

Morphotypes, capsid widths, and tail lengths of viruses from samples collected in the Eastern Tropical North Pacific oxygen minimum zone region (ETNP OMZ) on R/V New Horizon cruise NH1315 during June 2013

Website: <https://www.bco-dmo.org/dataset/823131>

Data Type: Cruise Results

Version: 1

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Project

» [Ecology and biogeochemical impacts of viruses in marine oxygen minimum zones](#) (OMZ Viruses)

Contributors	Affiliation	Role
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Abstract

Morphotypes, capsid widths, and tail lengths of viruses in samples collected in the Eastern Tropical North Pacific oxygen minimum zone region (ETNP OMZ) on R/V New Horizon cruise NH1315 from 13-28 June 2013. Viruses were deposited onto TEM grids, positively stained, and examined using a transmission electron microscope. Micrographs were collected and characterized by morphotype, as well as measured using ImageJ software.

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Coverage

Spatial Extent: N:18.92 E:-104.89 S:18.92 W:-108.799

Temporal Extent: 2013-06-19 - 2013-06-22

Dataset Description

Morphotypes, capsid widths, and tail lengths of viruses in samples collected in the Eastern Tropical North Pacific oxygen minimum zone region (ETNP OMZ) on R/V New Horizon cruise NH1315 from 13-28 June 2013. Viruses were deposited onto TEM grids, positively stained, and examined using a transmission electron microscope. Micrographs were collected and characterized by morphotype, as well as measured using ImageJ software.

Acquisition Description

Detailed protocols, including suggestions from the scientific community, are published on the lab website at <https://u.osu.edu/viruslab/protocols/> and maintained on protocols.io at <https://www.protocols.io/workspaces/sullivan-lab>.

Samples were collected from the Eastern Tropical North Pacific oxygen minimum zone region (ETNP OMZ) during the OMZ Microbial Biogeochemistry Expedition cruise (R/V NewHorizon, 13-28 June 2013). Seawater was collected from 16 depths spanning the mixed layer, oxycline, OMZ core, and below the OMZ. Collections were made using Niskin bottles on a rosette. Samples were preserved with EM-grade glutaraldehyde (2% final concentration), flash-frozen in liquid nitrogen and stored between -72 °C and -80 °C until analysis.

Viruses were deposited onto TEM grids with an air-driven ultracentrifuge (Airfuge CLS, Beckman Coulter, Brea, CA, USA) and positively stained by immersion in 2% uranyl acetate (Ted Pella, Redding, CA, USA). Prepared grids were examined using a transmission electron microscope (Phillips CM12, FEI, Hillsboro, OR, USA) with 100 kV accelerating voltage. Micrographs of 100 viruses per sample were collected using a Macrofire Monochrome CCD camera (Optronics, Goleta, CA, USA). Viruses were classified as myoviruses, podoviruses, siphoviruses or non-tailed viruses based on their morphology. Viral capsid diameters and tail lengths were measured using ImageJ software (US National Institutes of Health, Bethesda, MD, USA).

Processing Description

Virus capsid diameters and tail lengths were measured using ImageJ software (US National Institutes of Health, Bethesda, MD, USA).

BCO-DMO Processing:

- added station latitude and longitude;
- added date (from related dataset <https://www.bco-dmo.org/dataset/629125>).

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Related Publications

Brum, J. (2015). Adsorbing Viruses on TEM Grids v1. Protocols.io. doi:[10.17504/protocols.io.dar2d5](https://doi.org/10.17504/protocols.io.dar2d5)
Methods

Brum, J. (2015). Analysis of Viral Morphological Characteristics v1. Protocols.io.
doi:[10.17504/protocols.io.dde23d](https://doi.org/10.17504/protocols.io.dde23d)
Methods

Brum, J. (2015). Concentrating Viruses with an Amicon or Nanosep Centrifugal Ultrafiltration Device v1. Protocols.io. doi:[10.17504/protocols.io.c54y8v](https://doi.org/10.17504/protocols.io.c54y8v)
Methods

Brum, J. (2015). Positive and Negative Staining of Viruses on TEM Grids v1. Protocols.io.
doi:[10.17504/protocols.io.day2fv](https://doi.org/10.17504/protocols.io.day2fv)
Methods

