

Exxon Valdez Oil Spill
Data Management Program Final Report

Exxon Valdez Oil Spill Trustee Council Project 21120113
Final Report

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Study History: In 2012, the *Exxon Valdez* Oil Spill Trustee Council with support from the National Center for Ecological Analysis and Synthesis awarded a five-year (2012-2016) data management contract entitled “Collaborative Data Management and Holistic Synthesis of Impacts and Recovery Status Associated with the *Exxon Valdez* Oil Spill” to the Alaska Ocean Observing and its data management partner Axiom Data Science. This project (16120120) provided core data management services for the *Exxon Valdez* Oil Spill Trustee Council’s Long-Term Research and Monitoring Program, Gulf Watch Alaska, to help ensure data generated by this effort are available for long-term preservation, public discovery, and reuse. In 2015, the data management component expanded under a supplemental project (15150114-T) to provide additional data management support for the Herring Research and Monitoring Program. In 2016, the Alaska Ocean Observing System and Axiom Data Science were selected as the Data Management Program provider for the continuing Gulf Watch Alaska and Herring Research and Monitoring Programs from 2017-2021 under Program Numbers 17120113, 18120113, 19120113, 20120113 and 21120113. In 2020, the Data Management Program expanded to include three *Exxon Valdez* Oil Spill Trustees Council-funded science and technical projects that were not part of the Gulf Watch Alaska or Herring Research and Monitoring Programs.

Abstract: Since 2012, the Alaska Ocean Observing System and its technical partner Axiom Data Science have provided the *Exxon Valdez* Oil Spill Trustees Council with critical data management support, designed to assist study teams in efficiently meeting objectives and ensuring data produced or consolidated through the Gulf Watch Alaska and Herring Research and Monitoring Programs and other projects are organized, documented, and made publicly available. The 2017-2021 Data Management Program maintained continuity and built upon prior years data management efforts, supporting the entire data lifecycle. The data management infrastructure is comprised of the Alaska Ocean Observing System’s Data System and mature data management tools including the Research Workspace, the Metadata Editor, the Gulf of Alaska Data Portal, and the DataONE data repository. This infrastructure allowed for ongoing query, discovery, and use of data and metadata through web-based search, catalog, and visualization interfaces, and promoted long-term data preservation, public discovery, and reuse. Collectively, the regional data management expertise, the advanced cyberinfrastructure, and the end-to-end data system facilitated successful, full-lifecycle data management for the *Exxon Valdez* Oil Spill Trustee Council Programs. Datasets from 20 projects make up 58 data collections publicly available through the Gulf of Alaska Data Portal and replicated in the DataONE repository for long-term preservation and discovery by a broader audience of scientific users.

Key words: Data, DataONE, data repository, data management, data portal, Gulf of Alaska Data Portal, metadata, Research Workspace, Workspace

Project Data: This project did not include original data collection. Data collected for projects that contributed to this report are available through the Alaska Ocean Observing System (AOOS) Research Workspace and Gulf of Alaska Data Portal: <https://gulf-of-alaska.portal.aos.org/>

The Gulf of Alaska Data Portal, hosted by AOOS within their Data System, provides access to a wide range of data including: sensor feeds, operational oceanographic and atmospheric models, and satellite observations; monitoring and research studies covering oceanography, plankton, fish, marine bird and mammals; and research programs including Gulf Watch Alaska, the Herring Research and Monitoring Program, and historical and new studies funded by the *Exxon Valdez* Oil Spill Trustee Council.

The data are provided in two formats: one is a catalog showing a listing of available data sets; the other is an interactive map that allows users to view select data from the region. When available, metadata are provided with each file with specific study and contact information. There are no limitations on the use of Gulf Watch Alaska or Herring Research and Monitoring Program data; however, it is requested that the authors be cited for any subsequent publications that reference these program data. It is strongly recommended that careful attention be paid to the contents of the metadata file associated with these data to evaluate dataset limitations or intended use.

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Data Management Program

EXECUTIVE SUMMARY

In this Data Management Program from 2017 to 2021, the Alaska Ocean Observing System (AOOS) and its data management partner Axiom Data Science provided core data management support and services to the Gulf Watch Alaska (GWA) and the Herring Research and Monitoring (HRM) Programs, which are the long-term monitoring programs funded by the *Exxon Valdez* Oil Spill Trustees Council (EVOSTC). Starting in 2020, at the request of the EVOSTC, the Data Management Program was expanded to provide the same level of data management support for three newly-funded EVOSTC “Non-Program” projects (NPPs). These services included the development and enhancement of a central data management system to allow for access, analyses, and visualization of information and products produced from the GWA, HRM, and NPP efforts and ensure their long-term preservation, public discovery, and reuse. The overall goal of this program was to provide critical data management support to assist program and project researchers in efficiently meeting their objectives and ensuring data collected or consolidated were organized, documented, and available for their use and for future use by broader scientific and resource management communities.

This effort developed and implemented a central data management system for the EVOSTC’s GWA and HRM Programs and NPPs that supported the entire data lifecycle from sharing data among principal investigators (PIs) immediately after collection to eventual long-term preservation at a national data repository. The data management infrastructure is comprised of the AOOS Data System (including its data portals), and incorporates several mature tools, including: the Research Workspace, which is a scientific collaboration and data management tool used to secure, centralize, and publish data files on public data portals and catalogs; the Gulf of Alaska Data Portal, which is hosted through the AOOS Data System, provides public access to regional data, and allows users to visualize and integrate data from different sources, including the EVOSTC GWA and HRM Programs; and the Research Workspace DataONE Member Node, which delivers program data to the DataONE national long-term data repository.

Beyond these tools, data management services were provided to facilitate communication and coordination between program managers, PIs, and data management staff. Through this process, a rigorous data management support service was achieved that combined experienced data management personnel, regional data management expertise, and advanced cyberinfrastructure in an end-to-end system where facilitated, full-lifecycle data management led to accelerated data use and scientific discovery by researchers, program managers, and broader scientific audiences.

Through these efforts, a data management system was delivered to share over 2.0 million data files and 12.5 terabytes (TB) of data among over 100 users across GWA, HRM, NPPs, and EVOSTC members. Datasets from 20 EVOSTC-funded monitoring programs resulted in 58 data collections that are available publicly through the Gulf of Alaska Data Portal. This adds to the

collection of 53 datasets that were archived following the 2012 to 2016 GWA and HRM Programs. These datasets are discoverable alongside 300 additional GIS, environmental, numerical modeling, and remote sensing data resources for the Gulf of Alaska region. Ultimately, the GWA, HRM and NPP project datasets were replicated in the DataONE repository for long-term preservation and discovery. The DataONE archive, at present, hosts over 1.5 million environmental data objects available through the DataONE search engine and a growing network of over 40 data repositories.

INTRODUCTION

Following the 1989 *Exxon Valdez* oil spill ('the spill'), several decades of scientific research has occurred to monitor the impacts and recovery of the spill-affected Gulf of Alaska region and its resources. Over time, ecosystem impacts directly related to the spill have become more challenging to detect due to regime shifts, natural variability, climate change, and other anthropogenic changes. Data collected through long-term observations and focused research are fundamental to inform management decision-making by determining whether changes are spill-related or associated with other factors, and by identifying what potential recovery actions may be needed. To address these challenges and facilitate the recovery of injured resources, scientific and resource management communities need access to the most current scientific information and environmental intelligence tools to help make sound decisions.

Historically, data management activities for oceanographic and ecosystem observing programs have been isolated within physically distributed agencies, leading to low cross-agency utilization of data. Technical barriers, complex data formats, a lack of standardization, and missing metadata have also limited access to data and made the utilization of available scientific information cumbersome and daunting. Consequently, existing data are often underutilized. Managing these data holistically is also challenging due to the variety of data collection protocols and the vast range of variables involved. Data may derive from automated real-time sensors, remote sensing satellite/observational platforms, field/cruise observations, model outputs, and various other sources. Further, variables within the data can be far ranging from mesoscale ocean dynamics down to microscale zooplankton counts. The resulting datasets are often packaged and stored in unique formats, describing a wide spectrum of scientific observations and metrics. Due to the complexity of integrated ecosystem data streams, developing data management strategies to securely organize and disseminate the information is technically challenging. Distilling the underlying information into usable data products for various user groups requires a cohesive, end-to-end approach in addition to a fundamental understanding of the needs and requirements of originating scientists, user groups, and stakeholders.

In 2012, the *Exxon Valdez* Oil Spill Trustees Council (EVOSTC) awarded the Alaska Ocean Observing System (AOOS) a five-year data management contract entitled "Collaborative Data Management and Holistic Synthesis of Impacts and Recovery Status Associated with the *Exxon*

Valdez Oil Spill.” In that project (16120120), AOOS and its data partner Axiom Data Science (Axiom) successfully designed, developed and maintained an interactive web-based data management system to support the data management needs of the Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) Programs and the EVOSTC.

AOOS and Axiom continued to provide data management for both the GWA and HRM Programs during the second 5-year period (2017-2021) as a stand-alone Data Management Program rather than an embedded project within the GWA and HRM Programs. This program continued to utilize the now-mature central data management system that was developed, refined, and executed during the EVOSTC’s 2012-2016 GWA and HRM Programs, supporting the entire data lifecycle from sharing data among Principal Investigators (PIs) immediately after collection to eventual long-term preservation at a national data repository.

The data management system is composed of several core components for implementation including:

- the data management backbone infrastructure, which is comprised of the AOOS Data System (including its data portals);
- the Research Workspace (Workspace), previously referred to as the Ocean Workspace, which is a scientific collaboration and data management tool used to secure, centralize, share data amongst research teams, and also to publish data and metadata files to public portals and catalogs;
- the Metadata Editor, integrated into the Workspace, that uses program-specific metadata templates for the PIs and includes boilerplate information for fields that must contain program-wide metadata (e.g., access constraints, use constraints, and programmatic contact information);
- the AOOS hosted Gulf of Alaska (GOA) Data Portal, which provides public access to data, allowing users to discover, explore, for some datasets, visualize and integrate data from different sources, including the EVOSTC’s GWA and HRM Programs; and
- the DataONE repository, for which the Workspace operates as a Member Node for EVOSTC-funded project data and metadata to be deposited via an automated submission pathway.

All of these services allow for the query, discovery, and use of data and metadata through web-based search, catalog, and visualization interfaces hosted by AOOS and are made available for use by GWA and HRM researchers, program managers, and ultimately, broader scientific and resource management audiences. Data and metadata from the 2017-2021 programs are accessible via catalog listings on the GOA Data Portal and on the main AOOS Data Portal (Ocean Data Explorer) as downloadable files. The EVOSTC did not support further development of

visualization tools during the 2017-2021 program years; therefore, only a select number of GWA projects from the 2017-2021 timeframe have data visualized on the AOOS Data Portals, including the GOA Data Portal.

The goal of the 2017-2021 Data Management Program was to provide critical data management to support the GWA and HRM project investigators and Program Leads, and starting in 2020, to provide the same level of data management support for three newly-funded EVOSTC “Non-Program” projects (NPPs). NPPs are fixed-term, and not part of the long-term GWA or HRM Programs. The Data Management Program was designed to assist study teams in efficiently meeting their objectives and ensuring data collected or consolidated through the effort are organized, documented, and available for their use and for future use by the public and the larger scientific community. For over 10 years now, AOOS and Axiom have continued meeting the data management goal under a reduced budget, made possible by leveraging the extensive cyberinfrastructure and data management capacities of both Axiom and AOOS, while utilizing the existing collaborative relationships with program PIs to ensure continuity in the data collected across efforts. Together, AOOS and Axiom provided programmatic continuity for the GWA and HRM Programs and newly-funded EVOSTC NPPs utilizing the data management system developed for the GWA and HRM Programs in prior years. This system was maintained and augmented where necessary to enhance the accessibility of GWA, HRM and new EVOSTC project datasets to ensure they are readily available both now and into the future.

OBJECTIVES

The specific objectives of this project were to:

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 Ocean Workspace (now referred to as 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.

A change was made to Objective 3, which renames the “Ocean Workspace” to “Research Workspace.” We will refer to the Research Workspace, or “Workspace” throughout this report. Also, a new *Objective 8* was added to cover new EVOSTC Non-Program projects that were added to this Data Management Program starting in 2020 (Objective 8):

Objective 8. Perform original Data Management Program Objectives 1-7 for newly-funded EVOSTC Non-Program projects.

The Non-Program projects (NPPs) that were added to the Data Management Program in FY20 included Project Number 21110853 Pigeon Guillemot restoration project (2012-2019 legacy data 5-years new data; FY2020-2024) and Project Number 21200127 the Gulf Watch Ocean Acidification Monitoring project (FY2020-2022). In FY21, a third EVOSTC Non-Program project was added to the Data Management Program - Project Number 21210128 Status and trends of EVOS injured seabirds in the Kenai Peninsula coast and Kachemak Bay (FY2021-2025). Two of the new NPPs were not completed before the end of this term-program, as they span a three to five-year period exceeding the 2017-2021 Data Management Program funding period. The additional funding to complete these NPPs and the data management support with them was approved by the EVOSTC in January of 2022 as part of the next five-year funding period (2022-2026).

There were no other changes to the Data Management Program design, goals, or objectives.

METHODS

The Data Management Program prioritized data preservation and accessibility to the scientific and resource management communities. This was achieved through support for data submission and organization, metadata generation, and data transfer among study teams. The methods for this program focused on implementing the now mature, end-to-end data management system that assisted in the organization, documentation and structuring of GWA and HRM Program project data during the 2012-2016 data management efforts. The data management system has several core components and is designed to transfer data efficiently to long-term data repository and storage centers that make data publicly available for future use by researchers and other user groups. While the data management infrastructure used during this effort built upon existing systems and tools that were developed with previous funding from multiple sources (including the EVOSTC), they were sufficiently scalable to address new developments within the GWA and HRM Programs and the other focus areas (i.e., new EVOSTC Non-Program projects and Lingering Oil Program), and continued to meet the environmental intelligence needs of researchers and resource managers who require an effective understanding of ecosystems affected by the spill.

Initial Data Assessment

At the start of each year, the data management staff worked with GWA and HRM Program project PIs to assess the types of data that were to be collected during the year and to inform the

Data Sharing Plan development for each project PI. The data management team convened meetings with the GWA and HRM Program Leads to discuss the program-level data management strategy, and to verify the list of funded research projects. Using information generated during the meetings, an inventory of data expected to be generated and submitted by EVOSTC GWA and HRM sampling efforts was created. This inventory described the datasets, indicated the investigator responsible for the data, and noted the status of metadata for each dataset (Appendix 1). This inventory also provided a scaffold for which the data management team tracked data and metadata progress throughout the life of the program. The data management team also updated the data management procedures that were developed to guide project PIs during data documentation and curation throughout the lifetime of their individual projects. These procedures were then made available to all PIs through the Workspace. The overall data management framework for the program PIs resulted in defined procedures for the collection, quality, storage, maintenance, and dissemination of project data. Procedures were to be followed by PIs at any time during the preparation of their datasets but were most useful when considered at the onset of project planning and implemented during data collection.

Compliance with Data Sharing Protocols

The EVOSTC requires data sharing among all PIs and program components. The expectations for data management staff and project PIs were discussed and made explicit across the Program Leads and the data management team during the annual meetings with PIs. The Data Management Program required all PIs to adhere to the policies below, adopted by the GWA and HRM Program teams during the first five-year phase of the programs (2012-2016), unless prohibited by a partner agency:

- All data are posted on the Workspace as they become available following collection in order to promote internal integration and sharing within the project.
- These data are replaced with quality assured and controlled (QA/QC'd) data when available.
- Comprehensive metadata using FGDC (or ISO) standards accompany each dataset.
- Monitoring data are made available to the public as soon as they have been QA/QC'd or within one year following collection, whichever is sooner.
- Anyone making public use of another team's data contacts the data collector and provides appropriate attribution and credit.
- The Science Coordinating Committee must agree to any deviations from these policies in advance.

New to the 2017-2021 Data Management Program was a plan for addressing non-compliant PI's and programs. PIs that failed to submit timely data and metadata in accordance with the above

procedures would be subject to corrective action, including as a last resort, recommendation to withhold a portion of the funds until compliance is met. The data submission inventory table within the Workspace was used to identify potential PI non-compliance. A copy of the data submission inventory tracking table was sent to the GWA and HRM Program Leads quarterly to keep them informed of progress and to avoid non-compliance. Any out of compliance PIs would be notified by the data management team of any shortfalls to their data submission and metadata authoring at the annual one-on-one PI meetings (scheduled six months prior to annual report submission). Thereafter, non-compliant PIs would be required to correct any shortfalls within three months and steps to be taken were communicated to the relevant PIs to ensure future timeliness of submissions. Following any failure to correct these submissions within three months, an *Out of Compliance* notification would be submitted by the data management team to the GWA or HRM Program Leads and the associated PI. Clear documentation of what was required to correct any non-compliance would also be provided. Together with the notification, internal controls would be discussed with the Program Leads to determine root causes of non-compliance and to adjust expected timetables or help ensure the PI maintained compliance in the future. Thereafter, with additional oversight by the GWA or HRM Program Lead, the PI would be required to correct any non-compliance within three months and steps would have to be demonstrated to ensure future compliance. If after these corrective actions, the PI still failed to submit data, a *Non-Compliance Report* would be submitted by the data management team to the EVOSTC during the annual report cycle. The *Non-Compliance Report* would detail the nature of the non-compliance and corrective actions taken by the PI(s) and data management team. The report could also include a recommendation for financial withholdings until compliance has been achieved.

