

RESEARCH/PD ANNUAL REPORT - PROGRESS REPORT

2015 annual report - progress

Ervin Joe Schumacker

Understanding Potential Impacts of Seasonal Hypoxia Along the Quinault Reservation Coast

R/HCE-6

Submitted On: 04/28/2016 08:31:49 PM

METRICS & MEASURES

Metric/Measure	Value	Note
Acres of coastal habitat	0	500 - Approximate area of razor clam habitat on Pt. Grenville Beach between mouth of the Moclips River and Pt. Grenville.
Fishermen and seafood industry personnel	1	This figure is expected to be greater as fishers participate in nearshore water quality monitoring activities. Currently 1 fisher has worked extensively with the project designing the instrument platforms (modified crab pots).
Communities - economic and environmental development	0	Not applicable to the project at this time.
Stakeholders - sustainable approaches	30	Number of Taholah School students and staff that are currently benefit from the water quality data generated by this project.
Informal education programs	0	Approximately 30 student and staff from the Taholah School (NOT INFORMAL ED)
Stakeholders who receive information	30	Approximately 30 student and staff from the Taholah School
Volunteer hours	143	11 days of sampling conducted by class of 11 students for one hour with two staffers overseeing site visits and data monitoring.
P-12 students reached	11	Number of students in the Taholah School high-school natural resource class that participated in the project in 2015.
P-12 educators	3	Primary natural sciences instructor, Vice-Principal and Superintendent at the Taholah School.

REQUESTED INFORMATION

Publications

No **Publications** information reported

Students Supported

No **Students Supported** information reported

Narratives

Partners This Period

Taholah K-12 School

Types: Academic Institution

Scale: LOCAL

Notes: Participation by high-school natural resource science classes and staff

Olympic Coast National Marine Sanctuary (US DOC, NOAA, NOS, ONMS)

Types: Government

Scale: REGIONAL

Notes: Data collected by OCNMS moorings located adjacent to the Quinault study site.

STANDARD QUESTIONS

Impacts and Accomplishments

(1)

Type	impact
Title	Washington Sea Grant connects Quinault tribal students to Olympic Peninsula ecosystems and science
Relevance	The Quinault Indian Nation has treaty rights to more than 3,000 nautical square miles of ocean off Washington's Olympic Peninsula, which it co-manages with federal, state and tribal partners. Since 2006 this area has been impacted by low dissolved oxygen, or hypoxia, with dead fishes and crabs washing up in late summer on the coast. While the Quinault people have been part of local marine environment for millennia, Quinault students have had limited opportunities for scientific training and investigations.
Response	Washington Sea Grant-supported researchers developed a shore-based water quality monitoring program for Taholah High School. High school students conducted water quality sampling at estuarine and marine locations and researchers provided instruction to students and teachers. High school sampling data complement those collected by the Olympic Coast National Marine Sanctuary mooring buoy and data that will be collected by crab-pot sampling platforms designed by the research team.
	Eleven high school students and three teachers participated in water quality sampling. Sampling yielded useful data on temperature, salinity and dissolved oxygen, while providing students with hands-on learning about monitoring methods,

Results	instrument calibration and operation, data recording, analysis and visualization. This provided students with a foundation for understanding physical and biological changes to their ecosystems and how those changes connect to a larger ecosystem. The monitoring curriculum is being incorporated into the school's ongoing natural sciences program.
Recap	Washington Sea Grant researchers provided Native American students training in natural science and Taholah High School has integrated the onshore monitoring component into their ongoing natural sciences program.
Comments	
Primary Focus Area	Ocean Literacy and Workforce Development
Secondary Focus Areas	Healthy Coastal Ecosystems, Sustainable Fisheries and Aquaculture
Goals	Ocean and coastal resources are managed using ecosystem-based approaches. Fisheries are safe, responsibly managed and economically and culturally vibrant. The future workforce is skilled in disciplines critical to coastal and ocean economies and ecosystem health.
Partners	Olympic Coast National Marine Sanctuary (US DOC, NOAA, NOS, ONMS) Quinault Indian Nation Taholah K-12 School
PI Draft	<p>* Type impact * Title Connecting Quinault Tribal Students with local ecosystems and climate. * Relevance Quinault people have been a part of the local marine and terrestrial environment since time immemorial. Quinault students have had very limited ability to conduct scientific investigations of water quality due to available resources and guidance. * Response By loaning high-quality water sampling equipment to the Taholah School Natural Sciences program this project enabled students with the help of their faculty to directly collect physical information on water quality from their marine and river waters. * Results The onshore monitoring component of this project has had positive impacts on the Taholah High School students that have participated. By using the YSI 2030 meter provided through this project, the students and instructors have learned instrument calibration and operation, data keeping, data analysis and data sharing in graphic formats. Students are building a foundation to understand physical and biological changes to their local ecosystems and how those changes are part of greater systems. The Taholah School has been very proud to work on this project and intends to maintain the field sampling as part of their natural sciences program. * Recap Students have gained natural science investigation abilities they did not have before this project.</p>

