

Marine Plan Partnership



Integrating community-based monitoring with remote sensing to inform coastal ecosystem-based management

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Marine Planning Partnership for the North Pacific Coast

Enter Keywords ... SEARCH

Haida Gwaii

North Coast

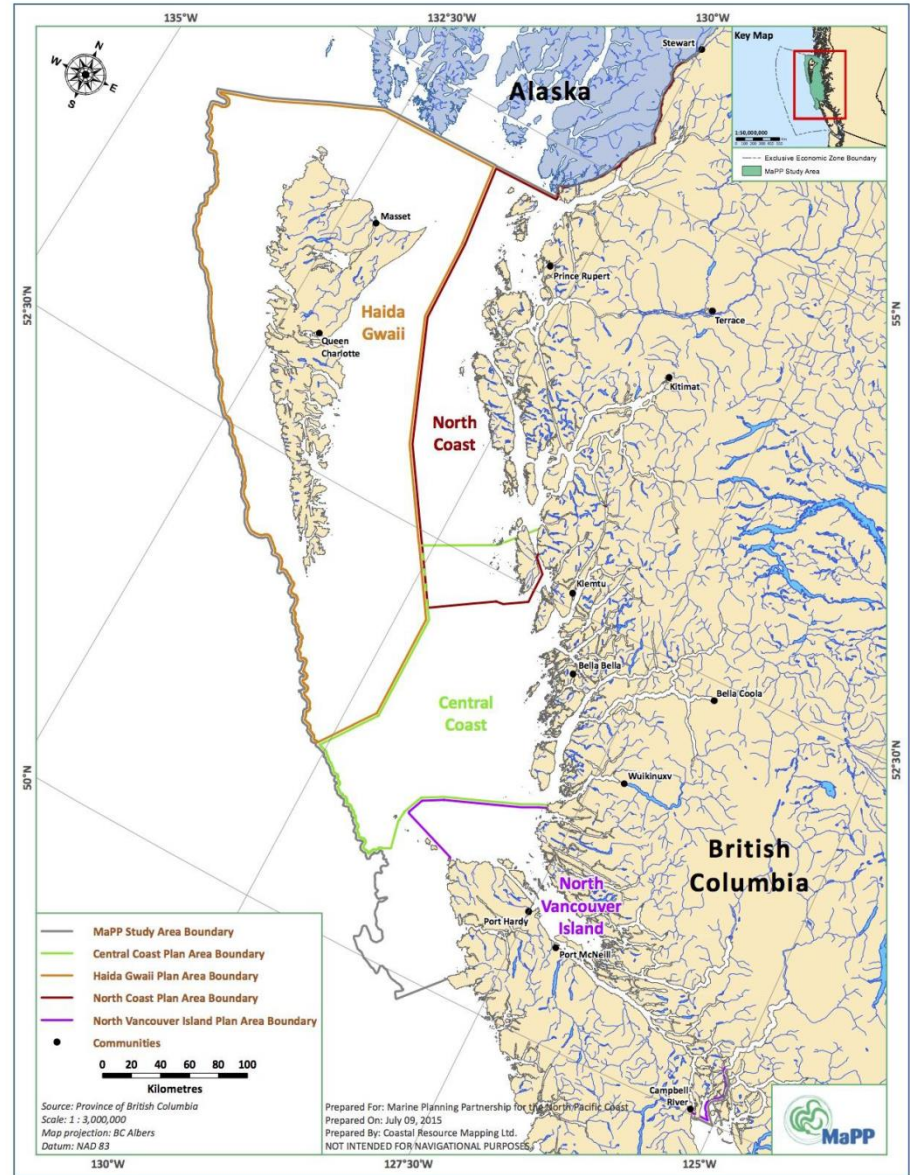
Central Coast

North Vancouver Island

Regional

A collaborative marine planning partnership between First Nations and the Province of British Columbia

www.mappocean.org



Marine Plan Partnership:

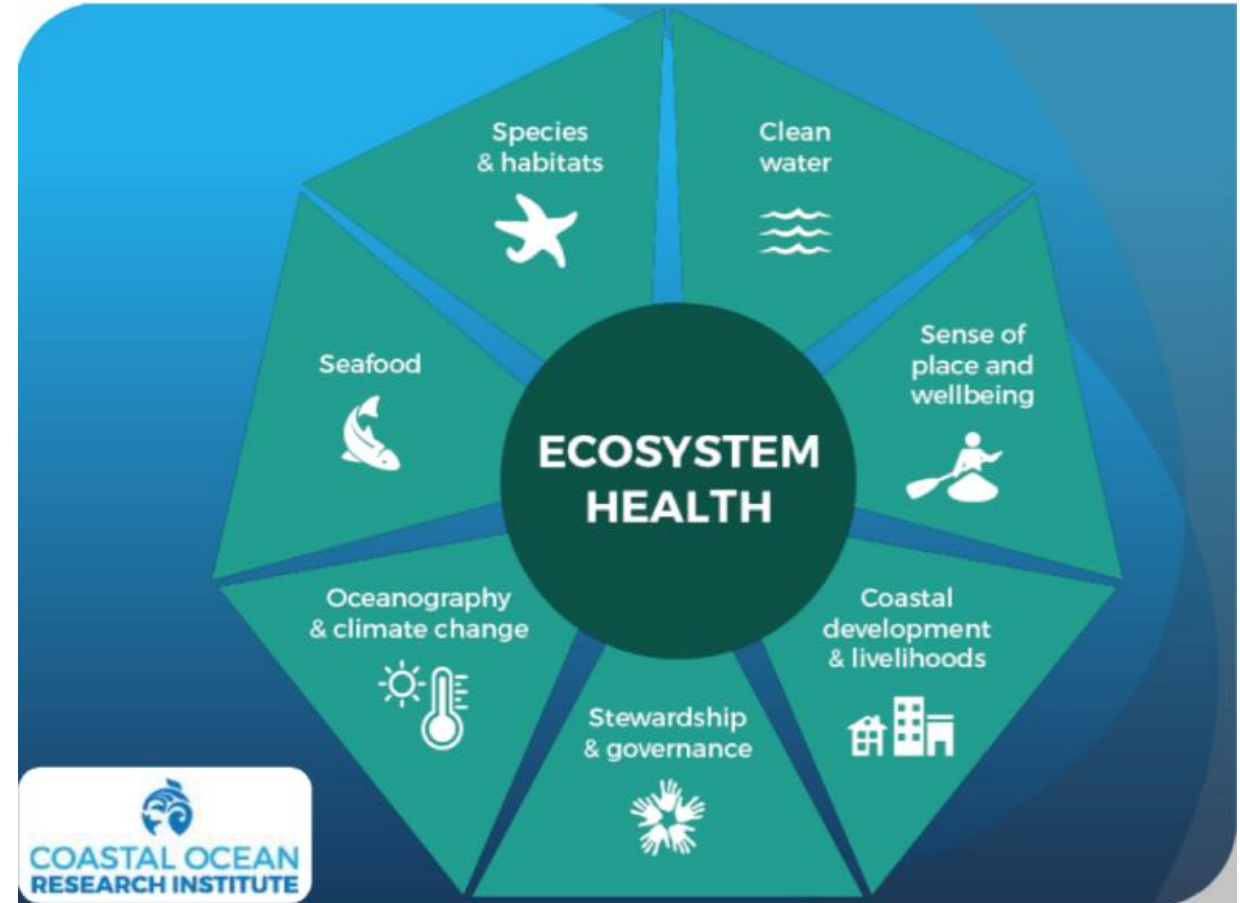
- Collaboration between Provincial Government and 17 First Nations
- 4 Subregional marine plans, supported by a Regional Action Framework
- Goals:
 - Protect marine environment;
 - Promote sustainable economic development;
 - Support coastal community well-being
 - Collaborative governance and management



MaPP's REGIONAL EBM MONITORING PROGRAM

MaPP identified 17 pilot regional “indicators”, informed by:

- Literature review, other programs, expert advice, Indigenous knowledge, sub-regional interests
- Indicators grouped under 7 themes
- Themes are cross-linked



WHY A REGIONAL EBM MONITORING PROGRAM?

