

Seawater data (2018-2021) recorded from the Friday Harbor Laboratories Ocean Observatory (FHLOO)

Website: <https://www.bco-dmo.org/dataset/826798>

Data Type: Other Field Results

Version: 2

Version Date: 2022-10-25

Project

» [FSML: Instrumentation at UW Friday Harbor Laboratories for Studies of the Biological Impacts of Ocean Acidification and Ocean Change](#) (FHLOO)

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Abstract

To our knowledge, the FHL Ocean Observatory serves as the only multi-sensor array (~2 m from the surface) in the San Juan Islands archipelago that monitors for temperature, salinity, pH(total), carbon dioxide, dissolved oxygen, chlorophyll concentration, turbidity, and current velocity. In addition to the suite of ocean properties listed above, we also monitor the microplanktonic community using a camera system called the Imaging FlowCytoBot (IFCB). The IFCB is an automated imaging flow cytometer that is designed for the continuous monitoring of phytoplankton and microzooplankton. Using a laser-triggered, high-resolution camera, the IFCB generates images and optical data of individual plankton and other particles in the size range of >10-150 μ m. Data produced by this project may be of interest to chemical and biological oceanographers, and climate scientists interested in the role of biogeochemistry in the global/regional climate system. This dataset includes pH, pCO₂, temperature, salinity, and dissolved oxygen data recorded from 2018-2021.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Supplemental Files](#)
- [Related Datasets](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)

- [Project Information](#)
 - [Funding](#)
-

Coverage

Spatial Extent: Lat:48.5461 Lon:-123.007
Temporal Extent: 2018-05-10 - 2021-12-31

Dataset Description

pH, pCO₂, temperature, salinity, and dissolved oxygen data were recorded from 2018-2021 from a sensor array at Friday Harbor Laboratories Ocean Observatory (FHLOO).

Methods & Sampling

Data are collected from a sensor array deployed at a floating dock at ~2-3 m water depth located at the University of Washington Friday Harbor Laboratories, Friday Harbor, WA (Lat = 48.5461, Long = -123.007). Sensors include: Sea-Bird SBE37 (temperature and salinity), Sunburst SAMI-pH (pH and temperature), Sunburst SAMI-pCO₂ (pCO₂ and temperature), Aanderaa Oxygen Optode 4351A (dissolved oxygen and temperature).

Data gaps (dates where instrument malfunctioned or was being serviced and there is no data) are reported in the supplemental file "[FHLOO v2 Data Gaps](#)" (PDF).

Data Processing Description

BCO-DMO Processing:

Version 1 (date 2020-10-15):

- converted date/time fields to ISO8601 format;
- added latitude and longitude as columns; values originally provided in dataset metadata.
- dataset history: note these data were originally provided as four separate datasets (listed under Related Datasets); those data have been corrected/updated by the project investigators and combined into one dataset. This is the version recommended for re-use.

Version 2 (date 2022-10-25):

- replaced previous version with version 2, which includes the following changes:
 - addition of new data added spanning 2021-05-07 to 2022-12-31;
 - "-9999" NA strings were changed to "nd";
 - the dataset has been filtered according to the data gap summary so that unreliable data (fouled sensors) are no longer included.
- BCO-DMO edits on this version include:
 - changed all dates to ISO8601 format;
 - replaced "NA" with "nd";
 - removed unnecessary columns.

[[table of contents](#) | [back to top](#)]

Data Files

File
FHLOO.csv (Comma Separated Values (.csv), 4.79 MB) MD5:601933ec9cb78bab0f5f0b4e93c1c05f Primary data file for dataset ID 826798

Supplemental Files

File
FHLOO v2 Data Gaps filename: FHLOO_v2_data_gaps.pdf (Portable Document Format (.pdf), 381.05 KB) MD5:43d45a16dfe7b5efb4bd5c2fe6b668a8 Additional metadata identifying data gaps (dates where instrument malfunctioned or was being serviced) for version 2 of the FHLOO dataset (826798).

Related Datasets

Replaces Old Versions

Sebens, K., Carrington, E., Gagnon, A., Grunbaum, D., Lessard, E., Newton, J., Swalla, B. (2020) **Dissolved oxygen and temperature recorded from 2018-2020 from a sensor array that measures pH, pCO₂, temperature, salinity, dissolved oxygen, chlorophyll, turbidity, and current velocity at Friday Harbor Laboratories Ocean Observatory (FHLOO)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-05-15 doi:10.26008/1912/bco-dmo.808629.1 [[view at BCO-DMO](#)]

Relationship Description: The "Dissolved Oxygen" dataset is considered deprecated/obsolete. Please use the "FHLOO" dataset instead because it contains corrections to the data values.

