

Form Rev. 10.3.14

*Please refer to the Reporting Policy for all reporting due dates and requirements.

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

12120120

2. Project Title: *See, Reporting Policy at III (C) (2).*

Collaborative Data Management and Holistic Synthesis of Impacts and Recovery Status Associated with the Exxon Valdez Oil Spill

3. Principal Investigator(s) Names: *See, Reporting Policy at III (C) (3).*

Matthew B. Jones

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

February 1, 2014-January 31, 2015

5. Date of Report: *See, Reporting Policy at III (C) (5).*

March 1, 2015

6. Project Website (if applicable): *See, Reporting Policy at III (C) (6).*

www.gulfwatchalaska.org

7. Summary of Work Performed: *See, Reporting Policy at III (C) (7).*

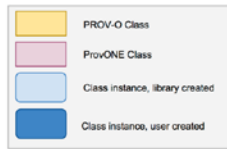
Duties shifted from data archiving to initiation of various synthesis activities. While data archiving was completed in the previous year, as planned, project personnel have continued to maintain and update datasets as needed and continue to develop data management infrastructure. Syntheses of archived data as well as additional data have begun and will continue through the next few years.

Archive Maintenance

Data outreach and collection was finalized although delayed conversations extended this work into FY14. Three projects were added to the Gulf of Alaska (GOA) Data Portal post-completion and numerous have been edited and updated to enhance detailed metadata. Metadata and datasets are updated as researchers provide additional information. The complete historical dataset now contains 97 data packages

Provenance

The Gulf of Alaska Historical Data Portal is undergoing improvements to enable reproducible science. This new provenance infrastructure allows users to track data inputs and outputs, store and document software and show data derivation history for objects.



Example instance graph using the ProvONE model

Based on Couture J. Historical CTD data from the Gulf of Alaska, 1970-2010 (<https://dev.nceas.ucsb.edu/#view/ctdMetadata20141114182614160183691>)

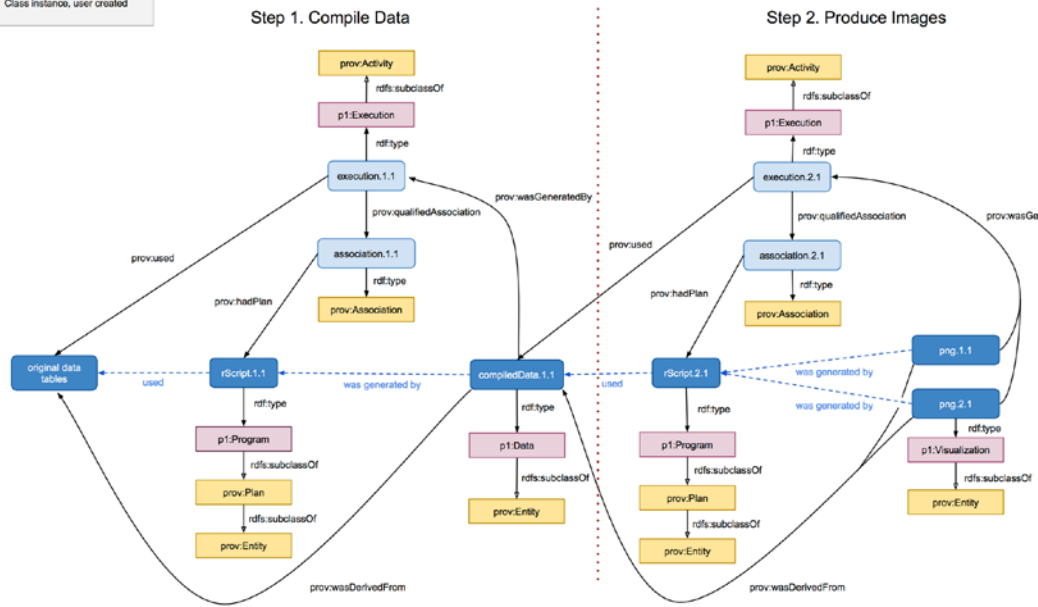


Figure 1: Provenance infrastructure tracks and documents complex interactions between objects and actions in data synthesis (step 1) and image generation (step 2), for example.

