

# **Semi-annual Program Performance Report for NA11NOS0120020 FY 2011 Alaska Regional Coastal and Ocean Observing System For reporting period December 1, 2012 – May 31, 2013**

*Prepared by Molly McCammon, Project PI on June 27, 2013*

## **1.0 Project Summary**

The Alaska Ocean Observing System (AOOS) is the regional association for Alaska, managing the statewide and three regional coastal and ocean observing systems for the Alaska region. The mission of AOOS is to provide coastal and ocean observations, forecasts and data and information products to meet agency and stakeholder needs. This proposal builds upon efforts begun with our initial funding, and takes into account the paucity of real-time observations in Alaska by relying extensively on collaborations and leveraging with other programs. The proposal represents the priorities identified by stakeholder workshops and adopted by the AOOS Board: 1) Increase access to existing coastal and ocean data; 2) Package information and data in useful ways to meet the needs of stakeholders; and 3) Increase observing and forecasting capacity in all regions of the state, with a priority on the Arctic and the northern Gulf of Alaska (GOA). AOOS has four thematic priorities: sustainability of marine ecosystems and fisheries and tracking of climate change and trends; safety of marine operations; mitigation of natural hazards and their impacts on coastal communities, especially inundation, coastal erosion, and changing sea ice conditions; and regional ocean and coastal partnerships and planning.

## **2.0 Progress and Accomplishments**

### **2.1 AOOS Regional Management**

#### *2.1.1 AOOS Board and Committees*

- AOOS Board met in Anchorage April 18 to approve an FY13 budget and work plan. Three new board members were approved: Shell Oil (Robert Raye), World Wildlife Fund (Margaret Williams), and North Pacific Fishery Management Council (Duncan Fields).
- Dugan conducted orientations with two of new board members.
- AOOS Executive Committee met April 18 to conduct Executive Director Molly McCammon's performance evaluation and approve renewal of her contract for the next 4 years.
- AOOS Data Management Advisory Committee met March 1 to review recent progress by the data management team.

#### *2.1.2 Participation in national IOOS activities*

- McCammon attended IOOS (Integrated Ocean Observation System) and IOOS Association spring meeting in Washington, DC March 6-8 including the IOOS Association annual meeting March 6.

- McCammon participated in regular meetings of the IOOS Joint Planning Working Group.
- Rob Bochenek, AOS data team lead, participated in the IOOS SOS meeting in Washington, DC in February as well as IOOS-facilitated bi-weekly SOS reference specification calls and DMAC (Data Management and Communications) coordinator meetings.
- AOS staff have participated in IOOS Education and Outreach calls.

#### *2.1.3 Partnerships and external affairs - Alaska*

- McCammon participated in meetings of Alaska Center for Climate Assessment and Policy Steering Committee (National Oceanic and Atmospheric Association's (NOAA) Alaska Regional Integrated Sciences and Assessments Program), member; NOAA's regional collaboration team, member; and Cook Inlet Regional Citizens' Advisory Council and its Executive Committee.
- McCammon reviewed responses to technical and public comments received on the draft Alaska Regional Climate Assessment Technical Report and Alaska chapter of National Climate Assessment, both of which she is a co-author.
- McCammon met with Jay Sterne, new fisheries staff for Senator Lisa Murkowski.
- AOS co-hosted with Alaska Sea Grant, sessions of the Alaska Marine Policy Forum on January 30, March 20 and May 15.
- McCammon, Dugan, and Interagency Personnel Agreement detailee Rosa Meehan participated on the Alaska Marine Science Symposium (AMSS) organizing committee – reading abstracts, securing keynote speakers, coordinating workshops, and developing a participant survey.
- McCammon and Bochenek attended the Pacific Marine Arctic Regional Synthesis (Pacmars) project data meeting in Boulder December 10-11 2012 and Tyler participated in the project's community outreach meetings in February in Barrow, Kotzebue and Nome.
- McCammon attended the Distributed Biological Observation (DBO) data workshop February 27-28 in Seattle.
- AOS facilitated a workshop March 25 to explore interest in developing an Arctic Animal Tagging Network. McCammon attended the inaugural Alaska Arctic Policy Commission meeting in Juneau March 23.
- McCammon updated the NPRB on recent activities at their board meeting May 17.

#### *2.1.4 Partnerships and external affairs – national & international*

- McCammon participated in the Polar Research Board meeting in Washington DC December 18-19 and May 30-31 and the Ocean Research Advisory Panel in Washington, DC January 14-16 and May 21-22.
- Meehan attended as a marine mammal expert a Marine Steering Group meeting for the Circumpolar Biodiversity Monitoring Program (CBMP) in Vancouver in December.

- McCammon attended a workshop in Washington DC April 22-23 to develop recommendations for sustaining the National Climate Assessment.
- McCammon and Bochenek attended the Arctic Observing Summit in Vancouver, B.C. April 30-May2, presenting two posters and participating in working groups.
- McCammon participated in Washington May 9-10 on an external review of NOAA's Arctic Research Program.
- Bochenek demonstrated the AOOS Arctic Portal to the Marine Planning Portal Network on May 22.

