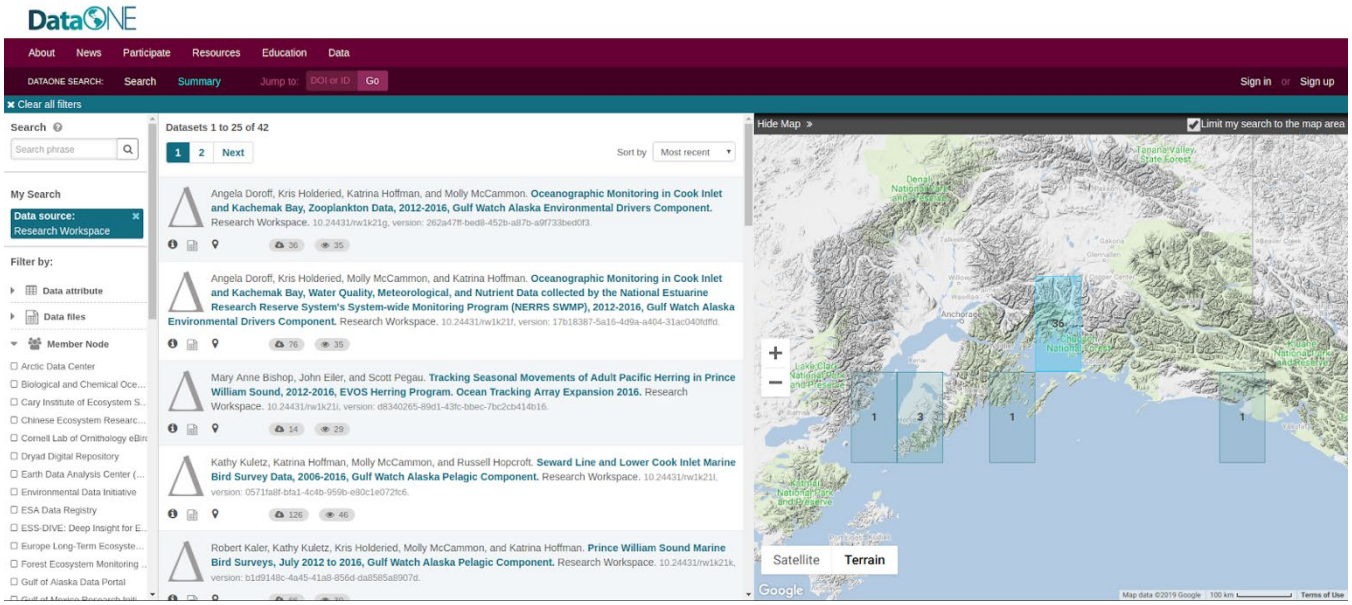
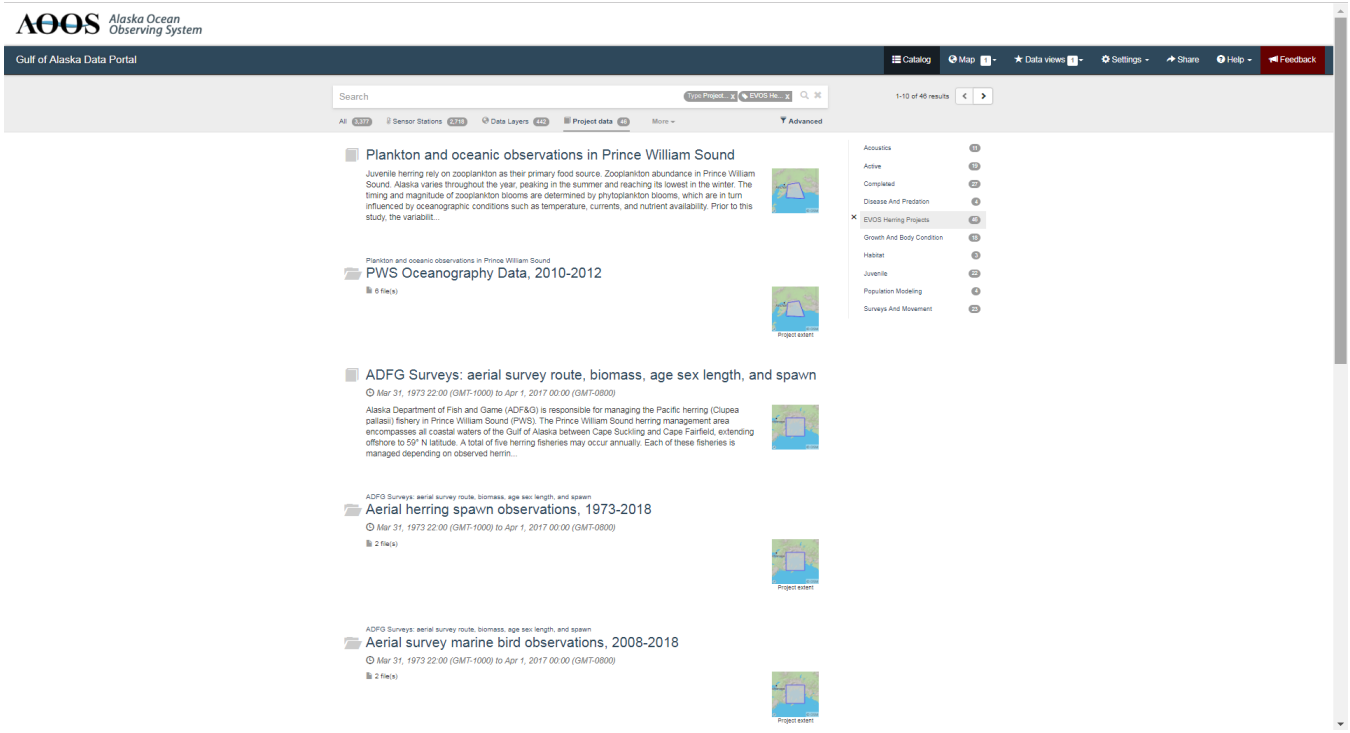


Figure 4. A screenshot of the 2012-2016 GWA and HRM datasets archived and available for public access through the Research Workspace Member Node in the DataONE Search catalog.

OBJECTIVE 5. *Publish and promote data collected by the HRM and GWA Programs, making it available for research, management, and general audiences*.

Once PIs have written metadata and that metadata have been reviewed and approved by Data Management team members from Axiom, the Research Workspace is used as a gateway to publish data and associated metadata to the Gulf of Alaska Data Portal. Through this portal, the data are publicly-available for discovery by researchers, managers, and general audiences. As data providers, PIs have ultimate control for managing which data and supplemental documents are made publicly available. Within each project in the Research Workspace, PIs elect to publish data folders to the portal using a simple, clearly marked checkbox. In FY18, all 2017 data finalized in the FY17 period were published by the PIs and made publicly available through the Gulf of Alaska Data Portal. Using the catalog within the Gulf of Alaska Data Portal, users can browse or search for datasets of interest to learn more about the project or download datasets and metadata of interest. Figure 5 provides an example.



