BioSpace25 - Biodiversity insight from Space
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Multi-scale mapping of charismatic megaflora: Using regional aerial survey data to inform satellite-based remote sensing of kelp forests in British Columbia

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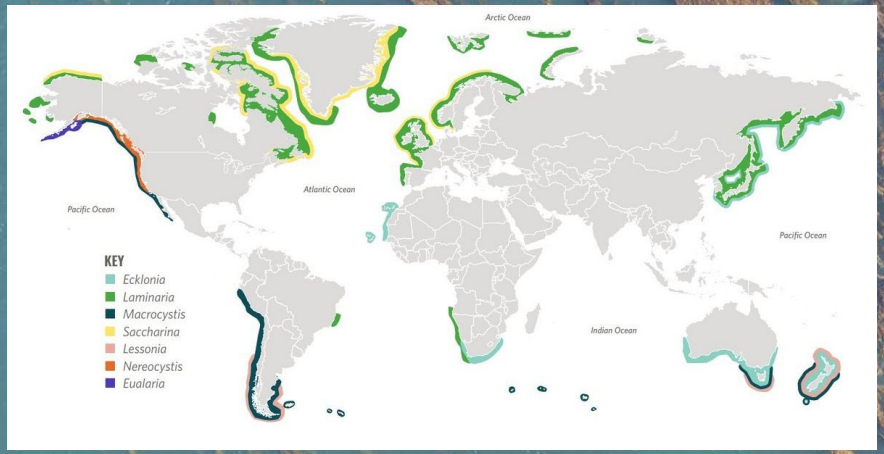
Kelp forests



Eger et al. 2024

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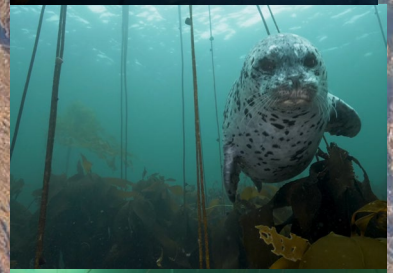
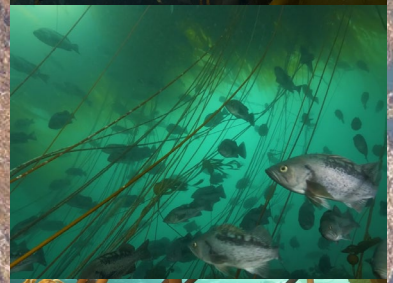




