Vegetation surveys at artificial reefs in Kāneʻohe Bay, Oʻahu conducted in 2022 and 2023 as part of a reef halo dynamics study

Website: https://www.bco-dmo.org/dataset/987227
Data Type: Other Field Results
Version: 1
Version Date: 2025-11-18

Project
» CAREER: Decoding seascape-scale vegetation patterns on coral reefs to understand ecosystem health: Integrating research and education from organismal to planetary scales (Coral Reef Halos)

Contributors	Affiliation	Role
Innes-Gold, Anne	University of Hawaiʻi at Mānoa (HIMB)	Principal Investigator, Student
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
The goal of this dataset was to quantify substrate cover (vegetation or sand) of the benthos surrounding artificial reefs in Kāneʻohe Bay, Oʻahu, Hawaiʻi from August 2022-2023. These surveys were done monthly. We recorded three 5-meter-long video transects, spaced evenly around each artificial reef, starting from each of the three top-layer cinder blocks of the artificial reef, positioned perpendicularly to the cinder block and going outwards into the seagrass meadow. On each video transect, photos were taken continuously starting at the artificial reef. Each photo was imported into ImageJ, where the scale was set based on a 10 cm measure on the transect, and then a virtual 20x20 cm quadrat was laid directly on the right side of the transect. Virtual quadrats were laid consecutively every 20 cm (e.g., a quadrat from each of 0-20 cm, 20-40 cm, 40-60 cm, etc. Then, 20 random points were generated inside each distance bin and classified as sand or vegetation.

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Coverage

Location: Kāneʻohe Bay, Oʻahu, Hawaiʻi
Spatial Extent: **N**:21.464275 **E**:-157.806396 **S**:21.464012 **W**:-157.806783
Temporal Extent: 2022-08-24 - 2023-12-04

Methods & Sampling

Surveys were conducted monthly from August 2022-December 2023. We recorded three 5-meter-long video transects, spaced evenly around the reef, starting from each of the three top-layer cinder blocks of the artificial reef, positioned perpendicularly to the cinder block and going outwards into the seagrass meadow. On each video transect, photos were taken continuously starting at the artificial reef. Each photo was imported into ImageJ (version 1.53t), where the scale was set based on a 10 cm measure on the transect, and then a

virtual 20x20 cm quadrat was laid directly on the right side of the transect. Virtual quadrats were laid consecutively every 20 cm (e.g., a quadrat from each of 0-20 cm, 20-40 cm, 40-60 cm, etc.). Then, 20 random points were generated inside each distance bin and classified as sand or vegetation.

BCO-DMO Processing Description

* The data table within the submitted file "vegetation_data.csv" (file uploaded 2025-11-21) was imported into the BCO-DMO data system for this dataset. Values "NA" imported as missing data values. Table will appear as Data File: 987227_v1_kaneohe-bay-halos-vegetation.csv (along with other download format options).

Missing Data Identifiers:
* In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* Date column converted to consistent format (it contained different format styles, some of which were missing the day '23-Jul'). Full dates were reconstructed from the individual Year, Month, Day columns and all Dates conform to ISO 8601 format yyyy-mm-dd.

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Data Files

File	
987227_v1_kaneohe-bay-halos-vegetation.csv	(Comma Separated Values (.csv), 333.17 KB) MD5:4d0a13b5b171ddb9e9f952fd7d8ad059
Primary data file for dataset ID 987227, version 1	

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Supplemental Files

File	
Vegetation_Photos.zip	(ZIP Archive (ZIP), 20.26 GB) MD5:b841769b2f11a3027a80d3d3fc2c0fc5
Vegetation photos (as referenced in the vegetation data table column "ImageName"). These files are stored in folders by: yyyymmdd/reefID/yyyymmdd_reefID_transectID/yyyymmdd_reefID_transectID_transectDistance_binNum.png example relative path within the zip package: 20220922/R3/20220922_R3_T2/20220922_R3_T2_1.4-1.6_B5.png	

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Related Publications

Innes-Gold, A. A., McManus, L. C., Lester, E., Ong, T. W., Cook McNab, A., Rahnke, S. A., Brett Pablo, J., Tokoyoda, A., Watson, D., & Madin, E. M. P. (2025). Herbivory and temperature mediate coral reef halo dynamics. The American Naturalist. https://doi.org/10.1086/738015
Results

National Institutes of Health (2022). ImageJ version 1.53t (Released 24 August 2022). Available from https://imagej.net/ij/index.html
Software

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Related Datasets

IsRelatedTo

Innes-Gold, A. (2025) **Fish community surveys at artificial reefs in Kāneʻohe Bay, Oʻahu conducted in 2022 and 2023 as part of a reef halo dynamics study.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-11-21 doi:10.26008/1912/bco-dmo.985611.1 [view at BCO-DMO]
Relationship Description: Datasets collected at artificial reefs in Kāneʻohe Bay, Oʻahu in 2022 and 2023 as part of a reef halo dynamics study (Innes-Gold, 2025; doi: 10.1086/738015).