Data Management Infrastructure

The data management infrastructure is comprised of the AOOS Data System (including its data portals), the Research Workspace, the Metadata Editor, the Gulf of Alaska (GOA) Data Portal, and the DataONE long-term data repository.

The AOOS Data System

The AOOS Data System is the backbone of the cyberinfrastructure leveraged to support end-to-end GWA, HRM, and NPP data management. This infrastructure has been developed to meet the guidelines and specifications recommended by the NOAA Integrated Ocean Observing System (IOOS) Program and endorsed by the federal Interagency Ocean Observation Committee and Global Earth Observation Program. AOOS maintains itself as a certified Regional Coastal Observing System (RCOS), which implements the provisions of the ICOOS Act establishing that certified entities integrated into the System are, for the purposes of determining liability arising from the dissemination and use of observation data, considered part of NOAA and therefore their employees engaged in the collection, management, and dissemination, of observation data in the System receive the same tort protections for use of that data as Federal employees. The AOOS Data System was built using several mature, open-source interoperability and data stewardship

systems to provide full-lifecycle data management services, including data ingestion, metadata, data aggregation and assembly, data catalogue and discovery, quality assurance and quality control (QA/QC), data access and transport, data storage, and end user input and feedback.

The Research Workspace

The Research Workspace (Workspace) was released in 2012 as a web-based data management application built specifically for storing and sharing data among members of scientific communities and research teams. Since its release in April 2012, the Workspace user-base has grown to more than 700 individuals from a number of large-scale scientific research programs, including the EVOSTC GWA and HRM Programs, the North Pacific Research Board’s Gulf of Alaska Integrated Ecosystem Research Program and Annual Research Programs, the Distributed Biological Observatory (DBO), the Marine Biological Observation Network (MBON, which includes the Arctic AMBON), the Arctic Animal Telemetry Network, the Marine Arctic Ecosystem Study, and several other integrated multidisciplinary programs.

As in prior years, the EVOSTC GWA and HRM Programs and their teams used the Workspace as an internal staging area prior to public release of their project data. The Workspace provides users with an intuitive, web-based interface that allows program scientists to create “projects” representing particular scientific studies or focuses of research within the larger GWA and HRM efforts (Fig. 1).

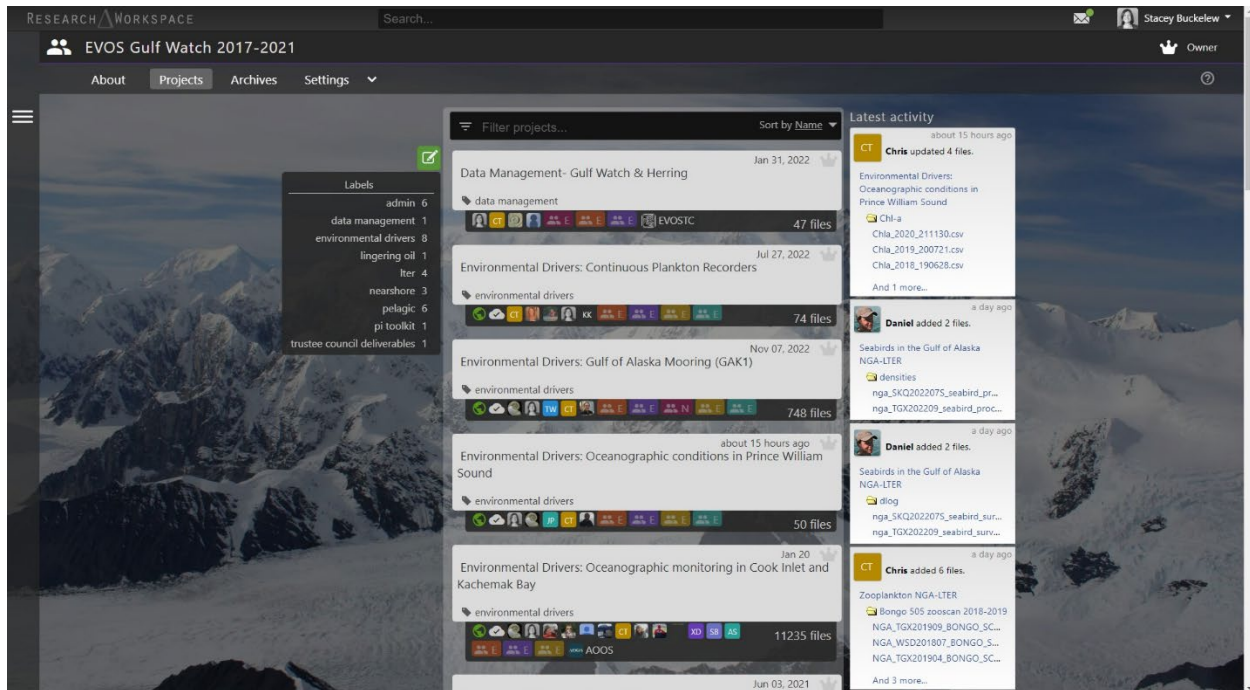


Figure 1. The overview page for the Gulf Watch Alaska campaign in the Research Workspace. The group is organized by individual projects, each of which contain ontological groupings of data files and products specific to those projects.

Within each project, users are able to create topical groupings of data using folders, and upload data along with contextual resources (e.g., documents, images and any other type of digital resource) to their project by simply dragging and dropping files from their desktop into their web-browser. Standard, discovery-level ISO 19115-2 compliant metadata can be generated for both projects and individual datasets using the integrated Metadata Editor within the Workspace, described in the next section. Users of the Workspace can be easily organized into campaigns, or groups (e.g., GWA and HRM), where everyone within a group can view the projects, folders, and files uploaded by other group members. This allows preliminary results and interpretations to be shared by geographically or scientifically diverse individuals working together on a project or program before the data are shared with the public. It also gives Program Leads and other stakeholders a transparent and front-row view of how users structured and described projects, and how their programs progressed through time. Version control for datasets is accomplished by tracking and providing access to past versions of datasets with the same file name.

The Metadata Editor

Properly describing and documenting the EVOSTC-collected datasets with metadata allows users to understand and track important details about the research. Additionally, metadata facilitates the search, retrieval, and ultimate reuse of data by a broader scientific community. A Metadata Editor is used to support the documentation of data and facilitate its accuracy and reuse, and allows for PIs to efficiently author standards-compliant metadata for both projects and individual files (Fig. 2). Content collected in the integrated Workspace Metadata Editor uses fields from the ISO 19115 suite of standards for geospatial metadata, which is the FGDC endorsed successor to the CSDGM, extended to describe taxonomic classification for biological datasets. To facilitate taxonomic descriptions, the Metadata Editor allows users to search the ~625,000 taxonomic entities of the Integrated Taxonomic Information System (ITIS) in order to rapidly add species information to metadata records. The Workspace, being a cloud-based service, permits researchers to move between computers during the metadata generation process in addition to allowing team members and administrators to simultaneously review and edit metadata in real time.

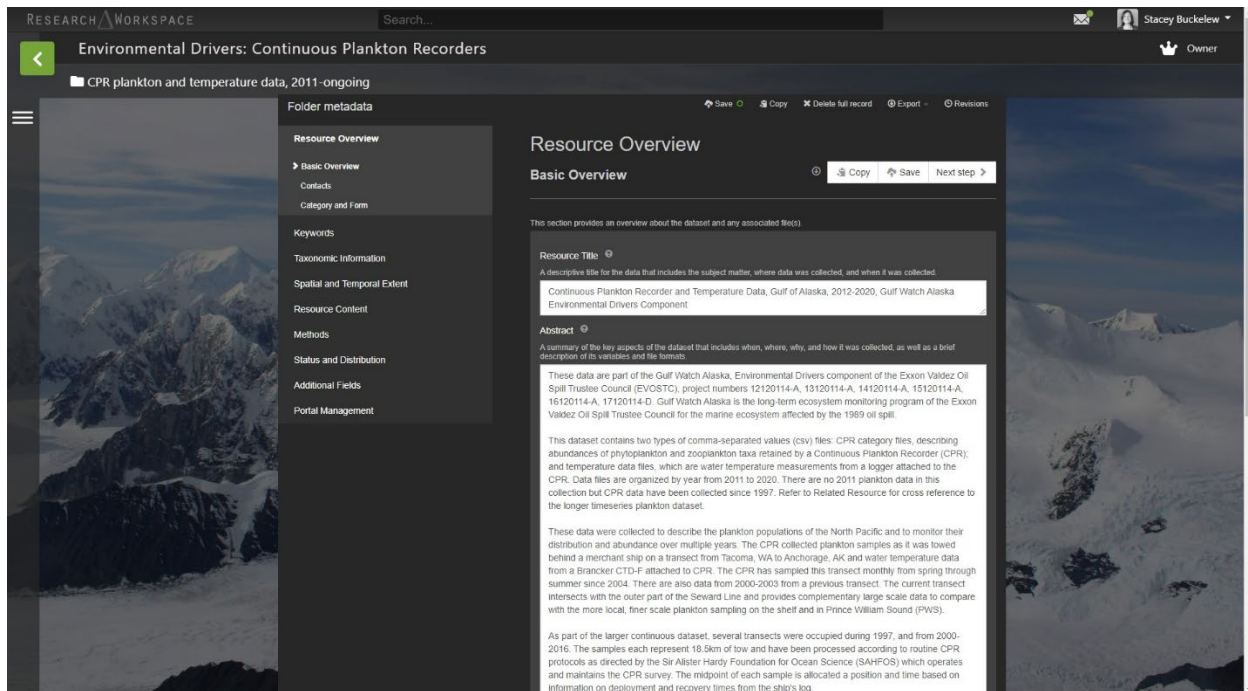


Figure 2. The Metadata Editor interface within the Research Workspace. The editor assists users in authoring robust, ISO standard-compliant metadata record alongside data objects.

Program-specific metadata templates developed for the EVOSTC project PIs include boilerplate information for fields that must contain program-wide metadata (e.g., access constraints, use constraints, and programmatic contact information). The templates were developed to help ease the metadata generation process through short, modular, and easily understood entry forms, and are intended to make metadata creation less cumbersome for PIs while standardizing the metadata across programs.

Metadata are typically generated at multiple points throughout the project lifecycle. At the onset of the project, high-level overview information about the project is documented, which includes the location, project timeline, contacts, keywords, taxonomic species, and expected data. As the project progresses and data are collected and moved through the QA/QC, processing, and analysis phases, more-descriptive metadata can be captured by the PI and the affiliated research teams. While the workflow for creating metadata may vary project-by-project, annual metadata revisions help to keep pace with new data submissions and any changes to the collection procedures. As project data mature, the completeness, content, and quality of the metadata record also matures to robustly describe the data and meet national format standards.

Technical Metadata Support

To facilitate metadata completeness, the Axiom data management workflow included technical support and oversight on metadata format and content throughout the project lifecycle. In-person meetings with project PIs were scheduled with the data management team at the annual meetings and through internet conferencing to discuss data submissions and metadata authoring progress.

The data management team also made available several tools to assist the PIs in authoring metadata, including written instructional materials, hands-on instruction in the Research Workspace, and a written-fillable and printable metadata questionnaire (as an alternative to using the integrated Metadata Editor). Metadata processes were put in place to ease the metadata authoring task required of the PIs and to help standardize the metadata formats across projects.

In the last phase of the metadata process, the data management team focused on quality control of the data and metadata, including data file formatting and documentation to ensure authoring meets best practices and accurately reflects data captured within individual data files. The quality control processes used the following steps:

- 1) a primary completeness check for required metadata fields and content, and subsequent correction by PI;
- 2) a secondary quality control check resulting in a list of any issues in the metadata that need be corrected by the PI; and
- 3) a final check for ISO-format validation after metadata quality issues have been addressed and before submitting the dataset(s) to a national archive or data repository.

Gulf of Alaska (GOA) Data Portal

After metadata were written to comply with content and quality requirements, the Workspace was then used as a gateway to efficiently publish data and associated metadata to a publicly-accessible data discovery portal supporting most of the EVOSTC programs and projects – the Gulf of Alaska (GOA) Data Portal (<https://gulf-of-alaska.portal.aos.org/>; Fig. 3). AOOS provides and maintains support for the GOA Data Portal, which has a customized public web interface that allows scientists, managers, and the general public to discover and download datasets collected through the EVOSTC GWA and HRM Programs as well as related datasets that already exist in the AOOS Data System. The portal uses the metadata and other contextual information from the Workspace to develop a series of search indexes utilizing a highly-scalable technology called Elastic Search. Elastic Search is a Java-based distributed indexing scheme that allows entire collections of documents, databases, and flat files to be indexed via several dimensions. When implemented, collections of information can be searched rapidly by spatial queries, time, text patterns, parameter, and taxonomy. This technology facilitates data discovery and access to information, metadata, and data using a Google-like search interface. Data are also discoverable through a catalog listing, that allows for spatial and temporal query filters and data download (Figs. 4 and 5).

The GOA Data Portal, on top of the other infrastructure available to this effort, provides a framework to rapidly deploy or edit the public-facing data catalogues of the GWA and HRM Programs using the Workspace as a secure point of entry.

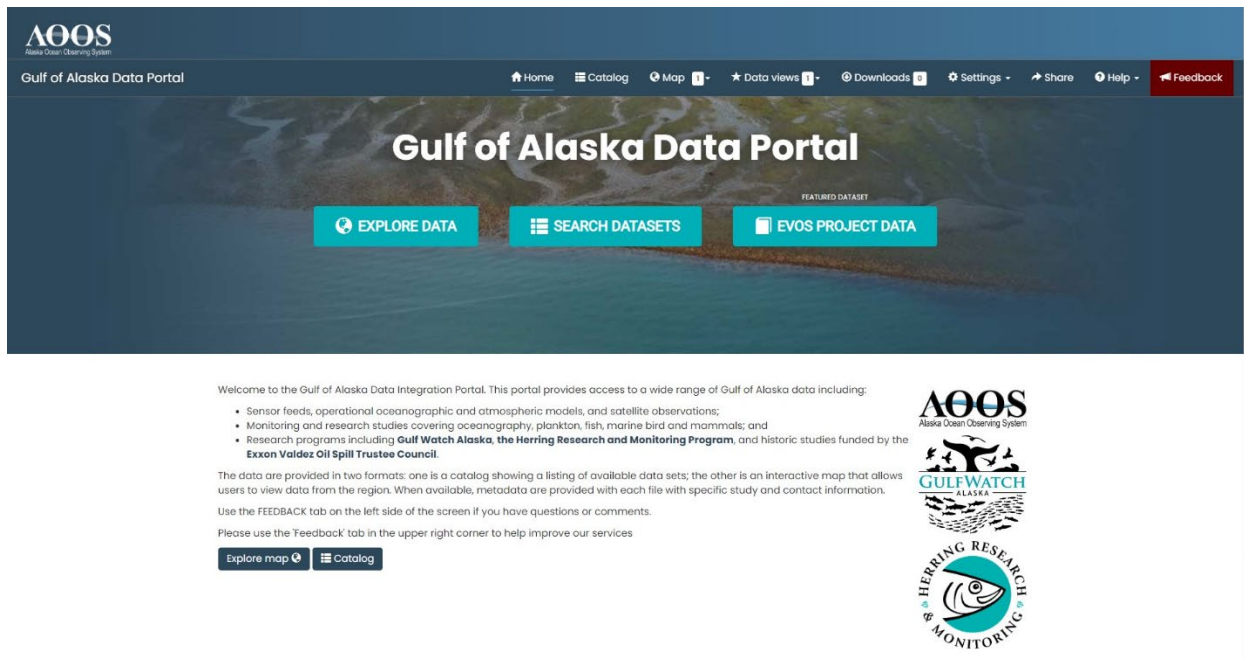


Figure 3. The overview page to the Gulf of Alaska Data Portal, which highlights the availability of information from the EVOSTC-funded GWA Program, HRM Program, Non-Program Projects, and historical study data.