Comments Primary Focus Area Healthy Coastal Ecosystems Secondary Focus Areas Ocean Literacy and Workforce Development Goals Ocean and coastal resources are managed using ecosystem-based approaches., Ocean and coastal habitats are protected, enhanced and restored., Fisheries are safe, responsibly managed and economically and culturally vibrant., Coastal water resources sustain human and ecosystem health., The public is ocean literate., The future workforce is skilled in disciplines critical to coastal and ocean economies and ecosystem health. Partners Taholah K-12 School

Tools, Technologies, Information Services / Sea Grant Products

No **Tools, Technologies, Information Services / Sea Grant Products** information reported

Economic Impacts

No **Economic Impacts** information reported

Community Hazard Resilience

No **Community Hazard Resilience** information reported

Meetings, Workshops, Presentations

No **Meetings, Workshops, Presentations** information reported

Leveraged Funds

(1)

Purpose	Understanding Potential Impacts of Seasonal Hypoxia Along the Quinault Reservation Coast - Cape Elizabeth moorings operating costs
Source	Olympic Coast National Marine Sanctuary
Amount	25800
Start Date	02-01-2015
End Date	01-31-2016

Washington Sea Grant Annual Report – Year 2

Period: February 1, 2015 – January 31, 2016

Project R/HCE-6 – Understanding Potential Impacts of Season Hypoxia Along the Quinault Reservation Coast.

Project PI – Ervin Joe Schumacker

Objectives:

The spatial scope, intensity and duration of hypoxia events on the 27-mile Quinault Reservation shoreline are unknown as is their impact on subtidal and intertidal ecosystems and specific organisms. Objectives of this two-year project along the coast are twofold:

1) Create a low-cost, model nearshore and shore-based monitoring network that engages tribal fishers and youth in gathering coastal water quality information. Data from this network will fill a critical information gap and will be quality-assured and shared on web-based public data portals.

2) Quantify potential impacts of seasonal hypoxia on a culturally important coastal shellfish species Pacific razor clam, (*Siliqua patula*) and use conclusions to adaptively manage that species and others. Data analyses will identify stresses to local species and contribute to ongoing west coast hypoxia and ocean acidification research.

Methodology and Results:

A nearshore water quality monitoring system was previously designed and tested but not deployed in 2015. Water quality monitoring instruments were purchased through this grant in summer 2014. Crab-pot instrument platforms were fabricated in Westport, WA over that summer. The initial crab-pot platform design jeopardized expensive instruments in the water and when they were lifted back on to vessels. In 2014 the platforms were redesigned and re-fabricated. Funding availability and the design issues noted did not allow deployment in the primary hypoxia season of 2014.

Unforeseen issues in 2015 again delayed deployment of the crab-pot platforms and instrument packages. A very low-abundance crab season combined with the largest bloom of *Pseudo-nitzschia spp.* diatoms recorded on the west coast severely limited the number of vessels of opportunity available in the summer of 2015. No funds were identified in this project to hire or charter vessels and it was necessary to insure that the instruments were revisited for maintenance and data download every two weeks or monthly at minimum to insure that the platforms had not been moved and that the instruments continued to work through the season. The project PI could not deploy the instruments purchased by this project until such time that there were assurances that they could be regularly monitored and secured. No vessels were available to do so.