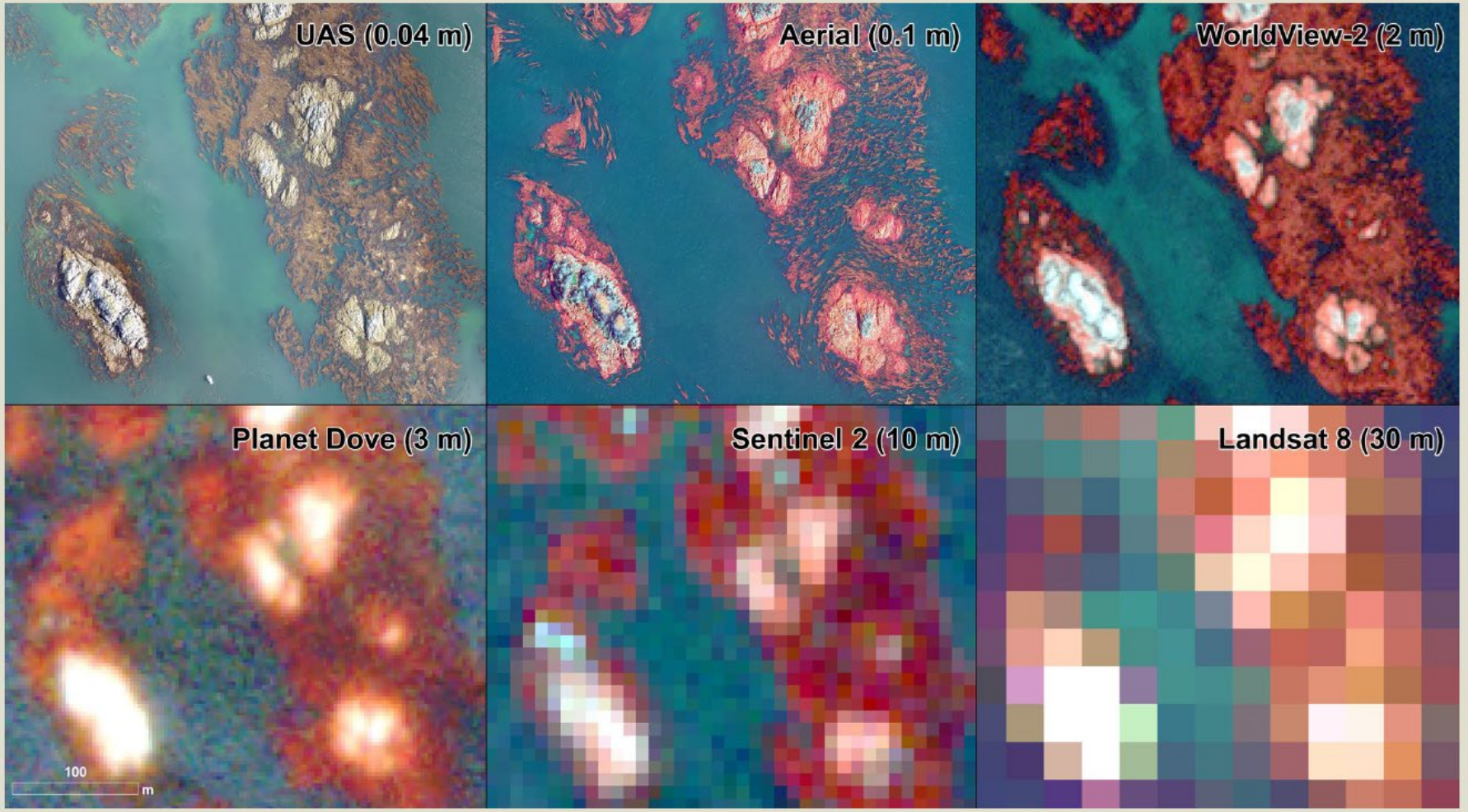
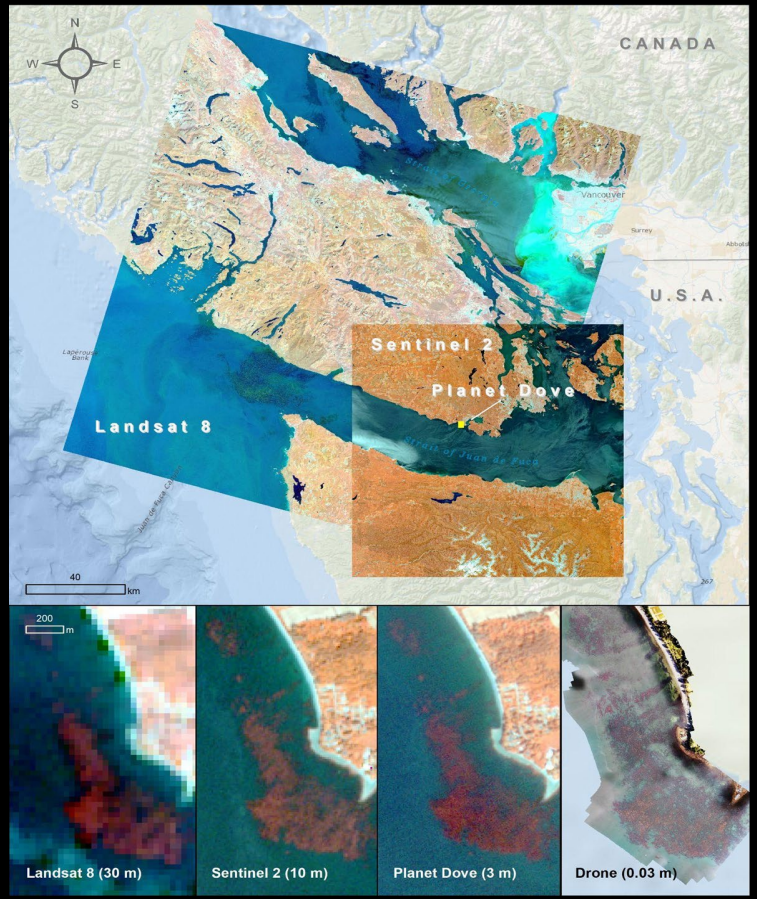