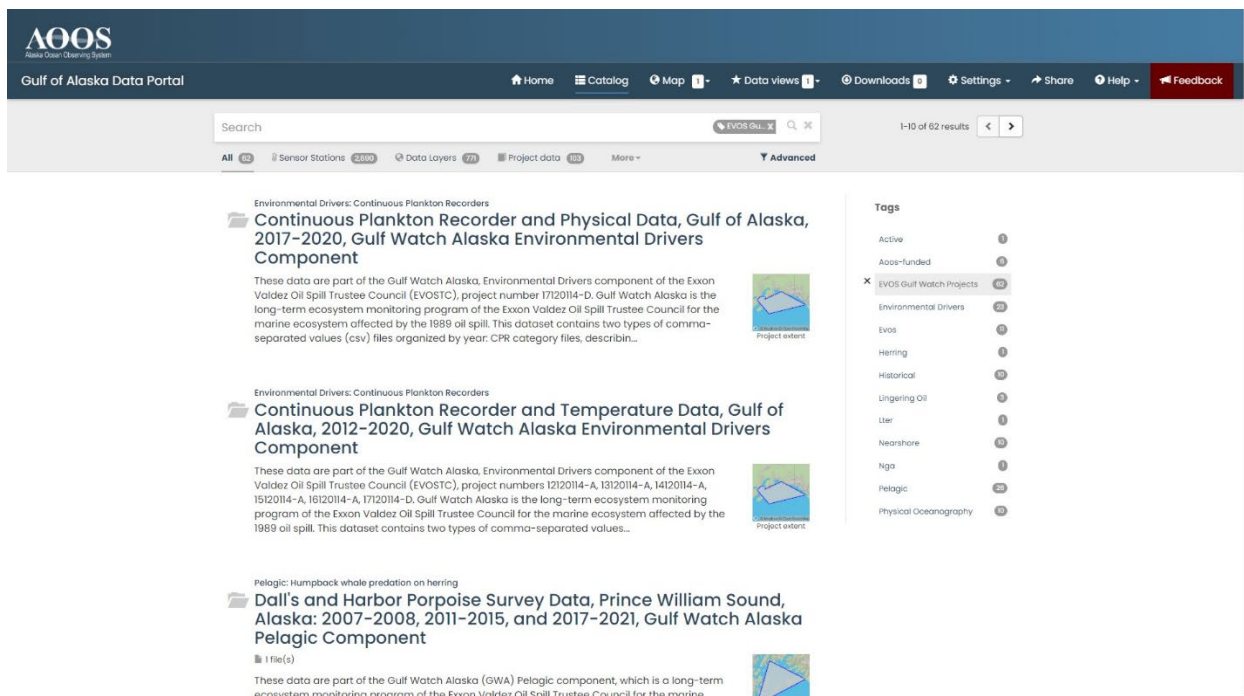


Figure 4. The catalog search interface where datasets within the portal can be searched. The catalog includes spatial and temporal filters and data download links.

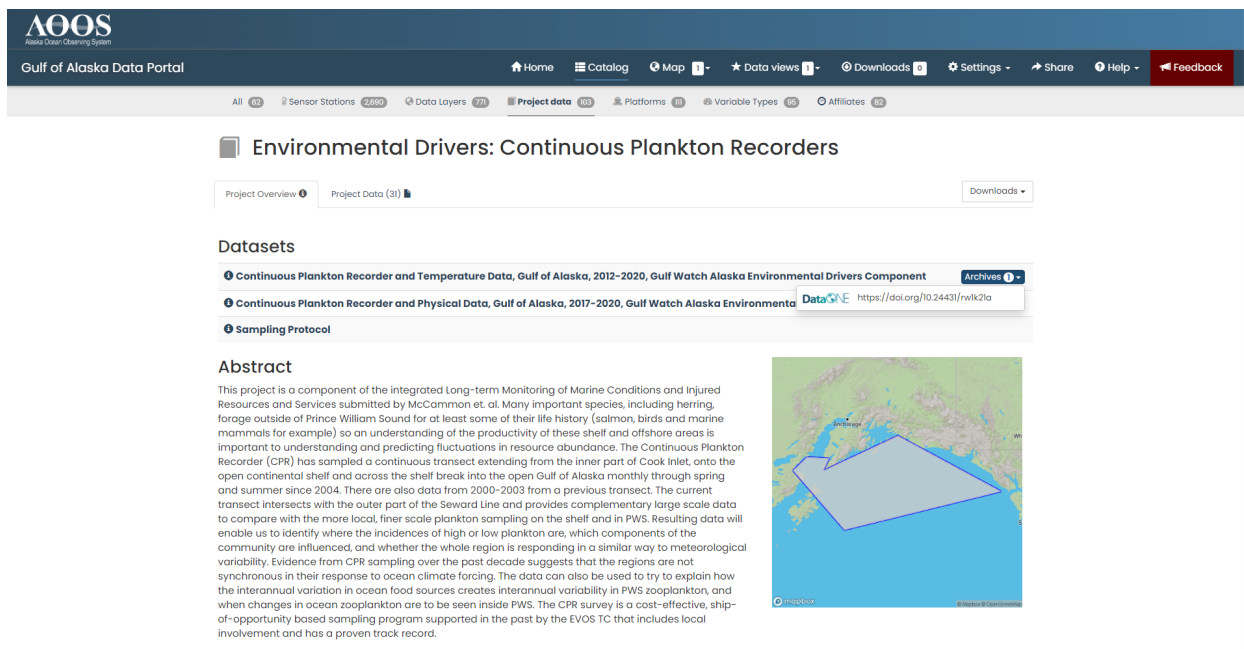


Figure 5. Screenshot of project data and metadata published from the Research Workspace into the Gulf of Alaska Data Portal. The digital object identifier (DOI) for the data is provided with a link to the archive at DataONE.

DataONE

To facilitate the long-term storage and public use of EVOSTC GWA and HRM Program as well as new EVOSTC NPP data, final data and metadata were submitted to DataONE (Data Observation Network for Earth). Founded in 2009, DataONE is a community-driven project providing access to data across multiple member repositories. It is a platform for innovative, collaborative environmental and ecological science programs to provide open, robust, persistent, and secure access to Earth observational data. DataONE links together existing cyberinfrastructure to provide a distributed framework that enables long-term preservation of diverse multi-discipline observational data. The distributed framework is composed of geographically distributed Member Nodes that provide resources for their own data and replicated data, and focus on serving their specific constituencies and diverse implementations. The Research Workspace is registered as a Member Node of the DataONE federation (<https://search.dataone.org/portals/RW>; Fig. 6).

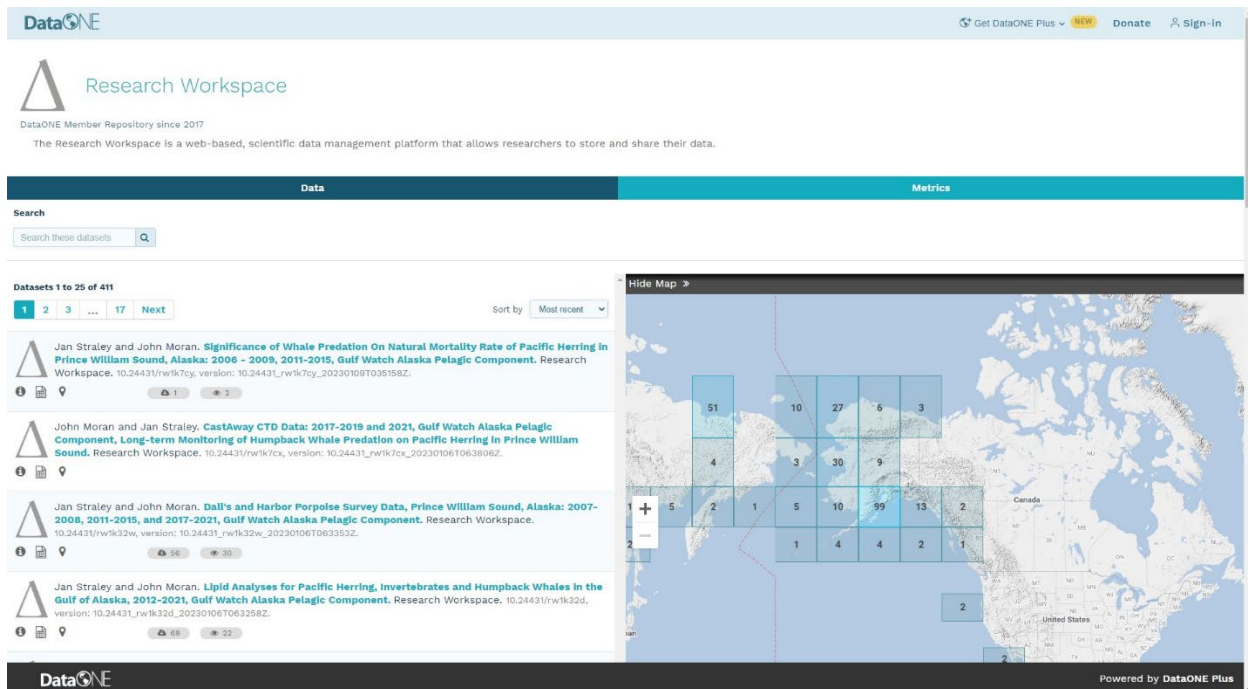


Figure 6. The Research Workspace Member Node at DataONE showcases archived data sets from across the EVOSTC-funded programs and projects.

RESULTS

Data management team members attended all the GWA and HRM program meetings where they presented progress made on data management tasks and objectives, received feedback on any recommended modifications to the data management approach and tools, provided PIs with ongoing training for data management tools, and coordinated one-on-one planning sessions for datasets to be delivered that year and beyond (Objective 6). The data management team also gathered feedback from PIs through group discussions and one-on-one meetings throughout the course of the program. This feedback was tracked and synthesized to identify what data management methods were 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.

Initial Data Assessment

At the start of the Data Management Program, the data management team-initiated services and oversight for EVOSTC GWA and HRM Program data-related activities (Objective 1). The AOOS-Axiom team convened data management meetings with the GWA and HRM Program Leads to discuss the program-level data management strategy, and to verify the list of funded

research projects. Additionally, the expectations for data management staff and program PIs were discussed and made explicit across the Program Leads and the data management team. Using information generated during the meeting, an inventory of data expected to be generated by EVOSTC GWA and HRM sampling efforts was adapted from the 2012-2016 efforts. This inventory described the datasets, indicated the investigator responsible for the data, and provided the status of metadata for each dataset (Appendix 1). This inventory was maintained and updated annually, and was reported to the Program Leads quarterly, as well as included in annual reports and workplans. The additional Objective 8 (to perform original Data Management Program Objectives 1-7 for newly-funded EVOSTC Non-Program projects) was implemented as new EVOSTC NPPs were onboarded to the Data Management Program (2020 and 2021).

Following the initial meetings with Program Leads and PIs, the data management team developed updated data management procedures to more efficiently guide project PIs through data documentation and curation throughout the lifetime of their projects and made them available through the Workspace. The data management team also updated the program-specific metadata templates for the PIs to use going forward with their projects.

Compliance with Data Sharing Protocols

In most cases, all projects within the GWA and HRM Programs met or exceed expectations for data sharing. Some projects were typically delayed annually due to late-in-year sampling schedules, longer sample processing times, and data processing delays. However, all were compliant and updated in a timely fashion to the Workspace. During the 2017-2021 Data Management Program, there were no unresolved data compliance issues, most of which were due to lab analysis delays or disruptions caused by the COVID-19 pandemic.

The Data Management Program continued to standardize and provide access to datasets from the first 5-year GWA and HRM efforts for continuity and integration (Objective 2). To maintain data continuity for internal files within the Workspace and build upon data management services from the first five-year effort (2012-2016), the folder structure for all GWA and HRM projects was updated to assist PIs in maintaining an organized approach for storing data and metadata for the 2017-2021 funding period. These new 2017 - 2021 data were stored in the Workplace alongside the data collected from 2012 - 2016 period for continued and easy access by the study teams. In August 2017, the EVOSTC staff and Science Panel members, depending on their affiliation, were also invited to the GWA and/or HRM Workspace groups for access to the data and to track how the data collection was progressing over time across both programs.

Data Management Infrastructure

During the 2017-2021 Data Management Program, several major data management system enhancements were completed to streamline and improve the performance of these systems to meet the Programs' needs, and to make data more easily discoverable and usable to a broader community of scientists, researchers, and decision-makers (Objectives 3 and 4). Enhancements conducted during the 2017-2021 funding cycle included automated data and metadata quality

assurance steps and completeness checks for metadata content and customized metadata entry forms based on data types and programmatic requirements. Continual adaptation of technology continued to keep pace with the volumes and diversity of data collected within the various EVOSTC programs, and the added functionality that was needed to provide connectivity among them.

The AOOS Data System

AOOS continued to support the Data Management Program efforts by hosting the GOA Data Portal through their operational data system. Information on the AOOS Data System and direct access to the flagship AOOS portal, the Ocean Data Explorer (ODE), can be found on the AOOS website (www.aoot.org). Access to other data portals (including the GOA Data Portal) can also be accessed through the AOOS website.

The Research Workspace (Workspace)

During the initial phase of the Data Management Program, the GWA and HRM Workspace groups were established for 20 projects, as well as 10 additional projects dedicated to aspects of program coordination and outreach (Objective 1). The Research Workspace was utilized consistently throughout the program duration as the internal location for file storage for data and program file sharing amongst PIs. Within six months of data collection, provisional data files were uploaded by PIs to the Workspace, which were then replaced with the final, quality reviewed files within 12 months post-collection. The exception being for zooplankton datasets, which typically have a longer laboratory processing component after field collection; in which case, these data were made available no more than two years after collection. As of December 2022, the Research Workspace houses over 1.9 million files and 11.1 TB of data from the GWA program, and over 33,000 files and 1.4 TB data from the HRM Program.

At the start of the 2017-2021 Data Management Program, Axiom hosted web-based Workspace user training to GWA PIs at the April 2017 spring PI meeting, and to both the GWA and HRM Program PIs at the in-person November 2017 PI meetings. This training included instruction on using the integrated Metadata Editor. The Workspace for the three Non-Program projects that were embedded in the Data Management Program starting in 2020 was managed similarly to the Workspace for the GWA and HRM Programs. Beyond the initial Workspace trainings offered to project PIs in the first year of the program, the data management team provided one-on-one assistance upon request or as new staff and new Non-Program projects came onboard. The GWA and HRM Programs and Non-Program project Workspace groups were password-protected to ensure data could be securely shared among study teams before they were ready for public release. Over the course of the entire program, the data management team continued to provide technical support to users and add new features to improve the Workspace capabilities and use by GWA and HRM PIs, and the new Non-Program project PIs. Axiom staff offered additional assistance throughout the Data Management Program via conference venues, webinars and support through email and in-person meetings, to help new PIs develop and improve their proficiency working in the Workspace (Objective 3).

Axiom staff introduced GWA and HRM team members to [Jupyter Notebooks](#), which is a cloud-based feature integrated into the Workspace that permits PIs to write numerical workflows and scripts in Python and R to leverage uploaded datasets as well as a library of public datasets. This allows computationally-intense scripts to be developed, shared, and run iteratively through the life of the project. This scripting environment was demonstrated to the GWA and HRM Program PIs by the data management team in 2017 and demonstrated a test-case using the Jupyter Notebooks scripting environment in the Workspace to create a reproducible workflow for analyzing GWA data. In 2019, Axiom staff hosted a half-day Jupyter Notebook Bootcamp during the Alaska Marine Science Symposium, which was designed to get researchers excited about using Jupyter Notebooks for reproducible analysis in the Workspace. The workshop included a hands-on demonstration of how to create and write a notebook that could analyze a simple dataset and create publication-ready plots. The workshop also instructed users how to start using this platform. Attendees were not required to have any experience prior to this workshop.

Software engineers at Axiom continued to provide support for the Workspace throughout the 2017-2021 program, which included resolving bugs and implementing new functionality in response to user feedback (Objectives 4 and 6). Below lists a few examples of some of the core enhancements made to the GWA and HRM Workspace campaigns:

- improved DataONE submission process & DOI generation,
- 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,
- 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, and
- added ability to download nested folder structures as zip files.

The Metadata Editor

Axiom supported revisions of the newly incorporated, ISO-compliant Metadata Editor based on usability feedback and also improved the connectivity between the Workspace and the GOA Data Portal for continuous datasets across funded efforts (Objectives 4 and 6). This included records of published resource identifiers (e.g., DOIs or accession numbers). In December 2016, the new Metadata Editor was released into the GWA and HRM Workspace campaigns. The new editor is more flexible and completely describes various dataset and project types. The new

editor also generates metadata in the ISO 19115 standards format that is necessary for preservation and publication in a DataONE Member Node. The new editor allows metadata creations at the folder level, which permits a simple way to describe a group of content as a single dataset (as opposed to having multiple redundant copies of metadata at the individual file level). It also streamlined the archive of long-term monitoring datasets with DataONE.

Throughout the Data Management Program, oversight of timely and organized data, metadata documentation, and other program documents to the Workspace occurred using a combination of data management personnel and technical infrastructure (Objective 3). The data inventory was used to track data and metadata submissions to the Workspace against data that were expected to be generated through the GWA and HRM program terms. Following these submissions, 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 records resulting in a list of issues in the metadata. The outcomes from these audits were communicated to the PIs and Axiom worked directly with them to implement any recommended changes before the dataset was considered final and ready for publication (Objective 7).

