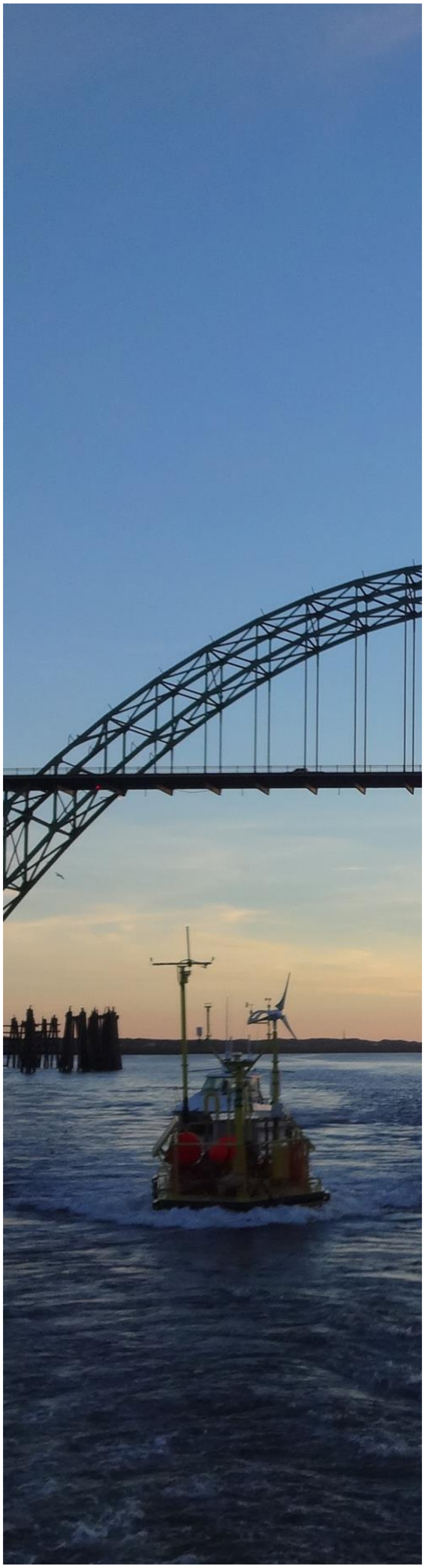

THE PACIFIC MARINE ENERGY CENTER

NORTH ENERGY TEST SITE

Annual Operations & Monitoring Report 2014

Prepared for the
Adaptive Management Committee

by

NNMREC
Northwest National Marine Renewable Energy Center

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ABBREVIATIONS AND ACRONYMS

AMC	Adaptive Management Committee
AMF	Adaptive Management Framework
AMP	Adaptive Mitigation Plan
AWAC	Acoustic Wave and Current profiler
EMF	Electromagnetic field
FINE	Fishermen Involved in Natural Energy
NETS	North Energy Test Site
NMFS	National Marine Fisheries Service
NNMREC	Northwest National Marine Renewable Energy Center
NOAA	National Oceanic and Atmospheric Administration
NOMAD	Navy Oceanographic Meteorological Automatic Device
ODFW	Oregon Department of Fish and Wildlife
OSU	Oregon State University
PMEC	Pacific Marine Energy Center
ROV	Remotely Operated Vehicle
SETS	South Energy Test Site
SWH	Significant Wave Height
UAF	University of Alaska Fairbanks
USFWS	US Fish and Wildlife Service
UW	University of Washington
WEC	Wave Energy Converter

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1 BACKGROUND

This Annual Operations and Monitoring Report summarizes the 2014 operational and environmental monitoring activities associated with the Pacific Marine Energy Center North Energy Test Site, located off the coast of Newport, Oregon.

1.1 WHAT IS THE PACIFIC MARINE ENERGY CENTER?

The Pacific Marine Energy Center (PMEC) is the collective name for a suite of test facilities available to the marine energy industry. These facilities are located in Oregon, Washington and Alaska.

PMEC includes scaled laboratory testing facilities for wave, tidal and river energy converters, and intermediate and full-scale open water wave energy converter (WEC) testing facilities.

PMEC is managed and operated by the Northwest National Marine Renewable Energy Center.

1.2 WHAT IS THE NORTHWEST NATIONAL MARINE RENEWABLE ENERGY CENTER?

The Northwest National Marine Renewable Energy Center (NNMREC) is one of three US Department of Energy-funded centers charged with facilitating the development of marine renewable energy technology through research, education, and outreach. Established in 2008, NNMREC is a partnership between Oregon State University (OSU), the University of Washington (UW) and the University of Alaska Fairbanks (UAF). OSU focuses on wave energy, UW's emphasis is tidal energy and UAF is involved in river energy.

We work closely with a variety of stakeholders, including device developers, community members, ocean users, federal and state regulators, and government officials, to conduct research about marine energy, provide test sites for prototype devices, and assist developers with planning and permitting activities.