Photo: Luba Reshitnyk

Optical RS mapping kelp forests

- **Overview RS applications for kelp forests**
  - **Kelp Mappers Guidebook (Reshitnyk et al., 2023; Cavanaugh et. 2021; Schroeder et al., 2019)**
- **Landsat -**
  - **<u>Pro</u>: Global continuous coverage, 1984-present, historical context**
  - **<u>Con</u>: limitations of 30 m resolution in complex coastline, no species data**
    - **California (Bell et. al, 2023, 2020, 2015; Finger 2021; Cavanaugh et al., 2019, 2010); Oregon (Hamilton et al., 2020); Falkland Islands (Houskeeper et al., 2022); Central Coast BC (Nijland et al., 2019); North Vancouver Island Man et al. in review)**

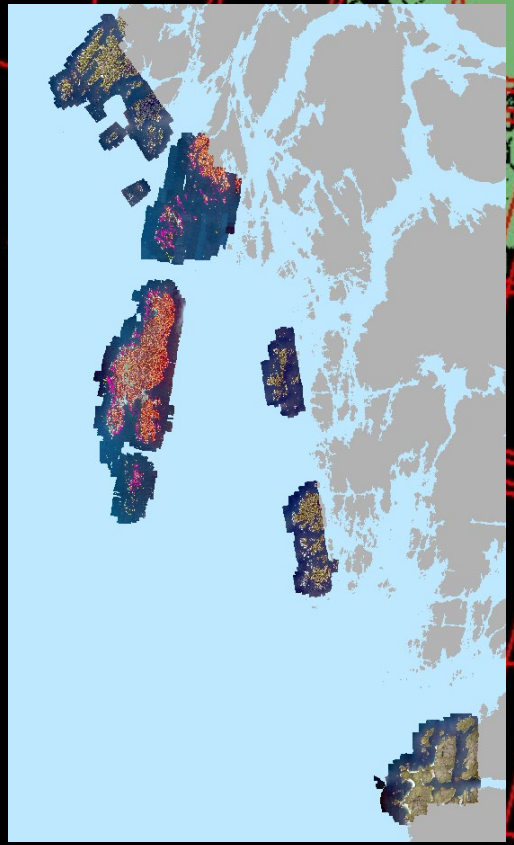


Objective

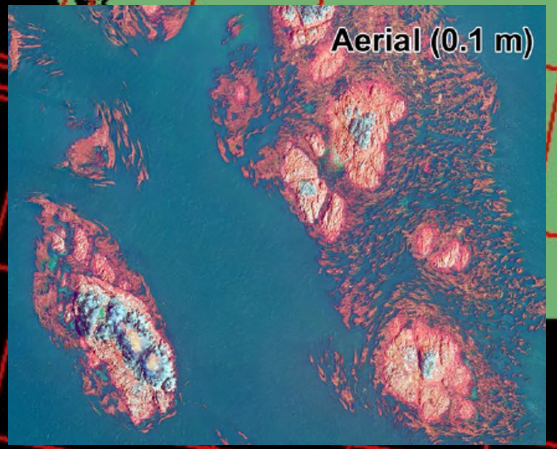
What is the distribution of BC's kelp forests and are they changing throughout time?

- Landsat time series (30 m)

How do Landsat (30 m) kelp canopy time series compare to fixed-wing (0.1 m) species-level time series?



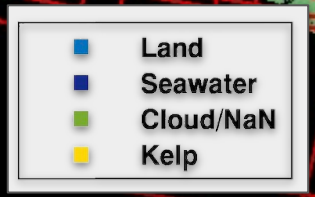
Landsat tiles coastal BC



Methods (Bell et al., 2023)

1. Landsat (4/5,7,8,9) surface reflectance data
   a. All imagery with coastline visible
   b. Clouds masked using pixel QA band
2. Land and intertidal mask: ASTER DEM + MNDWI
3. Binary decision tree classifier
   a. Four classes
   b. Manual clean up