To further assist project PIs in proficiently and efficiently using the integrated Metadata Editor in the Workspace, Axiom staff offered a metadata authoring workshop at the January 2019 Alaska Marine Science Symposium conference venue. There, Axiom developed and hosted a half-day workshop entitled Metadata 411 that provided 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. The workshop included hands-on practice exercises using the Research Workspace's Metadata Editor. In addition, Axiom hosted a three-hour metadata "office hours" session at the conference venue, to respond to any metadata-related questions the PIs had, or to provide them with one-on-one assistance relative to their project datasets.

The 2017-2021 GWA Program generated 48 unique data collections, each of which are accompanied with robust metadata documentation to help ensure these datasets are understandable, discoverable, and reusable into the future. The HRM Program generated 8 unique data collections. A list of these metadata records and the location where they can be found in the Workspace and the digital object identifier (DOI) for access through DataONE are in Appendix 2. For continuity, a list of data sets archived following the 2016 to 2021 GWA and HRM programs that were not continued as monitoring projects in the 2017 to 2021 funding cycle are listed in Appendix 3.

The Gulf of Alaska Data Portal

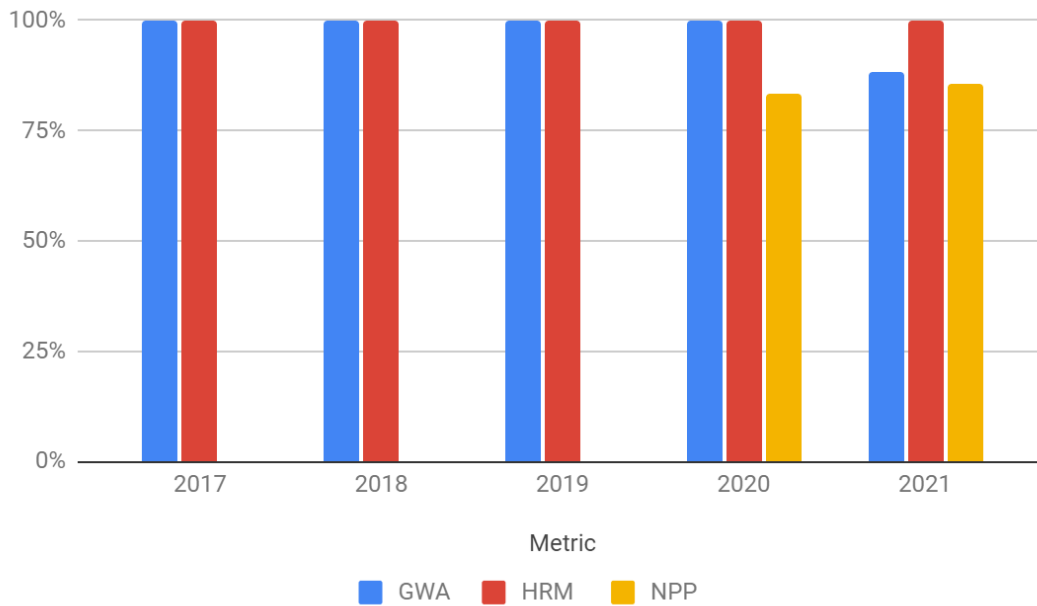
At the end of the 2012-2016 funding period, the completed data holdings from the 2012-2016 GWA and HRM programs were made publicly discoverable and citable through the GOA Data Portal, as well as being published and preserved with DataONE (Objective 5). The Data

Management team worked with GWA and HRM program PIs to finalize and publish any remaining lagged datasets from 2012-2016, which included datasets that typically have longer processing time, thus were delayed and not part of the initial 2012-2016 data archive. By September 2018, all outstanding 2012-2016 datasets were finalized, added to the Research Workspace, and made available through the GOA Data Portal.

During the 2017-2021 program, all project data sets for a given year ending in January were due to the Workspace by the following December 1 (e.g., project year 2020 data due to the Workspace by December 1, 2021, and December 1, 2022 for 2021 data, etc). Some datasets were routinely delayed due to longer sample processing times, data processing times, and late-in-the-year or delayed sampling schedules. Once PIs completed metadata writing for their respective 2017-2021 data and the metadata were reviewed and approved by Axiom, the data were published to the GOA Data Portal, making them available for research, management, and general audiences (Objective 5). As data providers, PIs had ultimate control for managing which data and supplemental documents were made publicly available. Within each project in the Workspace, PIs were able to publish data folders to the portal using a simple, clearly marked checkbox.

Axiom tracked and reported the status of data and metadata submissions to the Research Workspace and GOA Data Portal throughout the life of the program. The status was reported quarterly to GWA and HRM Program Leads and annually to the EVOSTC using the data inventory and summary statistics chart. Figure 7 shows a summary of the data inventory for the GWA, HRM, and NPPs, which was used to track the status of annual data submissions to the Workspace and the GOA Data Portal. All expected GWA, HRM, and NPP project data were submitted in a timely fashion according to the EVOSTC data sharing policy and made available for public access in the Gulf of Alaska Data Portal and DataONE archive with a few exceptions. Zooplankton data sets have a longer lab processing time and are not expected in final forms until two years after collection. For the GWA Program, the final 2021 zooplankton data are not expected until fall 2023, after which they will be made available in the Research Workspace, GOA Data Portal, and updated in the DataONE archive. For NPPs, provisional data are available in the Research Workspace and the Gulf of Alaska Data Portal. Those projects will be continuing beyond FY23 and are not required to archive final data until the end of the project term.

% project data in Research Workspace



% project data in Gulf of Alaska Data Portal

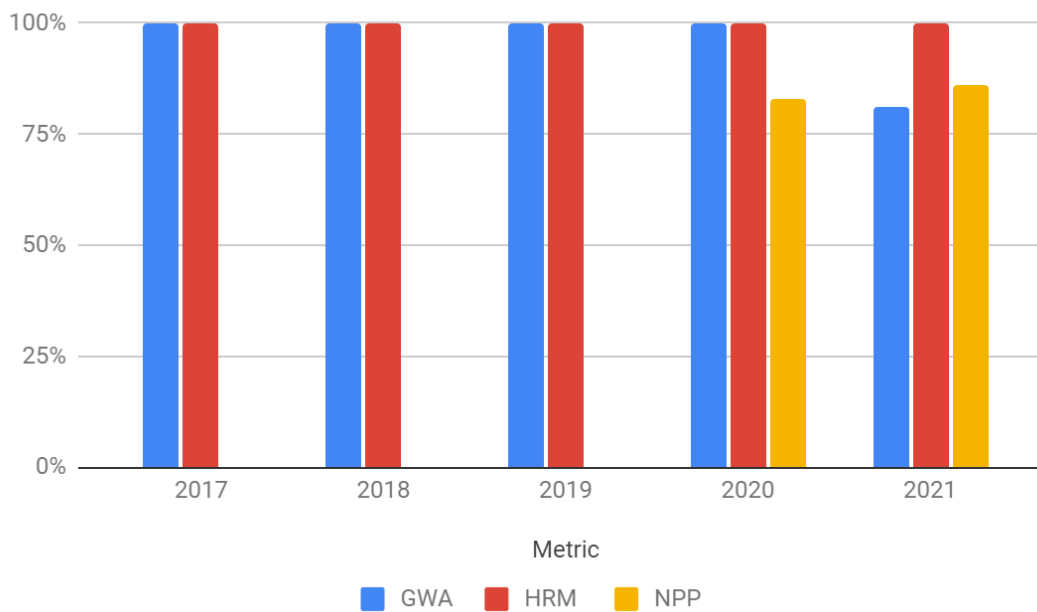


Figure 7. A summary of the data inventory used to track annual submissions of GWA, HRM, and NPPs data to the Research Workspace and the Gulf of Alaska (GOA) Data Portal. The figures show the percent of expected project data by program that have been shared within the Research Workspace and made publicly available in the GOA Data Portal.

In 2017, the data management team made a significant overhaul to the GOA Data Portal, which is a regional subset of AOOS's statewide ODE portal. The updated GOA Data 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 GOA Data Portal offers sophisticated charting abilities for data assets that can be visualized, allowing for comparisons between data sources within the portal, binning by time, and plotting of climatologies and anomalies. An example of the updated visualized GAK1 mooring data can be seen in Figure 8.

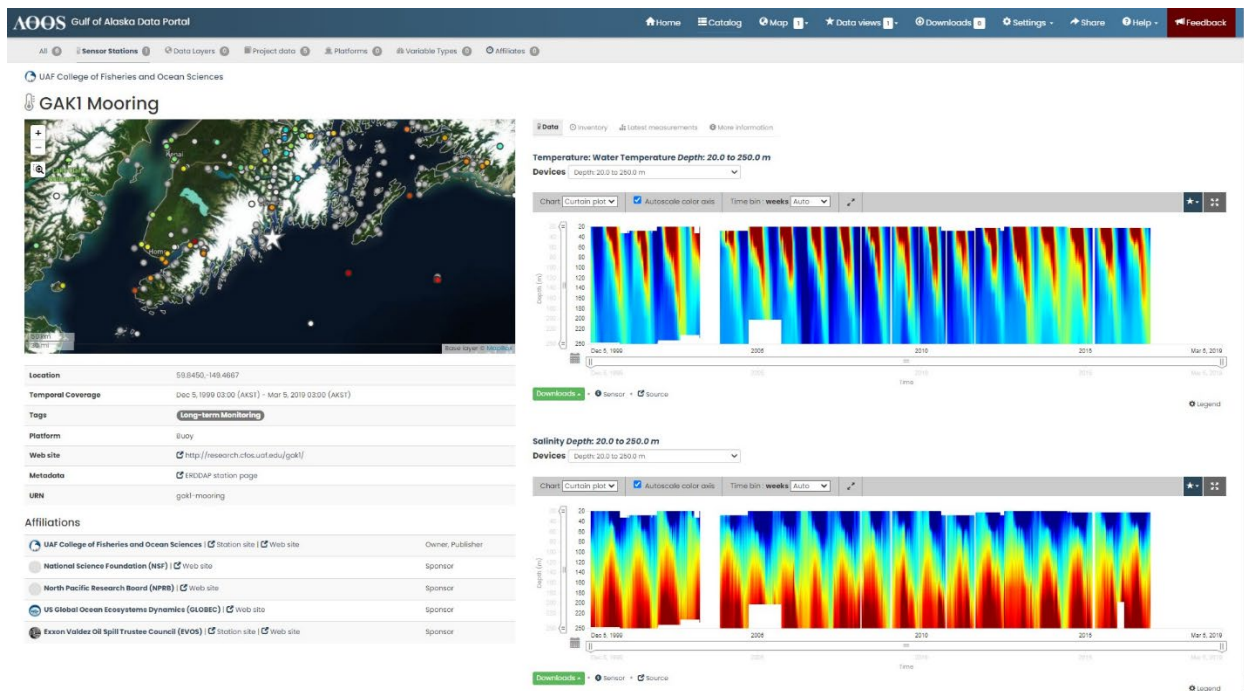


Figure 8. A screenshot of the GAK1 mooring data visualized in the ODE and GOA data portals. Data are presented as a time series of curtain plots displaying various ocean parameters by depth.

The Alaska Department of Fish and Game (ADF&G) herring fishery monitoring aerial survey data were also made publicly available for visual interaction and download within the GOA Data Portal. Users can map data layers for the entire data time series from 1973-present, 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. 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 (Fig. 9), herring biomass observations (total short tons) are mapped from 1974 to present.

A polygon is drawn over Hinchinbrook Island to create a histogram of the total tons of herring biomass from that time period.

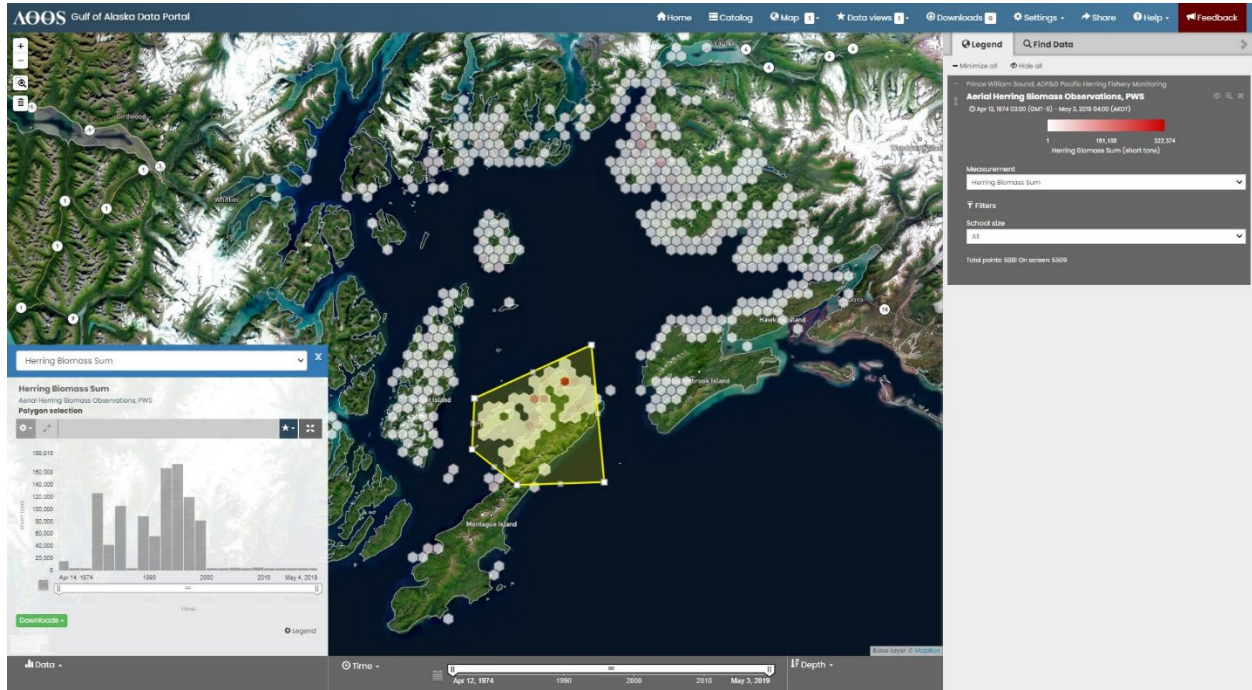


Figure 9. A screenshot of an interactive data map for ADF&G herring spawn data, 1973-present, available through the GOA Data Portal.

To expand EVOSTC-funded project data discovery avenues, Axiom also created a catalog listing of EVOSTC GWA and HRM data in the AOOS ODE, the main data discovery and visualization portal for AOOS. All GWA and HRM project datasets are now exposed in the AOOS ODE main data portal catalogue in addition to the GOA Data Portal. Adding the EVOSTC data to the AOOS ODE catalogue improves the public user success in finding EVOSTC data resources while searching the main AOOS Data System. The AOOS ODE Data Portal serves as both a data catalogue for accessing downloadable data files and a mapping and visualization tool for AOOS hosted data assets and was intended to support visualized data only for rapid data analyses, comparing data with other data types in the portal (data layering) and time series graphing. Much of the GWA and HRM data cannot be visualized on the ODE mapping tool, with some exceptions including the GAK1 Mooring data and the ADF&G Pacific Herring Fishery Monitoring data, which were visualized several years prior by AOOS. Visualization of any data comes with additional formatting and expense and was not part of the objectives requested by the EVOSTC during the 2017-2021 Data Management Program.

Benefits from statewide collaborations with other projects were demonstrated during January 2021 when the University of Alaska, Fairbanks (UAF) glider named “Shackleton” was outfitted

with an acoustic receiver to “listen” for acoustically tagged herring in Prince William Sound. Trial glider surveys, with assistance from HRM field efforts, were conducted in Prince William Sound as part of an AOOS supported program to use gliders for ecosystem assessments for fisheries management (AOOS EAFM Glider Project). The HRM Program, in collaboration with AOOS and UAF, tested the feasibility of using such gliders to detect tagged herring, and assisted with these pilot surveys. Real-time data from the glider was streamed to the GOA and ODE Data Portals for public access and data download (Fig. 10).