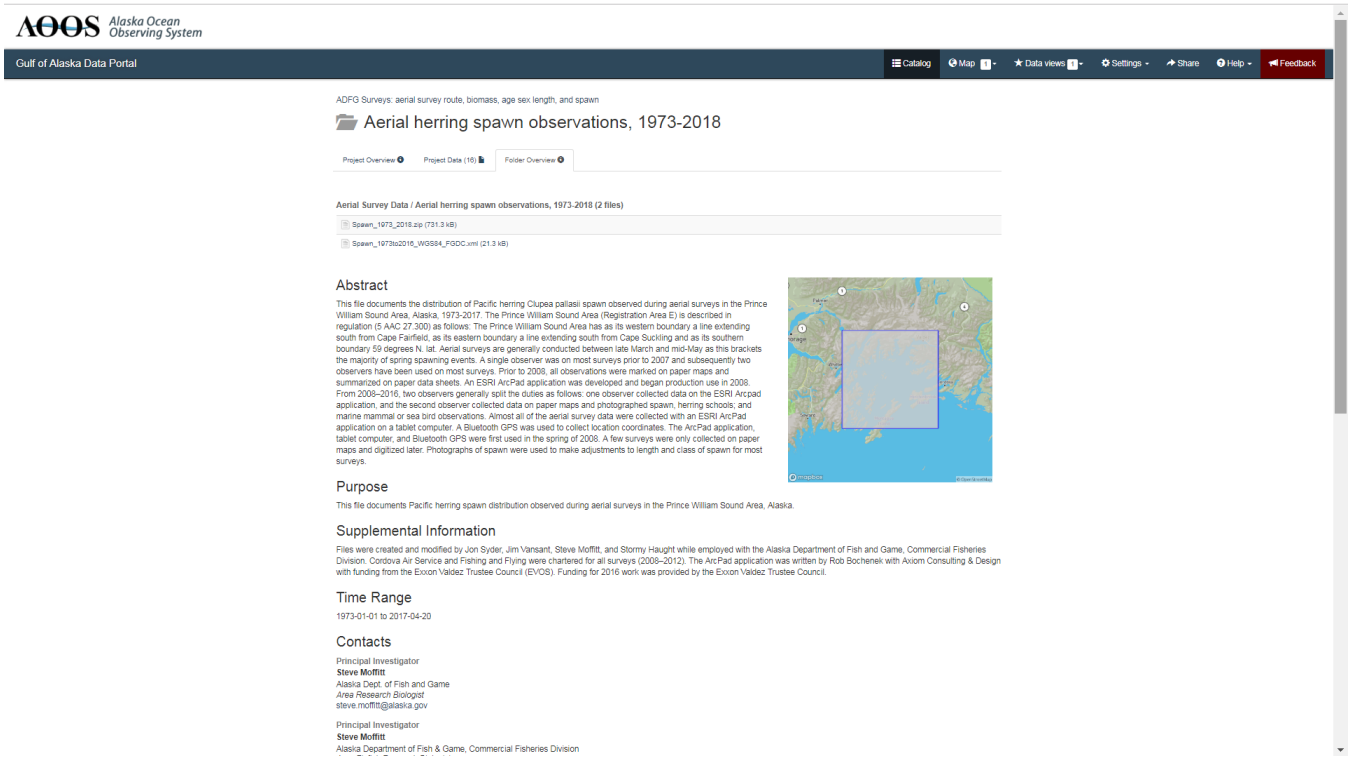


Figure. 5. An example dataset and catalog description for the ADFG survey data of the HRM Program that is available through the Gulf of Alaska Data Portal. A user can select the GWA or HRM label within the catalog and then navigate to the project of interest. A user can read an overview statement about the project, and then select the Project Data button to download data files and metadata of interest.

Also, in FY18, the ADFG herring fishery monitoring aerial survey data was made publicly-available for visual interaction within the Gulf of Alaska Data Portal. Specifically, users are able to map data layers for the entire data time series from 1973-2018, including herring spawn, age-sex-length, aerial survey routes, biomass, and seabird and marine mammal observation. Within the map, users can interact with the data to explore changes over time by filtering the data. A time slider bar can also be used to scroll data back in time. Users can see data values by hovering over points on the map. Or, custom data summaries can be applied by drawing a polygon over an area and extracting a histogram chart for that area. In the example below, herring biomass observations (total short tons) are mapped from 1974 to 2017 (Figure 6). A polygon is drawn over Hinchinbrook Island to create a histogram of the total tons of herring biomass from that time period. Data processing for 2018 survey data was completed in early 2019 and is now accessible through the Gulf of Alaska Data Portal.

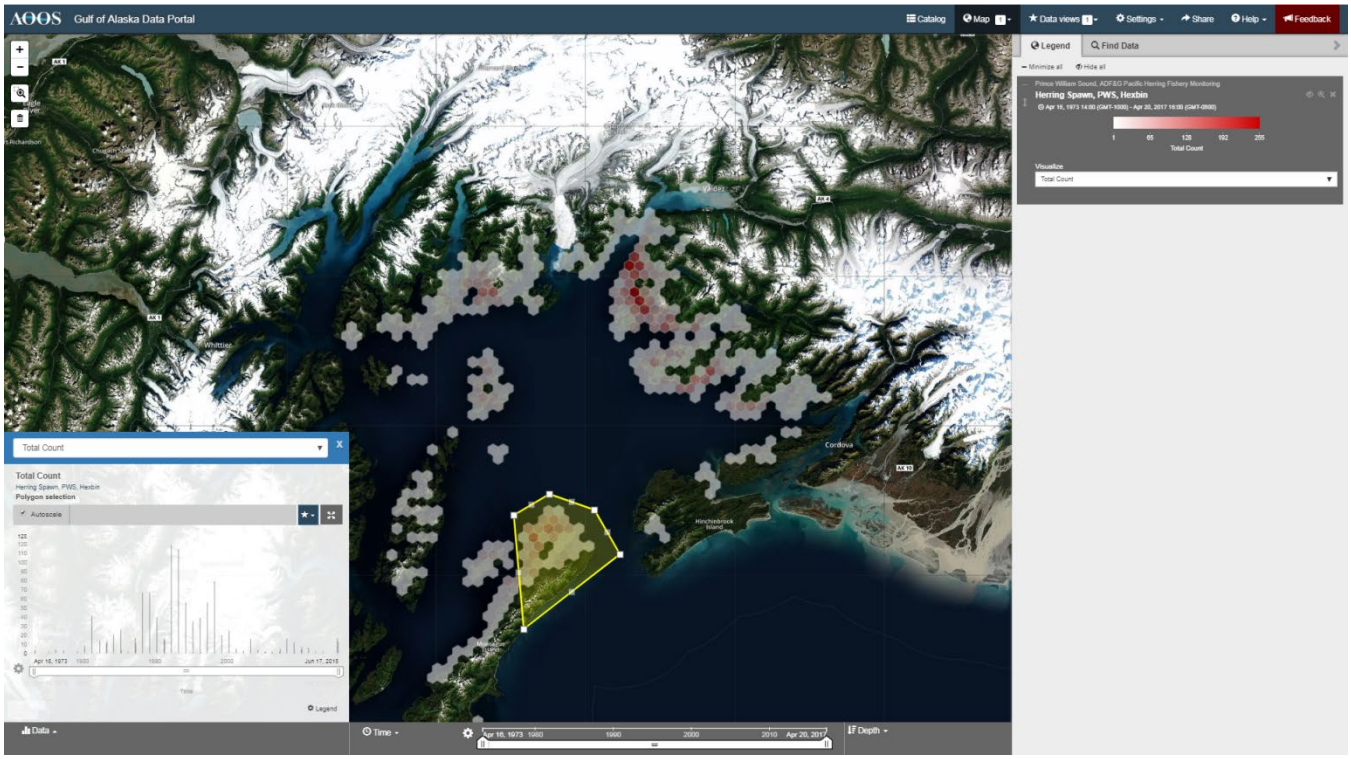


Figure. 6. A screenshot of an interactive data map for herring spawn data, 1973-2018, available through the Gulf of Alaska Data Portal for public access.

