

Plan Overview

A Data Management Plan created using DMPTool

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Title: Northern Salish Sea Habitat Mapping Data Management Plan

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Funder: Hakai Institute

Template: Hakai Institute Data Management Plan

Project abstract:

The Hakai Institute is collaborating on a research project led by Brian Timmer (PhD candidate, University of Victoria) examining long term changes in marine vegetation distribution in the Salish Sea. For this project, the Hakai Institute is producing a paired spatial dataset containing (1) high-resolution aerial imagery and (2) spatial extent of bull kelp (*Nereocystis luetkeana*).

High-resolution aerial imagery along the coast of the Salish Sea (Denman Island to the south end of Quadra Island) will be collected using the Hakai Airborne Coastal Observatory in the summer of 2023. These data will be collected and processed to produce orthomosaics of the area of interest by the Hakai Institute.

Luba Reshitnyk, head of the Hakai Marine Mapping Program and Hakai Science lead on this project, will lead the management of imagery acquisition, processing and analysis to determine the extent of bull kelp (*Nereocystis luetkeana*) present in the ACO imagery and use available ground truth data collected by Brian Timmer in the field. Brian Timmer will use the data as part of his PhD research examining long-term changes in bull kelp extent.

Start date: 05-01-2023

End date: 12-30-2024

Last modified: 04-15-2024

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Northern Salish Sea Habitat Mapping Data Management Plan

Data Overview

The Hakai Institute is collaborating on a research project led by Brian Timmer (PhD candidate, University of Victoria) examining long term changes in marine vegetation distribution in the Salish Sea. For this project, the Hakai Institute is producing a paired spatial dataset containing (1) high-resolution aerial imagery and (2) spatial extent of bull kelp (*Nereocystis luetkeana*).

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High-resolution aerial imagery will be collected on the Hakai Aerial Coastal Observatory (ACO). The ACO uses two fully integrated PhaseOne Industrial iXU-RS1000 medium format cameras for the collection of high-resolution aerial imagery. Combined, the synchronized camera system provides 4-Band combined NIR and RGB (4-Band CIR) imagery. ACO Imagery is positioned using the inertial navigation system (combined GPS and IMU), processed through PP-RTX. Positional accuracy of ACO imagery is $\pm 15\text{-}30$ cm. Images collected are photogrammetrically orthorectified into a single mosaic, where geometric distortion has been corrected using an associated digital elevation model and colour has been balanced in processing. Output 4-band mosaiced imagery will be 10 cm in resolution and provided in geotiff format. Imagery is visually reviewed by a secondary analyst to ensure that coverage over open water areas is complete. Imagery is reprocessed if necessary.

All ACO data are securely stored and backed up at Hakai Institute's Victoria, BC office and at the Hakai Institute node at UNBC in Prince George, BC. Data will be made discoverable through Hakai's metadata catalogue. Processed data will be freely distributed to Hakai collaborators. Raw data is available upon request.

Format: geotiff

Intended repository: All ACO data are securely stored and backed up at Hakai Institute's server at the University of Victoria Enterprise Data Centre and at the Hakai Institute node at UNBC in Prince George, BC. Data will be made discoverable through Hakai's metadata catalog.

License for reuse: Creative Commons Attribution 4.0 International

Processed data will be freely distributed to project collaborators. Raw data are available upon request. Data will be made discoverable through Hakai's metadata catalog. Hakai maintains the right to use data for downstream scientific purposes and projects of shared interest. This includes consolidation of data at regional, national and global scales as part of Hakai's commitment to long term science. In general, Hakai does not provide data to private sector companies for commercial purposes. Where necessary, imagery can be further masked to remove sensitive data. See data sharing section below.

Spatial extent of surface bull kelp canopy (*Nereocystis luetkeana*)

A spatial dataset (vector polygon shapefiles) of the extent of bull kelp canopy (*Nereocystis luetkeana*) will be derived from the imagery collected by the Hakai Airborne Coastal Observatory. Bull kelp canopy (ie. not submerged) will be mapped using a novel AI tool, the KelpOMatic, (Denouden & Reshitnyk, 2023) and, if necessary, image indices (e.g. blue-NDVI). Data are reviewed by a secondary analyst and manually edited where necessary. The final dataset is published using the following naming conventions:

YYYYMMDD_Region_Site_Mission/ProjectID_kelp.shp.

Format: vector shapefile (.shp)

License for reuse: Creative Commons Attribution 4.0 International

Intended repository: Hakai Institute Geospatial NAS and ESRI online data portal

Metadata package for the Hakai Data Catalog

A metadata record that will be published on the Hakai Data Catalog will include links to (1) the vector shapefiles, (2) a data dictionary describing feature attributes (see below) and (3) metadata describing the project and dataset.

Vector shapefiles of species distribution derived from ACO imagery will contain the following attributes, and conform to ISO19115 standards, including the following fields:

File name

Site name

Date of image acquisition

Region

Survey type (Unique or repeat)

Dataset Provider

Original image resolution

Image source

Sensor name

Tide height during image acquisition

Data sharing

Data citation

Dataset DOI (if applicable)

Location of the original data

Links to data

Species

Area

Perimeter

Delineation method

Confidence

Analyst

Notes

Data Sharing Policy and Timeline

Hakai collects data to use for scientific purposes. Hakai maintains the right to use data for downstream scientific purposes and projects of shared interest. This includes consolidation of data at regional, national and global scales as part of Hakai's commitment to long term science. In general, Hakai does not provide data to private sector companies for commercial purposes.