#### *2.1.5 Program management, administration, fundraising and financial oversight*

- AOOS annual audit nearing completion by Alaska SeaLife Center.
- New position of program coordinator hired: Ellen Tyler.
- Two proposals submitted are still pending: proposal to NOAA in response to Regional Ocean Partnership Program solicitation, and proposal with Aleutian Bering Sea Islands LCC and USGS Alaska Climate Center to develop a climate vulnerability index for the Aleutians.
- Several unsuccessful proposals were submitted during this period: proposal with UAA to NSF Biology Cyberinfrastructure program to support cyberinfrastructure development for biological resources including invasive species; and proposal with the National Snow and Ice Data Center to NSF Arctic Observing Network to incorporate the AOOS Research Workspace into the Advanced Cooperative Arctic Data and Information Service. We were encouraged to resubmit the latter proposal in response to reviewer comments.
- Draft contract with Alaska SeaLife Center for fiscal sponsorship underway.

## **2.2 Marine Operations**

### *2.2.1 Maintain Snotel stations in Prince William Sound (PWS) and Cook Inlet (CI)*

- Subaward to PWS Science Center. Annual maintenance conducted by National Resources Conservation Service (NRCS). Provided additional weather information from Kayak Island. Repaired Cape St. Elias weather station.

### *2.2.2 Pilot AIS dissemination of weather data*

- Subaward to Marine Exchange of Alaska (MXAK). 50' tower for AIS/WX transmitting unit in Juneau installed and awaiting final authority from NOAA/NWS to transmit.
- Radio transmitting authority granted for Homer AIS/WX system. Awaiting issuance of Maritime Mobile Service Identity (MMSI) before transmitting can begin.
- New WX system constructed at Eldred Rock (Lynn Canal/SE AK).
- All weather data compiled on 10-min interval and made available to NOAA/NWS and AOOS and into NDBC database.

### *2.2.3 Provide public access to High-Frequency Radar (HFR) data in Chukchi Sea & plan for future HFR*

- Subaward with University of Alaska Fairbanks.

- Replacement parts and upgrades purchased for 2013 field season.
- No field season activities during this time period. Planned logistics for 2013 field season deployments.

#### 2.2.4 *Maintain Weather Research and Forecasting (WRF) wind model for PWS and CI*

- Operationally produced 48-hour numerical forecasts for area of interest 2 times daily for each of 3 model variants STD, MPH and 3KM.
- Developed new verification techniques and tools aimed at understanding inter-site verification results between proximate sites.
- Added new verification sites and back-calculated statistics for these locations.
- Acquired new computing hardware (from internal UAA funds) dedicated to running newest WRF version (3.4.1) with existing and new variants.
- Initiated testing of new variants in new WRF 3.4.1 environments.

#### 2.2.5 *Maintain operational Regional Ocean Modeling System (ROMS) model for GOA*

- Subaward with Yi Chao for maintenance with daily update schedule.
- Produced 5-year hindcast run with PWS ROMS and results made available on AOS server.
- 5 new publications produced.

#### 2.2.6 *Validate hydrological model for PWS*

- Subaward to Prince William Sound Science Center. Hydrological model validation work underway. Contractor is preparing for installation of field equipment.

#### 2.2.7 *Ingest ROMS models for Bering Sea into JPL data assimilation system*

- Yi Chao subaward. No activity.

### **2.3 Coastal Hazards**

#### 2.3.1 *Monitor prior Alaska Harbor Observation Network (AHON) pilot projects in Seward and Kodiak and assess further expansion of AHON*

- Prior award with Alaska SeaLife Center. Other funding now being used. Assessment underway.
- Repairs/maintenance at Miller's Landing station and Seward Harbor station completed, including improvements to enclosures for web cams. All assets in Seward Harbor currently working as intended except for wind direction sensor.
- Underwater sensors to measure water temperature and conductivity, tide level and wave conditions not able to be deployed in Kodiak.

#### 2.3.2 *Maintain Coastal Data Information Program (CDIP) wave buoy in Cook Inlet*

- Buoy lost again in January. Reassessing where to redeploy.

#### 2.3.3 *Produce electronic sea ice atlas*

- Data continues to be incorporated into atlas.
- Years of extreme sea ice retreat (1954, 1958, 1968) identified in historical record and are being compared with recent extreme summer ice minima to document similarities and dissimilarities of forcing (winds). Journal paper to be prepared providing historical perspective on extreme summer ice retreats in Alaskan waters.

- Data at Alaska Region Headquarters (ARH) Ice Desk examined and found to overlap in information content with Dehn and NAVOCEANO historical charts. Primary value of ARH charts appears to be more realistic depictions of summer sea ice in recent decades compared to passive microwave imagery, which underestimates ice coverage – especially in situations of partial ice cover – during the melt season.

#### 2.3.4 *Develop coastal flooding, storm surge and sea level rise products.*

- Continuing to work on collaborative strategy as follow-up to Western AK coastal Hazards workshop held in May 2012.

## **2.4 Ecosystems/Fisheries and Climate Trends**

### 2.4.1 *Maintain Arctic Research Assets Map*

- Feedback group held in January.
- New features incorporated into map and new student hired to maintain.
- Met with NSF Arctic Observing Viewer team to discuss ways to reduce overlap.

### 2.4.2 *Support sampling along Seward Line*

- Subaward to University of Alaska Fairbanks (UAF). May cruise successfully executed. Average temperature in upper 100m was 0.7deg C colder than 15-year mean. Zooplankton communities appear to be delayed by cool environment.
- New CTD worked flawlessly.