OBJECTIVE 6. *Execute management, user feedback, and internal and external communications related to GWA and HRM data and data products*

In FY18, Data Management team members attended and presented at the GWA and HRM PI meeting November 14-16, 2018 in Anchorage. A data management program progress update was given, and presentation on improvements to the Research Workspace and corresponding changes in program procedures were provided. Future directions for the Research Workspace and the Gulf of Alaska Data Portal were also discussed.

One-on-one planning sessions with 18 PIs were scheduled in tandem with the PI meetings to review dataset status to be delivered in FY18. Four additional PI meetings were scheduled at the Alaska Marine Science Symposium in January 2019. To further assist project PIs in proficiently and efficiently using the Research Workspace, Axiom staff provided training via workshops at conference venues, as well as provided the usual support through email and in-person meetings. Axiom developed and hosted a half-day workshop during the January 2019 Alaska Marine Science Symposium entitled Metadata 411 (January 30 1:00-5:00 pm) to provide an overview of how to write metadata that describe a dataset. This workshop was open to GWA and HRM PIs as well as other scientists and technicians to gain a practical understanding of the information that makes up a metadata record while practicing by using the Research Workspace's Metadata Editor. Axiom also hosted a 3-hour metadata "office

hours" session on January 31, where Axiom was present at the Captain Cook Hotel to respond to any metadata-related questions the PIs had or provide them with one-on-one assistance relative to their project datasets. New in 2019, Axiom staff also hosted a half-day Jupyter Notebook Bootcamp on January 28 designed to get researchers excited about using Jupyter notebooks for reproducible analysis in the Research Workspace. The workshop included a hands-on example of how to create and write a notebook to analyze a simple dataset and create publication-ready plots, as well as show users how to get up and running with this platform. Attendees were not required to have any experience prior to this workshop. Presentations given by the data management team for the GWA and HRM program or to individuals PIs are provided in section 9c.

Team lead Janzen coordinated a call on April 30, 2018 with GWA and HRM Program Leads to discuss data management activities. During the April call, the program leads reviewed the status and issue with ADF&G data version consistency, as well as the status of the NCEAS historical data transfer to Axiom. Janzen attended the EVOSTC annual meeting on October 17, 2018 and presented on the 2018-19 Data Management Program for GWA and HRM as well as provided a data submission inventory update through October 2018 to the Council. Both the GWA and HRM Program leads attended this meeting. Janzen was unable to attend the Annual PI meeting in November 2018 (Anchorage), though both Data Management team liaisons from Axiom Data Science were in attendance and provided Janzen's data management update for FY18.

The November 30 Earthquake and government shutdown that followed resulted in limited communications between the Data Management lead and the GWA and HRM Program Leads late in FY18. Communications resumed soon after the government reopened; however, to circumvent any future interruptions, the Data Management lead (Janzen) recommends that a quarterly data management status report (including the updated data submission inventory) be emailed to GWA and HRM program leads. The quarterly reports should be concise and used simply to inform the program leads how PIs are performing with data submissions. Program Lead calls will continue to be scheduled as needed, quarterly either as a group or with individual Program Leads.

Finally, providing and maintaining a system to serve the GWA and HRM data management needs is a core component of the data management program. To ensure the efficacy of such a system, regular and structured feedback is required from data management system users, i.e., the program leads and PIs. The Data Management team gathered feedback from PIs through group discussions and one-on-one meetings and will continue to do so throughout the course of this program. This feedback is tracked and synthesized to identify what data management methods are working well and what procedural modifications or new technologies could be implemented to improve the performance of the data management system. In addition to gathering feedback throughout the year, the data management program team maintained regular contact with PIs over email to provide notification of approaching deadlines for data or metadata submission, asked questions related to these submissions, and/or responded to PIs' questions about data management procedures and responsibilities.

8. Coordination/Collaboration: *See,* Reporting Policy at III (D) (8).

a) Projects Within a Trustee Council-funded program

(1) Within the Program

As the Data Management Program, we provide all levels of data management support for all the projects under the GWA and HRM programs funded by the EVOSTC.

The Data Management program uses the Alaska Ocean Observing System (AOOS) data management technical infrastructure, which is collaborative by design, using the Research Workspace to give open access across the GWA and HRM program teams for file sharing and transparency of data progress. Backing this infrastructure is a Data Management team that is well-coordinated with GWA and HRM program leads and science teams for timely data submissions and accuracy of metadata authoring. Successful coordination and collaboration ensure data and products are available to general science and resource management communities. Through this collaborative work structure, the Data Management team is positioned to respond to the needs of the GWA and HRM programs by providing the required technical support and implementing requested modifications to the Research Workspace, improving accessibility and utility to scientists.

The data managers maintain regular communications with project PIs, program management, and EVOSTC staff through participation at the annual PI meetings in November and January (January 2019 was postponed due to the government shutdown), programmatic conference calls (April and July), and through regular program-wide email correspondence. At the meetings AOOS and the data management team communicate to all PIs about data submission progress and procedures through presentations and group discussions. Using emails, project PIs are notified of program data inventories and the submission timelines to help encourage compliance.

(2) Across Programs

(a) Gulf Watch Alaska

Overall coordination of the data management effort is provided by Dr. Janzen, the Data Management Program Lead (AOOS), who is responsible for ensuring coordination between this program and the GWA Program. AOOS time dedicated to the EVOSTC programs is focused on data management project oversight. Coordination across the program projects occurs through email, phone communications, and regularly scheduled in-person meetings. Axiom representatives from the Data Management team attended the annual PI meeting in November 2018, and Dr. Janzen (AOOS) and Stacey Buckelew (Axiom) join the regularly scheduled Program Management Team phone calls to help ensure a seamless response to data management and decision-support needs.

Regular communications are maintained between the Axiom data managers and the GWA Program Lead as well as the individual project PIs within the GWA Program. These communications are a continuation of effective working relationships developed with the science teams in the first five-year effort. Regular communications with individual project PIs are through annual one-on-one meetings, and regular email and/or phone conversations. One-on-one meetings were held with each project and program PI in November 2018 to track project and data submittal progress and provide hands-on support for data organization, formatting, and metadata authoring. The data managers also use email to inform individual PIs of their data submission progress using the data inventory table. The data management team can then respond to PIs inquiries and/or requests for additional assistance. Depending on the location of individual PIs, this assistance is provided through the most practical communication method (e.g., email, phone correspondence, or scheduled meetings).

(b) Herring Research and Monitoring

Overall coordination of the data management effort is provided by Dr. Janzen, the Data Management Program Lead (AOOS), who is responsible for ensuring coordination between this program and the HRM Program. AOOS time dedicated to the EVOSTC programs is focused on data management project oversight. Coordination across the program projects occurs through email, phone communications, and regularly scheduled in-person meetings. Axiom representatives from the Data Management team attended the annual PI meetings in November 2018, and Dr. Janzen (AOOS) and Stacey Buckelew (Axiom) join the regularly scheduled Program Management Team phone calls to help ensure a seamless response to data management and decision-support needs.

