NOAA'S PARTICIPATION IN THE INTERNATIONAL OCEAN SAMPLING DAY

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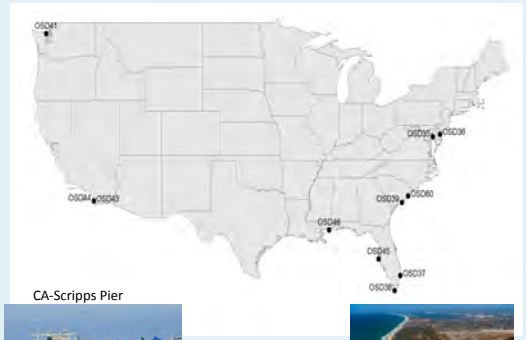
Abstract:

NOAA has been involved in marine microbial sciences for many decades. NOAA's interest in marine microbes stems from the need to better identify diversity, number, distribution and function of marine microbes in ecosystem functioning and services. Recently, NOAA joined the international efforts of the Ocean Sampling Day and of the Genomics Observatories. The Ocean Sampling Day (OSD) is a simultaneous sampling campaign of the world's oceans that will take place on the Summer solstice (June 21st) of 2014. These cumulative samples, related in time, space and environmental parameters, will provide insights into fundamental rules describing microbial diversity and function and will contribute to the blue economy through the identification of novel, ocean-derived biotechnologies. NOAA's various line office Laboratories (NOS/CCEHBR and COL, NMFS/NWFSC, OAR/AOML and OER) have participated in a pilot sampling project on June 21, 2013 and established 10 sampling sites around the country and in the 2013 Winter solstice pilot sampling. NOAA will participate in the 2014 OSD main vent.

OSD Pilot Studies

Pilot studies were initiated on the summer and winter solstice in 2012 and 2013 to help establish the sampling network, assess logistics (sampling, shipping and processing), bioinformatics capabilities (metadata capture, standards, storage, analysis and data exchange) and data policy that will be required to run the main event. Standardization of all procedures will ensure a high level of consistency between data points across Europe and beyond.



CA-Scripps Pier

CA- Tijuana River Estuary

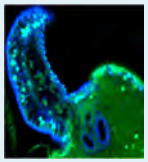
Future Expansion: River Sampling Day (RSD)

RSD is a sister initiative to Ocean Sampling Day, the global marine sampling campaign that is part of the EU-funded Micro B3.
Microbial communities in rivers are greatly under-researched, even though they play important roles in the biogeochemical cycling of nutrients and carbon, and the clean-up of freshwater pollution. To help address this gap in knowledge, River Sampling Day (RSD) was launched in 2013. It is a simultaneous sampling campaign of the world's rivers and estuaries. As one dataset, they will provide insights into fundamental rules of riverine microbial diversity and function, and will provide a snapshot of the microbial seed bank in participating rivers and river catchments. NOAA is slated to participate in the RSD by sampling waters in the Great Lakes and in some estuaries. We also hope that NOAA sites participating in RSD will form the core of an international freshwater Genomic Observatories Network.

Ocean Sampling Day (OSD) June 21, 2014

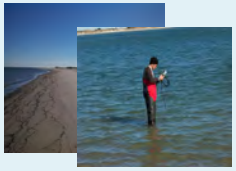
The Ocean Sampling Day (OSD) is a simultaneous sampling campaign of the world's oceans at sites selected as part of the initial OSD network. The goal of the project is to make available a large-scale dataset on marine viral, bacterial, archaeal and protists genomes and metagenomes to study microbial diversity and function and to define new targets for biotechnical applications. The database will provide a baseline for the marine environment, readily accessible to the research community, industry, the public and policy makers.
OSD builds on past efforts including the Global Ocean Survey (GOS), the International Census of Marine Microbes (ICoMM), and Tara Oceans. In addition OSD is being put together in collaboration with the Genomic Observatories Network (GOs Network), the Earth Microbiome Project (EMP), and the Global Genome Initiative (GGI). OSD is supported by EU 7FP project Micro B3 (Biodiversity, Bioinfomatics, Biotechnology) and a consortium of 32 industrial and academic partners from all over Europe.
In 2014, OSD will take place during the Summer solstice on June 21. This effort will build on the more than 60 international sites, including 12 in the U.S. that participated in the pilots OSD in June 2013 and the project is rapidly expanding. Current OSD participants include sites from Europe, Western Asia, North Africa, North and Central America, Australia, South Pacific and Antarctica. In addition, an OSD-Med community was formed with a total of 19 sites located in the Mediterranean Sea. Samples will be archived as part of the Smithsonian's Global Genome Initiative (up to 10,000 samples). The pilot event samples were sequenced by Argonne National Labs for bacterial 16S ribosomal RNA community profiles, as in-kind contributions.
(Information taken from websitehttp://www.microb3.eu/osd)