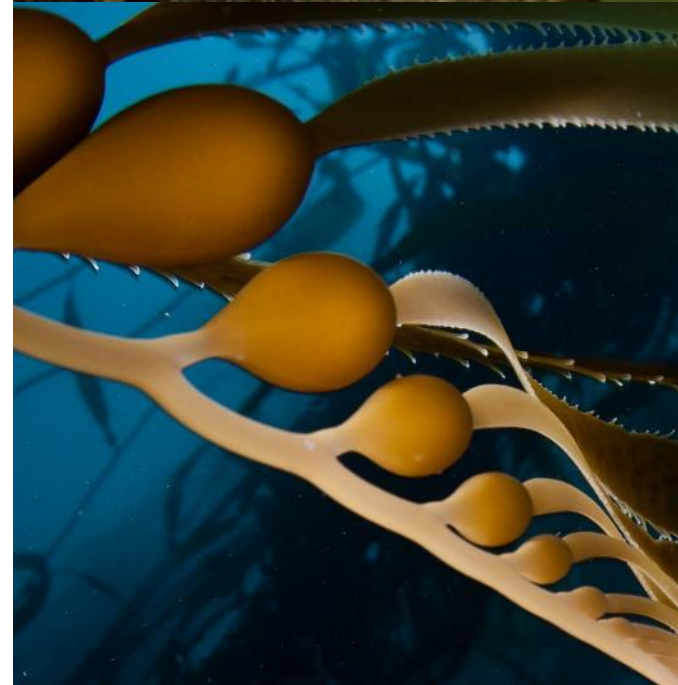
- Increasing understanding of the state of ecosystems
 - To evaluate and report on changes in the state of the ecological and human well-being systems within the MaPP region across multiple scales
- Informing decision-making and adaptive management
 - Inform marine plans; understand potential or growing threats to marine values (e.g., what management actions should we take, where, and when should we respond?)



REGIONAL EBM MONITORING

WHY KELP?

- Important habitats for multiple spp. of ecological, cultural, and economic importance
- Significant cultural, social, and economic importance for local First Nations
- Local observations of declines in kelp spp. distribution, condition, and harvest availability (e.g., bryozoans)
- Increasing stress from climate change and other pressures
- Increasingly important economically, possible increases in harvest (*e.g., Province seeing increased request for permits*)
- Direct management linkages for MaPP partners
- Data are lacking for much of BC



Collaborative Regional Kelp Monitoring

- First Workshop in April 2019
- Pulling together different existing datasets
- Identifying best methods to use for measuring and monitoring kelp
- Monitoring across the BC Coast



WORKING GOALS for the Regional Kelp Monitoring Program

1. Gain a better understanding of **kelp species' and habitat health**, **distribution and abundance**, and **patterns of use**, across the sub-regions; **document changes over time**; and **identify drivers of change**.

2. Inform important updates to the **sub-regional marine plans**, which do not include spatial or aspatial recommendations for marine aquatic plant harvest.

3. Inform management decisions and actions relating to **stressors** that may impact kelp species' and habitat health, distribution, and abundance.

4. Inform decisions on the amount, location, and techniques of marine **aquatic plant harvests**.

5. **Support and build capacity** for First Nations participation in management and monitoring activities.

6. Demonstrate the utility of a **coordinated regional monitoring approach** to help secure future funding resources for further regional monitoring programs.

Key Questions Developed



What do we have?

What is the current **spatial extent**, **biomass**, and **condition** of bull and giant kelp?



How's it doing?

How is this **changing over time** and does this **vary across the region**? Which kelp beds are more persistent?



If changing, why?

What **factors** are driving these changes? (e.g., harvest (yes/no), oceanographic variables (temperature, salinity), sea otters (occupation), proximity to development)



What else is affected?

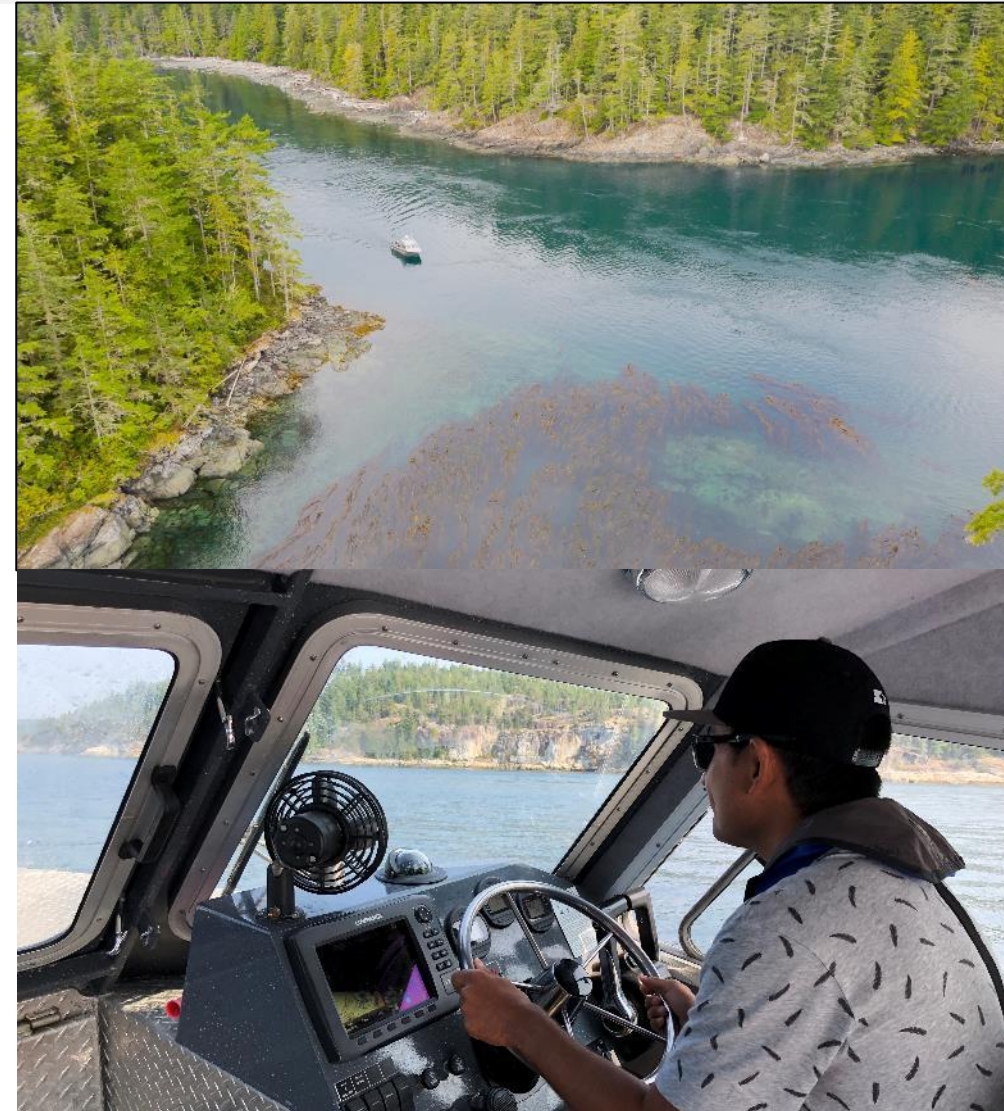
How are kelp-associated **fish** and **invertebrate** species affected by changes in kelp spatial extent, biomass, and condition?