Regular communications are maintained between the Axiom data managers and the HRM Program Lead as well as the individual project PIs within the GWA Program. These communications are a continuation of effective working relationships developed with the science teams in the first five-year effort. Regular communications with individual project PIs are through annual one-on-one meetings, and regular email and/or phone conversations. One-on-one meetings were held with each project and program PI in November 2018 to track project and data submittal progress and provide hands-on support for data organization, formatting, and metadata authoring. The data managers also use email to inform individual PIs of their data submission progress using the data inventory table. The data management team can then respond to PIs inquiries and/or requests for additional assistance. Depending on the location of individual PIs, this assistance is provided through the most practical communication method (e.g., email, phone correspondence, or scheduled meetings).

(c) Data Management

This report covers the FY18 Data Management Program for EVOSTC funded GWA, HRM, as well as partial support for projects 1810853 (pigeon guillemot restoration) and 18170115 (herring genomics).

(d) Lingering Oil

The Data Management team is interacting with other EVOSTC-funded projects, including the pigeon guillemot restoration and herring genomics projects, by providing them access to the Research Workspace to store data and final project reports. Though the Data Management team is not officially offering or funded to provide full data

management services to these projects in the same way we are with GWA and HRM, the team works with the EVOSTC Science Coordinator and maintains a Research Workspace group for information exchange between these EVOSTC funded projects and EVOS Trustees. This allows the Trustees to access final reports and other project documents loaded by the project PIs outside of the GWA and HRM programs, and has streamlined access to up-to-date reports while alleviating sending large documents by email.

b) Projects not Within a Trustee Council-funded program (but funded by the Trustee Council)

The Data Management Program provides data management support for the Trustee Council-funded GWA and HRM programs, which is fully described in this report, and also supports the Trustee Council-funded projects described in section 8.a.2.(d).

c) With Trustee or Management Agencies

AOOS brings a significant level of leveraged resources, infrastructure, regional data management projects and partnerships to this EVOSTC-funded Data Management Program. For one, AOOS is a certified Regional Association (RA) under the authority of the Integrated Coastal and Ocean Observation System Act of 2009 (ICOOS Act). The ICOOS Act directs NOAA to certify and integrate RAs into the U.S. Integrated Ocean Observing System (IOOS). Such integration formally establishes the role of the RA within the U.S. IOOS and ensures that the data collected and distributed by the RA are managed according to the best practices, as identified by NOAA. To become certified, applicants must demonstrate they meet the requirements established by the U.S. IOOS's Regulations to Certify and Integrate Regional Information Coordination Entities.

As the AOOS Data Management team, Axiom works to provide data management, visualization and preservation services, including providing access to and facilitating the use of the Research Workspace. The team offers similar services to a number of other programs that receive funding from or are administered or overseen by representatives from the Trustee Council and associated agencies. EVOS trustee agencies include: *1) National Oceanographic and Atmospheric Administration (NOAA); 2) US Department of Agriculture/US Forest Service; and 3) the US Department of the Interior (Bureau of Ocean Energy Management, US Fish and Wildlife Service, National Park Service and the US Geological Survey)*. Three state agencies are also represented by the EVOS Trustee Council include: *1) Alaska Department of Fish and Game (ADF&G); 2) Alaska Department of Environmental Conservation; and 3) Alaska Department of Law*.

The EVOSTC-funded Data Management Program benefits trustee or management agencies on many levels. For one, all data and final data products produced by the GWA and HRM programs are (or will be) made accessible and publicly available through the AOOS hosted Gulf of Alaska Data Portal and the DataONE Member Node, both of which are no-cost services that can be accessed by any member of the public. Other programmatic and statewide datasets are also accessible via the AOOS data system, and can be accessed by the same end user accessing the GWA and HRM datasets. DataONE provides access to data across multiple member repositories, supporting enhanced search and discovery of earth and environmental data. The Data Management Program also supports the non-program projects as described in Section 8.a.2.(d). Other associated programs affiliated with EVOS Trustee Council and affiliated management agencies are given below (Table 2).

Table 2. Associated EVOS Trustee Council programs and agencies for which AOOS and Axiom coordinate data management as well as other services.

Group, Agency	Level and Type of Coordination and How the project assisted EVOSTC or agency work	Representative
Regional Coastal Ocean Observing System: Alaska Ocean Observing System (AOOS). Integrated Ocean Observing System (IOOS), National Ocean and Atmospheric	Develop the integration of ocean and coastal observing capabilities, in collaboration with Federal and non-Federal partners, to maximize access to data and generation of information products, inform decision making, and promote economic, environmental, and social benefits Through the IOOS grant, AOOS provides partial	Carl Gouldman, Director, IOOS Dave Easter, Division Chief, IOOS

Administration (NOAA)	support on a few GWA supported projects (e.g, Seward Line environmental drivers ship time support). AOOS has invested a significant portion of their IOOS support to host the regions most sophisticated data acquisition system, which hosts the GWA Website and the Gulf of Alaska Data Portal as subsystem. This data system is highly leveraged by other large research and ecosystem-based programs (listed here). AOOS supports all the related EVOSTC and management agency projects by providing the backbone and base support to keep this data system operational, and also by providing data management services to all these groups and their projects.	
Integrated Ocean Observing System (IOOS), National Ocean and Atmospheric Administration (NOAA)	Develop community standards for sensor observations; make regional data nationally accessible. This supports all the data management activities for GWA and HRM as well as other projects listed here, and provides data in the correct formats to meet national and international data archival requirements and standards.	Derrick Snowden, Data Management and Coordination (DMAC) System Architect, IOOS
Alaska Ocean Observing System (AOOS) Data Management, (AOOS grants support funded through NOAA's IOOS Program)	Provide data management; cyberinfrastructure support. Works directly with member and non-member organizations to ingest and document new datasets as well as historical data assets that might not be available elsewhere or in a consistent useful format; data visualizations and product development Support data collection, data sharing and acquisition for the entire region of Alaska, including the Gulf of Alaska. These data are provided to the public and all interested users free of charge via the AOOS data system. The AOOS Data System leverages their own data portal system to support other programs listed in this table.	Molly McCammon, Executive Director, AOOS
Central and Northern California Ocean Observing System (CeNCOOS) Data Management, NOAA	Provide data management; cyberinfrastructure. Works directly with member and non-member organizations to ingest and document new datasets; visualizations Tools developed for CenCOOS can be leveraged for other projects listed on this table, as well as ingestion capability of new data types. Activities undertaken for CenCOOS can be leveraged across the national IOOS data system and other regions using the AOOS data system platform.	Henry Ruhl, Executive Director, CenCOOS
Southeast Coastal Ocean Observing Regional Association (SeCOORA)	Provide data management; cyberinfrastructure. Works directly with member and non-member organizations to ingest and document new datasets; visualizations	Debra Hernandez, Executive Director, SeCOORA