### 2.4.3 *Use AOOS glider for high-latitude observation node in Chukchi*

- No activity.

### 2.4.4 *Support Distributed Biological Observatory*

- No field activity. AOOS staff participated in DBO data meeting Feb 27-28.

### 2.4.5 *Maintain ocean acidification (OA) sampling along Seward Line & support OA sensors on moorings in Chukchi, Gulf of Alaska and Bering Sea*

- Subaward to UAF. Analysis and data QA/QC for 2012 samples completed.
- Conducted May Seward Line cruise with expanded sampling

### 2.4.6 *Test use of conductivity sensors at Cordova tide station*

- Subaward to PWSSC. Conductivity sensor installed. Still awaiting NOAA to make the final connection, which is expected in July 2013.

### 2.4.7 *Support mooring turnovers for biological monitoring*

- Subaward to PWSSC. Ocean Tracking Network acoustic array installed and data from existing receivers downloaded.

### 2.4.8 *Conduct Conductivity/Temperature/Depth (CTD) surveys in Kachemak Bay and lower Cook Inlet*

- Funds withheld from AOOS agreement for NOAA Kasitsna Bay Lab.
- Conducted monthly CTD surveys at mid-Kachemak Bay transect on 4 January, 12 February, 15 March, 21 April, and 21 May 2013.
- Conducted CTD surveys at Kachemak Bay entrance transect on 12 February and 21 April 2013.

- Provided CTD data to NOS/NCCOS researchers for PSP studies and to NOS/Coast Survey Development Lab for model validation. Working with AOS on upload to Ocean Workspace.
- Developed graphic products to illustrate vertical oceanographic patterns and how they change over time. Used in public presentations.

## **2.5 Regional Ocean and Coastal Partnerships and Planning**

### *2.5.1 Expand data management capacity to integrate data*

- Ongoing. See Section 2.6 below.

### *2.5.2 Create spatial visualization tools for AK through STAMP project - "Spatial Tools for Arctic Mapping and Planning"*

- Added over 80 new data layers to the tool, including RUSALCA and Arctic Marine Synthesis data.
- Convened a steering committee to begin planning fall 2013 stakeholder workshop.
- Demonstrated current data tool to individuals and small audiences for feedback.

## **2.6 Data Management & Products – Subaward to Axiom Consulting**

### *2.6.1 Support AOS website, data portal & applications. Maintain & provide access to products developed in this project. Explore developing multi-regional products with other RAs.*

- Several AOS applications converted to HTML 5 mapping framework.
- Portland data center promoted to primary center.
- Planning and design for next generation HPC storage cluster underway.
- Established relationship with CeNCOOS for leveraging of resources and convergence upon technology stack.

### *2.6.2 Ingest prioritized datasets, support warehouse and archive functions & provide access through query and mapping tools*

- Ingested approximately 120 biological (mammals and seabirds) data layers for STAMP tool/Arctic Portal and several new observational gridded data feeds.

### *2.6.3 Continue ADF&G (Alaska Department of Fish & Game) partnership*

- 2013 Yukon River Chinook forecast powered by AOS data feeds with complementary AOS web reporting page.
- AYK salmon monitoring database modified to support spatial data types.
- Subsets of NHD used to classify spatial footprints of AYK salmon projects.

### *2.6.4 Use NOAA Bering Sea models as demonstration for High Performance Compute – separate funding received in June 2011 and included in this grant.*

- Final report attached as Section 12.

### *2.6.5 Collaborate with other state, regional, national and international data management programs*

- Attended IOOS SOS Meeting and Data Summit in February.

- Attended ADIWG (Alaska Data Integration Working Group) meetings to assist in data integration across Alaska entities.
  - Attended Arctic Observing Summit in Vancouver BC to network with other Arctic data managers.
- 2.6.6 *Continue to develop IOOS SOS service and assist other RAs in deployment*
- IOOS SOS upgrades to 2.0 spec and version 4.0 of 52 North Codebase.
  - SOS data injectors developed for 15 national data sources.
- 2.6.7 *Develop new products and applications*
- Cook Inlet Response Tool released in January 2013.
  - AOOS Ocean Portal developed released for production use.
  - Alaska Platform of Opportunity (APOP) web portal developed for Bering Sea Aleutian Islands Landscape Conservation Cooperative (separate funding).
- 2.6.8 *Provide Data Management services for integrated research programs: EVOSTC Long Term Monitoring & Herring Research and Monitoring Programs; NPRB's Gulf of Alaska Integrated Ecosystem Research Program; RUSALCA program; and Arctic EIS program – all with separate funding*
- Currently supporting program with Ocean Workspace application.
  - Participating in monthly and other PI meetings as needed.
  - Visualized RUSALCA data and made available on AOOS portal.
- 2.6.9 *Serve up oil & gas industry data on AOOS portal*
- Annex 1 and 2 data submitted to NODC archives.
  - Data being served out through Research Workspace.
  - Currently 36 users who have requested access to industry-provided datasets.

## **2.7 Modeling & Analysis**

### *2.7.1 Initiate statewide circulation model exchange & ensemble modeling*

- Discussions underway to develop statewide modeling strategy.

