

**Schoolyard Program
Northern Gulf of Alaska
Long-Term Ecological Research Network**

The goals that have guided the design of LTER education programs are two-fold:

- 1) to improve understanding of long-term ecological research and Earth's ecosystems for students of all ages and the public at large and
- 2) to enhance the diversity of future generations of ecologists and educators involved in supporting long-term ecology research and education. (Bestelmeyer et. al., 2005)

While experiential education is the most effective strategies in STEM and environmental education, an “underwater” LTER requires an innovative approach to outreach and K-12 education. Data collection will occur through research cruises and by observing instruments far from shore. Ecosystem dynamics take place at a variety of spatial and temporal scales at the surface and in pelagic and benthic ecosystems in ways that are largely invisible to the public. Accordingly, in combination with effective public and K-12 outreach methods to schools and communities adjacent to the LTER, we propose to use video and animations as our primary means to increase understanding about the “state of the science” about NGA dynamics, our scientific approach, and what we learn.

Continuity with Outreach for the Gulf Watch Alaska Program

The groundwork to increase understanding of the benefit of long-term data collection has been laid through outreach during the first five years of the Gulf Watch Alaska (GWA) project, a long-term monitoring program for ecosystems impacted by the 1989 oil spill, funded by the *Exxon Valdez* Oil Spill Trustee Council.

GWA is expected to continue for another 15 years but with less attention and resources to support outreach to public and K-12 audiences. The GWA focus was on detecting environmental change as the NGA recovers from a major human-caused perturbation in the context of rapid, and relatively unpredictable, changes in climatic conditions. Outreach and education for the NGA LTER project thus provides the opportunity to build on the foundation created by the GWA.

In keeping with the first guiding goal for Schoolyard programs, the NVA LTER outreach and education focus will be on the broader ecological context and the understanding that can be gained through long-term, hypothesis-driven ecological research.

Marilyn Sigman, Alaska Sea Grant's marine education specialist has previous experience as the Program Manager of the NSF-funded Alaska Center for Ocean Science Education Excellence (COSEE) from 2009-2015 and as coordinator of the GWA outreach program from 2014-2016. She will provide the continuity between previous outreach and education resources focused on the Gulf of Alaska ecosystem and the LTER Schoolyard program.

For K-12 audiences, she will expand education resources previously developed and disseminated by Alaska Sea Grant (ASG) which include the standards-based *Alaska Seas and Watersheds*, a K-8 online curriculum and a COSEE Alaska website collection of lesson plans and units relevant to the Gulf of Alaska ecosystem. She will disseminate these resources through a searchable database of resources in a “For Educators” section of the project website, through presentations at regional and statewide science/STEM education conferences, and through professional development workshops for teachers and informal K-12 educators.

Sigman will coordinate additional outreach by project PIs and graduate students in coastal communities in the NGA through a variety of methods. The process and results of annual cruises will be an important focal point for increasing public understanding about GAK-1, the Seward Line and new annual sampling locations as a system of climate change “sentinels” for the Gulf of Alaska, Bering Sea and Arctic Ocean marine ecosystems.

Outreach to K-12 Teachers and Students

The Northern Gulf of Alaska is bordered by six school districts: Copper River and Chugach School Districts, with schools in Prince William Sound communities; Kenai Peninsula School District, Anchorage School District, and Kodiak Island Borough School District. Cordova and Valdez City School Districts also serve coastal communities within the larger geographic boundaries of the Copper River School District. The students are diverse. The Anchorage School District has several schools which are among the most diverse in the nation; approximately 100 different languages are spoken in the homes of the students. Tatitlek and Chenega Bay in Chugach School District are predominantly Alaska Native communities as are Nanwalek and Port Graham in the Kenai Peninsula School District and Old Harbor and Port Lions in the Kodiak Island Borough School District. Thus, outreach to these schools and communities will serve the second goal of enhancing the diversity of ecologists and educators involved in supporting long-term ecology research and education.

Online K-12 Education Resources Collection

We will develop an online “collection” of existing teaching resources relevant to place-based, culturally-responsive education about the NGA ecosystem. Alaska school districts are in the process of making individual decisions whether or not to align their district curriculum with the Next Generation Science Standards or with the existing Alaska State Science, Math, and Technology Standards. All districts are required to align with state cultural standards for students and also to address cultural standards for teachers in their teacher evaluation process. In accordance with the mixed nature of alignment with standards by districts, we will include resources aligned with either or both sets of STEM standards.

Virtual Field Trips

We will develop two “virtual field trips” (VFTs) with the Alaska SeaLife Center for the NGA LTER. A VFT that provided an overview of the GWA project was produced in 2014 with interviews with scientists heading up monitoring for four project components (nearshore ecosystem, pelagic ecosystem, environmental drivers, and lingering oil). A second GWA VFT, scheduled for completion in March, 2017, follows a storyline about scientists seeking to understand the oceanography and food web disturbances during the 2014-2016 warm water anomaly in the North Pacific Ocean. Two animations are under development for the second VFT to compare a “normal” annual cycle of a spring bloom and the alternation of stratified ocean conditions and wind-driven mixing during the winter with the dynamics observed by oceanographers during the event of “the Blob” of persistent warm water during the winter.