NNMREC's objectives are to:

- Develop its facilities to serve as an integrated, standardized test center for US and international developers of wave, tidal and river energy;
- Evaluate potential environmental, ecosystem, and human dimension impacts, focusing on the compatibility of marine energy technologies in areas with sensitive environments and existing users;
- Facilitate and conduct research to inform adaptive management of marine energy technologies;
- Study and consult on device and array optimization for effective deployment of wave, tidal and river energy technologies;
- Improve forecasting of the wave energy resource; and
- Increase reliability and survivability of marine energy systems.

NNMREC itself serves as a neutral voice of science and engineering to inform the public and decision-makers about the potential effects and capabilities of wave, tidal, and river energy technologies.

Our faculty and students come from civil, electrical, mechanical, and chemical engineering; oceanography; marine biology; sociology; and public policy. They investigate technical, environmental, and social dimensions of these marine energy technologies, and perform research that fills knowledge gaps.

1.3 WHAT IS THE NORTH ENERGY TEST SITE?

The North Energy Test Site (NETS) is PMEC's non-grid connected, open ocean test site located approximately 4.6 km (2.5 nautical miles) off Yaquina Head, north of Newport, Oregon. The site is about 3.4 km^2 (1 square nautical mile) and ranges in depth from 45 - 55 meters. It has a gently sloping soft, sandy bottom. Significant wave heights (SWH) average 1 - 2.5 meters during summer months at 6 - 9 second energy periods. During winter months SWHs increase to an average of 2 - 5 meters at 8 - 12 second energy periods, with maximum significant wave heights of 7 - 14 meters.

We have characterized the environmental conditions of the site, and has conducted a significant level of environmental monitoring, including baseline and operational monitoring for benthic habitat, marine mammal observations, electromagnetic field studies, and acoustics. The site is fully authorized under all relevant state and federal statutes.

1.4 NETS TESTING CAPABILITIES

NNMREC has developed the Ocean Sentinel instrumentation buoy to provide an electrical load and perform data acquisition for wave energy devices under test at the NETS. Based on the 6-meter Navy Oceanographic Meteorological Automatic Device (NOMAD) design, the Ocean Sentinel buoy is moored approximately 100 meters from the device under test and connected by a power and communication umbilical cable. Power generated by the test device is processed and dissipated in a load bank onboard the Ocean Sentinel. The Ocean Sentinel has an initial average power rating of 100kW. Onboard switchgear and power conversion equipment provides control of the load bank. Data may be transmitted from the device under test to the instrumentation buoy via a fiber optic connection through the umbilical cable. Wave and current data recorded by a measuring instrument nearby can also be transmitted to the buoy via wireless telemetry.

The Ocean Sentinel's data acquisition system records multiple parameters:

- Power measurements, including voltage and current;
- Environmental data, including waves, currents and winds; and
- Mooring force, strain gauges and other signals from instrumentation onboard the WEC device under test.

Data is recorded with redundancy onboard the Ocean Sentinel and can be sent to shore via wireless telemetry to OSU's Hatfield Marine Science Center in Newport. Data may also be accessed remotely. The Ocean Sentinel is designed for testing devices from May through October and is available for environmental testing year round.

1.5 NETS PAST ACTIVITIES

The first wave energy test at the NETS took place in 2012 with the deployment of the WET-NZ WEC and the Ocean Sentinel instrumentation buoy. The WET-NZ and Ocean Sentinel were deployed from late August to early October 2012 and monitoring studies were performed at the test site prior to, during and after the deployment. The 2012 test activities and monitoring are summarized in the 2012 Annual Operations and Monitoring Report.

In 2013, we completed a second successful testing season at the NETS. As no WEC tests were scheduled for 2013, we used the opportunity to deploy the Ocean Sentinel instrumentation buoy in order to gain a better understanding of mooring systems and how to improve them, as well as to continue environmental monitoring at the site. Details of the 2013 operations and monitoring can be found in the 2013 Annual Report.

1.6 NETS Adaptive Management, Review and Reporting

1.6.1 Adaptive Management Framework and Adaptive Mitigation Plans

Operations at the NETS are conducted in accordance with an **Adaptive Management Framework** (AMF). The purpose of the AMF is two-fold:

1. It provides a means for the broader regulatory and stakeholder communities to stay informed of and provide feedback on NNMREC test center monitoring and mitigation.
2. It provides a foundation for the monitoring and adaptive management associated with individual tests at the NETS. For each test performed at the NETS, an **Adaptive Mitigation Plan** (AMP) is developed that includes thresholds and mitigation actions for the particular test. Monitoring results are reviewed by NNMREC in real-time, whenever possible, to determine if thresholds have been exceeded. If the results show that thresholds are *not* exceeded then no action is taken. If results show that thresholds are exceeded, NNMREC will consult with National Marine Fisheries Service (NMFS), US Fish and Wildlife Service (USFWS) and the Oregon Department of Fish and Wildlife (ODFW) to develop an appropriate response. Responses may include changes to monitoring methods, project operations and/or mitigation actions, as appropriate.