Shore-based sampling was conducted in September, October and November 2015 by Taholah high-school students working with the PI and their instructor. The YSI-Pro 2030 water quality instrument was calibrated by the PI and the instructor and verified each sampling day. Data were recorded by students and entered into spreadsheets in the classroom. Interpretive graphs were developed there and posted in a display in the school hallways.

A total of three sites were sampled by the Taholah School team in 2015. 6 sites had been sampled in 2014 but narrowed to three in 2015 to better allow student access during limited time while still collecting representative data from in-river sites (salt-wedge intrusion) and a beach site (marine area) nearby. Within the lower Quinault River students sampled at a bridge crossing approximately ¼ mile upstream from the mouth, again just inside the mouth of the river near the ocean and then at a beach site sampling from the surf approximately ¼ mile south of the river mouth.

An advisor to the project stressed the value of in-river sampling for determining dissolved oxygen levels of marine waters that intrude into nearshore river mouths (with the “salt-wedge”) that have not been mixed by wave action. The data collected by the Taholah School in 2014 verified the value of the two in-river sites for detecting DO events as compared to surf sites where atmospheric mixing occurs. Surf sites appear to have value for tracking temperature and salinity and may assist documenting upwelling and downwelling events.

The Olympic Coast National Marine Sanctuary (OCNMS) is a partner and supporter of this project and places 3 seasonal moorings west-northwest of the Quinault River mouth each summer. The moorings are placed at 15, 42 and 65 meter depths and record temperature, salinity and DO. DO data from the 15 and 42 meter moorings are shown in Figures 7-10.

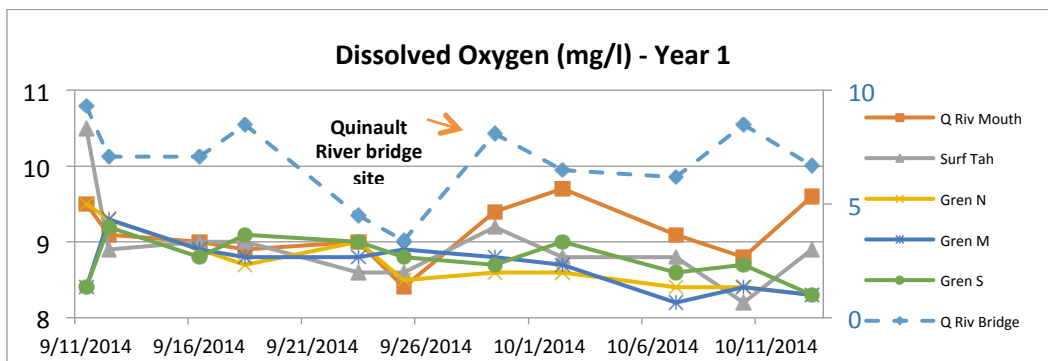


Fig.1) Dissolved oxygen data collected by Taholah School students Sep. 11 – Oct. 13, 2014. Quinault River bridge site is associated with secondary axis (right side). All other sites relate to main axis.

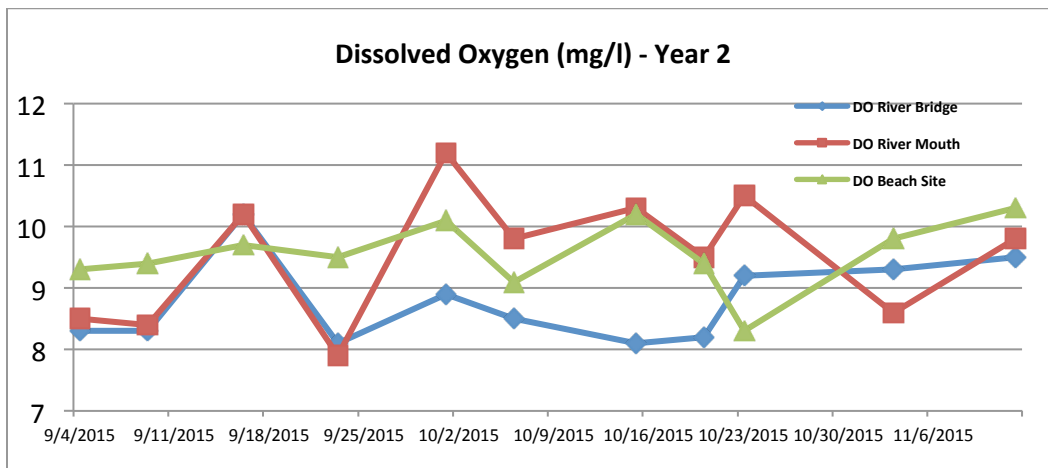


Fig. 2) Dissolved oxygen data collected by Taholah School students Sep. 4 – Nov. 12, 2015.