Coordinated Regional Kelp Monitoring

- Data collected at local and sub-regional scales across region by MaPP and external collaborators
- **Co-ordinated** sampling to compare status and change of kelp habitats across NSB
- Information about **potential drivers/stressors** that influence nearshore habitats
 - e.g., climate change vs. local coastal development vs. sea otter recovery
- Integrate with other ways of knowing (local and traditional knowledge, remote sensing, in situ sensors) to answer key questions and inform management



Field Component: Tiered Survey Design



Aerial Imagery
Tier 1 (120m) and 2+ (40m)



Tier 1:

Map Linear Extent and General Condition

Tier 2 / Tier 2+:

Map the Perimeter (Spatial Extent) • Quadrat Counts
Stipe Measurements • Reef Depth • Water Visibility



Giant Kelp and Bull Kelp Forests



Observations:

Tier 2+ Species ID, Habitat



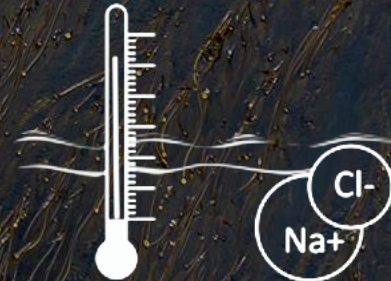
Divers:

Tier 3: Underwater Surveys

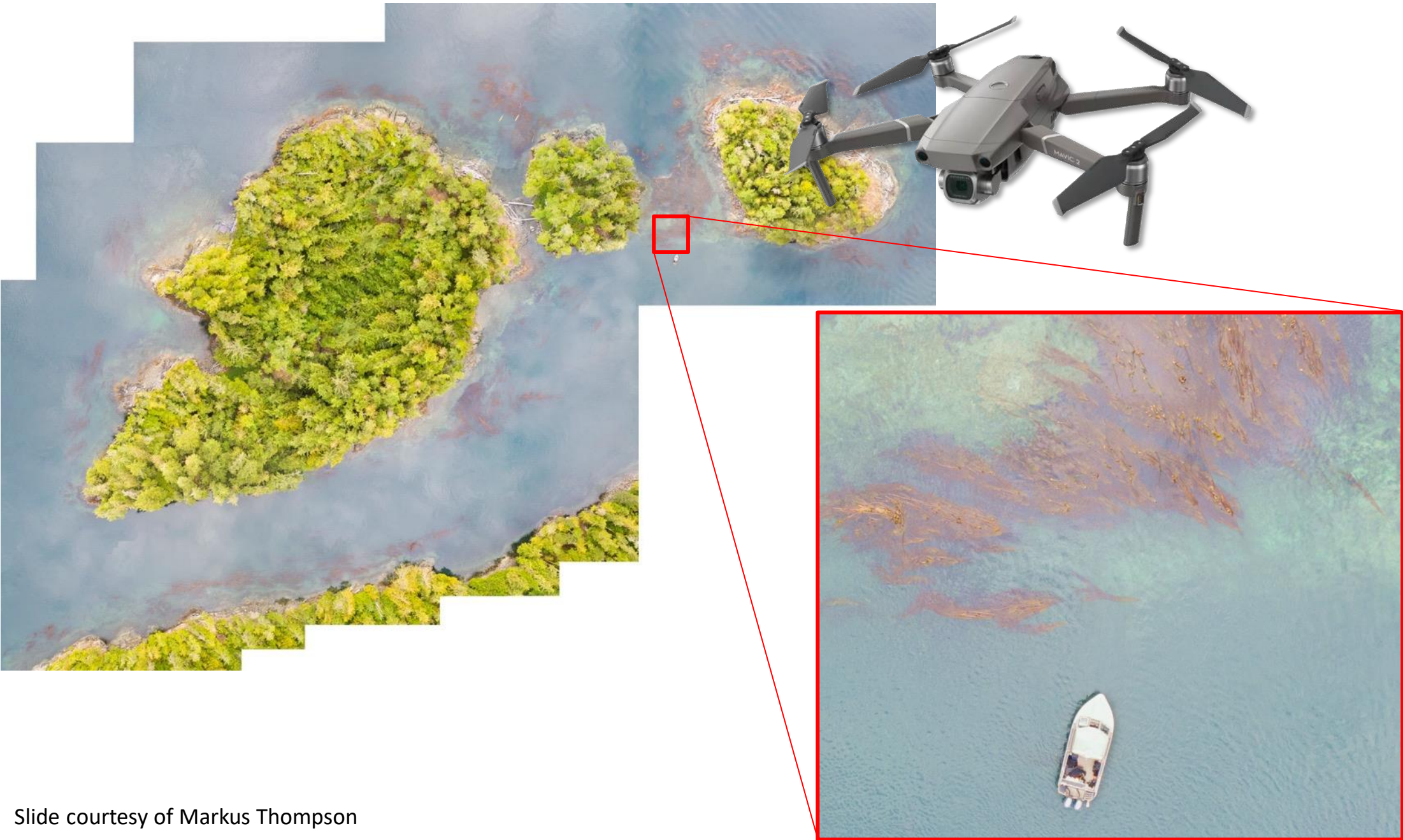


Temperature + Salinity

Tier 2+ (-1, -5, -10m)