   Each AMP accounts for the unique attributes of that specific test, such as the characteristics of the technology being tested, the mooring system being used and the duration of testing. In addition, results and analysis of previously completed monitoring studies are used to inform the plans for future tests.

1.6.2 Adaptive Management Committee

A key part of this Framework is the **Adaptive Management Committee** (AMC or Committee). Representatives of the following organizations were invited to join the Committee:

- Northwest National Marine Renewable Energy Center;
- US Army Corps of Engineers;
- National Marine Fisheries Service;
- US Fish and Wildlife Service;
- Oregon Department of Fish and Wildlife;
- Oregon Department of Land Conservation and Development;
- Oregon Department of State Lands;
- Oregon Coastal Management Program;
- Local Tribes;
- Fishermen Involved in Natural Energy;
- Surfrider Foundation; and
- Oregon Shores.

Representatives from other organizations may be asked to join the AMC, as deemed appropriate by NNMREC.

The purpose of the Committee is to review marine resource issues (i.e. benthic habitat, derelict gear, marine mammals, acoustics, and electromagnetic fields) related to wave energy testing activities at the NETS and to make recommendations for changes in monitoring, project operations, and/or adaptive management/mitigation thresholds for the test facility. Each year, we prepare an Annual Operations and Monitoring Report (Annual Report), which is provided to the Committee. The Annual Report is a compilation of monitoring results, adaptive management thresholds, and mitigation actions taken during tests conducted at the NETS during that year. The Committee meets on an annual basis to review results and provide guidance on future test center activities.

2 OPERATIONAL ACTIVITIES IN 2014

No WEC tests were planned for 2014; therefore we did not deploy the Ocean Sentinel and only conducted limited environmental monitoring.

The Ocean Sentinel anchors have remained deployed at NETS since 2013. It had been hoped that these would have been retrieved in early August, 2014. We initially attempted to contract with NRC Environmental Services, Inc. to charter the *NRC Quest* to undertake the operations; however, unforeseen circumstances meant that the *NRC Quest* became unavailable. We then looked into multiple alternatives including other vessels and marine salvage companies. By late August, we concluded that, due to scheduling, vessel availability, capacity limitations and costs issues, it was highly unlikely that the anchors could be retrieved in 2014. We have continued to look into alternatives and opportunities with the aim of retrieving the anchors in the spring or summer of 2015.

Up until late August 2014, we had also been planning to implement a year-long wave resource characterization study at NETS. This would have involved the deployment of a TRIAXYS buoy and a bottom-mounted AWAC profiler from October 2014 to October 2015. The plan was for these instruments to have been deployed near the eastern side of the 1-square nautical mile NETS, within a triangular area identified by three corner marker buoys. Due to logistical issues and budgetary constraints, we decided to shelve the planned wave characterization study at the NETS and focused on a similar study at the PMEC South Energy Test Site.

3 MONITORING AND THRESHOLDS

Due to the greatly reduced level of activity planned at NETS during 2014, and with agreement from the AMC, only a limited benthic monitoring program was undertaken. No acoustic or EMF monitoring was implemented at NETS in 2014. Unlike in previous years, this Annual Operations and Monitoring Report will not address Adaptive Management or Adaptive Mitigation Thresholds due to the limited monitoring that was undertaken.

3.1 BENTHIC CONDITIONS AND ORGANISMS MONITORING

The following section on focuses on the benthic conditions and organisms at NETS and discusses the findings of the 2014 activities with reference to previous years. This section was provided by NNMREC's Environmental Research Director, Dr. Sarah K. Henkel of the Hatfield Marine Science Center.

3.1.1 Overview

In summer 2014 the only structure in the water at NETS were the three anchors with buoys used during the deployment of the Ocean Sentinel in 2013. Because there was so little equipment in the water, we engaged in a reduced set of environmental surveys than conducted in previous years. Sampling and analysis was planned for June 2014 to keep the time series going and to further our understanding of 'normal' inter annual variability. In previous years, June sampling has been a good indicator of what might be expected in August and October. Because we were interested in closely monitoring for potential changes to sediment characteristics due to the presence of the anchors, we made additional sediment collections multiple times in 2014. Due to logistical constraints we report here on fish sampling conducted in May 2014, rather than June. The main objective of these measurements was to determine if sediment characteristics, macrofaunal, and/or fish assemblages differed during early summer 2014 (with only anchors in place) as compared to previous observations. We report organismal observations from early summer 2014 and compare patterns and metrics to 2010 - 2013.

3.1.2 Methods

Sediment Grabs

Macrofaunal invertebrates and sediment for grain size analysis were collected using a 0.1 m^2 box core from each of the usual 12 stations and around the Ocean Sentinel anchors on June 23 and 24, 2014. Sediment samples also were collected in April, September, and (around the anchors only) in October 2014. Upon retrieving the box corer on the boat, a sub-sample of sediment was taken from the undisturbed top layer of the collected sample. The remaining sediment was sieved onboard through a 1.0 mm screen. Collected organisms were preserved in 5 % buffered formalin then transferred to 70 % EtOH. Macrofauna were sorted into major taxonomic groups and identified by laboratory staff and contracted taxonomic experts. Grain sizes of the sediment were analyzed for samples from all visits using a Beckman Coulter Laser Diffraction Particle Size Analyzer (LD-PSA) to determine median grain size and percent silt/clay.