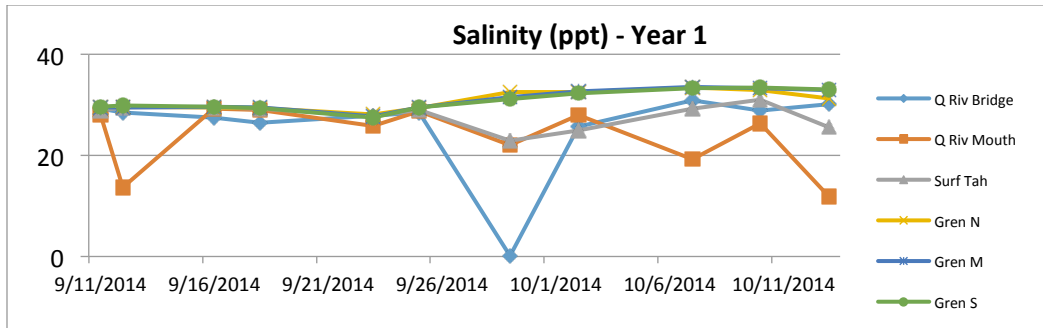


Fig. 3) Salinity data collected by Taholah School, Sep-Oct 2014. In-river sites are subject to tidal intrusion and fresh water outflow.

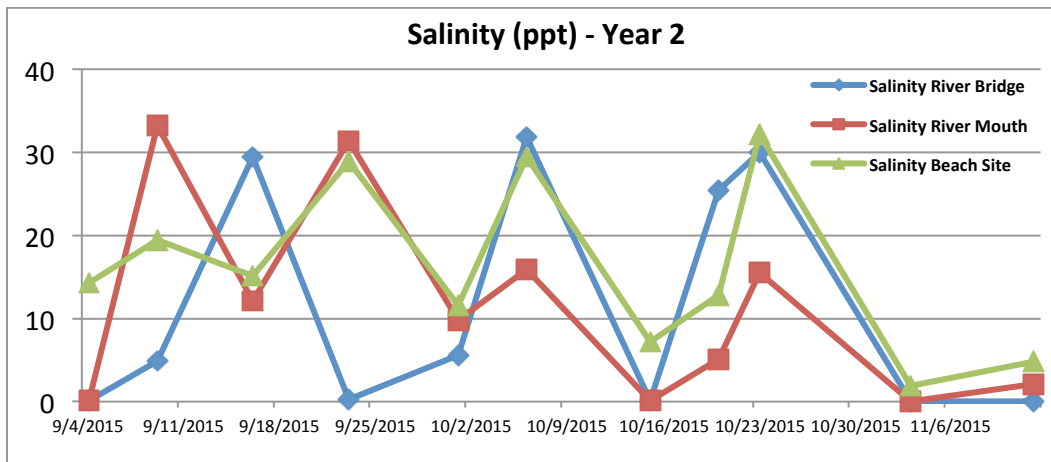


Fig. 4) Salinity data collected by Taholah School, Sep. 4 – Nov. 12, 2015. In-river sites are subject to tidal intrusion and fresh water outflow. Beach site also exhibits influence from Quinault River fresh water outflow.