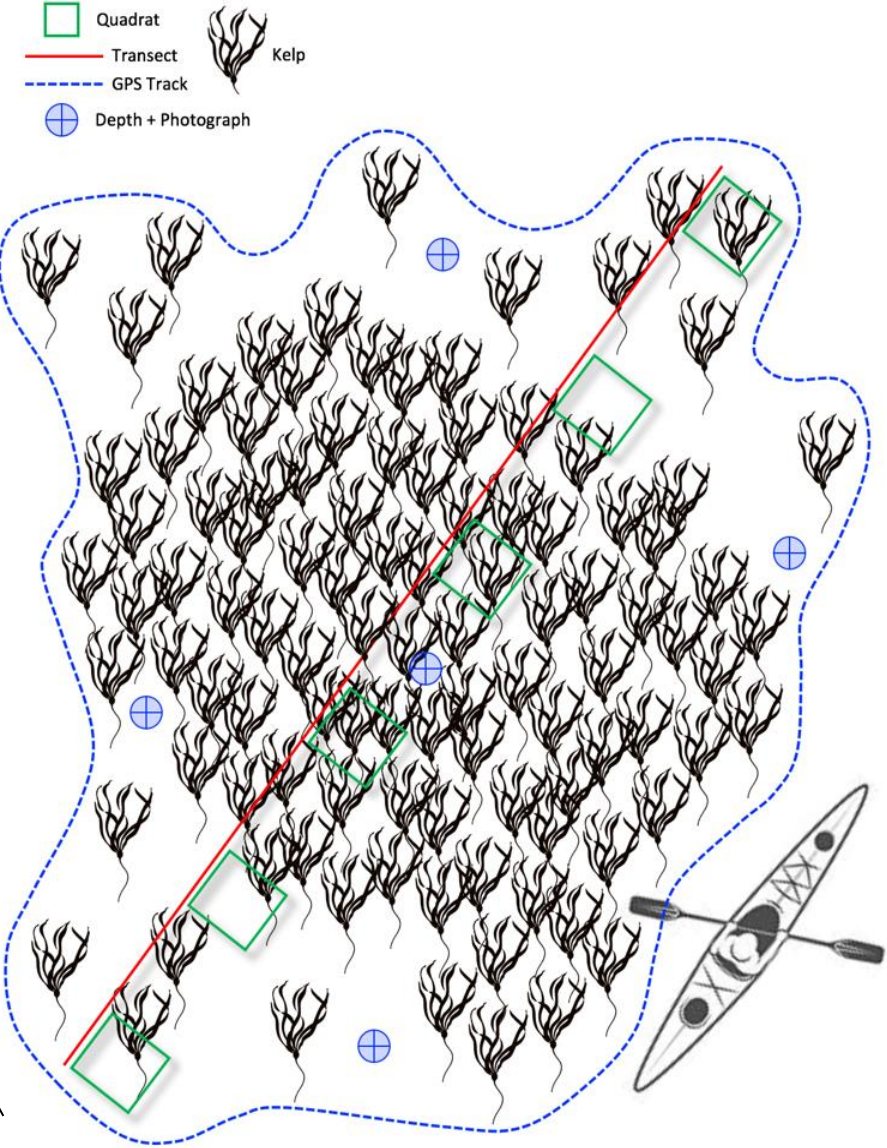
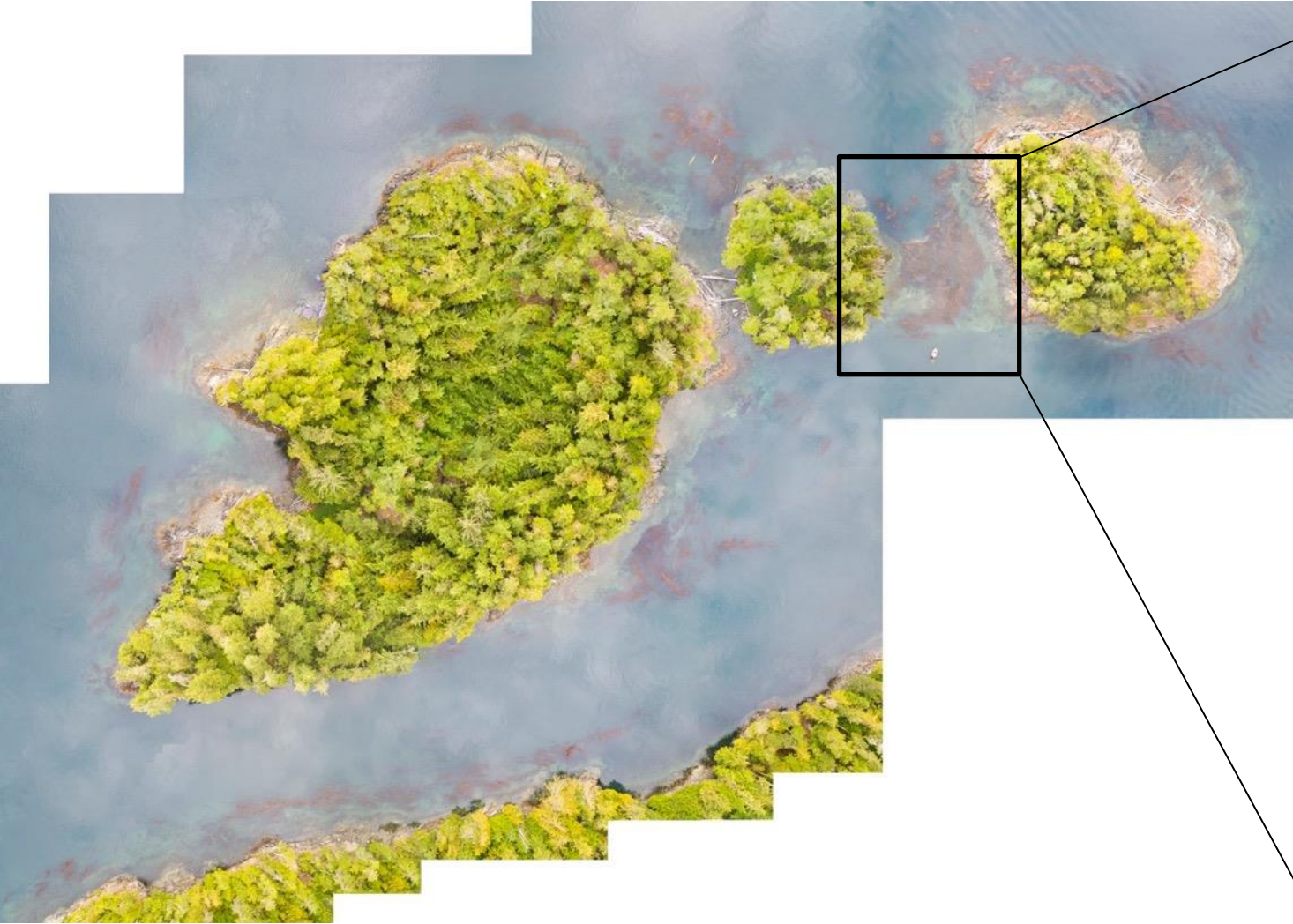


Tier 1: Kelp Spatial Extent from Drones



Slide courtesy of Markus Thompson

Tier 2: Kelp Spatial Extent, Density, and Size from the Surface

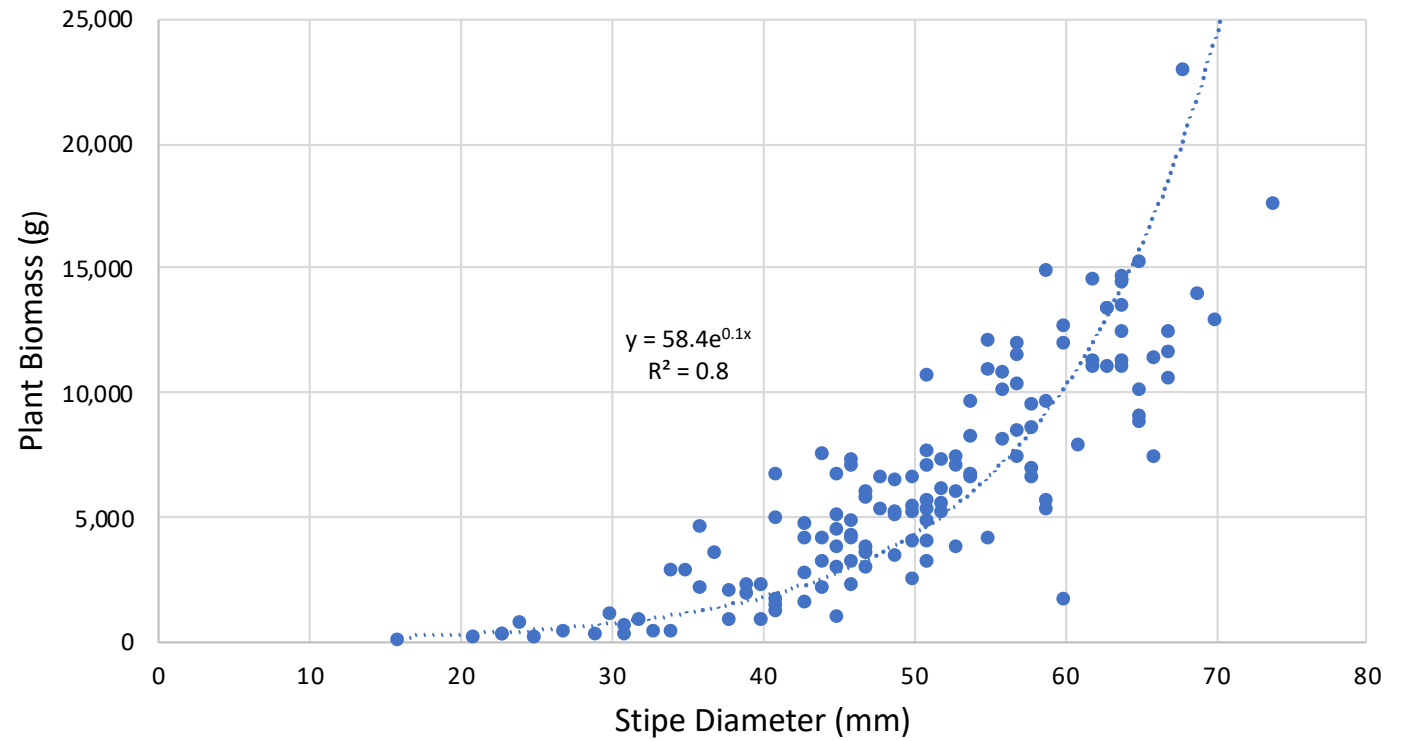


Slide courtesy of Markus Thompson

Estimating Biomass from Density and Size



Bull Kelp Biomass Regression 2019–2020





Guardian Training

- Field Logistics
- Equipment Training
- Drone Certification
- Data Management
- Training videos
- Field support
- Mentorship



Collaborations: Multiple Tools for Habitat Monitoring



Coast-wide Mapping

Satellite Imagery (Landsat, Worldview, Quickbird):
Hakai Geospatial & SPECTRAL LAB (UVic), UCSB/Wood's Hole (Tom Bell)