The VFTs for the NGA LTER will build on the concepts emphasized in the first two VFTs with an overview of the LTER and its hypotheses in Years 1-3 and on significant findings and new understandings in Years 4-5. An additional animation will be developed and incorporated into the first VFT to illustrate Alaska Coastal Current dynamics.

Web text and videos in the VFTs are accompanied by online middle school lesson plans. Lesson plans for the NGA LTER will focus on relevant marine ecology concepts in life science, physical sciences, earth science, technology, and engineering. The VFTs will be made available online and through the distribution of DVDs.

Professional Development of Educators

ASG has developed partnerships with the Anchorage, Kenai Peninsula, Chugach, and City of Cordova school districts by providing professional development training and mini-grants to support teacher training, local field trips, purchases of equipment and supplies, and the integration of ASG-sponsored curriculum materials into the District curriculum framework in alignment with the Next Generation Science Standards. This approach has proven effective in achieving systemic educational change in terms of increasing the amount and quality of marine and watershed education and teacher content knowledge and confidence in teaching about local marine and aquatic environment (Rezabeck and Sigman, 2016). Chugach School District, in particular, has used its grant funds to purchase environmental monitoring

technology, including a drone and AUV, and is in the process of developing lesson plans that will be incorporated into the ASW K-8 curriculum. This school district also provides distance-delivered education to students in Fairbanks who have been engaged in field trips to the UAF CFOS marine technology workshop.

ASG will disseminate the VFTs and the NGA educational resource collection through ASG-sponsored professional development workshops for K-12 educators and presentations at regional and statewide education conferences.

Community Outreach

Annual outreach visits to a small number of Alaska coastal communities along the Seward line are already funded by NPRB and Gulf Watch Alaska. ASG has Marine Advisory Agents in Cordova and Kodiak and partner with a number of organizations and agencies in a network of informal educators in the Gulf of Alaska region. They will work with network partners to schedule and publicize community presentations and arrange additional local media for LTER researchers. These partners include:

Anchorage: Anchorage Museum, Alaska Geographic/Interagency Visitor Center

Cordova: Prince William Sound Science Center

Seward: Alaska SeaLife Center, National Park Service Ocean Alaska Science and Learning Center

Homer: Center for Alaskan Coastal Studies, Kachemak Bay National Estuarine Research Reserve, Alaska Maritime National Wildlife Refuge/Alaska Islands and Ocean Visitor Center and Pratt Museum

Kodiak: UAF Kodiak Seafood and Marine Science Center, NOAA Lab

The Outreach Coordinator will also work with partners to incorporate relevant teaching activities about the LTER in other informal education programs throughout the region.

Video interviews of LTER scientists and the narrated animation of Alaska Coastal Current dynamics produced as part of the VFTs can also be shown at the Alaska Ocean and Islands Visitor Center, Homer (annual visitation:75,000), the Alaska SeaLife Center, Seward, (annual visitation:150,000), the Coastal America Ecosystem Learning Network, and the Smithsonian Institution Sant Ocean Hall Ocean Today kiosk (potential audience: 20-30 million).

References

Bestelmeyer, S., S. Dailey, M. Elser, P. Hembree, C. Landis, K. O'Connell, B. Simmons, S. Sommer, and S. Steiner. 2005. Handbook for LTER Education. Reviewed by LTER Education Representatives, Nov. 2005/

Rezabeck, C. and M. Sigman. 2016. Case Study: Increasing Environmental Literacy Through Professional Development in Alaska. Alaska Natural Resources and Outdoor Education association, Anchorage, AK. Web-published: <http://www.anroe.net/wp-content/uploads/2016/09/PDANROECASEStudyMarch102016ms.pdf>

Sigman, M. R. Dublin, A. Anderson, N. Deans, J. Warburton, G.I. Matsumoto, D. Dugan, and J. Harcharek. 2014. Using Large Marine Ecosystems and Cultural Responsiveness as the Context for Professional Development of Teachers and Scientists in Ocean Sciences. *J. Geoscience Education*. 62(1): 25-40.

	Year 1	Year 2	Year 3	Year 4	Year 5
Design educator webpages with K-12 resource collection links	x				
Update educator webpages and resource collection		x	x	x	x
Develop first VFT and animation	x	x	x		
Develop second VFT				X	X
Incorporate NGA teaching resources into ASG-sponsored professional development		x	x	x	x
Presentations for K-12 teachers & informal educators	Statewide STEM teacher conference	AMSS COSW	Statewide STEM teacher conference	AMSS COSW	Statewide STEM teacher conference