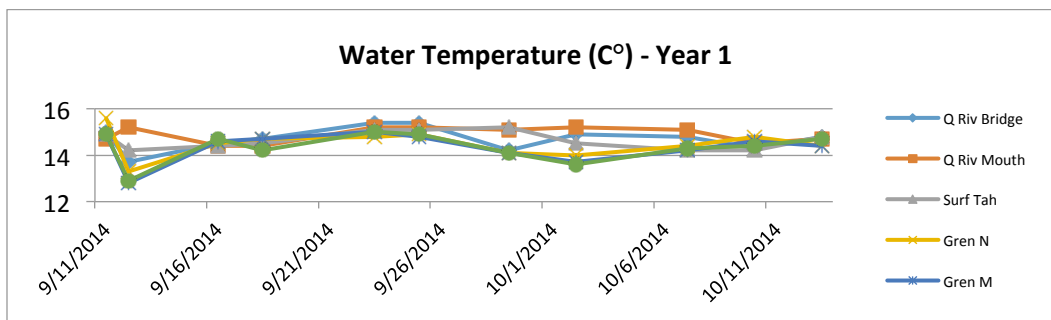


Fig. 5) Water temperature data collected by Taholah School Sep.-Oct. 2014. Sample sites on beaches south of the Quinault River are noted as Surf Tah and Gren N, M and S.

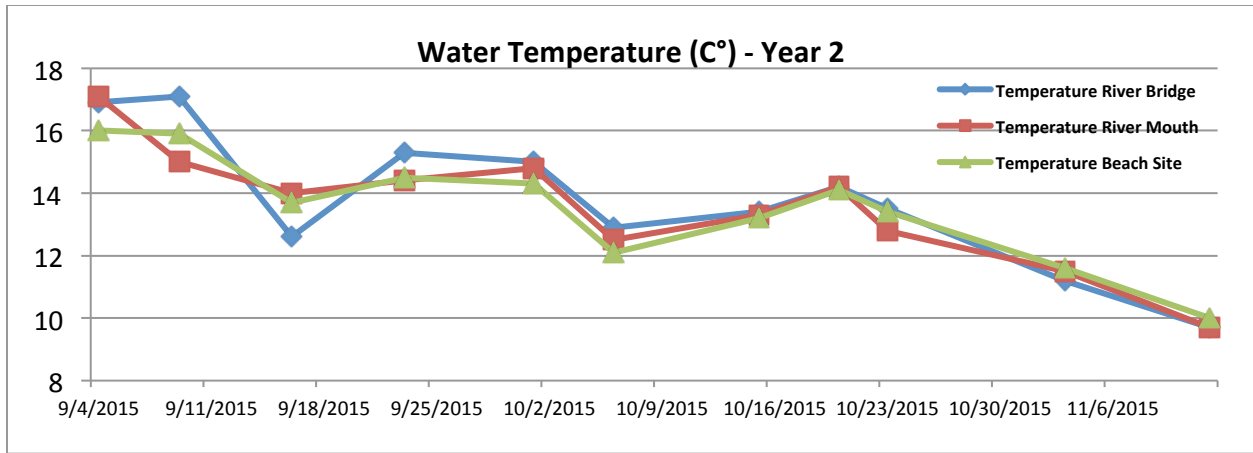


Fig. 6) Water temperature data collected by Taholah School Sep. 4 – Nov. 12, 2015.

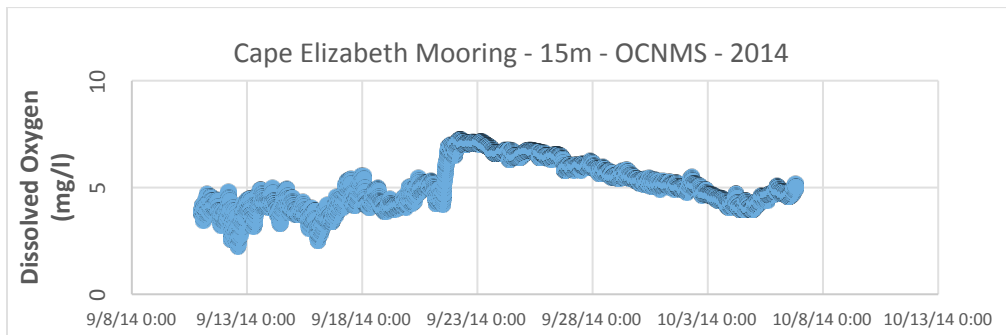


Fig. 7) DO data collected Sept. 11 – Oct. 6, 2014 by Sea Bird 37 SMP IDO mounted 1 meter above seafloor. 15m site is located approximately 3.8 km. west-northwest of Quinault River mouth.