Regional Level Mapping

Aerial Imagery (UAV/ACO):
Hakai Geospatial & MaPP



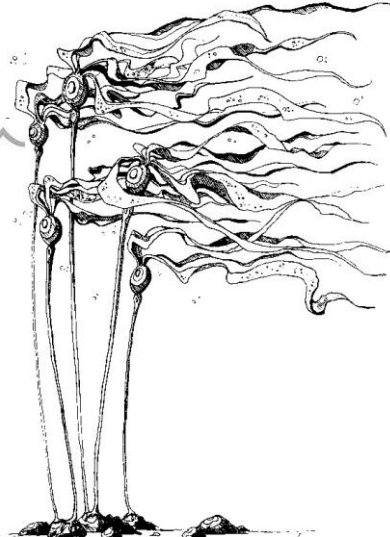
Site/local Mapping



Surface Work:
MaPP & Coastal Guardians



Intertidal/Subtidal Work:
Hakai Nearshore Team



Fisheries and Oceans Canada
Pêches et Océans Canada

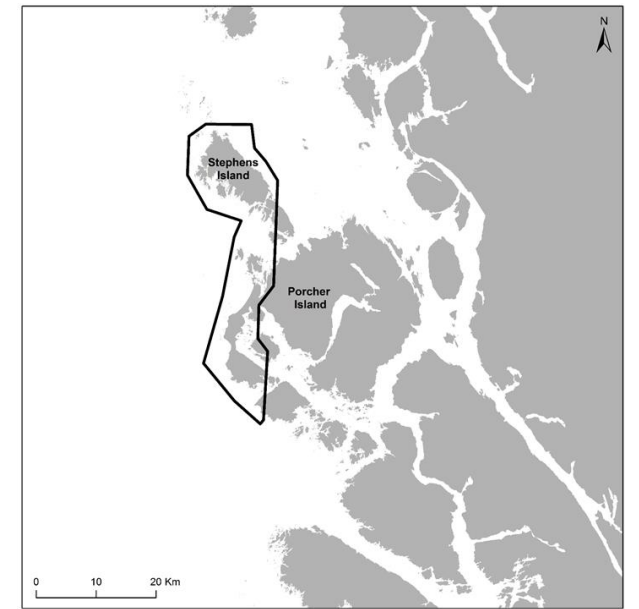
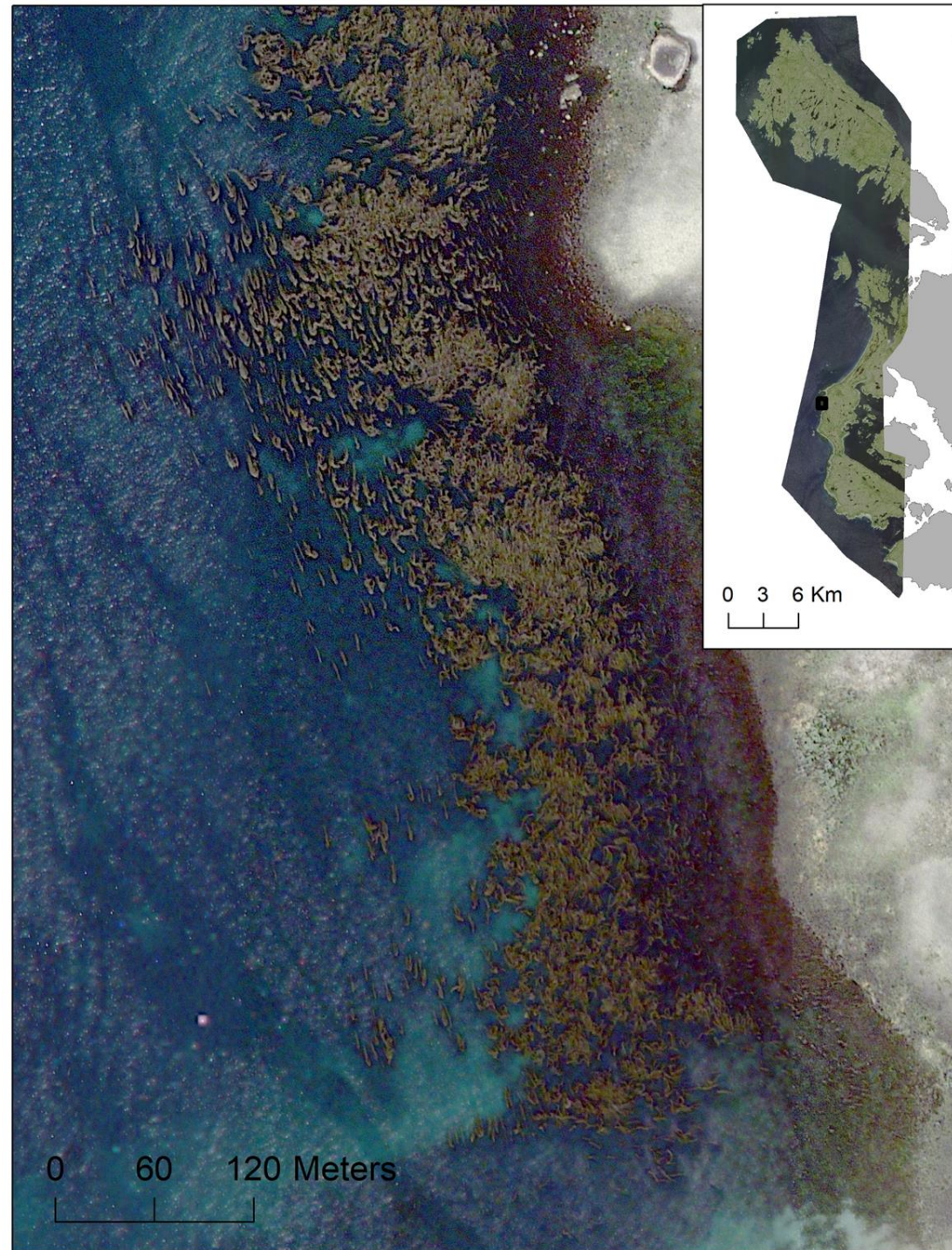