Bacteria



FL- Port Everglades

FL- Long Key



SC- North Inlet

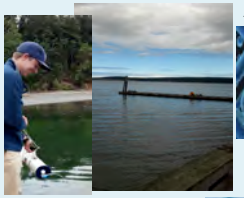
OSD NOAA Sites: Environmental and DNA data

Site	OSD 60	OSD 39	OSD 35	OSD 36	OSD 37	OSD 38	OSD 45	OSD 46	OSD 41	OSD 43	OSD44
Spring 2013											
Lat	33.32306N	32.75240N	38.6792N,	38.9144 N	26.1024N	24.7456N	27.6139N	30.2484N	48.0405 15N	32.865437N	48.040515N
Long	79.16763W	79.89954W	76.1742W	75.299281W	80.0938 W	80.7825W	82.7399	88.7482	123.025 684W	117.253626W	123.025684 W
Temperature oC	27.42	27.65	25.35		28.4	29	29.1	30.2	16.4	18.86	19.5
Salinity psu	33.61	23.8	9.74		32.6	35.76	34.4	20.6	24	33.79	32.02
Conductivity mS/cm	53.62	39.53					52.42				
pH	7.8	7.41			8	8.11	8.1				
Dissolved Oxygen mg/L	6.23	5.27			5.6	5.95	6.55	5.3	13.21	7.75	
Winter 2013											
Lat	33.32306N	32.75240N	38.6792N,	38.9144 N	26.1024N	24.7456N	27.6139N	30.2484N	48.0405 15N	32.866980N	48.040515N
Long	79.16763W	79.89954W	76.1742W	75.299281W	80.0938 W	80.7825W	82.7399	88.7482	123.025 684W	117.25725W	123.025684 W
Temperature oC	11.79	11.35			24.9	23.3	18.9	10.1	3.5	15.4	
Salinity psu	35.42	24.12			35.59	35.83	32.06	27.4	30.9	33.6	
Conductivity mS/cm	40.221	28.14									
pH	7.87	7.8			8	7.94	7.99				
Dissolved Oxygen mg/L	8.58	9.70			6.16	7.17	6.36	8.2			
DNA Spring Sampling ng/l	1365	3069	753		83	20	77	67	69	138	1155

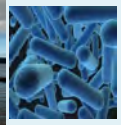
Location	SC North Inlet	SC Charleston Harbor	MD Chesapeake Bay	DE Delaware Bay	FI Port Everglades	FI Long Key	GOM-FL Tampa Bay	GOM MI Horn Island	WA Sequim Bay	CA Scripps pier	CA Tijuana River Estuary

NOAA Participation to the OSD

Following a NOAA organized workshop in December 2011, NOAA marine microbial scientists and interested program managers self-organized in a NOAA Marine Microbes Working Group designed to better coordinate NOAA microbial research and science. After learning of the OSD and the Genome Observatory 's activities, members of the group decided to participate in the 2013 OSD pilots and in the 2014 main event.
Five groups from 3 NOAA line offices (NOS, NMFS and OAR) collected DNA from water samples from 10 sites along with the environmental data (Table 1) associated with the samples, during the summer solstice of 2013. Samples from 7 sites were collected during the winter solstice, 2013. (See Map of the sites).
The filters with DNA were sent frozen to the DOE National Argonne Laboratory for DNA extraction and genomic analysis. Data received to date is presented in Table 1.
NOAA anticipates that the selected sites will be available for long-term monitoring and will become part of the international ocean Genomic Observatories Network.



Archaea



Virus

WA- Sequim Bay Pier

SC- Charleston Harbor

Conclusion:

NOAA's participation in OSD and RSD Summer solstice 2014 sampling and the establishment of genomic observatory sites will assist NOAA in fulfilling its mission by allowing for a better understanding of the microbial composition of our waters and their connection with the associated environmental conditions. This baseline characterization will also serve to assess changes in microbial composition and function over time.

Acknowledgments:

We want to thank the OSD leader Dawn Field (Oxford UK), the OSD coordinators: Mesude Bicak (Oxford, UK) and Anna Klindworth (Bremen, DE) and the RSD coordinator: Katja Lehmann (Oxford, UK) for their guidance and effective assistance. We are also in debt to Argonne National Laboratory for analyzing the samples and the Smithsonian Institution for archiving some of our samples.