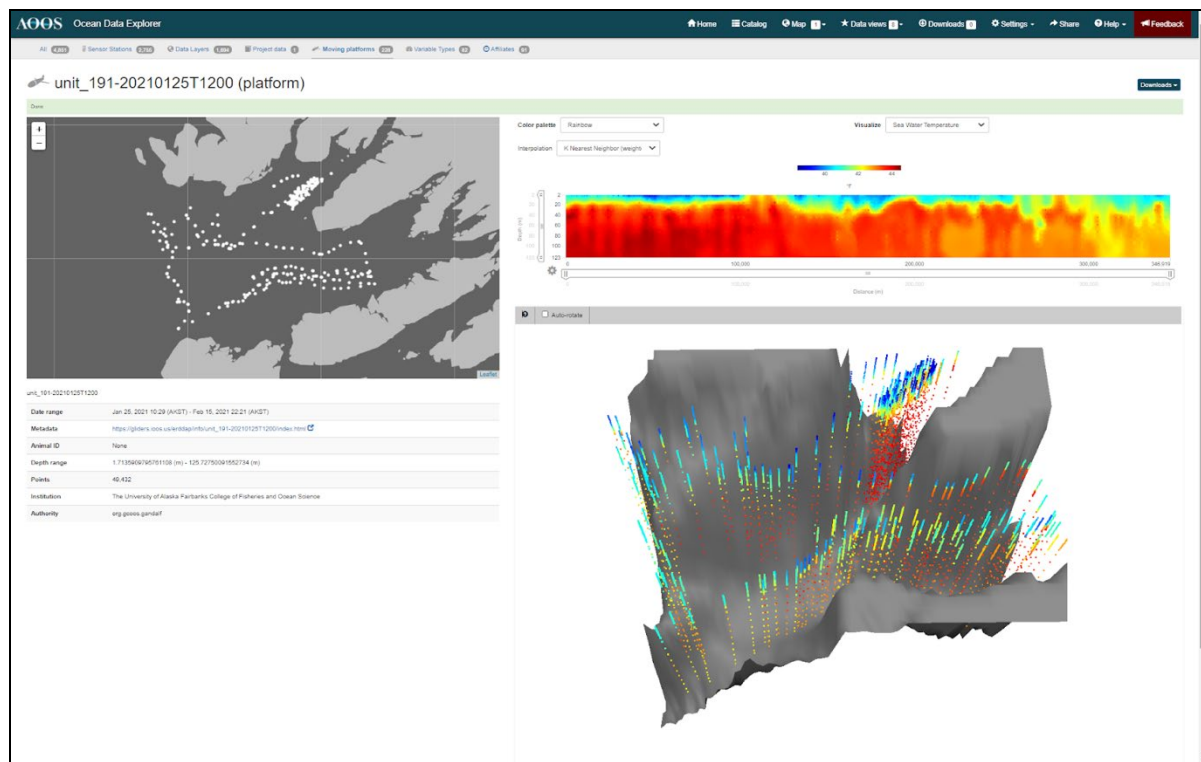


Figure 10. A screengrab of the underwater glider (“Shackleton”) real time data feed to the AOOS Data System. The data shown are from a Prince William Sound survey conducted during the winter 2021 herring tagging project.

DataONE

In June 2017, the Research Workspace (managed by Axiom) became the 41st Member Node in the DataONE Federation. The goal for becoming a DataONE Member Node was to satisfy the requirement of providing EVOSTC funded datasets to a public data repository center for long-term preservation and access (Objective 5). Being a Member Node simplifies the upload of content, generation of metadata and archive submission processes for the PI, while simultaneously providing transparency of program data management and archiving to the data managers, Program Leads, and funders. The technical pathway to DataONE was developed during the prior 2012-2016 GWA Program, and includes tools for metadata generation, archive package creation, and insertion into the DataONE data center. The automated data submission pathway from the Workspace was completed in 2017, when the Workspace became an official

DataONE Member Node. Being a Member Node not only allows PIs to automatically transfer data and metadata from the Workspace to DataONE for long-term preservation it also assigns a citable digital object identifier (DOI) to their data, allowing for discovery and legitimate reference by broader scientific audiences (Fig. 11).

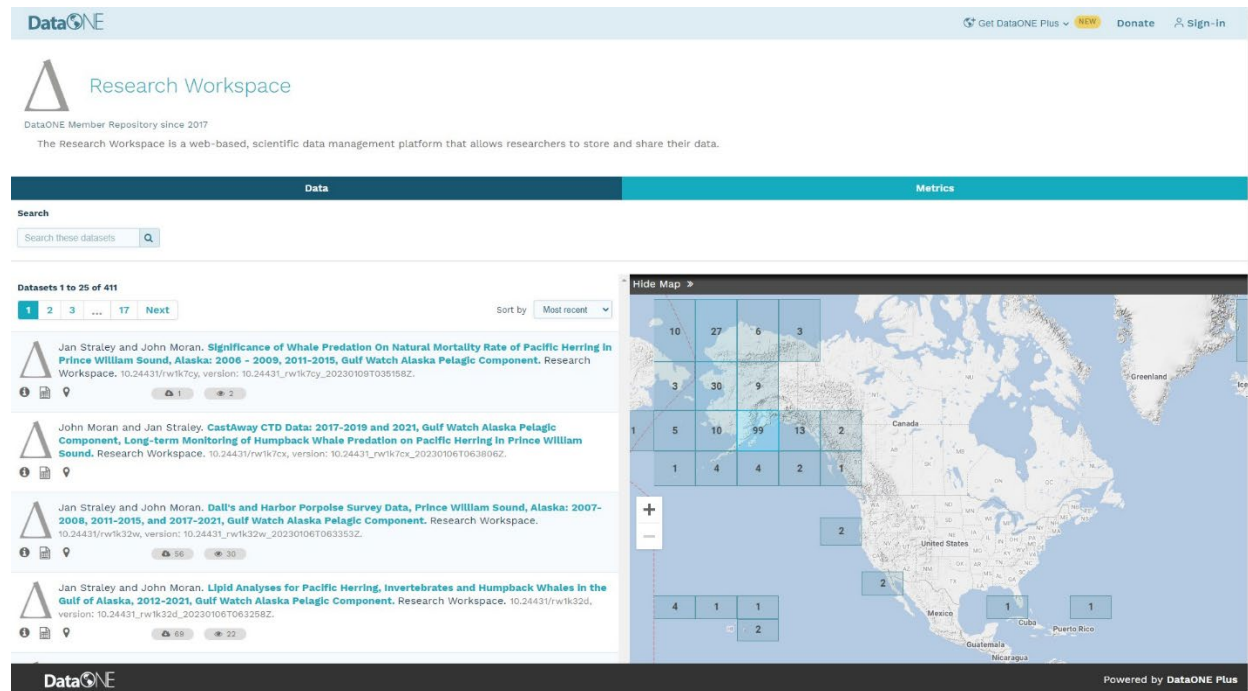


Figure 11. The search catalog for the Research Workspace DataONE Member Node which supports search and discovery of archived data sets from the EVOSTC-funded programs and projects.

Submissions of GWA and HRM data to the DataONE Member Node was a collaborative effort dependent upon the responsibilities of both the data management team at Axiom and the GWA and HRM PIs. After PIs uploaded final, quality-reviewed versions of their datasets into the Workspace, data management personnel reviewed data file content to verify that all expected data had been delivered, and then reviewed metadata generated by the PI for quality and completeness. Data management personnel then sent metadata review notes back to PIs documenting any further needs of the metadata for each dataset uploaded. After PIs had addressed the needs of their metadata, data management personnel reviewed the final metadata and then sent a Publication Agreement to PIs for them to authorize the readiness of the final data and metadata to DataONE. The final data were then submitted to DataONE for archive using the automated DataONE submission feature through the Workspace.

Axiom continued to work with DataONE to optimize the automated archive submission pathways and updated the final 2012-2016 datasets when the current cycle of improvements was tested and deployed. At the end of the 2012-2016 funding period, the existing (though incomplete) data holdings from the 2012-2016 GWA and HRM Programs were archived with

DataONE and made publicly discoverable and citable through the DataONE Search catalog: <https://search.dataone.org/portals/RW>. During 2017 and 2018, the Data Management team worked with GWA and HRM program PIs to finalize and publish any remaining lagged datasets from 2012-2016, which included datasets that typically have longer processing time, thus were delayed and not part of the initial 2012-2016 data archive submitted in 2016. By February 2018, all outstanding 2012-2016 datasets were finalized and added to the Research Workspace, and by early September 2018, these data were appended to the existing archived data packages in the DataONE Member Node for those respective projects. Additionally, minor metadata revisions were made to the DataONE archived resources for five additional datasets.

Axiom also worked with DataONE to inform updates to the front-end of the DataONE system to better support the more recent ISO 19115 metadata standard now available through the Workspace. This update improved how the GWA and HRM metadata and associated data citations are displayed within the DataONE Search Catalog.

A list of the datasets archived in the DataONE repository and replicated in the Research Workspace Member Node are listed in Appendix 2. These datasets are discoverable through DataONE Search (<https://search.dataone.org>), which is the default software for search and discovery of data and metadata within DataONE and are also discoverable directly through the Workspace DataONE Member Node. At the time of writing, DataONE provides access to nearly 1 million Earth observation dataset totaling nearly 83TB of data.

CONCLUSIONS

The Data Management Program provided data management support to the *Exxon Valdez* Oil Spill Trustees Council (EVOSTC) Gulf Watch Alaska (GWA) and Herring Research and Monitoring (HRM) Programs, and starting in 2020, to three additional EVOSTC Non-Program projects (NPPs), to ensure efficient organization, consolidation, and documentation of data collected for use by the study team as well for future use by the broader scientific and resource management communities. This work coordinated and shared costs with several existing data management projects that are parallel in scope to the data management needs of the EVOSTC GWA and HRM Programs and leveraged cyberinfrastructure and existing data management capacities of both the Alaska Ocean Observing System (AOOS) and Axiom Data Science technologies. The project supported data submission and organization, metadata generation, and data transfer among study teams to final publication and data preservation through a sophisticated data management system that utilized the Research Workspace as the main data hub for these actions. Axiom data managers, analysts, and domain-experts assisted project teams and quality reviewed metadata and data structure formats produced from program monitoring efforts. Project investigators (PIs) were advised in best practices for short-term and long-term data formats as well as metadata authoring throughout the project. Other forms of data analytics support were also provided to the PIs by the data management team using the sophisticated data infrastructure employed by AOOS and Axiom. Through regular data and metadata submission

tracking and engagement with PIs, the data management team helped to ensure that EVOSTC GWA and HRM Program projects and new Non-Program projects (NPPs) met their data sharing deliverables. Web-based tools to facilitate data discovery of the EVOSTC produced datasets included making the data searchable through the flagship AOOS Ocean Data Explorer catalogue in addition to the Gulf of Alaska (GOA) Data Portal. To ensure the long-term preservation of GWA and HRM Program and NPP data, final datasets and products were submitted to and published in the DataONE data repository, where they were assigned citable digital object identifiers (DOI) and can be discovered, accessed, and reused for retrospective analyses of the recovery of the spill-affected ecosystem as well as for future scientific assessments in the region.

ACKNOWLEDGEMENTS

These findings and conclusions presented by the author(s) are their own and do not necessarily reflect the views or position of the *Exxon Valdez* Oil Spill Trustee Council.

OTHER REFERENCES

This section includes EVOSTC reports, publicly available datasets, scientific presentations, and outreach associated with the project.

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Bochenek, R., S. Buckelew, S., W. Koeppen, and C. Turner. 2018. Data Management Support for the EVOSTC Long-Term Monitoring Program. Long-Term Monitoring Program (Gulf Watch Alaska) Final Report to the *Exxon Valdez* Oil Spill Trustee Council, project 16120114-D. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Janzen, C. D., S. Buckelew, and R. Bochenek. 2018. Data Management Program. Annual Report, Project 18120113. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Janzen, C. D., S. Buckelew, and R. Bochenek. 2019. Data Management Program. Annual Report, Project 19120113. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Janzen, C. D., S. Buckelew, and R. Bochenek. 2020. Data Management Program. Annual Report, Project 20120113. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska.

Publicly available datasets

AOOS Gulf of Alaska Data Portal: <https://gulf-of-alaska.portal.aos.org/>

DataONE Research Workspace Member Node: <https://search.dataone.org/portals/RW>

Outreach

Buckelew, S., I. Gill, and C. Turner. 2018. Metadata 411 workshop. Alaska Marine Science Symposium, January, Anchorage, AK.

Koeppen, W. 2018. Jupyter Notebook Bootcamp. Alaska Marine Science Symposium, January, Anchorage, AK.

Buckelew, S., A. Canino, I. Gill, and C. Turner. 2019. Metadata 411 workshop. Alaska Marine Science Symposium, January, Anchorage, AK.

APPENDIX 1. DATA INVENTORY.

Final data submission inventory of GWA, HRM, and NPP project data published through the Gulf of Alaska Data Portal at time of final report (February 2023). The numeric codes are: "2": Obligation to publish data has been met; "1" : Obligation to share data to Research Workspace has been met; "0": No project data has been shared; "n/a" : The project was not funded for that fiscal year and/or no sample collection occurred. *Data set with a longer post-processing period and final data are expected fall 2023.

| Program | Project | Dataset | 2017 | 2018 | 2019 | 2020 | 2021 |
|---------------------|--|--|------|------|------|------|------|
| GWA | Environmental drivers: Continuous Plankton Recorders | Plankton data | 2 | 2 | 2 | 2 | 0* |
| | | Temperature data | 2 | 2 | 2 | 2 | 0* |
| GWA | Environmental drivers: Gulf of Alaska Mooring (GAK1) | CTD data | 2 | 2 | 2 | 2 | 2 |
| | | Mooring data | 2 | 2 | 2 | 2 | 0* |
| GWA | Environmental Drivers: Oceanographic Conditions in Prince William Sound | Chlorophyll data | 2 | 2 | 2 | 2 | 2 |
| | | CTD data | 2 | 2 | 2 | 2 | 2 |
| | | Zooplankton data | 2 | 2 | 2 | 2 | 2 |
| GWA | Environmental Drivers: Oceanographic monitoring in Cook Inlet and Kachemak Bay | CTD data | 2 | 2 | 2 | 2 | 2 |
| | | KBNER meteorological data | 2 | 2 | 2 | 2 | 2 |
| | | KBNER nutrient data | 2 | 2 | 2 | 2 | 2 |
| | | KBNER water quality data | 2 | 2 | 2 | 2 | 2 |
| GWA | Environmental Drivers: Seward Line | Zooplankton data | 2 | 2 | 2 | n/a | 0* |
| | | Chlorophyll data | 2 | 2 | 2 | 2 | 1 |
| | | CTD data | 2 | 2 | 2 | 2 | 1 |
| | | Nutrient data | 2 | 2 | 2 | 2 | 1 |
| | | Seabird data (Kuletz) | 2 | 2 | 2 | 2 | 2 |
| GWA | Nearshore: Ecological trends in Kachemak Bay | Zooplankton data | 2 | 2 | 2 | 2 | 0* |
| | | Rocky intertidal community data | 2 | 2 | 2 | 2 | 2 |
| | | Mussel data | 2 | 2 | 2 | 2 | 2 |
| | | Rocky intertidal data | 2 | 2 | 2 | 2 | 2 |
| | | Substrate data | 2 | 2 | 2 | 2 | 2 |
| GWA | Nearshore: Intertidal Systems in Gulf of Alaska | Seagrass data | 2 | 2 | 2 | 2 | 2 |
| | | Oystercatcher diet & nest density data | 2 | 2 | 2 | 2 | 2 |
| | | Eelgrass data | 2 | n/a | n/a | n/a | n/a |
| | | Invertebrate and algae data | 2 | 2 | 2 | 2 | 2 |
| | | Marine birds and mammals data | 2 | 2 | 2 | 2 | 2 |
| | | Water quality data | 2 | 2 | 2 | 2 | 2 |
| | | Sea otter survey data | 2 | 2 | 2 | 2 | 2 |
| Sea otter scat data | 2 | 2 | 2 | 2 | 2 | | |

| Program | Project | Dataset | 2017 | 2018 | 2019 | 2020 | 2021 | | |
|--|--|--|---|---|------|------|------|-----|---|
| GWA | Pelagic: Fall and Winter seabird abundance | Seabird survey data | 2 | 2 | 2 | 2 | 2 | | |
| GWA | Pelagic: Forage fish distribution, abundance, and body condition | Forage fish count data | 2 | 2 | 2 | n/a | 2 | | |
| | | Forage fish morph data | 2 | 2 | 2 | n/a | 2 | | |
| | | Seabird diet data | 2 | 2 | 2 | n/a | 2 | | |
| | | Hydroacoustic data | 2 | 2 | 2 | n/a | 2 | | |
| | | Water chemistry (CTD & nutrients) data | 2 | 2 | 2 | n/a | 2 | | |
| | | Zooplankton data | 2 | 2 | 2 | n/a | 2 | | |
| GWA | Pelagic: Humpback whale predation on herring | Fluke id catalog | 2 | 2 | 2 | 2 | 2 | | |
| | | Energetic/stable isotope data | 2 | 2 | 2 | 2 | 2 | | |
| | | Whale survey data | 2 | 2 | 2 | n/a | 2 | | |
| | | Porpoise survey data | 2 | 2 | 2 | 2 | 2 | | |
| | | CTD data | 2 | 2 | 2 | n/a | 2 | | |
| GWA | Pelagic: Long-term killer whale monitoring | Acoustic catalog | 2 | 2 | 2 | 2 | 2 | | |
| | | Photo catalog | 2 | 2 | 2 | 2 | 2 | | |
| GWA | Pelagic: Prince William Sound Marine Birds | Summer bird survey data | n/a | 2 | n/a | n/a | n/a | | |
| HRM | ADFG Surveys: surveys and age, sex, and size collection | aerial biomass observation & routes data | 2 | 2 | 2 | 2 | 2 | | |
| | | aerial survey marine bird & mammal observations data | 2 | 2 | 2 | 2 | 2 | | |
| | | ASL data | 2 | 2 | 2 | 2 | 2 | | |
| HRM | Adult acoustic biomass surveys | processed acoustic data | 2 | 2 | 2 | 2 | 2 | | |
| | | biomass summary | 2 | 2 | 2 | 2 | 2 | | |
| HRM | Aerial surveys of juvenile herring | raw survey data | 2 | 2 | 2 | 2 | 2 | | |
| | | age 1 index | 2 | 2 | 2 | 2 | 2 | | |
| | | Herring disease program | prevalence summary | 2 | 2 | 2 | 2 | 2 | |
| HRM | Modeling and stock assessment of herring population dynamics in Prince William Sound | model codebase | 2 | 2 | 2 | 2 | 2 | | |
| | | Studies of reproductive maturity | age at maturity analysis (weight, length, gonad) database | 2 | 2 | n/a | n/a | n/a | |
| | | Annual herring migration cycle | collected fish data | 2 | 2 | 2 | 2 | 2 | |
| HRM | Lingering Oil: Immunological compromise of fish | genetic & lab-based experiments | 2 | 2 | 2 | 2 | 2 | | |
| | | NPP | Pigeon Guillemot (PIGU) Restoration Project | Annual PIGU Surveys on Naked Island Group and Control Group | n/a | n/a | n/a | 2 | 2 |
| | | | | Mink Surveys (bait stations, camera traps, track surveys) | n/a | n/a | n/a | 2 | 2 |
| Mink trapped on the Naked Island group (3 islands) | n/a | | | n/a | n/a | 0 | 0 | | |

| Program | Project | Dataset | 2017 | 2018 | 2019 | 2020 | 2021 |
|----------------|--|---|-------------|-------------|-------------|-------------|-------------|
| | | BLKW Productivity | n/a | n/a | n/a | 2 | 2 |
| NPP | Gulf Watch Ocean Acidification Monitoring | Physical data parameters (temp, salinity, dissolved O2) | n/a | n/a | n/a | 2 | 2 |
| | | Inorganic carbon chemistry data from LCI and PWS sampling transects | n/a | n/a | n/a | 2 | 2 |
| NPP | Status and trends of EVOS injured seabirds in the Kenai Peninsula Coast and Kachemak Bay | Marine bird observation | n/a | n/a | n/a | n/a | 2 |

APPENDIX 2. LIST OF 2017-2021 ARCHIVED DATA SETS.