Trawling

For collection of fishes, a beam trawl was used. The beam trawl is 2 m wide by 70 cm high with a 3 mm mesh liner the entire length of the net and a tickler chain. Tows were conducted for 10 minutes, and a constant speed of ~1.5 knots was attempted. A meter wheel on the sled of the trawl provided actual measures of the distance the trawl was on the bottom. The usual nine stations were attempted in both February and May; however, one May tow had to be discarded because of extreme quantities of ctenophores. Upon bringing the collection on board, fish and small epifaunal invertebrates were sorted into major groups and promptly euthanized and frozen. Larger invertebrates such as crabs and sea stars as well as elasmobranchs such as sharks and skates were identified, sexed if appropriate, measured, and released. Upon return to the laboratory, fish were identified to species and counted. Only the fish from both collections have been processed to date and are included in this report.

Data Analysis

Two-way ANOVAs were used to investigate differences in sediment characteristics (median grain size and percent silt clay) across depth at the site and over time (June 2010 to June 2014). Tukey's HSD *post hoc* tests were used to identify specific differences among depths or over time. For assemblage analyses, Shannon–Weaver diversity (H') and species richness (S) were calculated for each sample (macrofauna and fish separately). Indices were compared using two-way ANOVAs with the factors depth and month, and Tukey's HSD *post hoc* tests were used to identify specific differences among depths or over time.

Species count data were natural log (ln) transformed for multivariate analyses. Cluster analysis was conducted on the transformed density datasets for each 'assemblage' in order to produce groups of similar stations based on the species abundances. The SIMPROF routine in Primer 6 (Clarke 1993) determines if clusters in the dendrogram have statistically significant structure. Multidimensional Scaling (MDS) was used to display the transformed density data to examine species composition across stations.

3.1.3 Results

Sediment Characterization

The median grain size of the sampling stations over the course of the study ranged from 171 µm to 687 µm (no collections in 2014 had grain sizes larger or smaller than previously collected). As always, 30 m stations had significantly smaller median grain size than 40 and 50 m stations ($p < 0.001$), and no differences were detected between the 40 m and 50 m stations ($p = 0.870$). While sediment collected around the anchors (~ 45 m deep; gold series Figure 1) appears to have larger grain sizes than the 40 m stations (orange series) they were not statistically different ($p = 0.109$), likely due to the large variably in samples taken from both depths. However, 'anchor grabs' were statistically different from the 50 m stations ($p = 0.022$). No significant differences in median grain size were detected at the grab locations across all sampling months from June 2010 through October 2014 ($p = 0.917$).

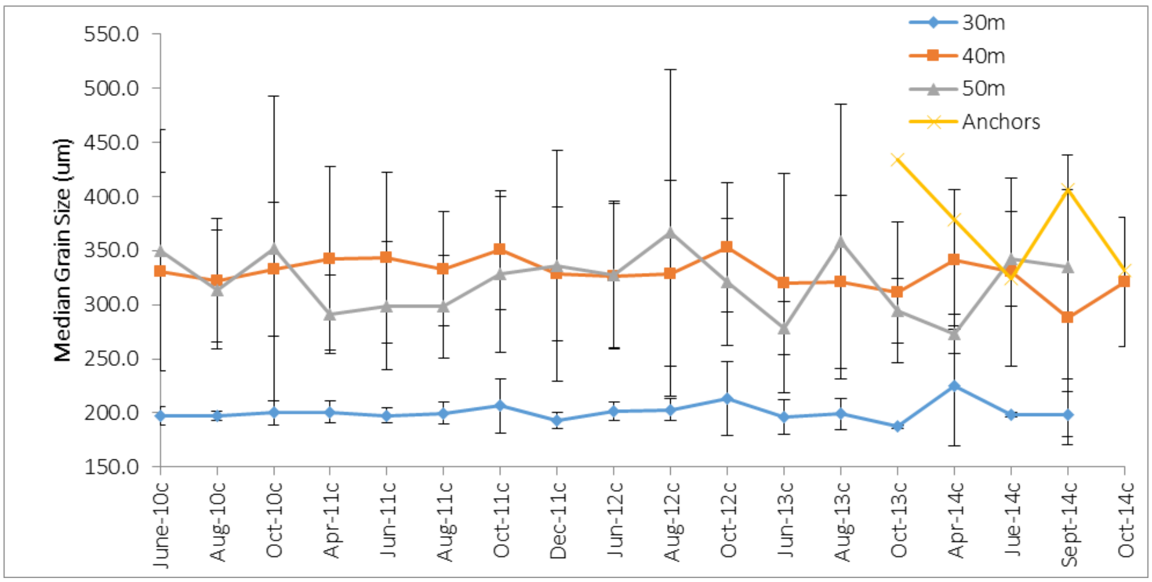

Figure 1: Median Grain Size of collected sediment. Values are means (with stddev) of 4-8 grabs at each depth.