Landsat tiles coastal BC

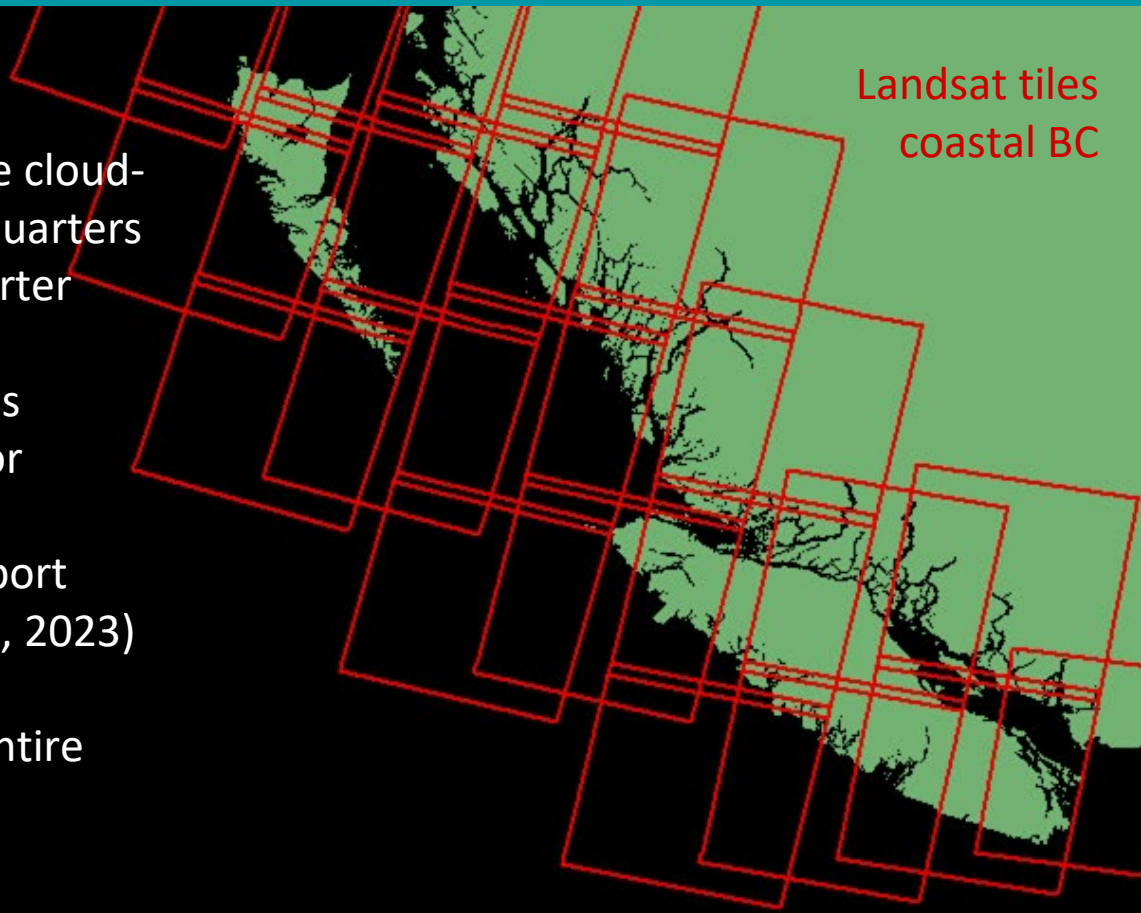


Methods cont’d

Annual time series:

- Year removed if :
  - >25% of pixels did not have cloud-free acquisition over two quarters and/or during the 3rd quarter (summer)
- Trend: Generalized least squares regression with ARto account for temporal autocorrelation
- Methods used in KelpWatch report cards (WHOI and TNC California, 2023)

Persistence (kelp detections over entire time series)