Development is occurring in parallel with DataONE provenance infrastructure and users will be able to choose from a web interface, Matlab, or R tools for generating provenance. Relationships are displayed in a clean user-friendly interface within the data portal (figure2). Design, documentation and structure models for this software were completed in this year and a functional developmental version currently documents Gulf Watch Alaska (GWA) data syntheses and visualizations.

Figure 2: Web display showing Provenance relationships within the metadata portal. Inputs and outputs for each object are defined with documented with timestamp and versioning.

Data Syntheses

Data from similar and overlapping Gulf Watch Alaska projects have been synthesized for further analysis. Synthesized datasets include oceanographic data, chlorophyll data, zooplankton data, algal cover and habitat data, seabird data, and marine mammal data. Eight synthesized datasets compile data from 39 historic and GWA datasets. Syntheses use provenance structures to document data inputs, manipulations, and outputs.

Synthesized data have also been visualized to represent spatial and temporal extents. Images include mapped sampling locations, summary graphs and animated maps to show data availability over time. Additional visualizations summarize data availability that cannot be accurately synthesized into one data table. These include spatial and temporal ranges of marine mammal and marine bird data.

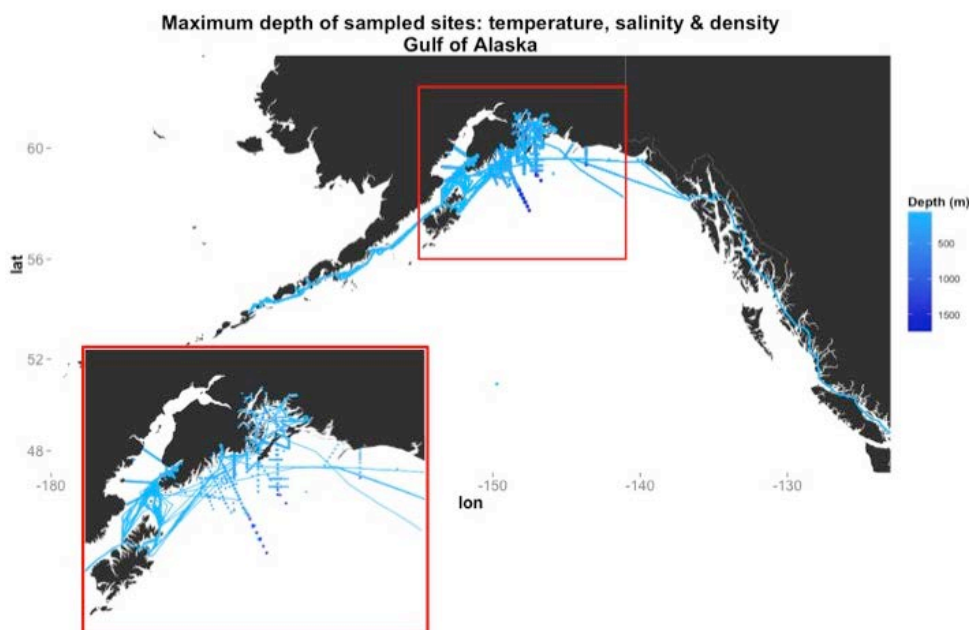


Figure 3: Spatial distribution of CTD data sites with depth of deepest sample represented in shade of blue. These data are available in one synthesized dataset with documented provenance relationships.

Broad Synthesis Activities

Requests for proposals were advertised, submissions were reviewed and two working groups were selected to conduct additional analyses of the GOA ecosystems based on the 25 years of data collected since the Exxon Valdez oil spill. These same steps were taken to recruit two post-doctoral researchers to participate in the working groups and conduct further analyses of the GOA systems. All of these efforts are planned to commence in 2015. The selected working groups will look at social-ecological relationships in the GOA and the effects of diversity on the stability of the GOA ecosystem. These projects are entitled *Understanding changes in the Coastal Gulf of Alaska Social-Ecological System: Analysis of Past Dynamics to Improve Prediction of Future Response to Natural and Anthropogenic Change* (Okey et al.) and *Applying portfolio effects to the Gulf of Alaska ecosystem: did multi-scale*

diversity buffer against the Exxon Valdez oil spill (Marshall et al.), respectively. Both groups have held organizational meetings and scheduled work to begin in early in 2015.