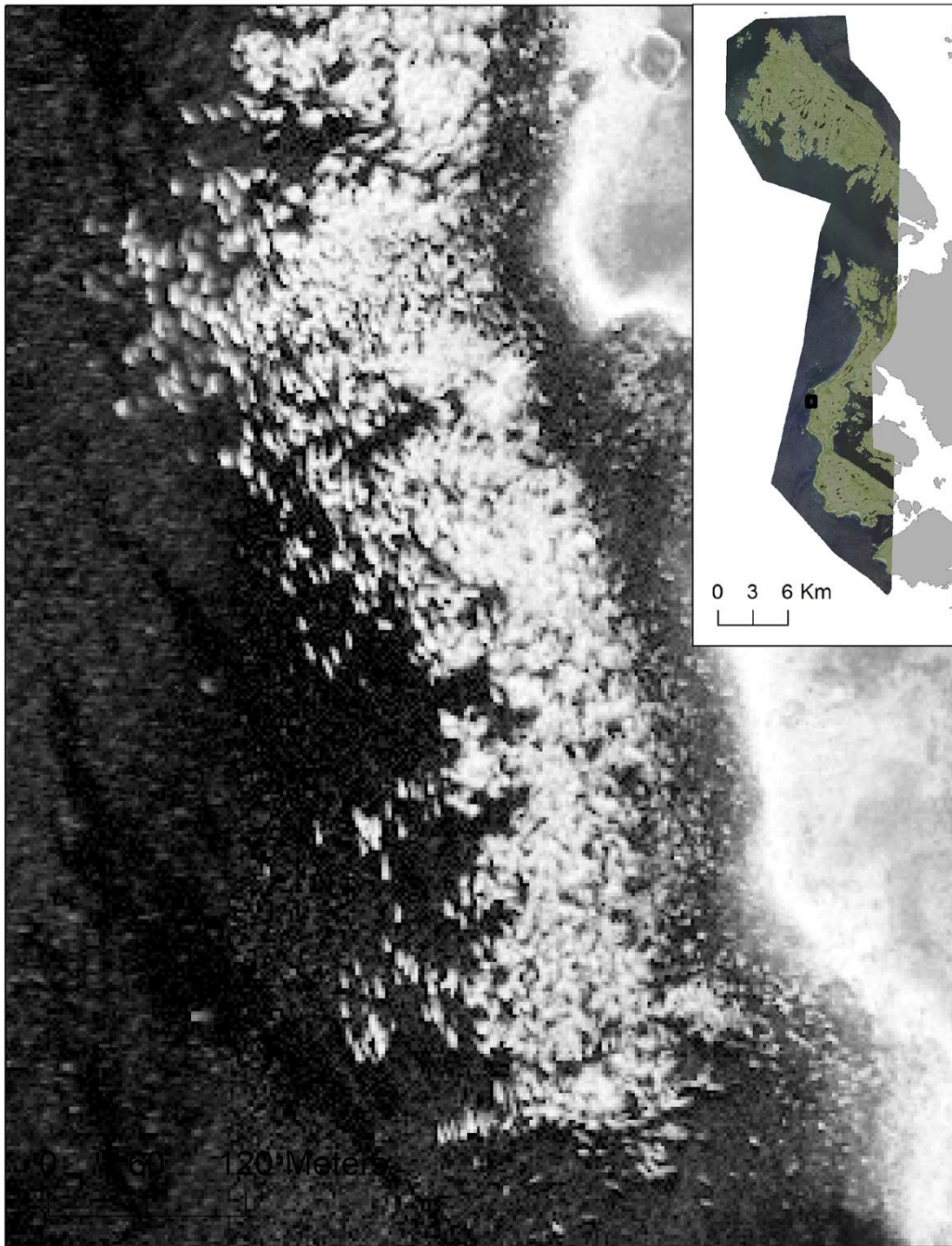
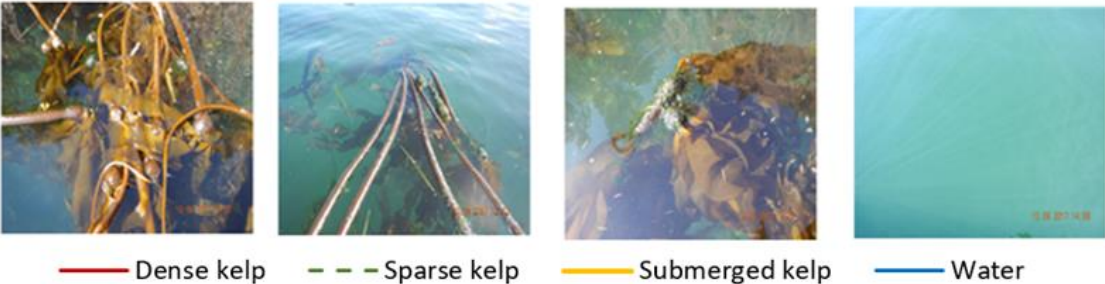
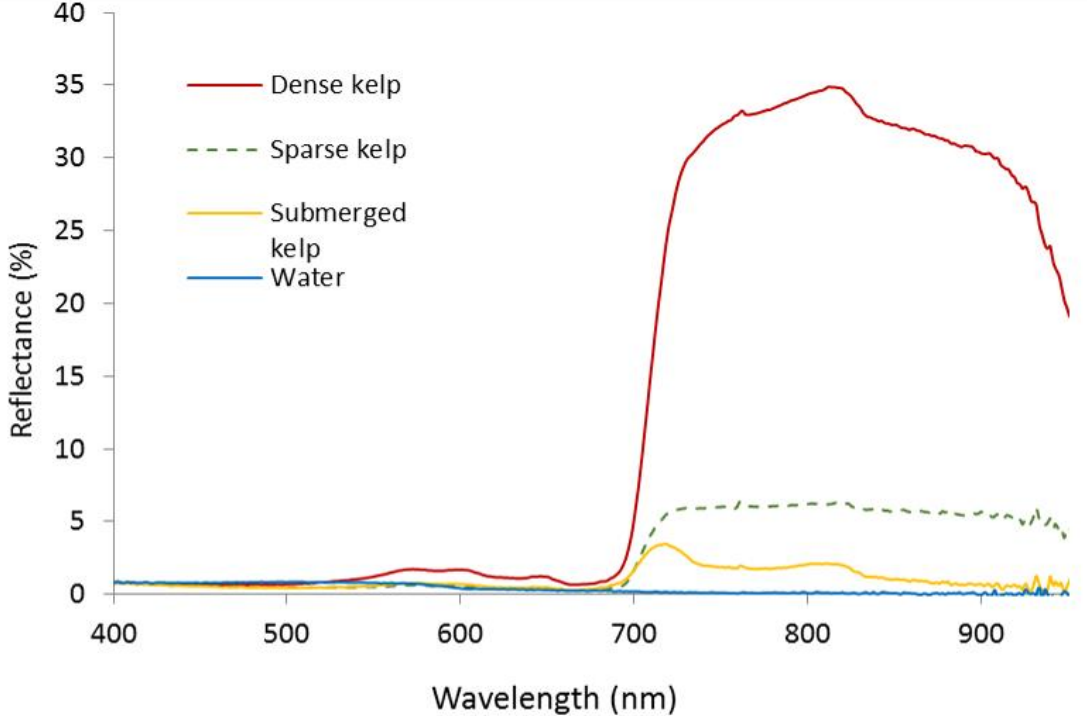
High Resolution Satellite Imagery