Macrofaunal Invertebrates

The number of species and H' diversity collected in each core varied by depth bin ($p < 0.001$). Tukey's pair-wise comparisons indicated significant differences in number of species between the regularly sampled 10 m depth bins for most combinations. However, the number of species collected in grabs from around the anchors (~45 m) was not significantly different from the number collected at 30, 40, or 50 m deep. In terms of H' diversity, the only significant difference was in the diversity at 30 m as compared to 40 m. Diversity (H') was similar across all other depth bins.

The number of species and H' diversity also varied significantly among collection dates ($p < 0.001$). For the number of species, however, only October 2012 samples were significantly different (higher) in number of species than all the other collections. Slightly more variability was seen over time in H' diversity with both August and October 2012 standing out as lower than other collection dates. As noted in previous annual reports, the decrease in diversity during summer/fall 2012 (and to some extent summer of 2013) was largely due to the dominance of the assemblage by a single polychaete worm and not actually a decrease of species present (Table 1).

MDS analysis showed that the species present and their relative abundances at the 12 regularly surveyed stations in June 2014 were indistinguishable from those collected 2010 to 2013. Overall, 30 m stations (green triangles; Figure 2) were quite similar and distinct from 50 m stations (aqua squares), which had less within depth similarity (spread out more on MDS plane). The 40 m stations (blue inverted triangles) were the least similar within depth bin and spread across the 30 and 50 m clusters. Organisms collected from around the anchors in 2013 and 2014 (45 m yellow open triangles; Figure 2) fell in with the 40 m (blue triangles) and 50 m (aqua squares) collections.

Table 1: Macrofaunal invertebrate diversity (Shannon-Weaver H', log base e) and number of species (S); values are means of grabs from 12 stations for each sampling time and 8 grabs around the anchors in June 2014.

		2010	2011	2012	2013	2014	2014 anchors
June	H’	2.359	2.318	2.264	1.814	2.221	2.032
	S	20.6	17.9	23.2	18.8	22.1	24.0
August	H’	2.456	2.565	1.2	1.893		
	S	19.6	20.5	23.3	21.4		
October	H’	2.507	2.246	1.623	1.916		
	S	22.4	18.4	26.6	25.3		