Brum, J. (2015). Using ImageJ to Measure Viral Dimensions in Micrographs v1. Protocols.io.
doi:[10.17504/protocols.io.ddf23m](https://doi.org/10.17504/protocols.io.ddf23m)
Methods

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Parameters

Parameter	Description	Units
Station	Station where sample was collected	unitless
Depth	Depth of sample	meters (m)
Capsid_width	Capsid width	nanometers (nm)
Tail_length	Tail length (where applicable)	nanometers (nm)
Morphotype	Morphotype (siphovirus, myovirus, podovirus, non-tailed)	unitless
Latitude	Station latitude	degrees West
Longitude	Station longitude	degrees East
Date	Date; format: YYYY-MM-DD	unitless

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Instruments

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Macrofire Monochrome CCD camera
Generic Instrument Name	Camera
Dataset-specific Description	Macrofire Monochrome CCD camera (Optronics, Goleta, CA, USA)
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Phillips CM12 transmission electron microscope
Generic Instrument Name	Electron Microscope
Dataset-specific Description	Epifluorescence microscope (Axio Imager. D2, Zeiss, Jena, Germany)
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of electrons behaving as waves.

Dataset-specific Instrument Name	Air-driven ultracentrifuge (Beckman)
Generic Instrument Name	Centrifuge
Dataset-specific Description	Air-driven ultracentrifuge (Airfuge CLS, Beckman Coulter, Brea, CA, USA)
Generic Instrument Description	A machine with a rapidly rotating container that applies centrifugal force to its contents, typically to separate fluids of different densities (e.g., cream from milk) or liquids from solids.

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Deployments

NH1315

Website	https://www.bco-dmo.org/deployment/628427
Platform	R/V New Horizon
Start Date	2013-06-13
End Date	2013-06-28
Description	Oxygen Minimum Zone Microbial Biogeochemistry Expedition (OMZoMBiE) Proposed Sampling Stations Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Ecology and biogeochemical impacts of viruses in marine oxygen minimum zones (OMZ Viruses)

NSF Award Abstract: Marine oxygen minimum zones (OMZs) are regions of the world's oceans that have low or no oxygen. Often referred to as "dead zones" because of their lack of larger organisms, OMZs actually support specific microbial communities adapted to survive in these low-oxygen regions. These microbes perform metabolic processes that produce greenhouse gases such as methane, and significantly alter global nitrogen budgets. In turn, viruses can alter every aspect of microbial communities by causing mortality and altering microbial functions; yet we know little regarding how viruses affect OMZ ecosystems, which is limiting our ability to predict future changes to the Earth system as these OMZs expand over time. This proposed research seeks to fill this knowledge gap by examining the types of viruses that are present in OMZs, as well as how they alter microbial communities and their impact on global processes. In the broader perspective, this proposed work will provide extensive datasets for 7 marine OMZ regions that can be interrogated through publically-available analysis tools, thus enabling environmental science for both research and educational purposes including real-world research experience in undergraduate classes to strengthen scientific education. One postdoc, two graduate students, and undergraduate students will be trained and mentored during this project. Furthermore, the

work will facilitate international collaboration with leading microbial oceanographers from across the world. This project will use recent advances in quantitative environmental viral analysis to rapidly enhance our knowledge of OMZ viral communities through examination of 100s of samples from 7 globally-distributed marine OMZ regions with varying levels of oxygen depletion. The specific aims of the project are to (i) gain a basic understanding of viral abundances, viral-induced microbial mortality, and viral community structure, as well as the environmental conditions that drive differences in these parameters, and (ii) assess the effects of viruses on nutrient and gas cycling in OMZs. These aims will be accomplished through analyzing viral metagenomes to assess how viral communities differ among the 7 diverse OMZ regions, and how they diverge from communities in oxygenated waters. Further, the viral metagenomes will be coupled with microbial metagenomes to assess virus-host dynamics and the effects of viral-induced mortality on microorganisms performing key metabolic functions. Finally, the abundance and expression of viral-encoded metabolic genes will be used to perform gene-based biogeochemical modeling to determine the extent of viral influences in OMZ biogeochemical cycling.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658040

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