## **2.8 Communication, Education & Outreach**

### *2.8.1 Support COSEE Alaska partnership*

- Co-hosted Communicating Ocean Sciences Workshop at AMSS in January.
- COSEE Alaska partnership helped conduct Communicating Science courses at the Fairbanks and Juneau campuses of UAF.
- Held pre-conference workshop for Alaska Sea Grant-sponsored Lowell Wakefield Symposium on evidence of climate change in Arctic marine ecosystems.
- Sponsored COSEE Alaska Ocean Science Fair as a “fair within a fair” at the Alaska Science and Engineering Fair in March 2013. Of 385 participants in 2013 statewide fair, 44 competed in ocean science fair with 52 projects, representing 28 communities statewide and showing a strong rural and Alaska Native presence. Judging involved scientists and cultural experts. In cooperation with the Alaska Chapter of Northwest Aquatic and Marine Education (NAME), Alaska SeaLife Center and Alaska Sea Grant, 9 awards were given to 12 students for their projects. An evaluation of the science fair program has been submitted as an article in a theme issue of the Journal of

Geosciences Education focused on geoscience education in the context of culture and place.

- COSEE Alaska staff actively encouraged use and further development of K-12 lesson plans developed during Arctic Ocean Ecosystem Scientist-Teacher Workshop held in May 2012 and co-sponsored by AOS. The impact of Ecosystem Workshops (Arctic Ocean, Bering Sea, and Gulf of Alaska ecosystems) on scientists and educators were featured in presentations by COSEE Alaska staff at the Alaska Marine Science Symposium and at national science and education conferences and highlighted in one of the journal articles submitted to the Journal of Geosciences Education.
- Launched “Watching Walrus,” a virtual field trip on Alaska SeaLife Center website in January (with link on AOS website). By April 30, it had received more than 2,400 hits.

#### *2.8.2 Support AOS website and publications*

- Continued to add content to website, including animations and new pages.
- Produced monthly updates.
- Circulated bi-monthly e-newsletter to listserve of over 500 recipients.

#### *2.8.3 Scope out potential Alaska Oceans & Coast Report*

- Continue to refine draft white paper with Alaska Sea Grant Program.

#### *2.8.4 Interact with stakeholders and partners*

- Staff hosted feedback sessions in January for Arctic Research Assets map and Arctic Portal.
- Staff developed “AOS 101” slides for Board and Associates to help communicate AOS.
- McCammon and Bochenek presented latest version of Cook Inlet Response Tool at December 7 meeting of the Cook Inlet Citizens Advisory Council.
- AOS hosted at the AMSS a town hall on January 22 on the AOS Arctic Buildout Plan and Access to Industry Data on the AOS Portal, and co-hosted the Communicating Ocean Sciences Workshop on January 21 and a session exploring Gulf of Alaska Research Collaborations on January 23.
- Bochenek demonstrated use of the AOS data tools for planning marine debris efforts at the Alaska Forum on the Environment in February.
- New AOS Program Coordinator Ellen Tyler demonstrated the Cook Inlet Response Tool and its application for oil response at a Shorezone webinar in February.
- McCammon presented March 29 at the management-focused session at the Sea Grant Wakefield Fisheries Symposium, focused on Responses of Arctic Marine Ecosystems to Climate Change.
- Tyler traveled to Wainwright and Barrow March 11-15 to participate in workshops on local knowledge of sea ice.
- In partnership with ACCAP and NOAA, AOS launched a survey to better understand what sea ice information products stakeholders use, and for what purposes.
- AOS facilitated a discussion with the Prince William Sound Science Center, the PWS Regional Citizens Advisory Council and the Natural Resource



Conservation District's Anchorage office to discuss repairs and maintenance of existing Snotel weather stations in Alaska.

### **3.0 Scope of Work (Priorities for next 6 months, December 1, 2012 – May 30, 2013, and anticipated changes to SOW)**

#### **3.1 AOS Regional Management**

##### *3.1.1 AOS Board and Committees*

- Full board and Data Management Committee meetings planned for fall 2013. .
- Solicit statewide tribal representative.
- Complete new board member orientations.

##### *3.1.2 Participate in national IOOS*

- Participate in IOOS regional meetings in November in San Diego.
- Review certification criteria implementation as it develops.

##### *3.1.3 Partnerships and external affairs – in Alaska*

- Begin planning for Community Based Monitoring Workshop with Alaska Sea Grant Program.
- Pursue funding for water level sensors for western Alaska.

##### *3.1.4 Partnerships and external affairs – national & international*

- Attend CERF conference in San Diego in November.
- Participate in NAS Gulf Program Advisory Group meetings in New Orleans and Texas

##### *3.1.5 Program management, administration, fundraising and financial oversight*

- Finalize long-term agreement with Alaska SeaLife Center for fiscal management.
- Work on additional funding proposals.
- Continue consideration of possible 501(c)(3).

#### **3.2 Marine Operations**

##### *3.2.1 Maintain Snotel stations in PWS and CI and wave buoy in CI*

- Contract improvements to camera systems.
- Re-deploy wave buoy in CI.

##### *3.2.2 Pilot AIS dissemination of weather data*

- Construct new WX sensor sites at: Naked Island, Rocky Island and Gustavus, all in Southeast Alaska.
- Work with NOAA to obtain required permits for transmitting data.