WorldView 2 Satellite
1.8m Multispectral
0.4m Pansharpened

Slide courtesy Sarah Schroeder

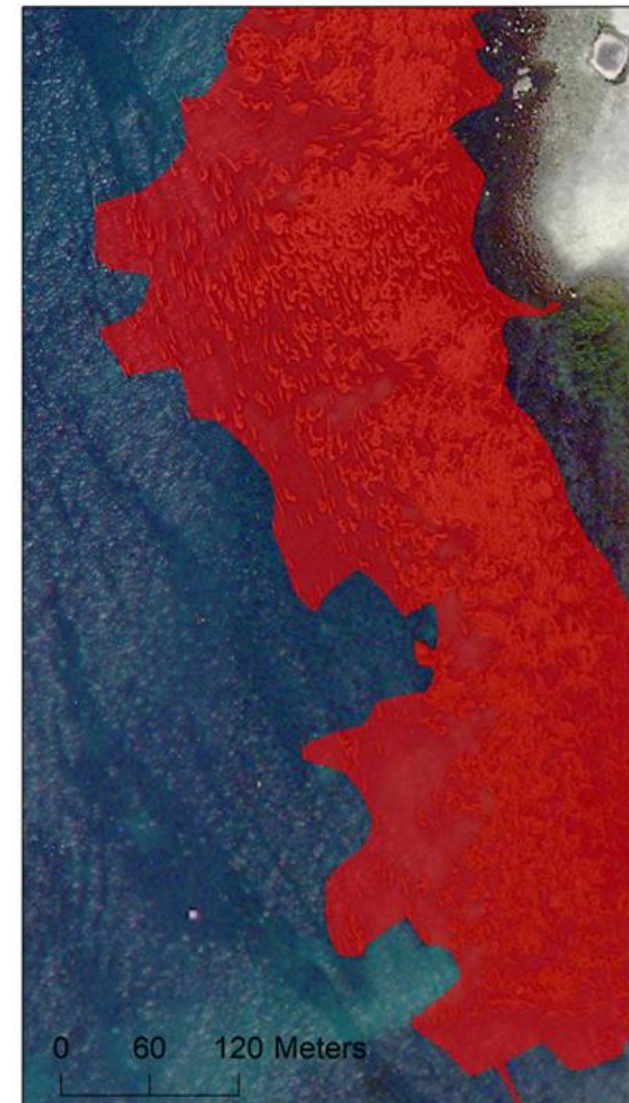
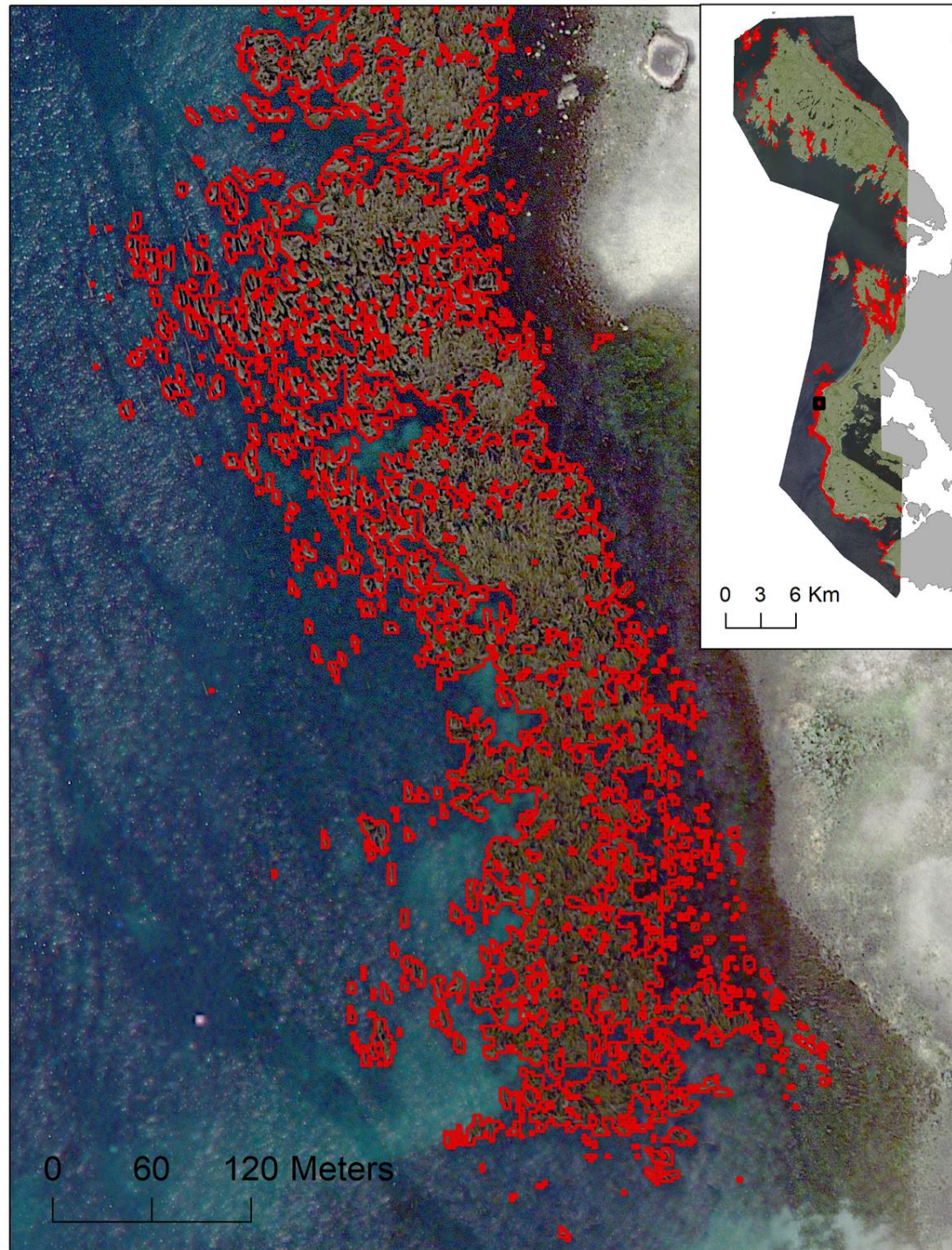


Kelp Detection

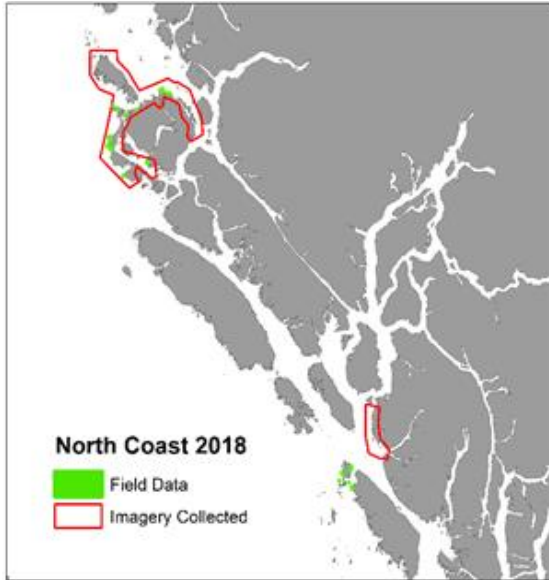


Kelp detected
using NDVI
threshold

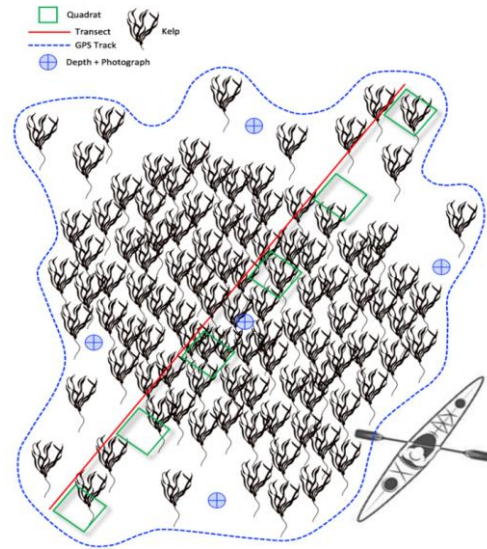
Next kelp pixels
are aggregated
into a “kelp
Bed” or
polygon



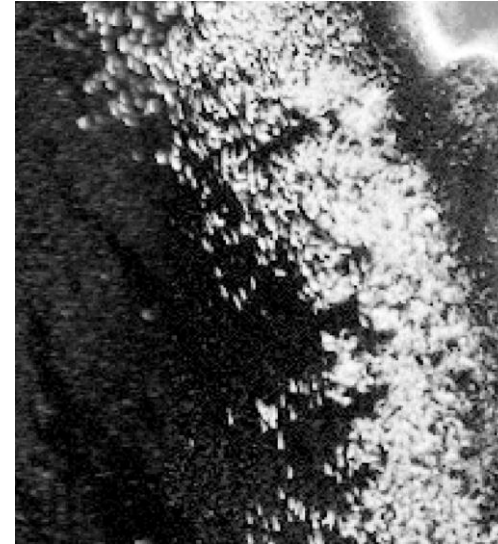
Biomass from Relationship between Imagery and Field Data