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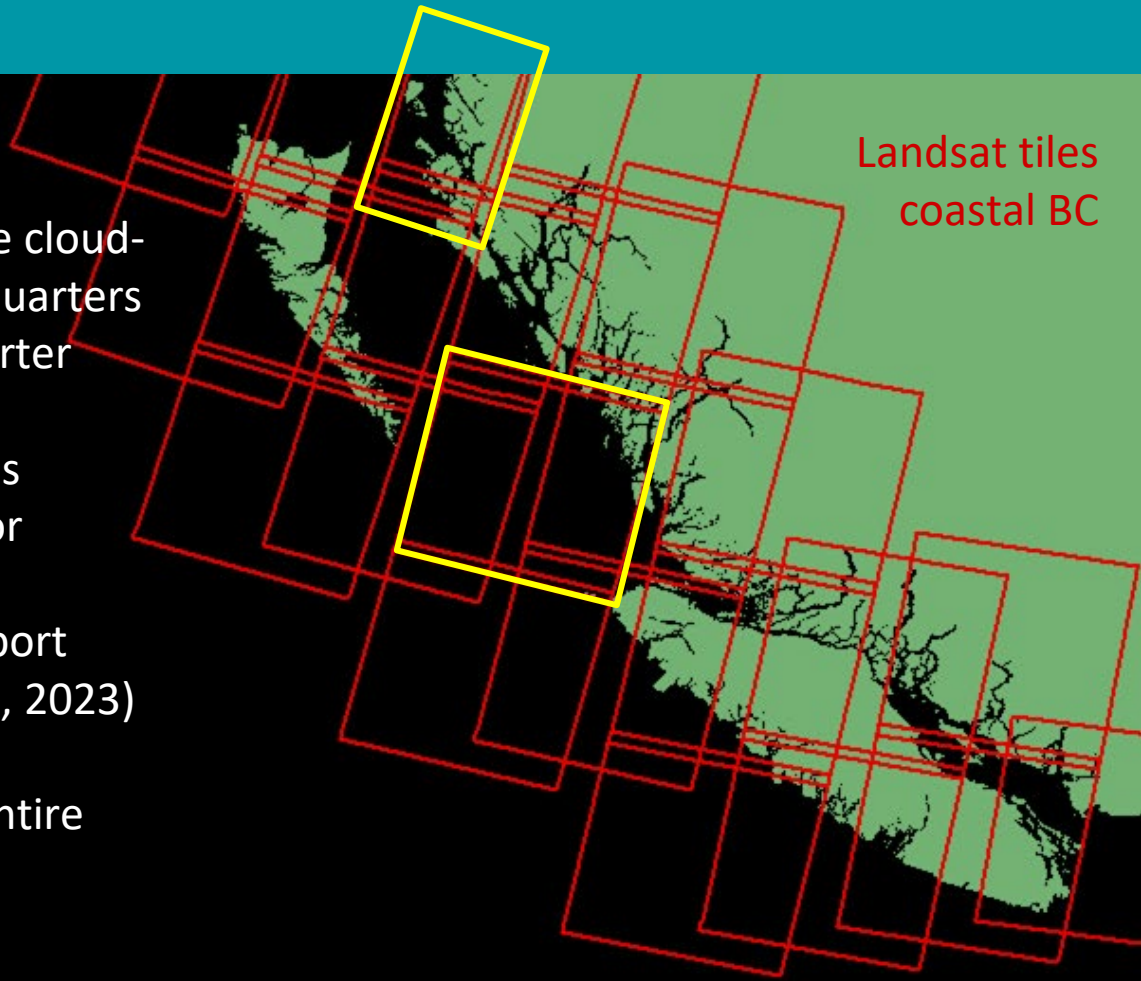