##### *3.2.3 Provide public access to HFR data in Chukchi & plan for future HFR*

- Operate 4 long-range HFR sites on northwest coast of Alaska: Pt Lay, Wainwright, Pt Barrow and Cape Simpson. Barrow and Simpson sites to be powered by renewable energy (wind and solar). Data to be collected and disseminated in real-time.

##### *3.2.4 Maintain WRF wind model for PWS and CI*

- Continue routine forecasts and verification project.

##### *3.2.5 Maintain operational ROMS model for GOA*

- Ingest 5-year PWS ROMS retrospective simulation and analysis to AOS

DMAC for further analysis and distribution.

- Move PWS forecast system from JPL's old computer system to new RSS cluster computer in coming year.

#### *3.2.6 Validate hydrological model for PWS*

#### *3.2.7 Ingest ROMS models for Bering Sea into Jet Propulsion Laboratory (JPL) data assimilation system*

- No activity. Completed.

### **3.3 Coastal Hazards**

#### *3.3.1 Monitor prior AK Harbor Observation Network pilot projects in Seward and Kodiak and assess further expansion of AHON*

#### *3.3.2 Maintain CDIP wave buoy in Cook Inlet*

#### *3.3.3 Produce electronic sea ice atlas*

- Finish incorporating data into atlas.
- Prepare metadata and user's guide.
- Present information about database at Navy Symposium on Ice-Diminished Arctic (July 2013, Washington, DC).
- Identify users to provide feedback for development of user interface.
- Solicit user feedback for web-interface design via webinar and survey.

#### *3.3.4 Develop coastal flooding, storm surge and sea level rise products.*

- Deploy wave buoy in Norton Sound (with separate funding).
- Seek funding to implement western AK water level collaborative.

### **3.4 Ecosystems/Fisheries and Climate Trends**

#### *3.4.1 Maintain Arctic assets map*

- Expand to statewide.

#### *3.4.2 Support sampling along Seward Line*

- Next cruise September 2013. Master's thesis and publications underway.

#### *3.4.3 Use A00S glider for high-latitude observation node in Chukchi*

#### *3.4.4 Support Distributed Biological Observatory*

#### *3.4.5 Maintain OA sampling along Seward Line & OA mooring sensors*

- Collect OA measurements on fall Seward Line cruise.

#### *3.4.6 Test use of conductivity sensors at Cordova tide station*

- Make final connection of sensor to tide station.

#### *3.4.7 Support mooring array for biological monitoring*

- Download data.

#### *3.4.8 Conduct CTD surveys in Kachemak Bay and lower Cook Inlet*

- Conduct monthly and seasonal CTD surveys.

### **3.5 Regional Ocean and Coastal Partnerships and Planning**

#### *3.5.1 Create data management capacity to integrate data*

- Ongoing. See section 3.6 below.

#### *3.5.2 Create spatial visualization tools for AK: STAMP*

- Continue adding relevant data layers to the STAMP/Arctic portal, including social and economic data, and downscaled climate change projections.

- Hold a fall stakeholder workshop demonstrating new tool and discussion of future steps.

### **3.6 Data Management & Products**

*3.6.1 Support AOOS website, data portal & applications. Maintain & provide access to products developed in this project. Explore developing multi-regional products with other RAs.*

- Work with NSIDC and ACADIS staff to re-draft NSF proposal.
- Continue transition to integrated HTML5 and iPad/iPhone friendly system.
- Develop user specific tools for individualized customization of AOOS services.
- Develop improved indexing of AOOS data assets so users can search by space, time and taxonomy.

*3.6.2 Ingest prioritized datasets, support warehouse and archive functions & provide access through query and mapping tools*

- Continue to ingest data sets to support STAMP tool and Arctic Portal with focus on fisheries, marine mammals, subsistence use and habitat.
- Ingest new data products being developed by ISER (Institute of Social and Economic Research) and SNAP (Scenarios Network for Alaska & Arctic Planning).
- Extend real time sensor portal to expose sensor archive and SOS backend.

*3.6.3 Continue ADF&G partnership*

- Complete Phase II work with ADF&G data feeds being served through data layers exposed through AOOS portals.

*3.6.4 Complete NOAA's High Performance Compute project*

- Publish project results.

*3.6.5 Collaborate with other state, regional, national & international data management programs*

- Develop proposals with UAF GINA and ACADIS (Advanced Cooperative Arctic Data and Information Service).
- Work with Arctic cyber infrastructure groups on collaborative proposals.

*3.6.6 Continue to develop/support IOOS SOS service and assist other RAs in deployment*

- Integrate QA/QC into sensor ingestion and storage.
- Develop 52 North to netCDF archive module.
- Implement ncSOS and 52 North broker wrapper.
- Develop common client interface.

*3.6.7 Develop new products and applications*

- Continue to redevelop Ocean Portal Framework in HTML 5 to enable AOOS applications to run on iPad/iPhone.
- Explore data visualizations for Seward Line, ocean moorings and ocean acidification data.

*3.6.8 Provide Data Management services for integrated research programs: EVOSTC Long Term Monitoring & Herring Research and Monitoring Programs; NPRB's Gulf of Alaska Integrated Ecosystem Research Program; RUSALCA program; and Arctic EIS program – all with separate funding*

- Cultivate and expand capabilities of AOS Research Workspace.
- Attend all PI meetings.
- Initiate Arctic EIS and Brenda Norcross Beaufort BOEM workspace groups.