Social-ecological systems: This project will first investigate the possible connections between social and ecological systems in the Gulf of Alaska through statistical analyses of a variety of elements. Social foci include impacts on fishing communities, human health, education, and regional demographics. Principal Component Analysis will be used to quantitatively identifying key community vulnerabilities and using existing frameworks, this working group will quantify non-monetary effects of the spill such as changes in culture or education. These quantified impacts will help to inform two existing Ecopath models of the Prince William Sound and GOA ecosystems. These models will be updated to be able to simulate different scenarios in order to predict responses to changes in the future.

Applying portfolio effects to the GOA: This group will assess the ecological portfolios and stability of populations and communities. Population stability will be assessed by looking at spatiotemporal data, investigating life history trait portfolios, and spatial variation portfolios.

Additionally, they are interested in fishery catch portfolios comparing pre and post spill catch compositions. At the community level, the group will investigate evidence for changing species interactions and community resilience using multispecies models applied to plankton, fish, and Steller sea lions in Prince William Sound and the GOA.

Table 1: Status of project milestones for year 3

Deliverable/Milestone	Status
Select NCEAS working group projects, begin organization	October 2014
Hire post-doctoral researchers	October 2014
Participate in LTM program PI Meeting	November 2014
Complete data syntheses of historical EVOS data	November 2014
Provenance prototype released and employed for syntheses of historic EVOS data	December 2014

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

A) This project continues to be highly collaborative within GWA and between programs. The continued management and addition of data are done in coordination with AOOS and Axiom Consulting, along with the GWA group. Additionally syntheses and visualizations are shared on the AOOS data platforms and include data from various projects.

Both NCEAS working groups selected include members from the GWA and/or HRM groups as well as various local and governmental agencies: Alaska Department of Fish and Game, NOAA Alaska Fisheries Science Center, US Geological Survey.

B) This year we collaborated directly with the marine birds research group to assist with data inventory, summaries and visualizations. Summaries represent datasets from various EVOSTC funded projects as well as external agencies. Similarly, additional syntheses, outlined above, are collaborations of various projects and research programs. These visualizations and synthesized data help inform the new NCEAS working group analyses.

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

In addition to continued data maintenance and sharing through the historic EVOS data site, this year's data and progress were shared at conferences, meetings and through the internal GWA project workspace. Data syntheses and visualizations were presented at small group meetings throughout the year as well the GWA annual meeting in Anchorage. Here we updated the group on our provenance developments, and synthesis products. Combined datasets and spatial and temporal representations of data available is also shared with the GWA and HRM groups through the internal AOOS workspace. In addition, we have initiated work to collate data for the two NCEAS synthesis groups, with a major effort on collating fisheries independent data from large regions of the Gulf of Alaska from the Alaska Department of Fish and Game. These data will be collated and made accessible through either a ADFG portal or through the historical data portal, and will be integrated for use in the synthesis analysis and modeling efforts.

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

None required.

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

Please see the associated budget form. The projected budget for 2015 is as originally budgeted, with some minor changes in personnel details. Expenditures for 2014 were significantly less than budgeted because, as expected, the synthesis working groups and synthesis postdocs were selected during 2014 but did not start activities until January, 2015. We expect to rollover these expenses so that the postdocs and working groups will take place in years 4 and 5 (rather than years 3 + 4 as originally planned). In addition, we have not been utilizing the software engineering funds after our initial work on provenance was completed as we need a more effective plan to integrate with AOOS and Axiom infrastructure. We plan to expend the software engineering funds in years 4 and 5 after another discussion with Axiom about how to best continue to collaborate.