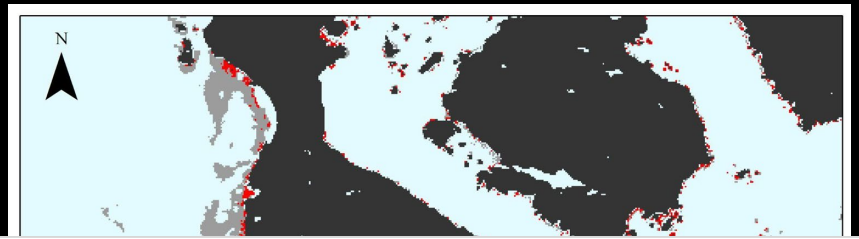
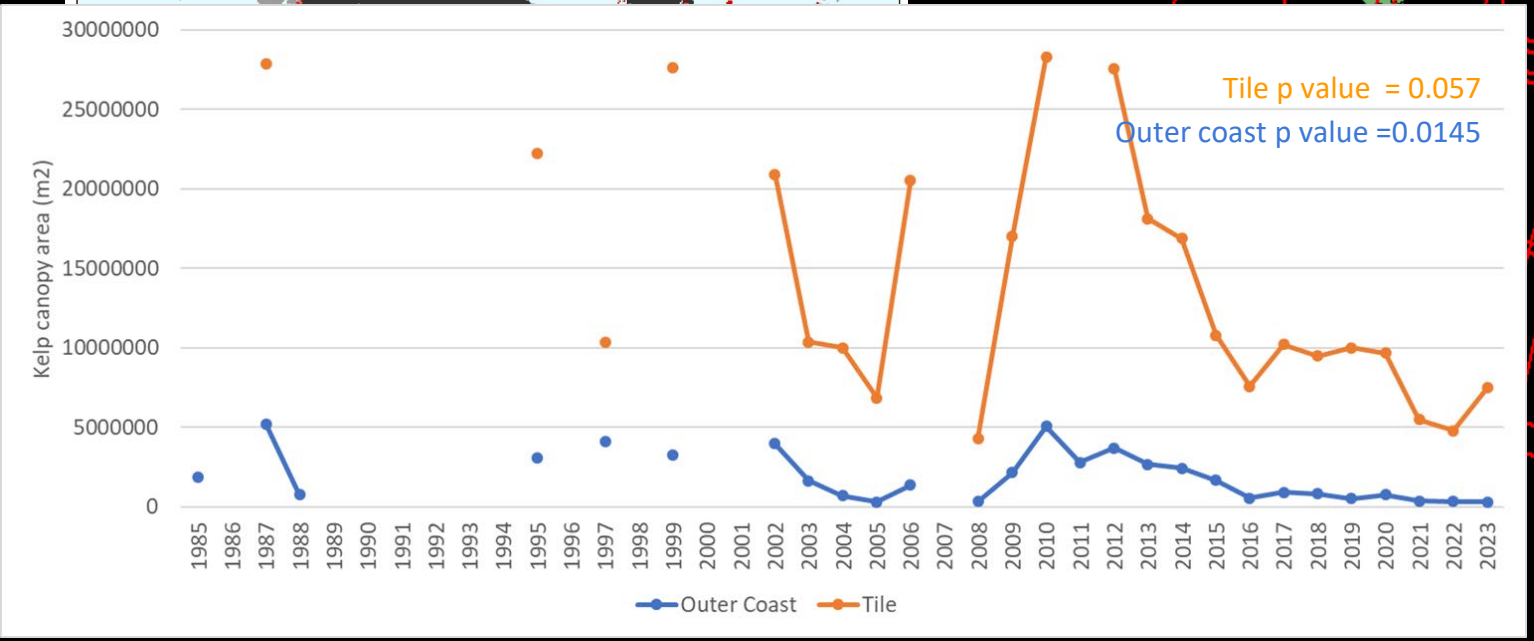
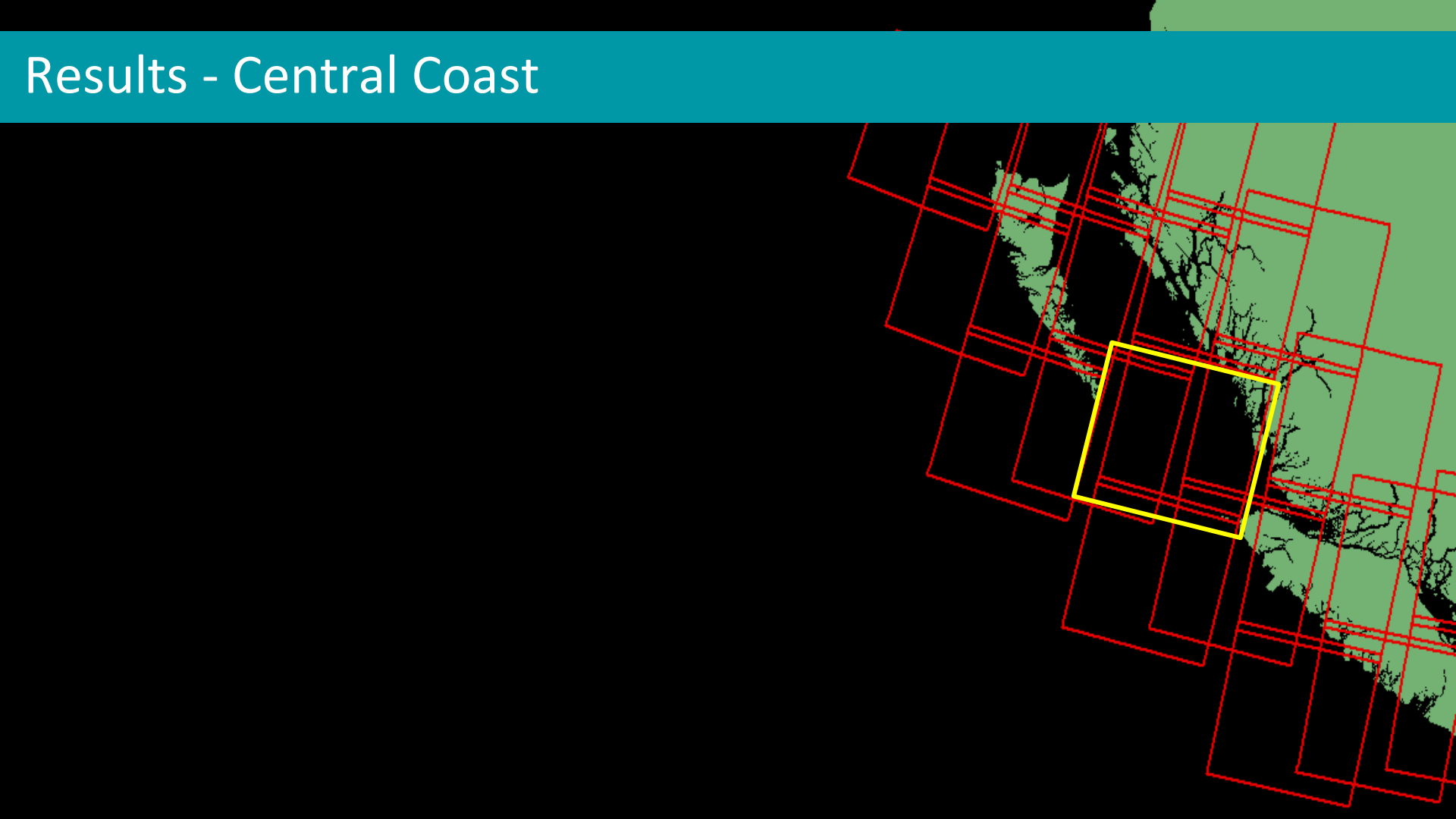