Innes-Gold, A. (2025) **Temperature measured at artificial reefs in Kāneʻohe Bay, Oʻahu in 2022 and 2023 as part of a reef halo dynamics study.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-11-18 doi:10.26008/1912/bco-dmo.987237.1 [view at BCO-DMO]
Relationship Description: Datasets collected at artificial reefs in Kāneʻohe Bay, Oʻahu in 2022 and 2023 as part of a reef halo dynamics study (Innes-Gold, 2025; doi: 10.1086/738015).

Innes-Gold, A. (2025) **Water nutrients measured at artificial reefs in Kāneʻohe Bay, Oʻahu in 2022 and 2023 as part of a reef halo dynamics study.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-10-16 doi:10.26008/1912/bco-dmo.987232.1 [view at BCO-DMO]
Relationship Description: Datasets collected at artificial reefs in Kāneʻohe Bay, Oʻahu in 2022 and 2023 as part of a reef halo dynamics study (Innes-Gold, 2025; doi: 10.1086/738015).

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Parameters

Parameter	Description	Units
ImageName	Image file name (see Vegetation_Photos.zip for images). Note, add the extension .png to the ImageName to get the complete filename.	unitless
Date	Survey date (ISO format)	unitless
Month	Month of survey (numeric)	unitless
Year	Year of survey	unitless
Day	Day of survey (numeric day of month)	unitless
Reef	Artificial reef number (R#)	unitless
Transect	Transect number, 1-3 (T#)	unitless
DistanceTransect	The distance from the central structure in cm. This is represented as a string range (for example '3.4-3.6')	unitless
BinNumber	Bin number, starting with 1 closest to the structure (B#)	unitless
NumberAlgae	The number of random points landing on algae	count
NumberSand	The number of random points landing on sand	count
QuadratSize	The size of the quadrat (description), always 20x20 cm	unitless
Notes	Notes	unitless
DominantVegetation	The dominant vegetation type; only done for some photos and not used in this analysis	unitless
Analyzer	The name of the person who did the analysis	unitless
Latitude	Latitude	decimal degrees
Longitude	Longitude	decimal degrees

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Instruments

Dataset-specific Instrument Name	Camera: Gopro Hero 10
Generic Instrument Name	Underwater Camera
Generic Instrument Description	All types of photographic equipment that may be deployed underwater including stills, video, film and digital systems.

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Project Information

CAREER: Decoding seascape-scale vegetation patterns on coral reefs to understand ecosystem health: Integrating research and education from organismal to planetary scales (Coral Reef Halos)

Website: http://oceansphere.org

Coverage: Hawai'i (field components) and global (synthetic components)

NSF Award Abstract:
Coral reefs worldwide are under increasing threat from a range of human-induced stressors. Climate change is understood to be a key global stressor threatening reefs, but the only proven levers for ecosystem managers to increase reef resilience is to mitigate local and regional stressors such as fishing pressure. A vexing question persists, however, which is how to measure the effects of fishing on ecosystems, particularly over the large spatial (e.g., >10s of meters) and temporal (multi-year) scales over which fishing occurs. One promising approach to doing so is using the large-scale vegetation patterns found on coral reefs globally, called "halos", to remotely observe when, where, and to what extent fishing pressure is affecting community structure and function. This program combines lab- and field-based experiments with cutting-edge satellite imaging technology and computer science approaches to provide a leap forward in our understanding of how species-level interactions can scale up in space and time to shape coral reef seascapes around the world. By drawing on these approaches, the synergistic education program: 1) integrates science and art (i.e., murals and satellite imagery) to educate and inspire Hawai'i's students and general public about coral reef ecology; 2) builds technological capacity in Hawai'i's underrepresented minority high school to graduate students, and 3) empowers these students with science communication skills to communicate with diverse audiences. By leveraging this research program and the cutting-edge technologies it will involve, the investigator establishes a strong foundation for long-term teaching and mentoring activities focused on increasing capacity within STEM-underrepresented minorities with Hawaiian and other Pacific Islander backgrounds. Decoding what coral reef halos can tell us about the effects of fishing on reef ecosystem health provides valuable knowledge to reef ecosystem managers and conservation practitioners as reefs continue to rapidly change due to human stressors.

This project combines lab- and field-based experiments with cutting-edge satellite imaging technology and computer science approaches to address the goals of: 1) determining the mechanisms that create the "halos" that form around coral patch reefs, and 2) testing the predictions arising from these mechanisms in a global arena. This project uses a transdisciplinary approach – spanning ecology, oceanography, geospatial science, and computer science – to address these goals. This program has three scientific objectives: to determine 1) which species interaction mechanisms and environmental factors cause reef halos and what their relative importance is; 2) whether these mechanisms are globally consistent or vary geographically; and 3) whether halos can therefore be used as an indicator of aspects of coral reef ecosystem health. In the process, this research advances our understanding of how remote observation tools (satellite and drone imagery; camera traps) can be integrated with computer science (machine learning) and ecological approaches (mechanistic experiments) to generate emergent insights that would not otherwise be possible.

This project is jointly funded by the Biological Oceanography Program, the Established Program to Stimulate Competitive Research (EPSCoR), and Ocean Education Programs.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1941737

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