Field Data collection at same time as imagery

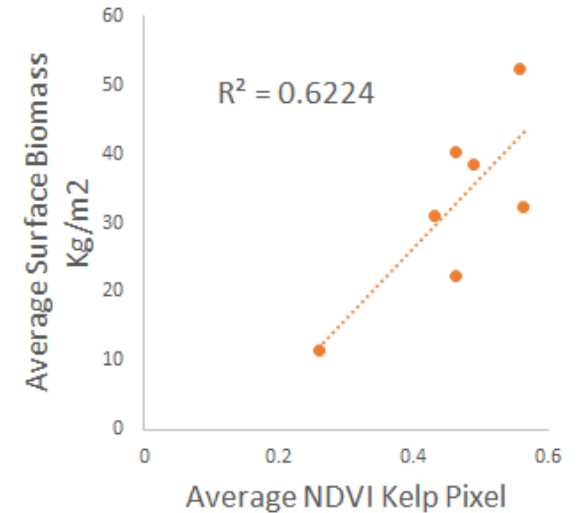


Tier 2: Measure spatial extent, species, density, size/biomass



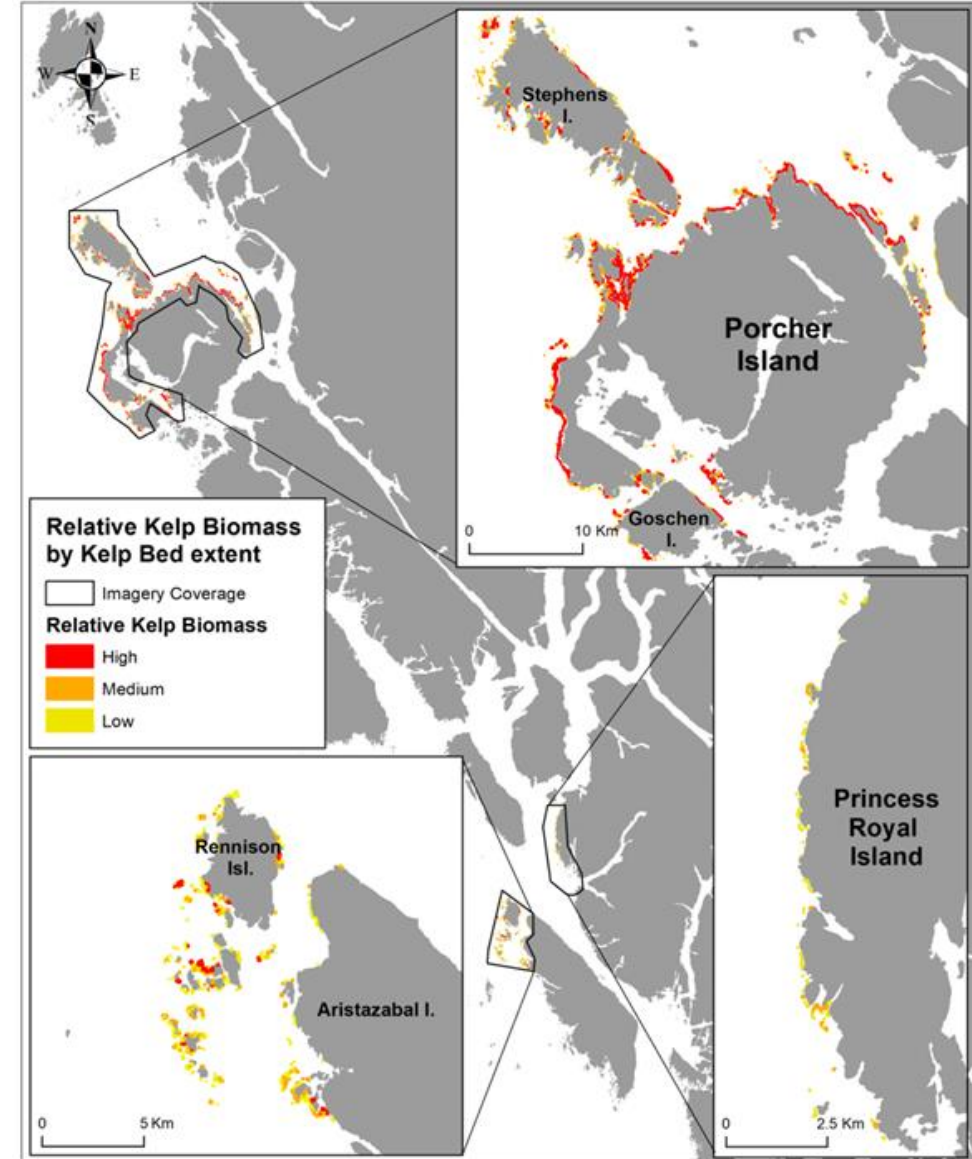
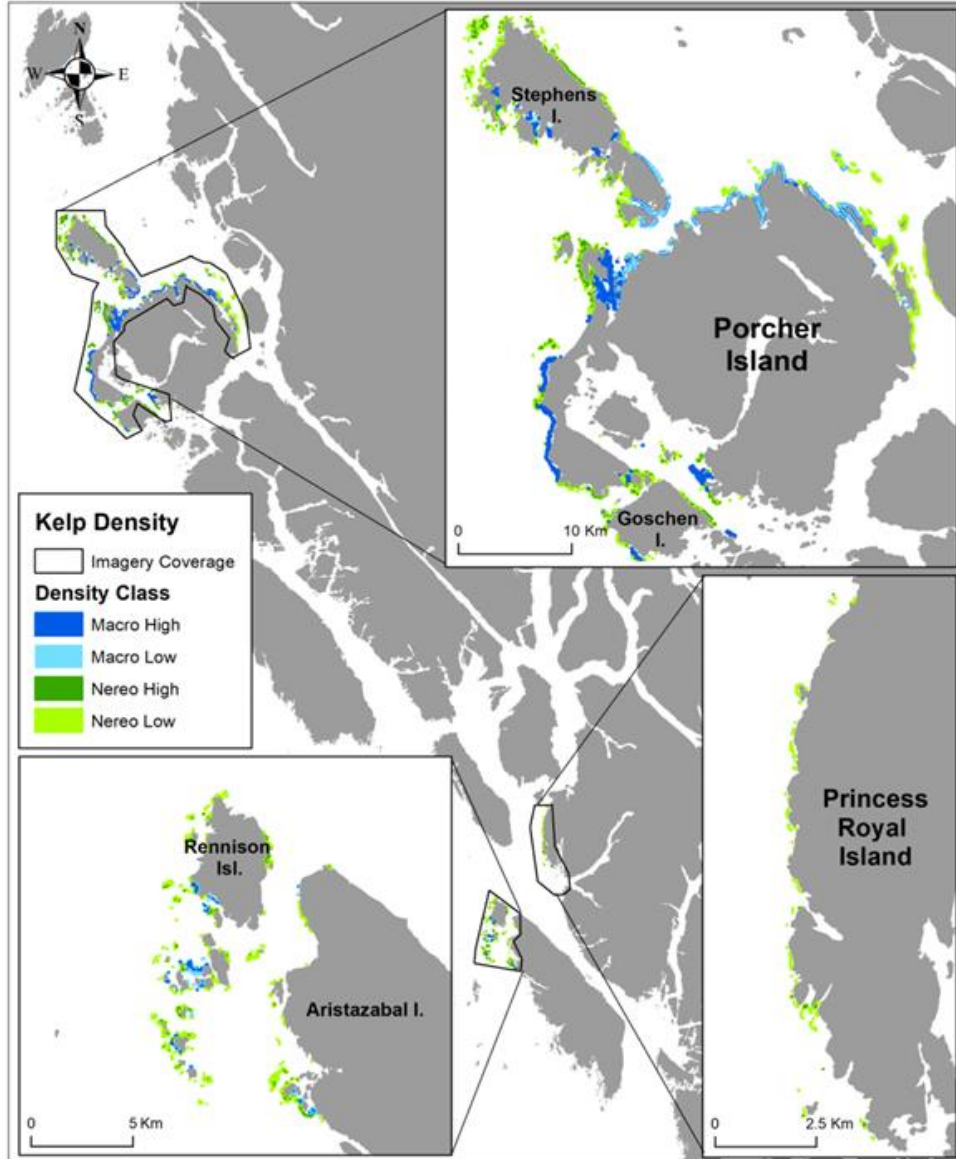
Pair field data with image values

Average Density or Biomass measured = pixel value



Density/Biomass estimates related to the NDVI per pixel

Integration: Kelp Density and Biomass





MaPP Connecting the dots...

- Collaborative Approach to Monitoring and Management between First Nations' and Provincial Governments
 - MaPP Spatial Plans
 - Marine Plant Harvest Policy
 - Marine Protected Area monitoring
 - Cumulative Effects Assessment
 - Kelp Restoration
 - Kelp aquaculture
 - First Nations' Traditional Use areas
- Identify funding opportunities (short term and long term)
- Collaborations within and beyond B.C!





Thank you!

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