Results - North Coast





Results - Central Coast



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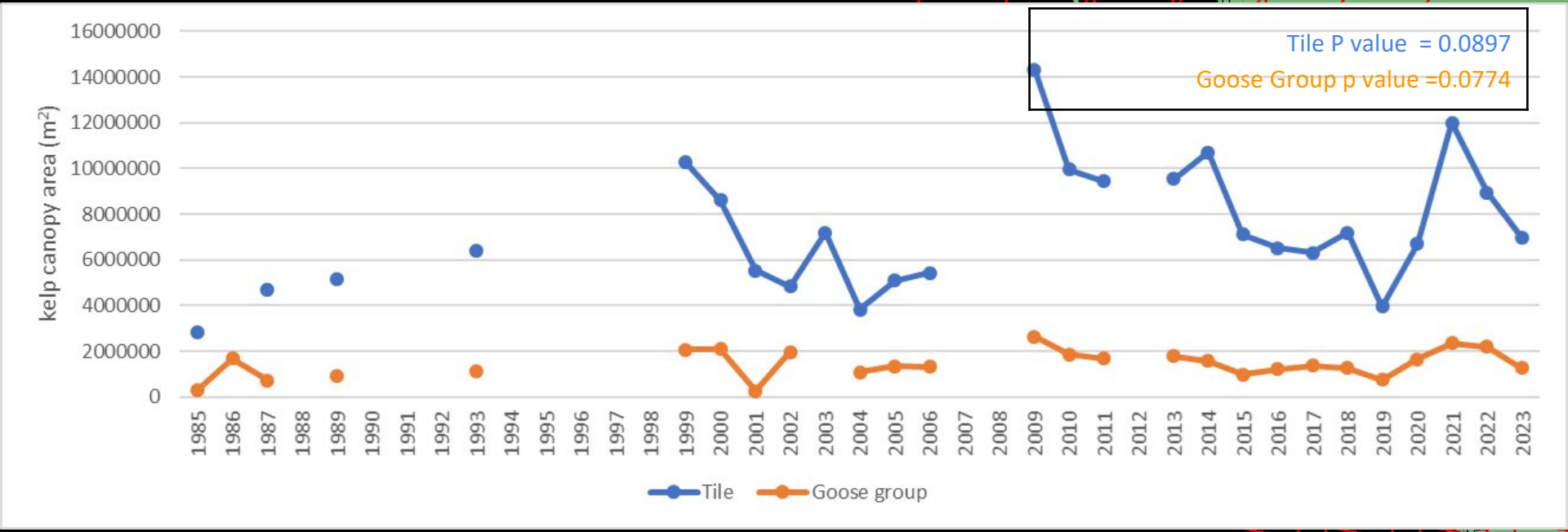