Sebens, K., Carrington, E., Gagnon, A., Grunbaum, D., Lessard, E., Newton, J., Swalla, B. (2020) **Temperature and salinity recorded from 2018-2020 from a sensor array that measures pH, pCO₂, temperature, salinity, dissolved oxygen, chlorophyll, turbidity, and current velocity at Friday Harbor Laboratories Ocean Observatory (FHLOO)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-05-22 doi:10.26008/1912/bco-dmo.811788.1 [[view at BCO-DMO](#)]

Relationship Description: The "Temperature and Salinity" dataset is considered deprecated/obsolete. Please use the "FHLOO" dataset instead because it contains corrections to the data values.

Sebens, K., Carrington, E., Gagnon, A., Grunbaum, D., Lessard, E., Newton, J., Swalla, B. (2020) **pCO₂ and temperature recorded from 2018-2020 from a sensor array that measures pH, pCO₂, temperature, salinity, dissolved oxygen, chlorophyll, turbidity, and current velocity at Friday Harbor Laboratories Ocean Observatory (FHLOO)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-05-12 doi:10.26008/1912/bco-dmo.808567.1 [[view at BCO-DMO](#)]

Relationship Description: The "pCO₂" dataset is considered deprecated/obsolete. Please use the "FHLOO" dataset instead because it contains corrections to the data values.

Sebens, K., Carrington, E., Gagnon, A., Grunbaum, D., Lessard, E., Newton, J., Swalla, B. (2020) **pH (total hydrogen scale) data recorded from 2018-2020 from a sensor array that measures pH, pCO₂, temperature, salinity, dissolved oxygen, chlorophyll, turbidity, and current velocity at Friday Harbor Laboratories Ocean Observatory (FHLOO)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-05-19 doi:10.26008/1912/bco-dmo.811757.1 [[view at BCO-DMO](#)]

Relationship Description: The "pH" dataset is considered deprecated/obsolete. Please use the "FHLOO" dataset instead because it contains corrections to the data values.

Parameters

Parameter	Description	Units
ISO_DateTime_UTC	Date (UTC) in ISO8601 format: YYYY-MM-DDThh:mmZ	unitless
ISO_DateTime_PST	Date (local time zone of PST/PDT) in ISO8601; format: YYYY-MM-DDThh:mm	unitless
Dox	Dissolved oxygen	micromoles O2 per kilogram (umol O2 kg-1)
OxSat	Dissolved oxygen saturation (percent)	unitless (percent)
Sea_Temp_Oxygen	Water temperature from Aanderaa Oxygen Optode	degrees Celsius
pCO2	Partial Pressure of CO2 in seawater	microatmospheres (uatm)
Sea_Temp_pCO2	Water temperature from Sunburst SAMI-pCO2	degrees Celsius
Sea_pH	Seawater pH	seawater pH units (total hydrogen scale)
Sea_Temp_pH	Water temperature from Sunburst SAMI-pH	degrees Celsius
Sea_Temp_SBE	Water temperature from Sea-Bird SBE37	degrees Celsius
Sal	Salinity	psu
Latitude	Latitude of sampling location	degrees North
Longitude	Longitude of sampling location (negative = west)	degrees East

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	Aanderaa Oxygen Optode 4351A
Generic Instrument Name	Aanderaa Oxygen Optodes
Dataset-specific Description	Aanderaa Oxygen Optode 4351A (dissolved oxygen and temperature)
Generic Instrument Description	Aanderaa Oxygen Optodes are instrument for monitoring oxygen in the environment. For instrument information see the Aanderaa Oxygen Optodes Product Brochure.

Dataset-specific Instrument Name	Sea-Bird SBE37
Generic Instrument Name	CTD Sea-Bird MicroCAT 37
Dataset-specific Description	Sea-Bird SBE37 (temperature and salinity)
Generic Instrument Description	The Sea-Bird MicroCAT CTD unit is a high-accuracy conductivity and temperature recorder based on the Sea-Bird SBE 37 MicroCAT series of products. It can be configured with optional pressure sensor, internal batteries, memory, built-in Inductive Modem, integral Pump, and/or SBE-43 Integrated Dissolved Oxygen sensor. Constructed of titanium and other non-corroding materials for long life with minimal maintenance, the MicroCAT is designed for long duration on moorings. In a typical mooring, a modem module housed in the buoy communicates with underwater instruments and is interfaced to a computer or data logger via serial port. The computer or data logger is programmed to poll each instrument on the mooring for its data, and send the data to a telemetry transmitter (satellite link, cell phone, RF modem, etc.). The MicroCAT saves data in memory for upload after recovery, providing a data backup if real-time telemetry is interrupted.