#### *3.6.9 Serve up oil & gas industry data on AOS portal*

- Manage access to industry data and facilitate updates to the resource.
- Make data publicly available with simple search tool.

### **3.7 Modeling & Analysis**

#### *3.7.1 Initiate statewide circulation model exchange & ensemble modeling*

- Develop statewide modeling strategy for AOS.

### **3.8 Communication, Education & Outreach**

#### *3.8.1 Support COSEE Alaska partnership*

#### *3.8.2 Support AOS website and publications*

- Produce summer newsletter, quarterly e-news, monthly ED updates and Facebook postings.
- Update observing project pages on website.
- Work with partner institutions to include link to AOS on their website.

#### *3.8.3 Scope out potential Alaska Oceans & Coast Report*

- Circulate white paper to potential partners.

#### *3.8.4 Interact with stakeholders and partners*

- Meet with key agency personnel to demonstrate existing Ocean Portal, receive feedback, and discuss needs.
- Improve systems for soliciting and assessing data portal feedback.
- Review outreach materials with individuals who are not familiar with AOS to assess effectiveness.
- Finish and tabulate results from sea ice user survey.
- Publicize Cook Inlet and Bering Strait wave buoy data to increase local usage.
- Conduct review of new sensor map display with representative stakeholders.

### **4.0 Personnel and Organizational Structure**

- IPA detailee retired at end of December. Student internship ended in February 2013. New student hired in March.
- Program manager Darcy Dugan back at work half-time in mid-April.
- New Program Coordinator Ellen Tyler started January 4.
- Three new board members approved at April Board meeting.

### **5.0 Budget Analysis**

All financial reports are up to date and have been submitted on time.

### **6.0 Issues**

#### *6.1 AIS/WX stations*

- Obtaining FCC permits to broadcast weather information over AIS continues to be issue.

## **7.0 Special Report: Regional Ocean Governance Organization Activities**

AOOS received a competitive grant in 2012 from NOAA's Regional Ocean Partnership Program to "*Create spatial visualization tools for Arctic Mapping and Planning.*"

- Conducted scoping process for new tools, including 20+ in-person interviews and an online survey.
- Completed final reports summarizing scoping findings and assessing decision support tools developed elsewhere and their applicability to Alaska.
- Held in-person project advisory group meeting in September to discuss progress and next steps
- Initial platform created for STAMP portal, including more than 200 data sets to date.
- Gave presentations on STAMP to multiple audiences including the North Pacific Fisheries Management Council, Beaufort Sea Partnership, Northwest Arctic Borough Subsistence Mapping Workshop, and Barrow community.
- Demonstrated current data tool to individuals and small audiences for feedback.
- Convened a steering committee to begin planning fall 2013 stakeholder workshop.
- Submitted grant proposal to NOAA in February 2013 that, if funded, would extend the STAMP project to the southern Bering Sea and Aleutian Islands with a focus on marine shipping.

## **8.0 Special Report: Efforts to Leverage IOOS Funding**

AOOS actively seeks to leverage IOOS funding in three ways: by submitting multiple proposals for funding from additional sources, by joining forces with other entities to support observing activities, and by providing data management services for other research programs.

*AOOS Proposals:*

- AOOS received one small grant from the Bering Sea/Aleutian Islands Landscape Conservation Cooperative to develop a "platform of opportunity" portal showing planned research cruises in Alaska waters to assist with coordination and cost efficiency.
- Two proposals submitted are still pending: proposal to NOAA in response to Regional Ocean Partnership Program solicitation, and proposal with Aleutian Bering Sea Islands LCC and USGS Alaska Climate Center to develop a climate vulnerability index for the Aleutians.
- Several unsuccessful proposals were submitted during this period: pre-proposal as part of Department of Defense Legacy Program to support Animal Tagging workshop and implementation plan; letter of intent to NOAA's SARP Program to develop an extreme weather/climate event threshold early warning application; proposal with UAA to NSF Biology Cyberinfrastructure program to support cyberinfrastructure development for biological resources including invasive species; and proposal with the National Snow and Ice Data Center to NSF Arctic Observing Network to

incorporate the AOS Research Workspace into the Advanced Cooperative Arctic Data and Information Service. We were encouraged to resubmit the latter proposal in response to reviewer comments.

- AOS collaborated with partners to submit a series of research ideas in response to the Bureau of Ocean Energy Management's call for science recommendations prior to lease sales in the Beaufort and Chukchi Seas and Cook Inlet. AOS' profile topics included new data integration tools, expanding data management infrastructure, compiling and analyzing oceanographic model hindcasts and forecasts, and contributing to an animal tagging network.

*Observing Consortia:*

- Most of our observing activities are highly leveraged. Two examples are the ocean acidification moorings: AOS contributes \$15k a year to an OA mooring consortium; and the Seward Line: AOS contributes \$100k a year to a consortium that totals \$400k a year.