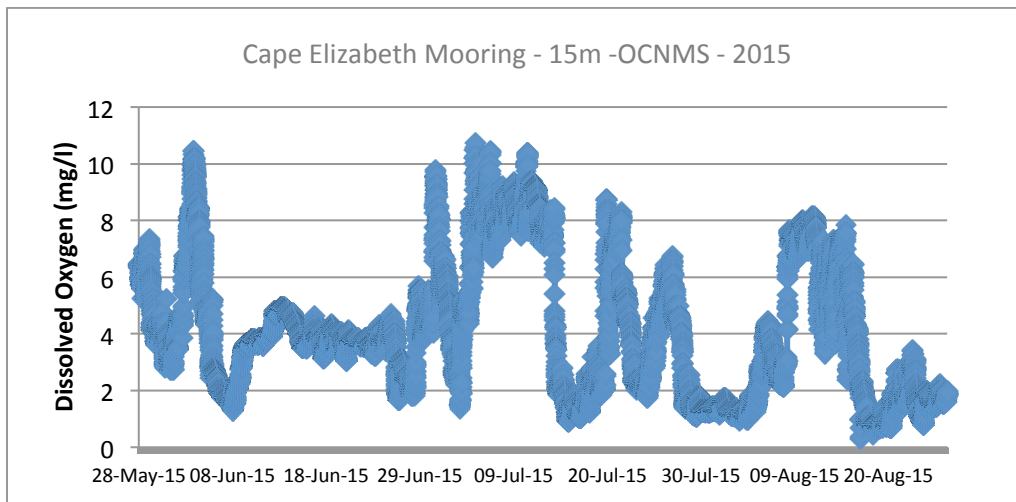


Fig. 8) DO data collected May 28 – Aug 26, 2015 by Sea Bird 37 SMP IDO mounted 1 meter above seafloor. Instruments were lost later in year. DO levels varied greatly at this location and indicate hypoxic conditions in the nearshore area in July and August, 2015.

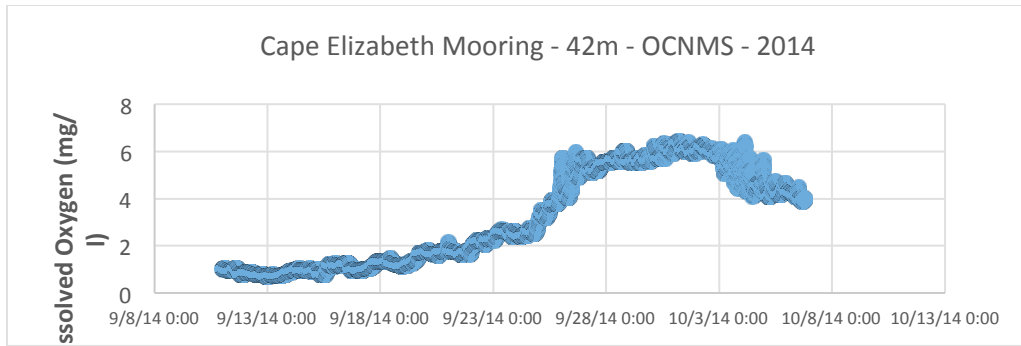


Fig. 9) DO data collected Sept. 11 – Oct. 6, 2014 by Sea Bird 37 SMP IDO mounted 1 meter above seafloor. 42m site is located approximately 12.7 km. west-northwest of Quinault River mouth.