Dataset-specific Instrument Name	Sunburst SAMI-pCO2
Generic Instrument Name	Submersible Autonomous Moored Instrument
Dataset-specific Description	Sunburst SAMI-pCO2 (pCO2 and temperature)
Generic Instrument Description	The Submersible Autonomous Moored Instrument (SAMI) measures and logs levels of dissolved chemicals in sea and fresh water. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

Dataset-specific Instrument Name	Sunburst SAMI-pH
Generic Instrument Name	Submersible Autonomous Moored Instrument
Dataset-specific Description	Sunburst SAMI-pH (pH and temperature)
Generic Instrument Description	The Submersible Autonomous Moored Instrument (SAMI) measures and logs levels of dissolved chemicals in sea and fresh water. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

[[table of contents](#) | [back to top](#)]

Deployments

FHLOO

Website	https://www.bco-dmo.org/deployment/808585
Platform	Friday_Harbor
Description	Friday Harbor Laboratories Ocean Observatory (FHLOO) located at the University of Washington Friday Harbor Laboratories, Friday Harbor WA. Data are collected from an array of sensors from a floating dock at ~2-3 m water depth. Lat = 48.5461, Long = -123.007

[[table of contents](#) | [back to top](#)]

Project Information

FSML: Instrumentation at UW Friday Harbor Laboratories for Studies of the Biological Impacts of Ocean Acidification and Ocean Change (FHLOO)

Coverage: University of Washington Friday Harbor Laboratories, Friday Harbor WA

Ocean change, including ocean acidification (OA), poses an unprecedented threat to oceanic and coastal ecosystems and to the societies that depend on them. The scale and complexity of the OA problem requires new spatially distributed data collection, and an integrated programmatic approach to OA research. The Salish Sea region, fed by waters of the Northeast Pacific, is particularly vulnerable to OA events associated with ocean upwelling and is already experiencing pH ranges that other areas will not see for many decades; commercial fisheries and shellfish aquaculture already appear to be affected or at risk. OA is further complicated in estuaries such as the Salish Sea by local processes including respiration, production, anoxia, and mixing, resulting in wide pH and pCO₂ variation in time and space. Long-range plans for ocean change research at FHL focus on integrated ocean carbonate system observations, utilizing new advances in the development of ocean sensors and instruments, and incorporating biological response studies under laboratory and field conditions. Field conditions will be simulated using environmental and ecosystem modeling studies, and our findings will provide information for assessment of policy, and socio-economic responses.

Societal needs will be fully integrated with our research, merging the relevance of the problem and the need for human adaptation to OA. FHL will engage in knowledge transfer, with data and information flowing to and from policy makers, affected communities, scientists, and the general public. The shellfish aquaculture community will benefit economically from the new data and tribal governments will accrue benefits that could help sustain traditional food sources. The public will benefit through targeted education activities that improve general understanding of ocean processes and especially ocean acidification. UW and FHL will train a workforce that is ready to discover and deal with the impacts of OA and to realize adaptive responses that will allow affected industries and communities to thrive in the presence of this threat. Users include groups engaged in marine resource-based economies, members of coastal tribes, managers of marine resources, researchers in academic and government laboratories, and both formal and informal educators. FHL education programs reach broadly, from high school teachers and their students to undergraduate and graduate students and postdoctoral researchers. At the graduate level, FHL will prepare students for careers inside and outside of academia. Under represented minorities (URM) are fully integrated into FHL activities, with the objective of increasing their representation in oceanography, biology, fisheries and other OA and ocean-related fields. We will leverage existing programs (UW IGERT in Ocean Change, FHL Blinks and REU site programs, FHL Research Apprenticeships, NSF BEACON at UW) and create new programs to recruit, mentor, and prepare a community of URM students both on and off the university campus. We will expand our ongoing engagement of Native American students in ocean change research and education, near their own college campus (NWIC) and with their own instructors, in a culturally respectful way.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Biological Infrastructure (NSF DBI)	FSML-1418875

[[table of contents](#) | [back to top](#)]