The imagery (i.e. orthomosaic) and spatial datasets derived from the imagery (bull kelp extent) will be made immediately available to internal project collaborators.

The imagery will be discoverable and publicly available 1 year after collection (including a metadata record on the Hakai Data Catalog). The spatial datasets derived from the imagery (bull kelp) are intended to be used by the Principal Investigators within three years. If the Hakai Institute receives requests or identifies other needs/use of the dataset prior to publication, the Hakai lead will communicate the data request to the PI (Brian Timmer) to discuss data sharing.

Data is released under CC BY 4.0. We do however expect researchers using these data to contact Hakai Institute for collaboration opportunities.

The Hakai Institute is committed to ensuring that data generated by or in collaboration with Hakai researchers is made available to the broader science community, where legal and ethical considerations allow, as detailed by the Hakai Open Science Data Policy. Foremost, we apply the CARE principles for Indigenous Data Governance and the First Nations Principles of OCAP, and where possible the FAIR Data Principles, while respecting and retaining intellectual property policies of projects and participants.

Data Publishing Plan

ACO imagery will be discoverable on the Hakai Institute Data Catalog and accessible upon request due to file size. Spatial datasets will be stored on the Hakai Institute Geospatial NAS and ESRI online data portal and a metadata record will be published to the Hakai Institute Data Catalog. A unique DOI will be produced for the eelgrass and kelp spatial datasets.

Roles and Responsibilities

Luba Reshitnyk will work with members of the Hakai Geospatial team to collect, review and produce the final image orthomosaic. Luba Reshitnyk will produce, review and publish the spatial datasets on bull kelp distribution. Brian Timmer is responsible for communication to collaborators, data review and analysis regarding imagery and spatial datasets described in this DMP. Any papers authored using the datasets produced for this project must result in Luba and Brian being offered co-authorship opportunities. Otherwise the principles outlined in the CRediT authorship guidelines apply: <https://www.elsevier.com/authors/policies-and-guidelines/credit-author-statement>.

Planned Research Outputs

Text - "TBD"

Climate change is reshaping coastal ecosystems, resulting in shifting global baselines for primary productivity, habitat availability, and biodiversity. These changes are often exacerbated within inland seas, where warming trends can be intensified by low mixing and vertical stratification of the water column. For example, within the northern regions of the Salish Sea, average sea surface temperatures (SST) have risen by ~2 °C during summer months over the past 50 years, with peak SST consistently reaching over 20 C in the past decade - well beyond the preferred ranges of kelps and seagrasses in the area. Further, the nearshore vegetation in this region of the Salish Sea serves as key migratory habitat for virtually all endangered stocks of juvenile salmon that leave the Fraser River, and also as spawning grounds to the last remaining un-collapsed stock of Pacific herring. Understanding how these historical environmental factors have influenced the modern distribution of marine habitat-forming species is essential to predicting the impacts of global change in temperate coastal ecosystems, yet detailed long-term baseline data for nearshore habitats is scarce.

In 1972, aerial imagery (both colour and NIR) was collected between Denman Island and Quadra Island, spanning ~90 km of shoreline in the northern Strait of Georgia as part of an initiative to evaluate the potential for harvesting of red seaweeds. These aerial surveys were complimented by 22 ground truth transects within the Comox/Denman subregion which detail roughly 100 species of intertidal and subtidal flora and fauna, giving an unprecedented glimpse into the historical community composition and biodiversity in the Salish Sea half a century ago. Comparing modern conditions with those from these historical surveys will allow an unprecedented look into the past half century of change within the Salish Sea, and may give insights to the future of coastal nearshore ecosystems that are expected to warm to these levels in the near future.

Intended repository

Published in an academic journal

Initial access level

Open Access

Anticipated release date

August 2024

Initial license

Anticipated file size

N/A

Dataset - "Aerial imagery of the Northern Salish Sea (east coast Vancouver Island, Denman Island, south end of Quadra Island)"

Aerial imagery collected in 2023 over coastal areas from Denman Island to Quadra Island. Data were collected at low tide (< 1.0 m) to ensure visibility of intertidal and subtidal habitats.

Intended repository: UVic Data Centre, Hakai NAS

Initial access level: Collaborators only

Anticipated release date: 2024-05-30

Initial license: Creative Commons Attribution 4.0 International

Anticipated filesize: ~20 GB

Dataset - "Spatial extent of surface canopy kelp (*Nereocystis luetkeana*) in the North Salish Sea (Denman to Quadra Island) 2023"

Spatial extent of bull kelp canopy (*Nereocystis luetkeana*) in the North Salish Sea derived from high resolution aerial imagery.

Planned research output details

Title	Type	Anticipated release date	Initial access level	Intended repository(ies)	Anticipated file size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
TBD	Text	2024-08-29	Open	None specified		None specified	None specified	No	No
Aerial imagery of the Northern Salish Sea (east co ...	Dataset	2024-05-29	Restricted	Hakai Institute ACO NAS	82 GB	Creative Commons Attribution 4.0 International	None specified	No	No
Spatial extent of surface canopy kelp (<i>Nereocystis</i> ...	Dataset	2024-05-29	Restricted	Hakai Institute Data Catalog	50 MB	Creative Commons Attribution 4.0 International	None specified	No	No