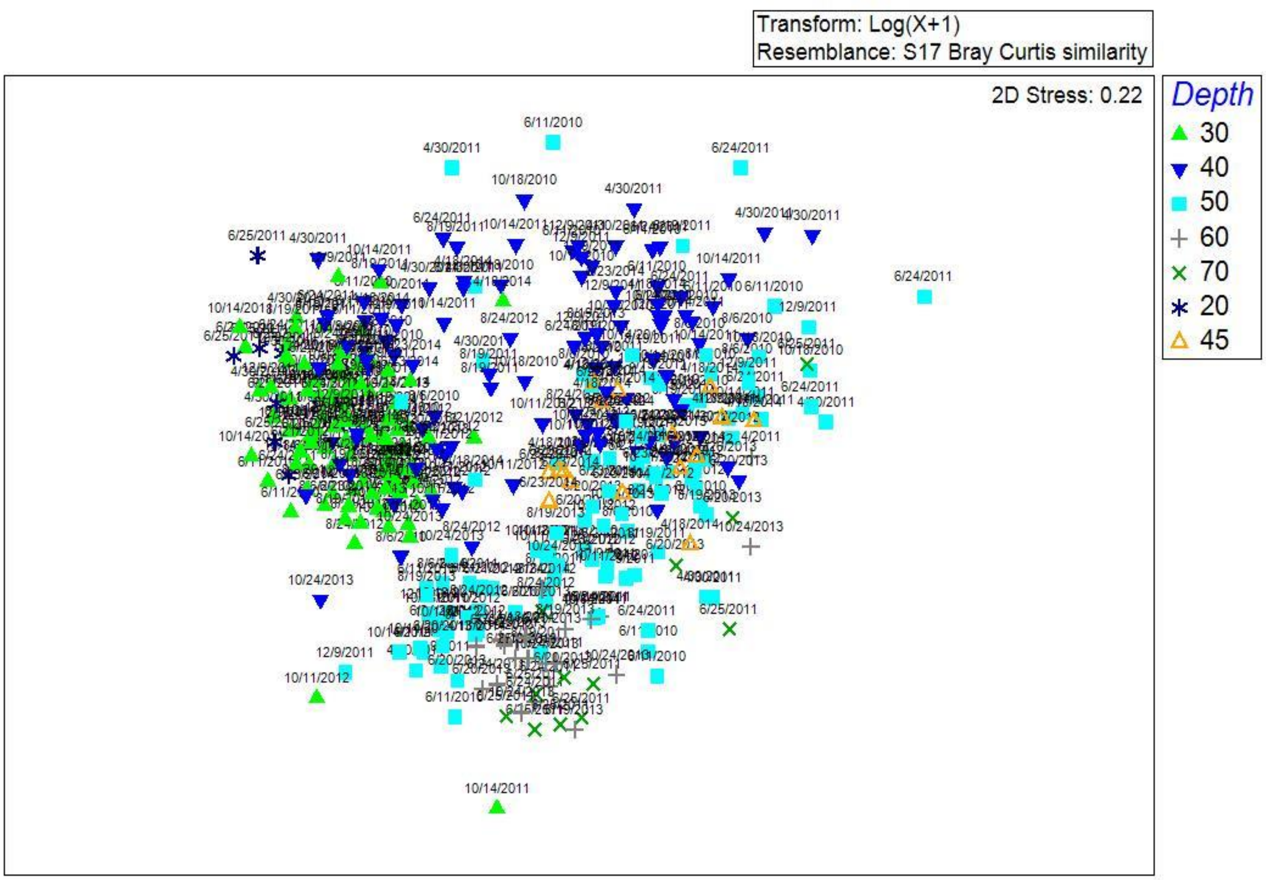

Figure 2: Multidimensional scaling (MDS) plot of the resemblance among macrofaunal invertebrate collections. Symbols are coded with the depth and labels indicate the date. Symbols that are closer together are more similar in species composition while symbols further apart are less similar in species composition.

Trawling

Fish collections made in May 2014 were lower in diversity (H') and number of species (S) than previous collections (Table 2) and distinct from most other collections in composition (magenta open diamonds; Figure 3). Overall H' diversity varied significantly by date ($P < 0.001$), but significant differences were not seen across depths. However, for the number of species, both collection date and depth were significant ($p < 0.001$ and $p = 0.027$, respectively). In terms of overall species composition, only one tow in May 2014 was statistically similar to other collections (blue asterisk; grouped with October 2011 and August 2013) and only one other previous tow (from August 2013) grouped with the rest of the May 2014 collections (magenta diamonds). The total numbers of each species caught in spring and summer collections 2010 - 2014 are listed in Table 3. Starting in June 2013, there is a shift in the dominant sanddab species from speckled to Pacific that becomes quite large by May 2014. In May 2014 there also were many fewer sole than previously collected.

Table 2: Fish diversity (Shannon-Weaver H', log base e) and number of species (S); values are means of 7 to 9 trawls for each sampling time. Empty cells are month-year combinations that were not sampled.

		2010	2011	2012	2013	2014
February	H'		1.47			1.235
	S		7.3			6.1
April	H'				1.376	
	S				10.4	
May	H'		1.474			0.566
	S		6.7			4.0
June	H'	1.176	1.114	1.558	1.676	
	S	6.8	5.3	6.9	14.1	
August / September	H'	1.288	1.457	1.264	1.253	
	S	6.2	7.8	5.8	9.3	
October	H'	1.798	1.823		1.176	
	S	8.4	8.7		4.9	
November	H'			1.137		
	S			4.6		
December	H'		0.865		1.217	
	S		5.0		5.6	