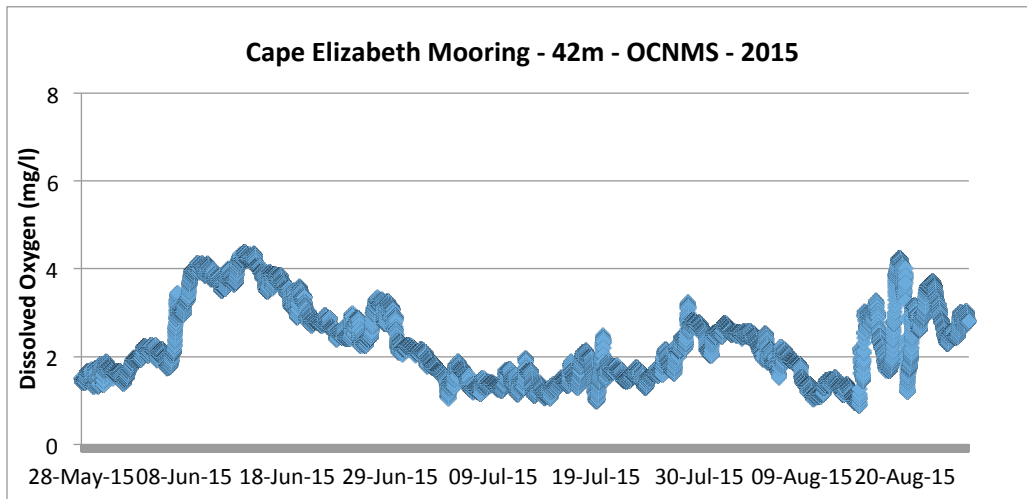


Fig. 10) DO data collected May 28 - Aug 26, 2015 by Sea Bird 37 SMP IDO mounted 1 meter above seafloor. Persistent hypoxic conditions are indicated from July to mid-August, 2015 at this station.

The 2014 OCNMS mooring data (Figs. 7 and 9) suggests a persistent hypoxic event was in effect in early to mid-September 12 km. west of the Quinault River mouth (42 meter site) and beach study sites but less so at the 15 meter site located approximately 3.8 km. from the river mouth. Both sites indicate a strong mixing event occurring near the end of September.

Figs. 1 and 3 show a drop in water temperature and slight increase in salinity at the same time period September, beginning near Sept. 23, 2014. The data collected by the Taholah School at the shore sites south of the Quinault River reflect a similar mixing event reflected in the OCNMS mooring data.

Another persistent low oxygen period near the benthos is evident in the data from the 42 meter site in 2015 (Fig. 10) indicating hypoxic conditions from early July through August, 2015 with mixing potentially beginning earlier in the season than the previous year.

Weather conditions in 2015 were markedly different than 2014 with many more precipitation events during the sampling period by the Taholah School students. The salinity data in particular reflects the many rain events that occurred in September, October and November. This in turn mixed the fresh water effectively and no low-oxygen events were noted.

Outreach

No presentations were done during this reporting period.

Challenges and Continuing Plans

Over two summer seasons the project has failed to deploy the nearshore monitoring component of this project and will attempt to correct that during summer 2016. The project has become a learning experience for this type of community supported science that depends upon available cost-free resources to be implemented. The project PI had not foreseen a crab season that had zero or very few vessels fishing during the summer months. This had not been the case for the previous 15 years of crab seasons. The value of the instruments purchased by this project is significant and leaving them without regular access in a shallow (~10 meters), remote, nearshore area is not advisable. Vessel visits are imperative to success for the network proposed by this project. Ideally this project would have budgeted for hiring vessels to monitor the instruments in a contingency such as occurred in summer 2015.

As noted in a previous report, crab fishers are challenged to properly download data from the 37 SMP ODO and Onset DO units. It was planned for the PI to accompany them on at least two initial progress checks to download and maintain the instruments but that did not occur.

Onshore training will be conducted in May 2015 to accustom fishers to the use of the software and download hardware. The project PI did not anticipate that the interfaces for data download and instrument reset would be in the DOS based format used by SeaBird Electronics in their SeaTerm software. Though not complex, it is a format not seen before by any of the active Quinault fishers and needs thorough training to develop the skill to use it properly, especially when onboard a vessel in the nearshore area. The project will conduct training on shore before going to sea in 2016 to assure some level of comfort with the equipment.

Juvenile clam population densities will continue to be monitored at the reservation beach sites and a site south of the reservation near Pacific Beach, WA to determine if differences in survival exist between sites.

Water quality monitoring by the Taholah School students will continue at the three sites with some adjustment to better avoid fresh water influence by the Quinault River at the beach site.

It remains the intention of the Quinault Department of Fisheries to deploy the monitoring stations each season in the future and encourage expansion of a nearshore, community based, scientific monitoring system that will aid managers and researchers.