Datasets generated by the GWA, HRM, and NPP Programs from 2017 to 2021 that are stored in the Research Workspace and made publicly available in the Gulf of Alaska Data Portal and archived in the DataONE repository with a digital object identifier (DOI) for long-term preservation. Note: The continuing Non-Program Projects were not finalized in this funding period and data will be archived upon completion.

| Project | PI | EVOSTC Project # | Resource Information | |
|--|------------------------------------|--------------------------|----------------------|---|
| Environmental drivers: Continuous Plankton Recorders | Clare Ostle, Sonia Batten | 17120114-D to 21120114-D | Citation: | Ostle, C. and Batten, S. (2023). Continuous Plankton Recorder and Temperature Data, Gulf of Alaska, 2011-2020, Gulf Watch Alaska Environmental Drivers Component. Dataset.10.24431/rw1k21a. |
| | | | Dataset content: | CPR Plankton category; temperature data |
| | | | Years: | 2012-2020 (plankton); 2011-2020 (temperature and physical data) |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k21a |
| Environmental drivers: Gulf of Alaska Mooring (GAK1) | Seth Danielson, Thomas Weingartner | 17120114-I to 21120114-I | Citation: | Danielson, S. (2019). Temperature and Salinity Timeseries data from the GAK1 Mooring, Seward, AK, 1998-2017. Gulf Watch Alaska Environmental Drivers Component. Dataset. |
| | | | Dataset content: | T,S,P data from the GAK1 Mooring |
| | | | Years: | 1998-2017 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32q |
| Environmental drivers: Gulf of Alaska Mooring (GAK1) | Seth Danielson, Thomas Weingartner | 17120114-I to 21120114-I | Citation: | Danielson, S. (2023). Temperature and Salinity time series data from the GAK1 Mooring, Seward, AK, 2017-2022. Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k44x |
| | | | Dataset content: | T,S,P data from the GAK1 Mooring |
| | | | Years: | 2017-2022 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k44x |
| Environmental drivers: Gulf of Alaska Mooring (GAK1) | Seth Danielson, Thomas Weingartner | 17120114-I to 21120114-I | Citation: | Danielson, S., Weingartner, T. (2019). CTD profile time series data from the GAK1 project, 2012-2016. Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k1b |
| | | | Dataset content: | CTD data |
| | | | Years: | 2012-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1b |
| Environmental drivers: Gulf of Alaska Mooring (GAK1) | Seth Danielson, Thomas Weingartner | 17120114-I to 21120114-I | Citation: | Hill, D. (2023). Coastal freshwater discharge simulations for the Gulf of Alaska, 1931-2021. Dataset. 10.24431/rw1k7d3 |
| | | | Dataset content: | Modeled freshwater discharge data |
| | | | Years: | 1931-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7d3 |
| Environmental Drivers: Oceanographic Conditions in | Rob Campbell | 17120114-G to 21120114-G | Citation: | Campbell, R. (2023). Oceanographic Conditions in Prince William Sound, CTD, Chlorophyll-a, and Zooplankton Data: 2013-2021, Gulf Watch Alaska Environmental Drivers Component. Dataset.10.24431/rw1k19. |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|--|--------------------------|----------------------|--|
| Prince William Sound | | | Dataset content: | Chl-a, CTD, zooplankton data |
| | | | Years: | 2013-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k19 |
| Environmental Drivers: Oceanographic monitoring in Cook Inlet and Kachemak Bay | Steve Baird, Jim Schloemer | 17120114-J to 21120114-J | Citation: | Baird, S. Guo, C. Schloemer, J. (2023). 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), 2012-2021, Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k21f |
| | | | Dataset content: | KBNERR meteorological, nutrient, and water quality data |
| | | | Years: | 2012-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k21f |
| Environmental Drivers: Oceanographic monitoring in Cook Inlet and Kachemak Bay | Kris Holderied, Martin Renner | 17120114-J to 21120114-J | Citation: | Holderied, K. Renner, M.(2023). Oceanographic Monitoring in Cook Inlet and Kachemak Bay, CTD Data, 2012-2021, Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k32v |
| | | | Dataset content: | CTD data |
| | | | Years: | 2012-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32v |
| Environmental Drivers: Oceanographic monitoring in Cook Inlet and Kachemak Bay | Kris Holderied, Jim Schloemer, Caitlin McKinstry | 17120114-J to 21120114-J | Citation: | Holderied, K., Schloemer, J., McKinstry, C. (2023). Oceanographic Monitoring in Cook Inlet and Kachemak Bay, Zooplankton Data, 2012-2019, Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k21g |
| | | | Dataset content: | Zooplankton category data |
| | | | Years: | 2012-2019 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k21g |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R., Clarke Hopcroft, C. (2019). Seward Line Conductivity, Temperature, and Depth (CTD) Data, 2012 to 2017, Gulf Watch Alaska Environmental Drivers Component. 10.24431/rw1k32m |
| | | | Dataset content: | CTD data |
| | | | Years: | 2012-2017 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32m |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Danielson, S., Dobbins, E. (2023). Water column properties measured by CTD sensors during seasonal cruises in the Gulf of Alaska for the Northern Gulf of Alaska LTER project, 2018-2021.. Dataset. 10.24431/rw1k459 |
| | | | Dataset content: | CTD measurements from all stations sampled by NGA LTER cruises. This includes and replaces the prior Seward Line CTD dataset and the GAK1 CTD dataset. |
| | | | Years: | 2018-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k459 |
| Environmental Drivers: Seward Line | Kathy Kuletz | 17120114-M to 21120114-M | Citation: | Kuletz, K. (2020). Seward Line and Lower Cook Inlet Marine Bird Survey Data, 2006-2017, Gulf Watch Alaska Nearshore Component. Dataset. 10.24431/rw1k1m |
| | | | Dataset content: | Seabird observation and processed density data |

| Project | PI | EVOSTC Project # | Resource Information | |
|------------------------------------|------------------|--------------------------|----------------------|---|
| | | | Years: | 2012-2017 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1m |
| Environmental Drivers: Seward Line | Kathy Kuletz | 17120114-M to 21120114-M | Citation: | Kuletz, K., Cushing, D., and Labunski, E. (2023). Marine bird survey observation and density data from Northern Gulf of Alaska LTER cruises, 2018-2021. Dataset.10.24431/rw1k45w |
| | | | Dataset content: | Seabird obs and processed densities from all LTER cruises. This dataset is the continuation of the prior seabirds dataset, with expanded sampling on all LTER cruises. |
| | | | Years: | 2018-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k45w |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R., Clarke Hopcroft, C. (2019). Seward Line zooplankton biomass and abundance data from Spring and Summer cruises aboard the Tiglax, 2012 to 2017, Gulf Watch Alaska Environmental Drivers component. Dataset. 10.24431/rw1k32j |
| | | | Dataset content: | Zooplankton data: multinet and calvet |
| | | | Years: | 2012-2017 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32j |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R. (2022). Zooplankton abundance and biomass observations obtained from the QuadNet, as analyzed by traditional microscopy, during seasonal cruises in the Northern Gulf of Alaska (NGA) LTER Program, 2018-2020. Dataset.10.24431/rw1k587 |
| | | | Dataset content: | zooplankton biomass and abundance. This dataset represents the expansion and continuation of the Seward Line zooplankton sampling by NGA LTER cruises. The 2021 data will be archived by September 2023. NGA LTER data has an archive deadline of 2 years from the end of the Spring-Fall field season in which it was collected. |
| | | | Years: | 2018-2020 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k587 |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R. (2023). Zooplankton abundance and biomass observations determined traditional microscopy, from Multinet samples collected during research cruises for the Northern Gulf of Alaska LTER site, 2018-2020. Dataset. 10.24431/rw1k591 |
| | | | Dataset content: | zooplankton biomass and abundance. This dataset represents the expansion and continuation of the Seward Line zooplankton sampling by NGA LTER cruises. The 2021 data will be archived by September 2023. NGA LTER data has an archive deadline of 2 years from the end of the Spring-Fall field season in which it was collected. |
| | | | Years: | 2018-2020 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k591 |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R. (2022). Gelatinous zooplankton abundance and biomass observations from methot nets on research cruises for the Northern Gulf of Alaska LTER site, 2018-2020. Dataset. 10.24431/rw1k58z. |
| | | | Dataset content: | zooplankton biomass and abundance. This dataset represents the expansion and continuation of the Seward Line zooplankton sampling by NGA LTER cruises. The 2021 data will be archived by September 2023. NGA LTER data has an archive deadline of 2 |

| Project | PI | EVOSTC Project # | Resource Information | |
|------------------------------------|---|--------------------------|----------------------|---|
| | | | | years from the end of the Spring-Fall field season in which it was collected. |
| | | | Years: | 2018-2020 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k58z |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Hopcroft, R. (2023). Zooplankton abundance observations collected from the 500 um Bongo Net, as analyzed by Zooscan, from research cruises for the Northern Gulf of Alaska LTER site, 2018-2019. Dataset.10.24431/rw1k7cz |
| | | | Dataset content: | zooplankton biomass and abundance. This dataset represents the expansion and continuation of the Seward Line zooplankton sampling by NGA LTER cruises. The 2021 data will be archived by September 2023. NGA LTER data has an archive deadline of 2 years from the end of the Spring-Fall field season in which it was collected. A problem was identified with the 2020 data that has delayed its publication. This will be published along with the 2021 data by September 2023. |
| | | | Years: | 2018-2019 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7cz |
| Environmental Drivers: Seward Line | Russell Hopcroft, Thomas Weingartner, Seth Danielson | 17120114-L to 21120114-L | Citation: | Hopcroft, R., Strom, S., Clarke Hopcroft, C. (2019). Prince William Sound Chlorophyll-A and Nutrient Data, 2012 to 2017, Gulf Watch Alaska Environmental Drivers Component. Dataset. 10.24431/rw1k1i |
| | | | Dataset content: | Chlorophyll and nutrient final data merged with CTD |
| | | | Years: | 2012-2017 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1i |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Strom, S., Fredrickson, K. (2023). Chlorophyll-a concentrations from research cruises for the Northern Gulf of Alaska (NGA) LTER site, 2018-2021. Dataset.10.24431/rw1k45f |
| | | | Dataset content: | Chl-a concentration data from NGA LTER cruises. This is a continuation and expansion of Seward Line chlorophyll data. |
| | | | Years: | 2018-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k45f |
| Environmental Drivers: Seward Line | Russell Hopcroft | 17120114-L to 21120114-L | Citation: | Aguilar-Islas, A., Kaufman, M. (2021). Dissolved inorganic nutrient data from stations sampled on NGA-LTER seasonal cruises, 2018-2020. Dataset. 10.24431/rw1k586 |
| | | | Dataset content: | Dissolved inorganic nutrient data from NGA LTER cruises. This is a continuation and expansion of Seward Line nutrient data. |
| | | | Years: | 2018-2020 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k586 |
| Nearshore Ecosystems | Heather Coletti, Jim Bodkin, Brenda Ballachy, Dan Monson, Dan Esler, Mandy Lindeberg, Tom Dean, Ben | 17120114-H to 21120114-H | Citation: | Katrin Iken and Brenda Konar. (2023) Long-term Monitoring of Ecological Communities in Kachemak Bay, 2012-2022, Gulf Watch Alaska Nearshore Component. Research Workspace. 10.24431/rw1k6cw, version: 10.24431_rw1k6cw_20221222T212743Z. |
| | | | Dataset content: | This dataset contains information about ecological communities in Kachemak Bay, Gulf of Alaska as collected by intertidal surveys conducted during spring 2012 to 2022. Following protocols established for Prince William Sound, surveys were conducted to document a range of communities and variables in Kachemak Bay, including the following: (1) infaunal clam populations at four |

| Project | PI | EVOSTC Project # | Resource Information | |
|----------------------|---|--------------------------|----------------------|---|
| | Weitzman, Kim Kloeker, George Esslinger | | | gravel beach sites; (2) limpet (<i>Lottia</i> spp) size-frequency distribution at rocky intertidal sites; (3) mussel (<i>Mytilus trossulus</i>) size-frequency distribution at three rocky intertidal sites (Port Graham, Outside Beach, and Cohen Island), expanded to six sites in 2015); (4) the percent cover of taxa in the kelp overstory, the percent cover of understory, and counts of individual taxa > 2 cm; (5) the percent cover of substrate categories according to the Wentworth classification scheme; (6) the density of sea stars and large anemones found along transects in the low intertidal, along a 30X1 m swath (= 30 m ²); (7) shoot density of seagrass (<i>Zostera marina</i>) at four sites; and (8) temperatures measured in the low intertidal zone of rocky shores. |
| | | | Years: | 2012-2022 |
| | | | DataONE Archive: | https://doi.org/10.24431/rw1k6cw |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Gulf Watch Alaska Nearshore Component: Black oystercatcher nest density and chick diets from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2006-2016. Dataset. 10.5066/F7WH2N5Q |
| | | | Dataset content: | Marine bird and mammal survey data collected in KATM, KBAY, and KEFJ beginning in 2006 (summer) or 2008 (winter) and ending in 2021; the archive includes data on summer and winter transects, species observations, and densities. This has been submitted and is working its way through the USGS archiving process now, with the expectation that the 201-2021 data will be visible in the archive in early March. |
| | | | Years: | 2006-2021 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F7WH2N5Q http://alaska.usgs.gov/portal/project.php?project_id=99 http://science.nature.nps.gov/im/units/swan/monitor/nearshore.cfm |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | USGS Alaska Science Center, National Park Service Southwest Alaska Inventory and Monitoring Network., 2018, Intertidal Soft-Sediment Bivalves from Prince William Sound, Kachemak Bay, Katmai National Park and Preserve, and Kenai Fjords National Park (ver. 2.0, September 2022): U.S. Geological Survey data release. 10.5066/F71834N0. |
| | | | Dataset content: | These data are part of the Gulf Watch Alaska (GWA) long-term monitoring program and describe bivalve count and size sampling and observations conducted at intertidal soft-sediment sampling sites in the northern Gulf of Alaska. This dataset consists of five comma separated files (.csv): 1) bivalve taxonomy table, 2) bivalve sampling site table, 3) bivalve count table, 4) bivalve size table, and 5) list of Gulf Watch Alaska principal investigators and collaborators. |
| | | | Years: | 2007-2021 |
| | | | USGS archive: | https://doi.org/10.5066/F71834N0 |
| Nearshore Ecosystems | Katrin Iken, Brenda Konar | 17120114-H to 21120114-H | Citation: | Katrin Iken and Brenda Konar. (2023) Long-term Monitoring of Ecological Communities in Kachemak Bay, 2012-2022, Gulf Watch Alaska Nearshore Component. Research Workspace. 10.24431/rw1k6cw. |
| | | | Dataset content: | <i>Lottia</i> , mussel, clam, community composition, substrate, swath, seagrass, and temperature logger data |
| | | | Years: | 2012-2022 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1o |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | USGS Alaska Science Center, National Park Service Southwest Alaska Inventory and Monitoring Network., 2016, Intertidal |