Data Management, NOAA	Tools developed for SeCOORA can be leveraged for other projects listed on this table. as well as ingestion capability of new data types. Activities undertaken for SeCOORA can be leveraged across the national IOOS data system and other regions using the AOOS data system platform.	
Beluga Sightings Database Visualization, NOAA-National Marine Fisheries Service (NMFS)	Produces visualizations, guidance on building community standards for submitting marine mammal stranding observations. AOOS hosts The Cook Inlet Beluga Whale Ecosystem Portal.	Mandy Migura, Marine Mammal Specialist, NOAA (2018) (Current position, Broad Conservation LLC)
Russian-American Long-term Census of the Arctic (RUSALCA), NOAA	Provides access to Workspace; guidance on data and metadata management; archiving; visualizations in support of mission. RUSALCA was an international consortium effort to coordinate biological, geological, chemical and physical oceanographic sampling strategies to be pursued in the Bering Strait and the Chukchi Sea. The cruise objectives for the United States partner were to support the U.S. interagency Study of Environmental Arctic Change (SEARCH) Program, the NOAA Ocean Exploration Program and the Arctic Ocean Census of Marine Life (ArcOcCoML).	Kathy Crane, Program Manager Arctic Research Program, U.S. Mission Coordinator for RUSALCA, NOAA (2015) (Current position, ArcticLynx LLC, and Univ. of Hawaii SOEST)
Building coupled storm surge and wave operational forecasting capacity for Western Alaska, NOAA-IOOS Program - OTT (Ocean Technology Transition)	Provide data management and outreach support for transitional project that is developing a multi-scale, multi-process integrally coupled wave-surge forecast modeling system, refined and validated with a focus on transition to operations while resolving key issues that presently limit forecast reliability in western Alaska. The system will be designed to fit into the NOAA ESTOFS Pacific Storm Surge Guidance System framework. The specific goal is to enable significant advancement of NOAA's high-fidelity operational surge and wave models, ADCIRC and WAVEWATCH III, within the northern Pacific Ocean, Bering, Chukchi and Arctic Seas.	Joannes Westerink, Civil and Environmental Engineering and Earth Sciences, University of Notre Dame, IN
Core Program, North Pacific Research Board (NPRB)	Provide guidance given on data and metadata best practices; access to and facilitation of the Workspace; organization and archiving of historical projects; Now the data management team for NPRB. NPRB funds are administered through the EVOSTC. Data management from the NPRB programs is being managed by Axiom Data Science, and is leveraging the Research Workspace and the data system developed by AOOS to make data public and available for sharing, and standardized for long-term,	Matthew Baker, Science Director, NPRB Jo-Ann Mellish, Program Manager, NPRB

	national archival.	
Arctic Integrated Ecological Research Program (AIERP), NPRB	Fully facilitate data and metadata management working directly with PIs, from initial sharing within the group to long-term archiving at NPRB	Danielle Dickson, Program Manager, NPRB
Arctic Marine Biological Observation Network (AMBON), Bureau of Ocean Management (BOEM)	Coordinate all data management activities for AMBON using the Workspace	Katrin Iken, Lead Principal Investigator, Professor, College of Fisheries and Ocean Sciences, University of Alaska, Fairbanks
Arctic Ecosystem Integrated Synthesis (Arctic EIS), BOEM	Provide guidance to program management on data and metadata best practices; access to and facilitation of the Workspace; organization and archiving of completed projects	Franz Mueter, Lead Principal Investigator, Associate Professor, College of Fisheries and Ocean Sciences, University of Alaska, Fairbanks
Marine Arctic Ecosystem Study (MARES), BOEM	Develop data management plans for each sampling effort; access to and facilitation of the Workspace; acquire and ingest into AOOS Arctic Data Portal environmental datasets identified by program PIs as important context for MARES program; facilitate conversion of data into long-term preservation-ready formats; submission of datasets to long-term archives	Francis Wiese, Lead Project Manager, Stantec
Central Beaufort Sea Wave and Hydrodynamic Modeling Study (BOEM)	Provide data management and outreach support for a joint data synthesis and modeling effort between the University of Alaska, Fairbanks (UAF), the University of Alaska Anchorage (UAA), and the U.S. Geological Survey (USGS) Coastal & Marine Geology Program-Pacific Coastal & Marine Science Center (PCMSC). The Alaska Ocean Observing System (AOOS) and the AOOS data management contractor Axiom Data Science are providing data management services and outreach for this project. Through field observations, historical and new, the goal is to adequately document wave and sediment transport conditions within Stefansson Sound/Foggy Island observationally and provide input data assimilation and validation support for project modeling activities.	Jeremy Kasper, Lead Principal Investigator, University of Alaska, Institute of Northern Engineering
Alaska Data Integration working group (ADIwg), U.S. Geological Survey (USGS)	Generate community standards for project data; advise on translation from ADIwg metadata content profile into suite of ISO geospatial metadata of standards The mission of the Arctic LCC is to identify and provide information needed to conserve natural and cultural resources in the face of landscape scale	Josh Bradley, Data Manager, Arctic Landscape Conservation Cooperative (LLC), US Fish and Wildlife Service

	stressors, focusing on climate change, through a multidisciplinary program that supports coordinated actions among management agencies, conservation organizations, communities, and other stakeholders. The conservation goals of the Arctic LCC are: to provide information on, and predict the effects of climate- driven changes and other landscape stressors; determine how climate driven changes affect subsistence users; and provide improved data and information access to managers and policy makers.	

9. Information and Data Transfer: *See,* Reporting Policy at III (D) (9).

a) Publications Produced During the Reporting Period

Not applicable

b) Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

Specific presentations given by data management program team members during FY18 are listed below, including a metadata workshop hosted by Axiom Data Science at the 2019 Alaska Marine Science Symposium to which all GWA and HRM PIs were invited.

Data Management Presentations and Workshops

Buckelew, S., Turner, C., and Janzen, C. 2018. Data management update for the Gulf Watch Alaska Program. Oral presentation. 2018 Gulf Watch Alaska Program PI Meeting, Anchorage, AK. 15 November 2018.

Buckelew, S., Turner, C., and Janzen, C. 2018. Data management update for the Gulf Watch Alaska Program. Oral presentation. 2018 Herring Program PI Meeting, Anchorage, AK. 14 November 2018.

Janzen, C., Buckelew, S. 2018. EVOSTC 2018-19 Data Management Program for GWA and HRM. Oral presentation. EVOSTC Meeting, Anchorage, AK. 17 October 2018.

Koeppen, W. 2018. Jupyter Notebooks for Reproducible Workflows. Oral presentation. 2018 Gulf Watch Alaska Program PI Meeting, Anchorage, AK. 15 November 2018.

Buckelew, S., Gill, I., and Turner, C. 2019. Metadata 411. Metadata Workshop. 2019 Alaska Marine Science Symposium, Anchorage, AK. 30 January 2019.

Koeppen, W. 2019. Jupyter Notebooks Boot Camp. Technical Workshop. 2019 Alaska Marine Science Symposium, Anchorage, AK. 29 January 2019.

Gill, I., Turner, C. and Wilson, M. 2019. Metadata Office Hours. Metadata Technical Support Session. 2019 Alaska Marine Science Symposium, Anchorage, AK. 31 January 2019.

c) Data and/or Information Products Developed During the Reporting Period, if Applicable

In FY18, Axiom staff worked with the Nearshore Benthic Systems team members to finalize work on some workflow standardizations to create data and products from mussel data. Specifically, Axiom staff scientist, William Koeppen, worked closely with Jim Bodkin (USGS Alaska Science Center, Emeritus) and Heather Coletti (National Park Service, SW Alaska Inventory & Monitoring Network (Science Coordinating

Committee) to build Jupyter Notebook scripts[1] to process and summarize mussel bed width data as a function of time and region. Previously, this work was accomplished by manually updating a series of Excel sheets, and resulted in many non-standardized plots. The updated notebook process concatenates data files across collection years, generates basic statistical summaries, outputs CSVs with the summary results and generates consistent, publication-quality plots in a manner of seconds (Figures 7 and 8). At the time of this report, Koeppen, Bodkin, and Coletti are expanding the notebooks and results to include results from their primary core analysis and size-frequency distribution data.