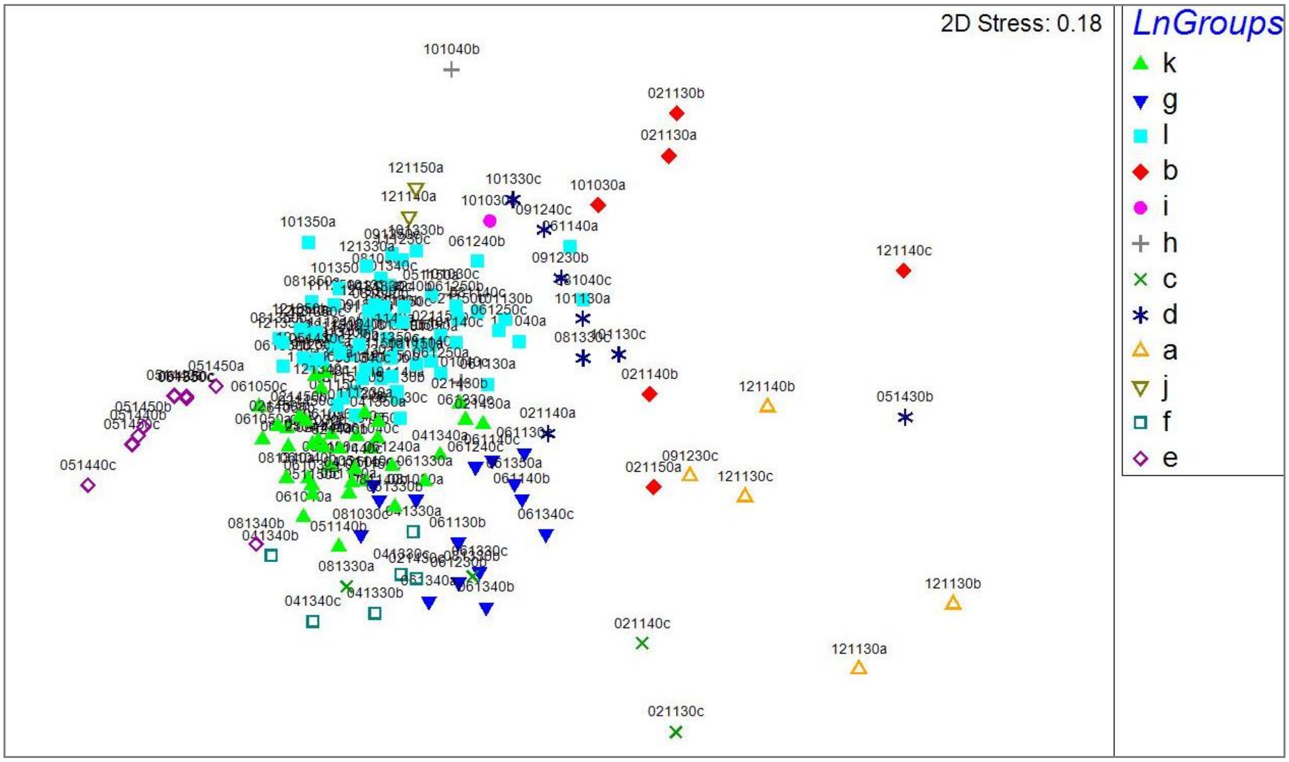

Figure 3: Multidimensional scaling (MDS) plot of fish assemblages collected around PMEC-NETS 2010-2014. On this plot, the different symbols represent significantly different groups of stations and the label indicates both the collection month and depth. E.g. 051440c is the May 2014 collection from 40 m deep, 3rd replicate (c).

3.1.4 Summary

Sediment conditions at the twelve established sampling stations around the Ocean Sentinel deployment location during 2014 did not vary from observations made previous years. The increased shell hash observed around the anchors in the 2012 ROV footage and October 2013 samples was greatly reduced by the April 2014 collection. Since no changes to the sediment characteristics were observed, we hypothesized that the device installation, operations, and removal likely also did not affect the infaunal assemblages surrounding the site. This hypothesis appeared to be confirmed as the diversity and number of species collected at the anchor grab locations did not differ from most previous collections, and the multivariate analysis showed the anchor grabs having similar assemblages to 40 and 50 m stations.

The observed change in fish species composition in 2014 was not unexpected. The first three and a half years of sampling (June 2010 to December 2013) were conducted during La Niña conditions with an expected switch to El Niño in early 2014. Additionally, the Pacific Decadal Oscillation was negative from 2006 to 2013 and became positive in January 2014. Thus, starting in 2014, ocean conditions were quite different on the Oregon central coast compared to all the data collected at NETS prior. It is fortunate that our 'baseline' time series is extensive enough to cover both these oceanographic/climatic regimes. If we only had fish data during La Niña conditions and future testing was to occur during El Niño conditions, inaccurate conclusions might be drawn if a reduction of fish species were observed during such tests.

3.1.5 Considerations for Future Monitoring

We plan to conduct box core surveys in April and June 2015 to match up with SETS box core collections and keep monitoring around the anchors before they are removed in summer 2015. Additionally, we will endeavor (as funding allows) to conduct June 2015 trawling to have an additional "El Niño" data point. We have no plans to survey NETS after June 2015 until a confirmed WEC test is planned. NNMREC believes 6 years of surveys to be sufficient to characterize the spatial and temporal dynamics of the site.

Table 3: Numerical abundance of fish collected in spring and summer beam trawl samples. June 2011 and May 2014 had fewer trawls than usual.