| Project | PI | EVOSTC Project # | Resource Information | |
|----------------------|-----------|--------------------------|----------------------|---|
| | | | | mussel (<i>Mytilus</i>) data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park (ver. 3.0, September 2022): U.S. Geological Survey data release, https://doi.org/10.5066/F7FN1498 . |
| | | | Dataset content: | Mussel bed data collected at study blocks in all four regions beginning in 2008 (KATM, KEFJ, and WPWS) or 2012 (KBAY) and ending in 2022; data for the KBAY region are archived with DataONE and the other regions are archived with the USGS data repository; the archives each include data on mussel bed sites and counts and sizes |
| | | | Years: | 2008-2022 |
| | | | USGS archive: | https://doi.org/10.5066/F7FN1498 |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | USGS Alaska Science Center, National Park Service Southwest Alaska Inventory and Monitoring Network., 2022, Rocky intertidal data from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park: U.S. Geological Survey data release, https://doi.org/10.5066/F7513WCB . |
| | | | Dataset content: | Rocky intertidal data collected at study blocks in each of the four regions; start dates for data collection vary between 2006 and 2020 and end in 2022; data for the KBAY region are archived with DataONE and the other regions are archived with the USGS data repository; the archives each include data on intertidal seaweed cover, motile invertebrates, limpets, and sea stars |
| | | | Years: | 2006-2022 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F7513WCB |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Kloecker, K. A. and Monson, D. H., 2020, Gulf Watch Alaska Nearshore Component: sea otter mortality age data from Katmai National Park and Preserve, Kenai Fjords National Park, and Prince William Sound, Alaska, 2006-2017: U.S. Geological Survey data release, https://doi.org/10.5066/F7H993CZ . |
| | | | Dataset content: | The data consist of information related to collection of sea otter carcasses. Collectors walked selected shorelines searching for signs of carcasses. Date, location, carcass condition, parts collected, and notes are all recorded. Specimens collected include: complete carcasses, whole skulls, bacula, mandible, teeth, whiskers, tissue. Selected shorelines are in Alaska and include locations in Katmai National Park and Preserve, Kenai Fjords National Park, and Prince William Sound. The time interval includes 2006-2017. |
| | | | Years: | 2006-2017 |
| | | | USGS archive: | https://doi.org/10.5066/F7H993CZ |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Kloecker, K. A. and Monson, D. H., 2017, Gulf Watch Alaska, Nearshore Monitoring Component: Sea Otter Foraging Observations from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park, 2012-2016: U.S. Geological Survey data release, https://doi.org/10.5066/F7N29V4R . |
| | | | Dataset content: | The data consists of observations made of foraging sea otters (<i>Enhydra lutris</i>). Observers used Questar field model spotting scopes and binoculars to identify prey. Date, local time, dive duration, success, prey type, prey size, prey number, handling time and surface time are all recorded. Sites are in Alaska and include locations in Katmai National Park and Preserve, Kenai Fjords National Park and Prince William Sound. The data in this file were collected 2012-2016. |
| | | | Years: | 2012-2016 |

| Project | PI | EVOSTC Project # | Resource Information | |
|----------------------|-----------|--------------------------|----------------------|--|
| | | | USGS archive: | https://doi.org/10.5066/F7N29V4R |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | USGS Alaska Science Center, National Park Service Southwest Alaska Inventory and Monitoring Network, University of Alaska Fairbanks., 2022, Sea otter spraint data from Kachemak Bay, Katmai National Park and Preserve, Kenai Fjords National Park and Prince William Sound: U.S. Geological Survey data release, https://doi.org/10.5066/P9EDM6NL . |
| | | | Dataset content: | This dataset consists of observations of sea otter (<i>Enhydra lutris</i>) fecal samples (spraint). Observers examined fresh spraint piles to identify major prey classes in the samples and to determine sea otter diets in the Gulf of Alaska region. |
| | | | Years: | 1979-2021 |
| | | | USGS archive: | https://doi.org/10.5066/P9EDM6NL |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., Weitzman, B. P. and Robinson, B. H., 2022, Sea otter aerial survey data from lower Cook Inlet, Alaska, 2017: U.S. Geological Survey data release, https://doi.org/10.5066/P9Q4DA3T . |
| | | | Dataset content: | This dataset consists of three tables related to abundance and distribution of northern sea otters (<i>Enhydra lutris kenyoni</i>) in lower Cook Inlet, Alaska, based on data collected during a series of population-wide aerial surveys in May 2017. The dataset consists of: (1) sea otter counts along strip transects, (2) sea otter counts in Intensive Search Unit (ISU) within the transects, and (3) Transect coordinates. |
| | | | Years: | 2017 |
| | | | USGS archive: | https://doi.org/10.5066/P9Q4DA3T |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., 2018, Gulf Watch Alaska Nearshore Component: sea otter aerial survey data from Katmai National Park and Preserve, 2008 - 2018 (ver. 2.0, March 2020): U.S. Geological Survey data release, https://doi.org/10.5066/F7930SG7 . |
| | | | Dataset content: | These data describe sea otter (<i>Enhydra lutris</i>) aerial survey observations from the waters around Katmai National Park and Preserve from surveys conducted in 2008, 2012, 2015, and 2018. Sea otters are a keystone predator, well known for structuring the nearshore marine ecosystem through their consumption of invertebrate prey. The dataset consists of 3 comma-delimited files (CSV) exported from Microsoft Excel. The data consists of (1) Strip transect counts, (2) Intensive Search Unit (ISU) counts, and (3) Transect coordinates. |
| | | | Years: | 2008-2018 |
| | | | USGS archive: | https://doi.org/10.5066/F7930SG7 |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., 2017, Gulf Watch Alaska Nearshore Component: Sea Otter Aerial Survey Data Kenai Fjords National Park, 2002-2016: U.S. Geological Survey data release, https://doi.org/10.5066/F7CJ8BN7 . |
| | | | Dataset content: | These data describe sea otter (<i>Enhydra lutris</i>) aerial survey observations from the waters around Kenai Fjords National Park between 2002 and 2016. Sea otters are a keystone predator, well known for structuring the nearshore marine ecosystem through their consumption of invertebrate prey. The dataset consists of 3 comma delimited files exported from Microsoft Excel. The data consists of 1. Strip transect counts, 2. Intensive Search Unit (ISU) counts, and 3. Transect coordinates. |
| | | | Years: | 2002-2016 |

| Project | PI | EVOSTC Project # | Resource Information | |
|----------------------|-----------|--------------------------|----------------------|---|
| | | | USGS archive: | https://doi.org/10.5066/F7CJ8BN7 |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., Weitzman, B. P. and Robinson, B. H., 2021, Sea otter aerial survey data from northern and eastern Prince William Sound, Alaska, 2014: U.S. Geological Survey data release, https://doi.org/10.5066/P9OG6SR5 . |
| | | | Dataset content: | This dataset consists of three tables related to abundance and distribution of northern sea otters (<i>Enhydra lutris kenyoni</i>) in northern and eastern Prince William Sound, Alaska, based on data collected during a series of population-wide aerial surveys in June 2014. The dataset consists of: (1) sea otter counts along strip transects, (2) sea otter counts in Intensive Search Unit (ISU) within the transects, and (3) Transect coordinates. |
| | | | Years: | 2014 |
| | | | USGS archive: | https://doi.org/10.5066/P9OG6SR5 |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., Monson, D. H. and Robinson, B. H., 2021, Sea otter aerial survey data from the outer Kenai Peninsula, Alaska, 2019: U.S. Geological Survey data release, https://doi.org/10.5066/P9TTJVBC . |
| | | | Dataset content: | This dataset consists of three tables related to abundance and distribution of northern sea otters (<i>Enhydra lutris kenyoni</i>) near the outer Kenai Peninsula, Alaska, based on data collected during a series of population-wide aerial surveys in June 2019. The dataset consists of: (1) sea otter counts along strip transects, (2) sea otter counts in Intensive Search Unit (ISU) within the transects, and (3) Transect coordinates. |
| | | | Years: | 2019 |
| | | | USGS archive: | https://doi.org/10.5066/P9TTJVBC |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Esslinger, G. G., Monson, D. H. and Robinson, B. H., 2021, Sea otter aerial survey data from Western Prince William Sound, Alaska, 2017: U.S. Geological Survey data release, https://doi.org/10.5066/P9KNKOG1 . |
| | | | Dataset content: | This dataset consists of three tables related to abundance and distribution of northern sea otters (<i>Enhydra lutris kenyoni</i>) in western Prince William Sound, Alaska, based on data collected during a series of population-wide aerial surveys in June 2017. The dataset consists of: (1) sea otter counts along strip transects, (2) sea otter counts in Intensive Search Unit (ISU) within the transects, and (3) Transect coordinates. |
| | | | Years: | 2017 |
| | | | USGS archive: | https://doi.org/10.5066/P9KNKOG1 |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Coletti, H. A. and Kloecker, K. A., 2017, Gulf Watch Alaska Nearshore Component: Marine Bird and Mammal Survey Data from Katmai National Park and Preserve and Kenai Fjords National Park, 2012-2016: U.S. Geological Survey data release, https://doi.org/10.5066/F7416V6H . |
| | | | Dataset content: | The data consists of date, time, latitude, longitude, species abbreviation, count, and behavior. This has been submitted and is working its way through the USGS archiving process now, with the expectation that the 201-2021 data will be visible in the archive in early March. |
| | | | Years: | 2012-2016 |
| | | | DataONE archive: | https://dx.doi.org/10.5066/F7416V6H |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | USGS Alaska Science Center, National Park Service Southwest Alaska Inventory and Monitoring Network, University of Alaska |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|---------------------------------|--------------------------|----------------------|--|
| | | | | Fairbanks College of Fisheries and Ocean Sciences., 2016, Intertidal Temperature Data from Kachemak Bay, Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park (ver. 3.0, August 2022): U.S. Geological Survey data release, https://doi.org/10.5066/F7WH2N3T . |
| | | | Dataset content: | This dataset consists of date, time, and temperature measurements from intertidal rocky sampling sites, including predicted tide height at the time of the reading, which is used to distinguish air from water temperature readings. The data are provided as comma separated values (.csv) files derived from data downloaded from HOBO temperature loggers. |
| | | | Years: | 2006-2022 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F7WH2N3T |
| Nearshore Ecosystems | See above | 17120114-H to 21120114-H | Citation: | Rider, M., Apeti, D.A., Jacob, A.P., Kimbrough, K.L., Davenport, E.D., Bower, M., Coletti, H.A., Esler, D. (2020). A Synthesis of Ten Years of Chemical Contaminant Monitoring Data in National Park Service - Southeast and Southwest Alaska Networks. Technical Memorandum. https://doi.org/10.25923/dbyq-7z17 |
| | | | Dataset content: | This report summarizes the contaminant results from marine sampling conducted between 2007 and 2018 by the National Park Service (NPS) Southeast Alaska Network (SEAN) and Southwest Alaska Network (SWAN) and their partners in association with the NOAA National Mussel Watch Program (MWP). |
| | | | Years: | 2007-2018 |
| | | | NOAAS archive: | https://doi.org/10.25923/dbyq-7z17 |
| Pelagic: Fall and Winter Seabird Abundance | Mary Anne Bishop, Anne Schaefer | 17120114-E to 21120114-E | Citation: | Bishop, M., Schaefer, A. (2023). Fall and Winter Seabird Abundance Data, Prince William Sound, 2007-2021, Gulf Watch Alaska Pelagic Component. Dataset. 10.24431/rw1k32x |
| | | | Dataset content: | Seabird survey data from fall and winter |
| | | | Years: | 2007-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32x |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Citation: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Forage Fish Size, Age, and Energy Density Data from Prince William Sound, Alaska |
| | | | Years: | 2012-2019 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Citation: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Marine Bird and Mammal Survey Data from Prince William Sound, Alaska |
| | | | Years: | 2012-13; 2015-2019 |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|-----------------|--------------------------|----------------------|--|
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Metadata title: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Conductivity, Temperature, Depth Profile Data from Prince William Sound, Alaska |
| | | | Years: | 2012-2019 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Metadata title: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Zooplankton hydroacoustic and biomass data |
| | | | Years: | 2012-2019 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Metadata title: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Nutrient Depth Profile Data from Prince William Sound, Alaska |
| | | | Years: | 2012-2019 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Metadata title: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Forage Fish Catch and Morphology Data from Prince William Sound, Alaska |
| | | | Years: | 2012-2015 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Forage Fish Distribution, Abundance, and Body Condition | Mayumi Arimitsu | 17120114-C to 21120114-C | Citation: | Arimitsu, M. L., Piatt, J. F., Heflin, B. and Marsteller, C. E., 2017, Gulf Watch Alaska - Pelagic Ecosystems Forage Fish Component - data from Prince William Sound: distribution, abundance, and morphology of fish, zooplankton, and predators and oceanographic Conditions (ver. 2.0, February 2021): U.S. Geological Survey data release, https://doi.org/10.5066/F74J0C9Z . |
| | | | Dataset content: | Hydroacoustic Survey Data from Prince William Sound, Alaska |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|-------------------------|--------------------------|----------------------|---|
| | | | Years: | 2013-2015 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F74J0C9Z |
| Pelagic: Humpback Whale Predation on Herring | John Moran, Jan Straley | 17120114-O to 21120114-O | Citation: | Straley, J., Moran, J. (2023). Lipid Analyses for Pacific Herring, Invertebrates and Humpback Whales in the Gulf of Alaska, 2012-2021, Gulf Watch Alaska Pelagic Component. Dataset. 10.24431/rw1k32d |
| | | | Dataset content: | Marine mammal and prey lipid database |
| | | | Years: | 2012-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32d |
| Pelagic: Humpback Whale Predation on Herring | John Moran, Jan Straley | 17120114-O to 21120114-O | Citation: | Moran, J., Straley, J. (2023) Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in Prince William Sound, Alaska: 2006 - 2009, 2011-2021, Gulf Watch Alaska Pelagic Component 10.24431/rw1k7cy |
| | | | Dataset content: | Whale survey database |
| | | | Years: | 2006 - 2009, 2011-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7cy |
| Pelagic: Humpback Whale Predation on Herring | John Moran, Jan Straley | 17120114-O to 21120114-O | Citation: | Straley, J., Moran, J. (2023). Dall's and Harbor Porpoise Survey Data, Prince William Sound, Alaska: 2007-2008, 2011-2015, and 2017-2021. Gulf Watch Alaska Pelagic Component. Dataset. 10.24431/rw1k32w |
| | | | Dataset content: | Porpoise observation data |
| | | | Years: | 2007-2008, 2011-2015, and 2017-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32w |
| Pelagic: Humpback Whale Predation on Herring | John Moran, Jan Straley | 17120114-O to 21120114-O | Citation: | Moran, J., Straley, J. (2023). CastAway CTD Data: 2017-2019 and 2021, Gulf Watch Alaska Pelagic Component, Long-term Monitoring of Humpback Whale Predation on Pacific Herring in Prince William Sound. Dataset. 10.24431/rw1k7cx |
| | | | Dataset content: | CTD data |
| | | | Years: | 2017-2019 and 2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7cx |
| Pelagic: Long-term Killer Whale Monitoring | Craig Matkin | 17120114-N to 21120114-N | Citation: | Matkin, C., Olsen, D. (2023). Acoustic Recordings of Killer Whales in Prince William Sound and Kenai Fjords, 2012-2021, Gulf Watch Alaska Pelagic Component. Dataset. 10.24431/rw1k32s |
| | | | Dataset content: | Acoustic data and catalog |
| | | | Years: | 2012-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32s |
| Pelagic: Long-term Killer Whale Monitoring | Craig Matkin | 17120114-N to 21120114-N | Citation: | Matkin, C., Olsen, D. (2019). Kenai Fjords and Prince William Sound Long-Term Photographic Monitoring of Killer Whales, 2012-2016, Gulf Watch Alaska Pelagic Component. Dataset. 10.24431/rw1k1s |
| | | | Dataset content: | Photo summary and catalog. Images included in archive through 2016, then available through Gulf of Alaska data portal as size became prohibitive for archiving. |
| | | | Years: | 2012-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1s |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|----------------------------|--------------------------|----------------------|--|
| Pelagic: Prince William Sound Marine Birds | Robert Kaler, Kathy Kuletz | 17120114-M to 21120114-M | Citation: | Kaler, R., Kuletz, K. (2023). Prince William Sound Marine Bird Surveys, July 2012 to 2018, Gulf Watch Alaska Pelagic Component. Dataset.10.24431/rw1k21k |
| | | | Dataset content: | Seabird survey data for summer and environmental data |
| | | | Years: | 2012-2018 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k21k |