Axiom Staff Member Trevor Golden has also been contributing to Gulf Watch Alaska phytoplankton data standardization. Using data from the Environmental Drivers group, we've finished the process of adding latitude and longitude information to phytoplankton sampling data from Cook Inlet and Kachemak Bay (only station information is present by default) and will begin visualizing these data in the Gulf Watch data portal in the next period.

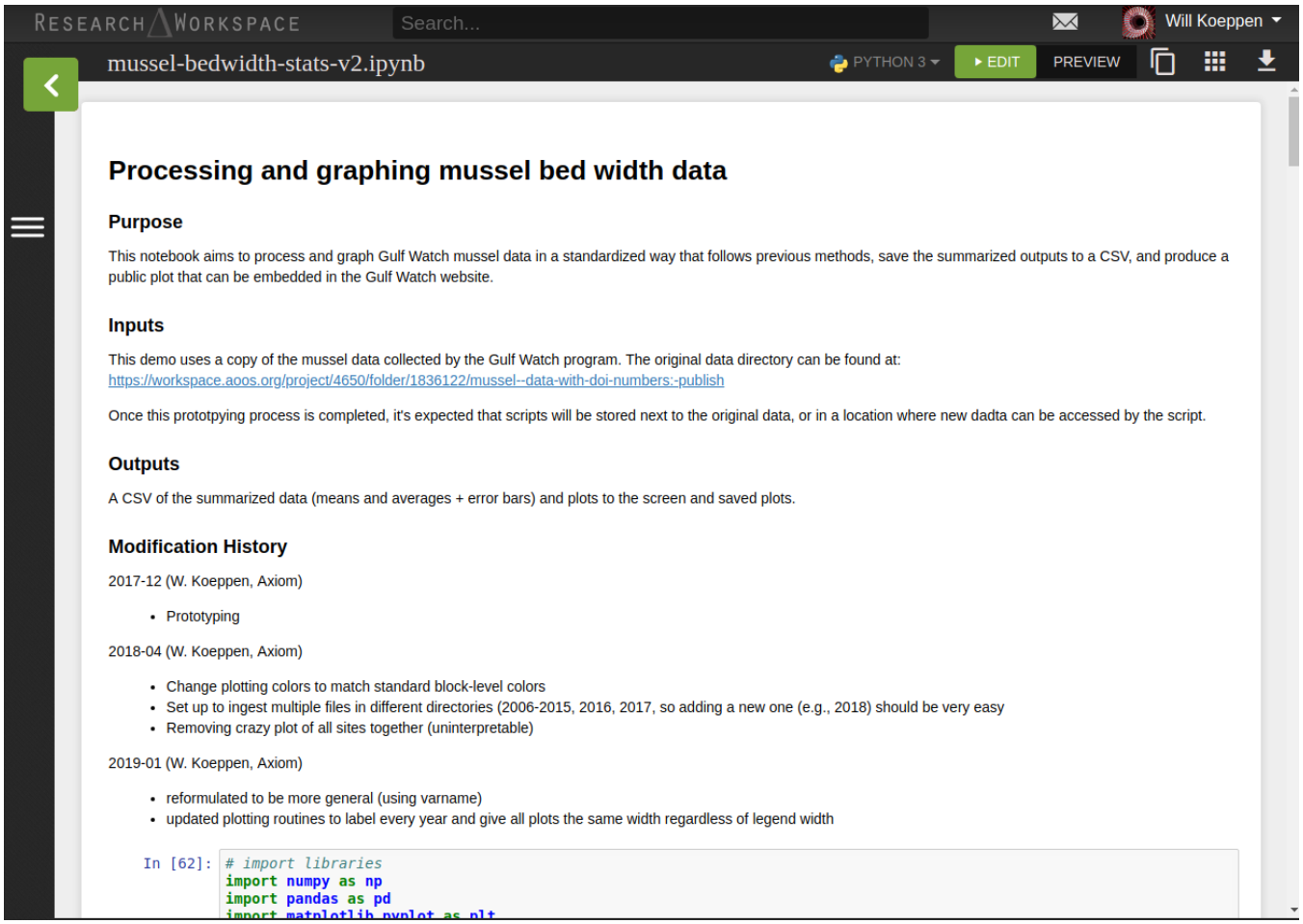


Figure 7. A screenshot of the computing environment in the Research Workspace's Jupyter Notebooks, where scientists can develop interactive numerical workflows or statistical computations on any data loaded within the Research Workspace.