Common Name	**Latin Name**	**June 2010** n = 9	**May 2011** n = 9	**June 2011** n = 7	**June 2012** n = 9	**Apr 2013** n = 9	**June 2013** n = 9	**May 2014** n = 8
Speckled sanddab	*Citharichthys stigmaeus*	624	280	45	80	274	167	144
Pacific sanddab	*Citharichthys sordidus*	106	23		9	83	259	908
Sanddab. Unid. Juvenile	*Citharichthys spp*	71	178	2	36	220		
Sole, English	*Parophyrs vetulus*	204	104	17	77	1577	119	29
Sole, Butter	*Isopsetta isolepis*	51	111	163	130	123	330	6
Sand Sole	*Psettichthys melanostictus*	18	8	50	37	26	10	4
Sole. Unid. Juvenile	*Pleuronectidae*			7			128	
Sole, Rex	*Glyptocephalus zachirus*		16	2	1	3		
Sole, Dover	*Microstomus pacificus*						2	
Sole, Petrale	*Eopsetta jordani*						1	
Tomcod	*Microgadus proximus*				43	138	377	15
Sandlance	*Ammodytes hexapterus*		1		3	3	22	10
Smelt, Unid. Juvenile	*Osmeridae spp.*	7			2	11	137	
Smelt, Whitebait	*Allosmerus elongatus*	1				15	22	
Smelt, Night	*Spirinchus starksi*						19	
Snake Prickleback	*Lumpenus sagitta*					46		
Sculpin, Pacific Staghorn	*Leptocottus armatus*	1	23		1	3	12	1
Lingcod	*Ophiodon elongatus*						30	
Snailfish sp.	*Liparidae spp.*		1	2	3		24	
Poacher, Pricklebreast	*Stellerina xyosterna*		1			1	3	
Poacher, Warty	*Chesnonia cerrucosa*	2			5	1	9	
Poacher, Tubenose	*Pallasina barbata*	2	1					2
Poacher, Pygmy	*Odontopyxis trispinosa*					2		
Rockfish, Canary	*Sebastes pinniger*	2		1			10	
Rockfish, Blue	*Sebastes mystinus*						6	
Rockfish, Black	*Sebastes melanops*	28		1				
Rockfish, Widow	*Sebastes entomelas*						6	
Rockfish, Yellowtail	*Sebastes flavidus*						4	
Irish Lord	*Hemilepidotus sp.*					5	13	
Arrowtooth flounder	*Atheresthes stomias*						4	
Big Skate	*Raja binoculata*					1	2	
Smooth Alligatorfish	*Anoplagonus inermis*	2	1				1	
Northern ronquil	*Ronquilus jordani*						3	
	Total number taxa collected	**12**	**12**	**8**	**12**	**16**	**25**	**9**

3.2 Site Visits and Visual Observations

In past years, marine mammal, entangled or injured species, and derelict gear observations have occurred in conjunction with scheduled operational and monitoring activities at NETS. However, as these activities were scaled back dramatically in 2014, it was necessary to use vessels of opportunity when possible. We coordinated with scientists from OSU, Hatfield Marine Science Center and NOAA, as well as Captain Mike Kriz of the *R/V Elakha* to schedule site visits to the NETS in conjunction with other on-water activities and research. Those who were going to be in the vicinity of NETS were encouraged to undertake a visual inspection of the Ocean Sentinel anchor buoys and mooring gear if weather conditions and time permitted.

A limitation of using vessels of opportunity is that the time that non-NNMREC personnel had to undertake NNMREC tasks was limited as often this was being done as a favor. Consequently, visual observations were generally limited to ensuring the anchor marker buoys look secure and in their defined location, and no entangled marine mammals or derelict gear was obvious from the surface.

3.2.1 Summary of Planned and Successful Site Visits

The primary vessel that we use for monitoring is the *R/V Elakha*. The 54-foot *Elakha* is owned and operated by OSU. While the *Elakha* is an ideal vessel for our activities, it is not exclusively for NNMREC use, so scheduling must be coordinated by OSU Ship Operations to accommodate the research needs of a number of OSU and federal and state agency researchers.

Figure 4: The *R/V Elakha*. Photograph: David Fox, ODFW.

As always, open ocean activity can be hampered by weather and equipment issues. If a scheduled research cruise is canceled for any reason, re-scheduling has to fit around others who have the vessel booked. Using alternative vessels is cost prohibitive (in the range of $5,000 for a site visit to NETS compared with less than $1,000 using the *Elakha*).

Table 4 summarizes site visits to NETS in 2014. The *Elakha* was unavailable due to scheduled maintenance or unforeseen repairs for most of the month of March and for protracted periods during November and December. On average, NETS was visited almost 1.6 times per month during 2014. During the northbound whale migration, we visited the NETS over 3 times per month on average. However, there was only one successful visit in May plus one attempted visit when the trip was aborted due to deteriorating weather.

As with all other years, there were no reports of entangled or injured species and/or derelict gear.

Table 4: Site visits to NETS by month in 2014.

	Successful Visit	Trip Aborted	Trip Canceled	Comments
January	0	0	0	
February	1	0	2	
March	0	0	1	Vessel unavailable for 27 days
April	3	0	2	
May	1	1	0	
June	6	0	0	
July	0	0	2	
August	2	0	0	
September	4	0	2	
October	2	0	5	
November	0	0	0	Vessel unavailable for 19 days
December	0	0	4	Vessel unavailable for 18 days

3.2.2 Considerations for Future Monitoring

NNMREC has and will continue to consult with NMFS and ODFW (through their participation in the AMC) to ensure the efficacy of the visual observations and derelict gear monitoring and response methods for the duration of project activities. In addition, NNMREC - through Oregon Sea Grant - has and will continue to participate in Fishermen Involved in Natural Energy (FINE) meetings and engage directly with members of the fishing community.

4 FUTURE TEST PLANS

There are currently no tests scheduled for 2015 and only limited environmental monitoring is planned. While the Ocean Sentinel anchors remain in place, site visits will continue to be organized based on the predefined schedule.

We will continue to update the Adaptive Management Committee as plans develop.

5 ACKNOWLEDGEMENTS

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6 REFERENCES

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