*Data Management Services for related programs:*

- Exxon Valdez Oil Spill Trustee Council's Long Term Monitoring & Herring Research and Monitoring Programs
- North Pacific Research Board's Gulf of Alaska Integrated Ecosystem Research Program
- Russian-US Long-term Census of the Arctic (RUSALCA) program
- Arctic Ecosystem Integrated Study (EIS)
- Serve up oil & gas industry data on AOS portal

**9.0 Special Report: Updates to RA Board Membership**

- ADF&G Board member Cora Campbell delegated her position to Chris Siddons. Paul Gill replaced Shane Montoya as the US Coast Guard board member.
- Three new board members were approved: Shell Oil (Robert Raye), World Wildlife Fund (Margaret Williams), and North Pacific Fishery Management Council (Duncan Fields), bringing the AOS board total to 19. We are still seeking a statewide tribal representative. See updated IOOS governance template below.

Region	Type of Governance	Distribution of Governance Board Membership							Total Number of Board Members	
		Government				Non-Government				
		State*	Local	Tribal	Federal	Research Institute	Industry	NGO**		Foreign (all sectors)
AOOS	MOU	4			4	7	2	2		19
CaRA	MOA	3				1	6	2		12
CeNCOOS	MOU	2			2	8		3		15
GCOOS	MOU	2			2	3	5	3		15
GLOS	501(c)(3)		1		3	1	4		1***	10
MARACOOS	501(c)(3)	2			3	8		2		15
NANOOS	MOA	2		2	2	4	3	2		15
NERACOOS	501(c)(3)	5			2	6	4	1	2	20
PaciOOS	MOA	5			2	1	3	1	2	14
SCCOOS	MOU				1	7		1	2	11
SECOORA	501(c)(3)	2			1	13	6	3		25
ACT						4	1			5

\* includes Sea Grant and territorial governments

\*\* includes Fishery Management Councils

\*\*\* "bi-national" International Joint Commission

## 10. Special Report: Governance Activities and Accomplishments

- AOOS Board met in Anchorage October 30, focusing on strategic planning for next five years. As follow-up, the Executive Director assessed organizing as non-profit corporation instead of consortium governed by MOA, and solicited broad spectrum of new board members, especially from private sectors.
- AOOS Board met in Anchorage April 18 2013 to approve an FY13 budget and work plan. Three new board members were approved: Shell Oil (Robert Raye), World Wildlife Fund (Margaret Williams), and North Pacific Fishery Management Council (Duncan Fields).
- Two new board members received orientation.
- AOOS 101 slides produced and distributed to board for their use.
- AOOS Executive Committee met April 18 to conduct Executive Director Molly McCammon's performance evaluation and approve renewal of her contract for the next 4 years.
- AOOS Data Management Advisory Committee met October 5 to review recent progress by the data management team.
- AOOS Data Management Advisory Committee met March 1 to review recent progress by the data management team.
- AOOS annual audit nearing completion by Alaska SeaLife Center.
- New position of program coordinator hired: Ellen Tyler. IPA Detailee retired in December 2012.
- Draft contract with Alaska SeaLife Center for fiscal sponsorship underway.

## 11. Special Report: Education and Outreach Activities

The IOOS E&O Inventory is updated for AOOS.

### 11.1 Education

- Supported COSEE Alaska partnership.
- Participated in 2012 National Marine Educators Association conference in June in Anchorage attended by more than 350 marine educators.

- Worked with COSEE staff to assess AOS communication and outreach activities and make recommendations for modifications.
- Online teacher's guide with lesson plans finalized for AOS co-sponsored publication of *Pete Puffin's Wild Ride*, which features Alaska's currents.
- Co-hosted Communicating Ocean Sciences Workshop at AMSS in January.
- COSEE Alaska partnership helped conduct Communicating Science courses at the Fairbanks and Juneau campuses of UAF.
- Held pre-conference workshop for Alaska Sea Grant-sponsored Lowell Wakefield Symposium on evidence of climate change in Arctic marine ecosystems.
- Sponsored COSEE Alaska Ocean Science Fair as a "fair within a fair" at the Alaska Science and Engineering Fair in March 2013. Of 385 participants in 2013 statewide fair, 44 competed in ocean science fair with 52 projects, representing 28 communities statewide and showing a strong rural and Alaska Native presence. Judging involved scientists and cultural experts. In cooperation with the Alaska Chapter of Northwest Aquatic and Marine Education (NAME), Alaska SeaLife Center and Alaska Sea Grant, 9 awards were given to 12 students for their projects. An evaluation of the science fair program has been submitted as an article in a theme issue of the Journal of Geosciences Education focused on geoscience education in the context of culture and place.
- COSEE Alaska staff actively encouraged use and further development of K-12 lesson plans developed during Arctic Ocean Ecosystem Scientist-Teacher Workshop held in May 2012 and co-sponsored by AOS. The impact of Ecosystem Workshops (Arctic Ocean, Bering Sea, and Gulf of Alaska ecosystems) on scientists and educators were featured in presentations by COSEE Alaska staff at the Alaska Marine Science Symposium and at national science and education conferences and highlighted in one of the journal articles submitted to the Journal of Geosciences Education.
- Launched "Watching Walrus," a virtual field trip on Alaska SeaLife Center website in January (with link on AOS website). By April 30, it had received more than 2,400 hits.