[1] https://workspace.aoos.org/help/JupyterNotebooks.html#jupyter-notebooks

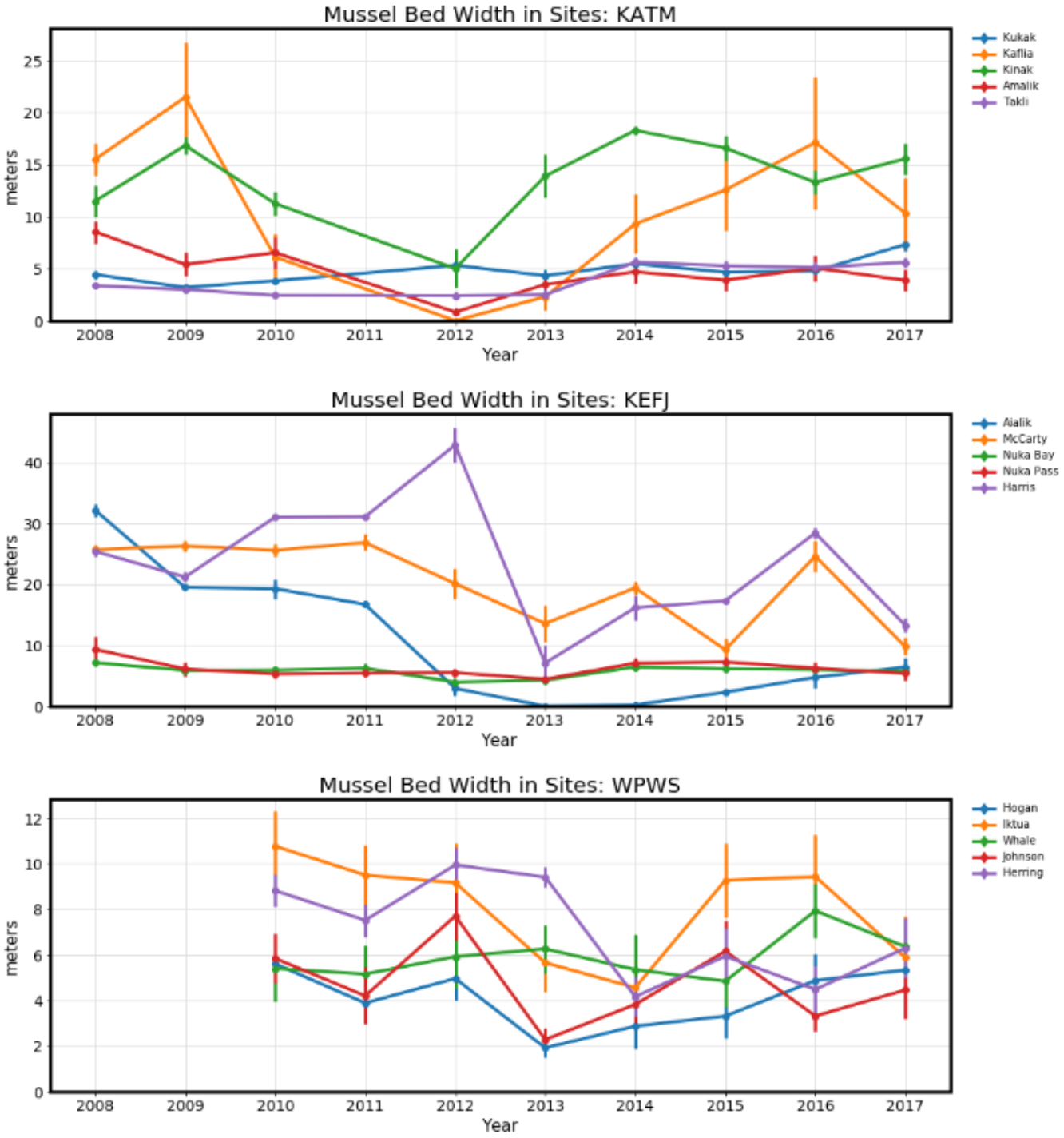


Figure 8. A screenshot of standardized time series graphs created in Jupyter Notebooks for mussel bed site data from the Nearshore Benthic Systems component. At the time of this report, 2018 data was still undergoing QC review by the USGS.

d) Data Sets and Associated Metadata that have been Uploaded to the Program's Data Portal

The status (as of March 29, 2019) of the 2017 data and provisional 2018 data submissions from GWA and HRMs programs currently available through the research Workspace and the Gulf of Alaska Data Portal is shown in Table 3. Annual summary statistics for data submissions (as of March 29, 2019) are provided in Table 4.

Table 3. A summary of the 2017 data and provisional 2018 data from GWA and HRMs programs available through the Research Workspace and the Gulf of Alaska Data Portal as of March 29, 2019. The numeric codes "2" : Obligation to publish data has been met; "1" : Obligation to share data to Workspace has been met; "0.5" : Obligation to share data has been partially met; "0" : No data from this season was shared for the project; "n/a" : The project was not funded during this season; "P": process study with data not expected until end of project.

Program	Project	Dataset	2017	2018	Comments
GWA	Environmental drivers: Continuous Plankton Recorders	Plankton data	2	0	
		Temperature data	2	0	
GWA	Environmental drivers: Gulf of Alaska Mooring (GAK1)	CTD data	2	0	
		Mooring data	2	0	
GWA	Environmental Drivers: Oceanographic Conditions in Prince William Sound	Chlorophyll data	2	0.5	
		CTD data	2	0	
		Zooplankton data	2	0.5	
GWA	Environmental Drivers: Oceanographic monitoring in Cook Inlet and Kachemak Bay	CTD data	2	1	
		KBNERR meteorological data	2	0	
		KBNERR nutrient data	2	0	
		KBNERR water quality data	2	0	
		Zooplankton data	2	0	
GWA	Environmental Drivers: Seward Line	Chlorophyll data	1	1	Raw data are in the RW. Combine format for publishing expected by 1 April 2019.
		CTD data	2	1	
		Nutrient data	1	1	Raw data are in the RW. Combine format for publishing expected by 1 April 2019.
		Seabird data (Kuletz)	2	1	
		Zooplankton data	2	0	2018 data still being processed
GWA	Nearshore: Ecological trends in Kachemak Bay	Rocky intertidal community data	2	0	
		Mussel data	2	0	
		Rocky intertidal data	2	0	

		Substrate data	2	0	
		Seagrass data	2	0	
GWA	Nearshore: Intertidal Systems in Gulf of Alaska	Oystercatcher diet & nest density data	2	1	
		Eelgrass data	2	n/a	Not collected after 2017.
		Invertebrate and algae data	2	1	
		Marine birds and mammals data	2	1	
		Water quality data	2	1	
		Sea otter survey data	2	1	
		Sea otter scat data	2	1	
GWA	Pelagic: Fall and Winter seabird abundance	Seabird survey data	2	1	
GWA	Pelagic: Forage fish distribution, abundance, and body condition	Forage fish count data	2	2	
		Forage fish morph data	2	2	
		Seabird diet data	2	1	
		Hydroacoustic data	2	2	
		Water chemistry (CTD & nutrients) data	2	2	
		Zooplankton data	2	0	
GWA	Pelagic: Humpback whale predation on herring	Fluke id catalog	2	0	
		Energetic/stable isotope data	2	1	
		Whale survey data	2	1	
		Porpoise survey data	2	1	
		CTD data	2	1	
GWA	Pelagic: Long-term killer whale monitoring	Acoustic catalog	2	1	
		Photo catalog	2	1	
		Biopsy data	n/a	n/a	No biopsy samples were collected in 2017 or 2018.
		Orca genetic sampling	0.5	0.5	Event data in the RW, but genetic results have not been returned from the lab for both 2017-2018

		Prey genetic sampling	0.5	0.5	Event data in the RW, but genetic results have not been returned from the lab for both 2017-2018
		Orca database (encounter information, pod size, etc).	0	0	2017 & 2018 Delayed - Planned submission for Summer 2019.
GWA	Pelagic: Prince William Sound Marine Birds	Summer bird survey data	n/a	0	No surveys conducted in 2017
Herring	ADFG Surveys: surveys and age, sex, and size collection	aerial biomass observation & routes data	2	1	
		aerial survey marine bird & mammal observations data	2	1	
		ASL data	2	1	
Herring	Adult acoustic biomass surveys	raw acoustic data	2	1	
		processed acoustic data	2	1	
		biomass summary	2	2	
Herring	Aerial surveys of juvenile herring	raw survey data	2	2	
		age 1 index	2	2	
Herring	Herring disease program	prevalence summary	1	1	
		raw lab data	1	1	P
Herring	Modeling and stock assessment of herring population dynamics in Prince William Sound	age composition	2	2	
		model codebase	2	2	
		output data	2	2	
Herring	Studies of reproductive maturity	lab analysis (weight, length, gonad) database	1	1	P
		collection database	1	1	P
		scales database	1	1	P
		histology database	1	1	P
Herring	Annual herring migration cycle	collected fish data	1	1	P

Table 4. Summary statistics of data submissions by 29 March 2019 (19 projects composing 66 datasets). PIs have until December 1, 2018 to submit 2017 data to the Research Workspace, and December 1, 2019 to submit 2018 data. Some datasets are routinely delayed due to longer sample processing times, data processing times, and late-in-the-year or delayed sampling schedules. Datasets that were not collected in a given year are not included in the metrics below. 'Process' datasets (those with a 'P' in the 'Comments' column), do not have an obligation to publish annually to the Gulf of Alaska Data Portal and are also excluded from the percentages.

Data Submission Metrics	**2016**	**2017**	**2018**
Obligation to shared datasets in the RW, % complete	100%	96.9%	67.2%
Obligation to published through the GOA portal, % complete	100%	89.7%	17.2%

10. Response to EVOSTC Review, Recommendations and Comments: *See,* Reporting Policy at III (D) (10).

Response to Science Panel Comments in 2017 on the FY18 Data Management Program Workplan

Can the PI confirm that data will be available and not require specially approved access to get to the data?