Herring Research and Monitoring

| Project Name | PI | Project # | Resource Information | |
|---|---------------------|-----------------------------------|----------------------|---|
| ADFG Surveys: aerial survey, biomass age sex length, spawn | Jennifer Morella | 17120111-F to 21120111-F | Citation: | Morella, J. (2023). Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska, 1973-2021. Dataset. 10.24431/rw1k440 |
| | | | Dataset content: | aerial spawn observation data, aerial survey routes |
| | | | Years: | 1973-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k440 |
| ADFG Surveys: aerial survey, biomass age sex length, spawn | Jennifer Morella | 17120111-F to 21120111-F | Citation: | Morella, J. (2023). Age-Sex-Length-Weight data for Pacific Herring in Prince William Sound, Alaska, 2014-2021. Dataset. 10.24431/rw1k441 |
| | | | Dataset content: | age-sex-weight-length (ASWL) data and scale growth data |
| | | | Years: | 2008-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k441 |
| ADFG Surveys: aerial survey, biomass age sex length, spawn | Jennifer Morella | 17120111-F to 21120111-F | Citation: | Morella, J. (2023). Aerial survey observations of Pacific herring biomass, marine birds, and marine mammals in Prince William Sound, Alaska, 2008-2021. 10.24431/rw1k43z |
| | | | Dataset content: | aerial biomass observation data, aerial spawn data, aerial survey marine bird observations, aerial survey marine mammal observations |
| | | | Years: | 2008-2022 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k43z |
| Adult biomass surveys | Peter Rand | 17120111-G to 21120111- G | Citation: | Rand, P. (2023). Adult Herring Biomass Survey Data, Prince William Sound, 2012-2021, EVOS Herring Program. /10.24431/rw1k7d2 |
| | | | Dataset content: | raw & processed acoustic files; herring biomass summary |
| | | | Years: | 2000-2016 (raw); 2012-2021 (processed) |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7d2 |
| Aerial surveys of juvenile herring | Scott Pegau | 16120111-O/ 10100132-F | Citation: | Pegau, S. (2023). Aerial surveys of juvenile herring, Prince William Sound, 2010-2021, EVOS Herring Program. 10.24431/rw1k111 |
| | | | Dataset content: | raw & processed aerial; survey files; age 1 index summary |
| | | | Years: | 2010-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k111 |
| Herring disease program | Paul Hershberger | 17120111-E, to 216120111- E | Citation: | Hershberger, P. (2023). Herring Infections Prevalence Data, 2007-2021, EVOS Herring Program. Dataset. 10.24431/rw1k32b |
| | | | Dataset content: | disease prevalence summary |
| | | | Years: | 2007-2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32b |
| Meta-analysis of global herring population dynamics | Trevor Branch | 17120111-C to 21120111- C | Citation: | Joshua Zahner, Trevor Branch. (2023). Ovec8hkin/pws-herring-basa: 2023 Model (Version v2022). Zenodo. https://doi.org/10.5281/zenodo.7637590 |
| | | | Dataset content: | ASA model codebase, input and output data files. This project was transitioned from being archived as a dataset to archived as a software project. Now, the github repo for the project has been archived and will be updated whenever new code is committed. |

| Project Name | PI | Project # | Resource Information | |
|---|------------------|--------------------------|----------------------|--|
| | | | Years: | 2023 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1t |
| Annual herring migration cycle | Mary Anne Bishop | 17120111-B to 21120111-B | Citation: | Bishop, M., Gallenberg, E. (2023). Annual Herring Migration Cycle, Prince William Sound Alaska, April 2017- April 2022. Dataset. 10.24431/rw1k21i |
| | | | Dataset content: | herring telemetry tag log and detection data |
| | | | Years: | 2017-2022 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k21i |
| Immunological compromise of fish/Herring Genetics | Kristen Gorman | 17170111-D to 19170111-D | Citation: | Gorman, K. (2023). Studies of reproductive maturity among age cohorts of Pacific Herring in Prince William Sound, 2017-2019, EVOS Herring Program. Dataset. 10.24431/rw1k7d4 |
| | | | Dataset content: | herring collection, scale growth, histology, and lab studies |
| | | | Years: | 2017-2019 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7d4 |
| Immunological compromise of fish/Herring Genetics | Andrew Whitehead | 17170115 to 21170115 | Citation: | The data have been deposited with links to BioProject accession number PRJEB27171 in the NCBI BioProject database (https://www.ncbi.nlm.nih.gov/bioproject/). |
| | | | Dataset content: | Whole genome resequencing to study population genomic change through space (California to Alaska) and time (1991 to 2017) for Pacific herring (<i>Clupea pallasii</i>) |
| | | | Years: | 2017-2021 |
| | | | DataONE archive: | n/a |

Non-Program Projects

| Project Name | PI | Project # | Resource Information | |
|------------------------------|--------------|----------------------|----------------------|--|
| Ocean Acidification Sampling | Jeff Hetrick | 20200127 to 22200127 | Citation: | Hetrick, J. (2023). Ocean acidification in the Gulf of Alaska: dissolved inorganic carbon sampling from cruises in 2020. Dataset. 10.24431/rw1k7dj |
| | | | Dataset content: | dissolved inorganic carbon samples from several sampling sights |
| | | | Years: | 2020 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7dj |
| Ocean Acidification Sampling | Jeff Hetrick | 20200127 to 22200127 | Citation: | Hetrick, J. (2023). Ocean acidification in the Gulf of Alaska: dissolved inorganic carbon sampling from cruises in 2021. Dataset. 10.24431/rw1k7di |
| | | | Dataset content: | dissolved inorganic carbon samples from several sampling sights |
| | | | Years: | 2021 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7di |

APPENDIX 3. LIST OF 2012-2016 PREVIOUSLY ARCHIVED DATA SETS.

Datasets generated by GWA and HRM programs from the 2012 to 2016 that are stored in the Research Workspace, and made publicly available in the Gulf of Alaska Data Portal and archived in the DataONE repository with a digital object identifier (DOI) for long-term preservation. Note: this list does not include monitoring projects that continued in the 2017 to 2021 funding cycle (see Appendix 2).

| Project | PI | EVOSTC Project # | Resource Information | |
|--|--------------------------------|--|----------------------|---|
| Nearshore Ecosystems | Doroff | 12120114-L, 13120114-L, 14120114-L, 15120114-L, & 16120114-L | Citation: | Sea Otter Diet Data, Long-term Monitoring of Ecological Communities in Kachemak Bay, 2008-2015: Gulf Watch Alaska, Nearshore Component |
| | | | Dataset content: | Sea otter diet data |
| | | | Years: | 2008-2015 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1e |
| Nearshore Ecosystems | See above | 12120114-H to 15120114-H | Citation: | Gulf Watch Alaska Nearshore Component: Monitoring Site Locations from Prince William Sound, Katmai National Park and Preserve, and Kenai Fjords National Park |
| | | | Dataset content: | rocky intertidal, mussel sampling, and soft sediment site location information, and eelgrass bed locations |
| | | | Years: | 2003-2015 |
| | | | USGS Archive: | https://doi.org/10.5066/F78S4N3R |
| Lingering Oil: Harlequin Ducks and Sea Otters | Dan Esler, Brenda Ballachy | 12120114-Q, 13120114-Q, 14120114-Q, 15120114-Q, & 16120114-Q | Citation: | Harlequin duck capture and EROD activity data from Prince William Sound, Alaska, 2011, 2013, and 2014, Gulf Watch Alaska Lingering Oil Component |
| | | | Dataset content: | Oil spill response data |
| | | | Years: | 2011, 2013-2014 |
| | | | USGS archive: | http://dx.doi.org/10.5066/F7KD1W1M |
| Lingering Oil: Harlequin Ducks and Sea Otters | Dan Esler, Brenda Ballachy | 12120114-Q, 13120114-Q, 14120114-Q, 15120114-Q, & 16120114-Q | Citation: | Sea otter gene expression data from Kodiak, the Alaska Peninsula and Prince William Sound, Alaska, 2005-2012 |
| | | | Dataset content: | Sea otter gene expression data |
| | | | Years: | 2005-2012 |
| | | | DataONE archive: | http://dx.doi.org/10.5066/F789141P |
| Lingering Oil: Tracking of Oil Levels and Weathering | Mandy Lindeberg, Mark Carls | 20200114-P & 21200114-P | Citation: | Lingering Oil Measurements, Site, Sample, and Photographic Data from Prince William Sound, 2015, Gulf Watch Alaska Lingering Oil Component |
| | | | Dataset content: | Hydrocarbon database; Site, survey, gravimetric, oil composition, and sample chain of custody data; lingering oil survey photos |
| | | | Years: | 2015 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32f |

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| Pelagic: Long-term Killer Whale Monitoring | Craig Matkin | 17120114-N to 21120114-N | Citation: | Database of Southern Alaska Killer Whale Surveys and Encounters, 2001 to 2016, Gulf Watch Alaska Pelagic Component |
| | | | Dataset content: | Killer whale survey database |
| | | | Years: | 2001-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1r |
| Pelagic: Long-term Killer Whale Monitoring | Craig Matkin | 17120114-N to 21120114-N | Citation: | Biopsy Summaries and Biochemical Data from Killer Whales in Alaska, 2012-2016 |
| | | | Dataset content: | Biopsy summary data |
| | | | Years: | 2012-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k7d1 |
| Pelagic: Long-term Killer Whale Monitoring | Craig Matkin | 17120114-N to 21120114-N | Citation: | Prince William Sound Killer Whale Satellite Telemetry Data, 2004 to 2016, Gulf Watch Alaska Pelagic Component |
| | | | Dataset content: | Satellite tagging data |
| | | | Years: | 2004-2014 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k32e |
| Acoustic consistency: intensive surveys of juvenile herring | Rand | 12120111-G, 13120111-G, 16120111-G | Citation: | Intensive Acoustic Surveys of Juvenile Herring, Prince William Sound, 2013-2014, EVOS Herring Program |
| | | | Dataset content: | raw & processed acoustic files; herring biomass summary |
| | | | Years: | 2013-14 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1u |
| Acoustic consistency: intensive surveys of juvenile herring | Rand | 12120111-F, 13120111-F, 14120111-F, 15120111-F, 16120111-F | Citation: | Acoustic Juvenile Herring Abundance Data, Prince William Sound, 2012-2015, EVOS Herring Program |
| | | | Dataset content: | raw & processed acoustic files; herring biomass summary |
| | | | Years: | 2007-2016 (raw); 2012-2015 (processed) |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1v |
| Age at first spawn | Vollenweider & Heintz | 12120111J | Citation: | Age at First Spawn for Herring in Prince William Sound, 2012-2015, EVOS Herring Program |
| | | | Dataset content: | histological analysis, scale growth measurements, fish age, and biological characteristics of the fish |
| | | | Years: | 2012-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k115 |
| Fatty acid analysis as evidence for winter migration of age-0 herring | Heintz | 12120111-I, 13120111-I | Citation: | Fatty Acid Analysis as Evidence for Winter Migration of Age-0 Herring in Prince William Sound, 2010-2012, EVOS Herring Program |
| | | | Dataset content: | fatty acid, growth, energy, RNA/DNA, diet data |
| | | | Years: | 2010-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k110 |

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|---|-----------------|--|----------------------|---|
| Meta-analysis of global herring population dynamics | Branch | 12120111-C to 16120111-C | Citation: | Using Bayesian Age-Structured-Analysis (ASA) Model for Herring Population Dynamics in Prince William Sound, EVOS Herring Program |
| | | | Dataset content: | ASA model codebase, input and output data files. This project is being transitioned from being archived asa dataset to archived as a software project. When this is complete, the github repo for the project will be archived and updated whenever new code is committed |
| | | | Years: | n/a |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1t |
| Fish predation on juvenile herring | Bishop | 10100132-G | Citation:: | Fish Predation on Juvenile Herring in Prince William Sound, Alaska, 2009-2012, EVOS Herring Program |
| | | | Dataset content: | fish catch and prey data |
| | | | Years: | 2009-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1z |
| Genetic stock structure of herring in PWS | Wildes & Guyon | 16120111-P | Citation:: | Genetic Stock Structure of Herring in Prince William Sound, 2012-2015, EVOS Herring Program |
| | | | Dataset content: | fish genetics data |
| | | | Years: | 2012-2015 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k114 |
| Growth and energy in overwintering herring | Heintz | 10100132-D | Citation: | Growth and Energy of Overwintering Herring in Prince William Sound, 2009-2012, EVOS Herring Program |
| | | | Dataset content: | fatty acid, growth, energy, RNA/DNA, diet data |
| | | | Years: | 2009-2015 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1y |
| Herring capture | Bishop | 12120111-A, 13120111-A, 14120111-A, 15120111-A, 16120111-A | Citation: | Validation of acoustic surveys for Pacific herring, 2010-2016: EVOS Herring Program |
| | | | Dataset content: | fish morphometrics; gear deployment log; master cruise list |
| | | | Years: | 2009-2015 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1a |
| Juvenile herring intensive condition monitoring | Gorman & Kline | 12120111-M, 13120111-M | Citation: | High Temporal and Spatial Resolution Study of Herring Condition in Prince William Sound, Energetics Data, Prince William Sound, 2011-2012, EVOS Herring Program |
| | | | Dataset content: | age-0 herring morphology and energetic condition data |
| | | | Years: | 2011-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k17 |
| Juvenile herring intensive | Heintz & Gorman | 12120111-M, 13120111-M | Citation: | High Temporal and Spatial Resolution Study of Herring Condition in Prince William Sound, Growth and Diet Data, 2011-2012: EVOS Herring Program |

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| condition monitoring | | | Dataset content: | data related to seasonal changes in growth, energy stores, and diet of young-of-the-year (YOY) herring in PWS |
| | | | Years: | 2011-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k16 |
| Juvenile herring condition monitoring | Heintz & Gorman, Kline | 12120111-L, 14120111-L, 15120111-L, 16120111-L | Citation: | Juvenile Herring Condition Monitoring, Energetics Data, Prince William Sound, 2005-2016, EVOS Herring Program |
| | | | Dataset content: | energetics data |
| | | | Years: | 2005-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k13 |
| Juvenile herring condition monitoring | Heintz & Gorman | 12120111-L, 14120111-L, 15120111-L, 16120111-L | Citation: | Juvenile Herring Condition Monitoring in Prince William Sound, Growth and Diet Data, 2012-2016, EVOS Herring Program |
| | | | Dataset content: | growth, energy, RNA/DNA, diet data |
| | | | Years: | 2012-2016 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k15 |
| Meta-analysis of global herring population dynamics | Branch, Trochta | 12120111-Q, 14120111-Q, and 16120111-Q | Citation: | Meta-analysis of Global Herring Population Dynamics, 1974 to 2011, EVOS Herring Program |
| | | | Dataset content: | global herring biomass summaries |
| | | | Years: | n/a |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1i |
| Non-lethal sampling of juvenile herring | Boswell | 12120111D | Citation: | Non-lethal Sampling: In-Situ Estimation of Juvenile Herring Sizes in Prince William Sound, 2013-2014, EVOS Herring Program |
| | | | Dataset content: | ROV video files; herring measurement data\ |
| | | | Years: | 2013-2014 |
| | | | DataONE archive: | n/a |
| Physical oceanographic characteristics of nursery habitats | Gay | 10100132-E | Citation: | Physical Oceanographic Characteristics of Herring Nursery Habitats in Prince William Sound, 2010-2012: EVOS Herring Program |
| | | | Dataset content: | moored and cast CTD; thermistor data |
| | | | Years: | 2010-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k116 |
| Plankton & ocean observations in PWS | Campbell | 10100132-A | Citation: | Oceanographic Conditions in Prince William Sound, CTD, Chlorophyll-a, and Zooplankton Data: 2010-2012, EVOS Herring Program |
| | | | Dataset content: | Chl-a, CTD data, zooplankton data |
| | | | Years: | 2010-2012 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k14 |
| Tracking seasonal movements of | Bishop | 17120111-B to 21120111-B | Citation: | Tracking Seasonal Movements of Adult Pacific Herring in Prince William Sound, 2012-2014, EVOS Herring Program |

| Project | PI | EVOSTC Project # | Resource Information | |
|--|---------|--------------------------|----------------------|---|
| adult Pacific herring in PWS | | | Dataset content: | herring telemetry tag log and detection data |
| | | | Years: | 2012-2013 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k1x |
| ADFG Surveys: aerial survey, biomass age sex length, spawn | Morella | 17160111-F to 21160111-F | Citation: | Haught, S., Moffitt, S. (2020). Aerial survey observations of Pacific herring biomass in Prince William Sound, Alaska, 1973-2007. Dataset. 10.24431/rw1k442 |
| | | | Dataset content: | aerial biomass observation data |
| | | | Years: | 1973-2007 |
| | | | DataONE archive: | https://doi.org/10.24431/rw1k442 |