### **11.2 Outreach**

- Continued to add content to AOS website, including animations and new pages.
- Produced monthly Executive Director updates.
- Initiated bi-monthly e-newsletter to listserve of over 500 recipients.
- Refined draft white paper on potential *Alaska Oceans & Coast Report* with Alaska Sea Grant Program.
- Dugan participated in Ocean Festival in Cordova in September.
- Will Koeppen (Axiom Consulting and Design) presented an overview of AOS Arctic Portal on November 13 at Northern Oil and Gas Forum in Anchorage.



- Dugan visited Kotzebue Oct 24-26 to participate in workshop of the Northwest Arctic Borough subsistence mapping project and give update on STAMP project.
- Dugan met with North Slope Borough's wildlife, search and rescue, and planning departments to share latest on AOS activities and resources November 1-2 in Barrow. Gave community presentation at Barrow library, now available on YouTube courtesy of the Barrow Arctic Science Consortium.
- Staff hosted feedback sessions in January for Arctic Research Assets map and Arctic Portal.
- Staff developed "AOS 101" slides for Board and Associates to help communicate AOS.
- McCammon and Bochenek presented latest version of Cook Inlet Response Tool at December 7 meeting of the Cook Inlet Citizens Advisory Council.
- AOS hosted at the AMSS a town hall on January 22 on the AOS Arctic Buildout Plan and Access to Industry Data on the AOS Portal, and co-hosted the Communicating Ocean Sciences Workshop on January 21 and a session exploring Gulf of Alaska Research Collaborations on January 23.
- Bochenek demonstrated use of the AOS data tools for planning marine debris efforts at the Alaska Forum on the Environment in February.
- New AOS Program Coordinator Ellen Tyler demonstrated the Cook Inlet Response Tool and its application for oil response at a Shorezone webinar in February.
- McCammon presented March 29 at the management-focused session at the Sea Grant Wakefield Fisheries Symposium, focused on Responses of Arctic Marine Ecosystems to Climate Change.
- Tyler traveled to Wainwright and Barrow March 11-15 to participate in workshops on local knowledge of sea ice.
- In partnership with ACCAP and NOAA, AOS launched a survey to better understand what sea ice information products stakeholders use, and for what purposes.
- AOS facilitated a discussion with the Prince William Sound Science Center, the PWS Regional Citizens Advisory Council and the Natural Resource Conservation District's Anchorage office to discuss repairs and maintenance of existing Snotel weather stations in Alaska.

## **12. Special Report: High Performance Computing grant final report**

### ***12.1 Background***

AOS received funds in June 2011 through NOAA's competitive High Performance Compute (HPC) program to test the use of the AOS HPC servers to increase the accessibility of NOAA model outputs. These funds were added to the overall AOS grant. Originally the models to be used were ecosystem models being developed by NOAA's Pacific Marine Environmental Laboratory as part of the Bering Sea Integrated Ecosystem Research Program, but other models were used since these were not available.

Model outputs are complex in nature, can be very large in file size (megabytes to terabytes) and are packaged in advanced formats (netCDF, HDF, etc.). The general public typically under-uses these valuable resources, which are mainly accessible to a small subset of the scientific community specialized in dealing with these data types. Client based applications can have steep learning curves for users, may be hindered by network bandwidth, and frequently require knowledge of data transfer protocols and data source formats. Although progress has been made to develop server software (THREDDS, ncWMS, LAS, etc.) for visualization and interoperability transactions using NetCDF data formats, these systems have typically been run on standalone servers which lack sufficient CPU power, storage capacity and throughput to visualize and analyze these data in acceptable timeframes for the development of web based multi-user tools. However, these problems can be addressed by developing a framework for parallelizing these workloads across compute nodes configured in a High Performance Computing Cluster (HPCC).

This project configured an 8 node storage cluster and 16 node compute cluster connected over an Infiniband high bandwidth (40 Gb/sec) network fabric to provide the HPC capacity for experiment. A test matrix of aggregated netCDF files sizes was then benchmarked for visualization (tile generation from ncWMS) and analysis (virtual sensor time series extraction).

### **12.2 Model Test Cases**

- Jet Propulsion Laboratory 1 KM daily global sea surface temperature grid
- Arctic Regional Super Computing Center 3 KM Alaska Statewide hourly air temperature grid
- Alaska Experimental Forecast Facility 4 KM Cook Inlet/Prince William Sound hourly air temperature

### **12.3 Results**

- Virtual sensor performance is maximized when netCDF files are stored in aggregates of approximately 500 MB. Virtual sensor performance for 500MB file aggregates was observed to about 10 times faster than accessing the same data in 50MB aggregates. Furthermore, performance suffered as file aggregates approached the 4 GB physical limitation of netCDF files during testing.
- A linear/horizontally scaling performance factor was observed as compute nodes were added to the parallelization and map reduce scheme for virtual sensor analysis on large model/gridded data sets.
- The production of tiled images of large gridded data sets was not affected by size of the netCDF file aggregate (probably due to the hyperslab functionality of netCDF).
- Tile production can be load balanced across compute nodes resulting in horizontally scaling performance for visualization.

#### ***12.4 Conclusions***

- HPC techniques can provide a platform for centralized analysis and visualization of large netCDF collections, which can easily scale as needed by the user base.
- In addition to hardware configuration, system architects need to consider the packaging strategy of their netCDF storage approach.
- These results will be described in a journal publication that is currently under development.