The process for making data from the EVOS Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) programs publicly available is as follows. Project PIs upload preliminary and final datasets to the Research Workspace within one year of collection for sharing among collaborators. PIs maintain ownership of the data they have submitted to the Research Workspace; therefore, they have access to data from the 2012-16 and 2017-21 funding cycles without needing special permissions. Once data are finalized (e.g., within one year of data collection, in most cases) data are published from the Research Workspace to the AOOS Gulf of Alaska (GOA) Data Portal.

All data published to the GOA portal are accessible by the public with no restrictions or specially approved access. In the portal, these data are discoverable alongside the publicly-available final data from the 2012-2016 GWA and HRM projects. These data are further made available to the public through the Research Workspace DataONE member node, a preservation-oriented data repository that is openly accessible to the public. The DataONE archives, similar to the GOA portal, will continue to be updated with final data from the 2017 to 2021 funding cycle.

Note: In original response, we provided instructions and links for navigating to the public-facing data in the GOA Portal. We do not include those instructions here as they can be found in the FY18 Work Plan.

Are the ADFG herring datasets available on the DataONE portal? If not, they should be made accessible.

The ADFG Prince William Sound datasets have been submitted to the Research Workspace for sharing among collaborators. Some of these datasets have been made available to the public through both the Gulf of Alaska (GOA) Data Portal and DataONE. An inventory of these datasets and their publication status are shown in the Figure 9. The data management team is awaiting a final decision from ADFG Commercial Fisheries division about whether to make the remainder of the data available publicly. We will update the EVOSTC with this information as soon as we have a response.

ADFG Herring Surveys, Prince William Sound: aerial survey route, biomass, age sex length, and spawn
EVOS Herring Research Workspace c https://workspace.aoos.org/project/283281/files

Dataset	Years	Public in GOA portal?	GOA portal link	Archived with DataONE?	DataONE doi link
Aerial herring biomass observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a692c-ea24-11e0-b73c-0019b9dae22b	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.16
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/ee8a753e-ea24-11e0-a20d-0019b9dae22b	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.17
Aerial herring spawn observations	1973-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/ad7118be-ea24-11e0-b488-0019b9dae22b/79b1cc76-5f1f-41d7-bb79-3f7e995d6d89	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.18
Aerial survey marine bird observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/258864ed-5fe3-4ae1-af41-fee3222612aa/d3964546-4786-11e5-953e-00265529168c	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.19
Aerial survey marine mammal observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/00357656-e3b9-4d22-9d03-345ffb0b7320	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.20
Aerial survey sea lion observations	2008-2016	yes; visualized & available for download	http://portal.aoos.org/gulf-of-alaska.php#module-metadata/c893364d-0e8a-42de-8947-9212b588cc43/d39650b8-4786-11e5-9543-00265529168c	yes; 2007-09 only	https://search.dataone.org/#view/df35a.22.21
Age Sex Length Data	1973-2014	no	-	yes	https://search.dataone.org/#view/df35b.273.7
Age Sex Length Data	2015-2016	no	-	no	-
PWS Herring Acoustics	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-
PWS Herring Acoustic	1997-2014	no	-	no	-
Scale Measurement Data	1982-2016	no	-	no	-

Figure 9: Screen capture of Axiom's inventory of ADF&G Herring datasets, displaying the time span of each dataset, its availability in the Gulf of Alaska Data Portal, and whether it has been archived in DataONE

What is the status on linking DataONE to Workspace for all projects?

In June 2017, we launched the Research Workspace DataONE Member Node (RW MN), a preservation-oriented data repository for datasets published from the Research Workspace (news release here). Datasets published from the Research Workspace to the Research Workspace DataONE Member Node are issued a citable digital object identifier (DOI), and are discoverable through DataONE search interfaces alongside datasets and metadata from the other 40+ repositories that make up the DataONE federation.

The final data holdings from the 2012-2016 GWA and HRM programs were archived in the Research Workspace Member Node and are now publicly discoverable and citable through the AOOS Gulf of Alaska Data Portal and the DataONE Search catalog. These data resources are linked to any related datasets from the EVOS historical data salvage project (conducted by NCEAS), which are also stored in a DataONE Member Node.

Within the Research Workspace, datasets archived with DataONE are visible under the Archives tab within each project. Here PIs can view the resource title, DOI, and link to the associated data and metadata. Additionally, the DOI is reflected in the Gulf of Alaska (GOA) Data Portal, from which any member of the public can navigate from the GOA Data Portal to the archived dataset within DataONE.

In future Research Workspace updates, an archive page will be added to the EVOS GWA and HRM campaign which lists the archive dataset citations for the entire program (as opposed to individually by projects), and this list will include links to DataONE.

Note: In the original response, we provided a screenshot of the Research Workspace showing the Archives tab within each project.

11. Budget: *See,* Reporting Policy at III (D) (11).

The Data Management Program does not require any funding adjustments to the authorized level of funding. All budget items are either on target or are reporting as underspent as of January 31, 2019.

Cumulative totals for Years 1 and 2 represent only the posted expenditures as of the end of Year 2, January 31, 2019. However, not all year-end expenditures for a given year are posted by the program year-end date (January 31), due to program activities that occur during the last months of the Program year, and subsequent invoicing to the project that occurs after the years' end. Regardless, no individual line item will exceed the originally proposed amount once the Year 2 expenditures have all been processed/posted.

- Personnel actual cumulative budget is underspent. This line covers Program Lead Janzen's salary (and fringe) on the project. In Year 1, the project award was not in place until three months after the project start date of February 1, 2017; therefore, no salary was billed for those first three months on the project in Year 1. In Year 2, Janzen did not participate in the fall annual PI meeting, and in December-January, the government shutdown caused cancellation of the routinely scheduled GWA, HRM and Data Management Program meeting. The government shutdown also delayed reporting schedules, shifting a significant number of the annual billable hours from December/January ahead into February/March.
- Contractual actual cumulative budget is underspent, due largely to the fact the contracted program services Axiom provides that occur during the last quarter of the Program year (including the last month of the program year - January) are subsequently invoiced after the program year ends on January 31. This means a complete year-end contractual expenditures accounting for the project are not final until after the year-end date of the given budget year (January 31). Quarters 1 and 4 are very active quarters for the Data Management Program, therefore expenditures during these periods make up a significant portion of the annual budget. The reported cumulative expenditure accounting ends on January 31, 2019, thus simply is not representing the last quarter of Year 2 contractual invoicing.

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$8.1	$8.4	$8.6	$8.9	$9.2	$43.2	$7.9
Travel	$0.0	$0.6	$0.6	$0.0	$0.6	$1.8	$0.6
Contractual	$191.9	$191.0	$190.8	$191.1	$190.2	$955.0	$319.8
Commodities	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect Costs (*will vary by proposer*)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
SUBTOTAL	$200.0	$200.0	$200.0	$200.0	$200.0	$1,000.0	$328.3
General Administration (9% of	$18.0	$18.0	$18.0	$18.0	$18.0	$90.0	N/A
PROJECT TOTAL	**$218.0**	**$218.0**	**$218.0**	**$218.0**	**$218.0**	**$1,090.0**	**$328.3**
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0