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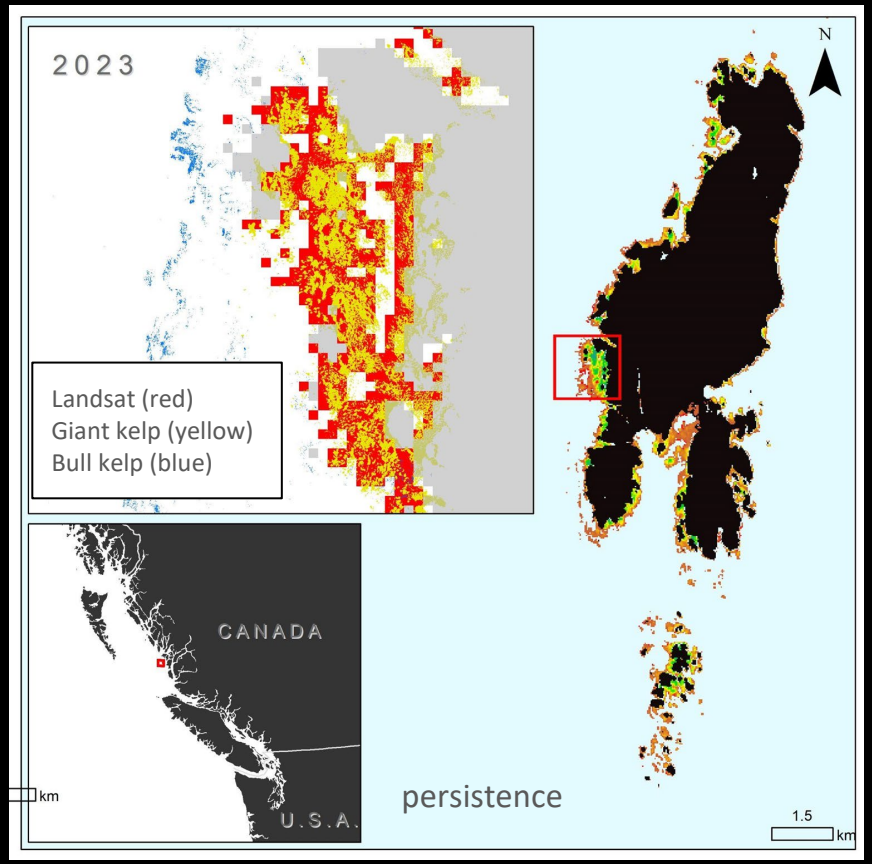
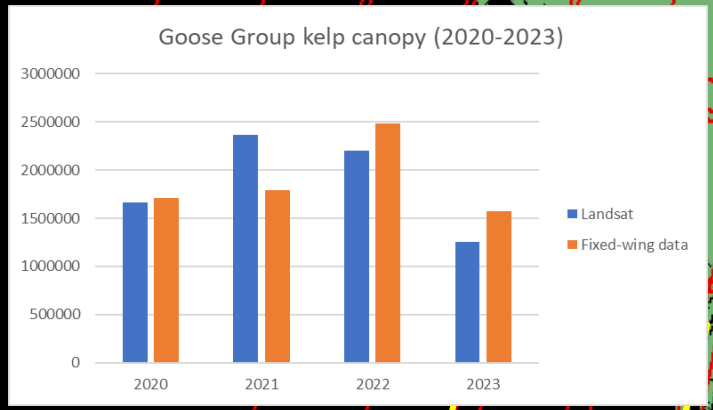
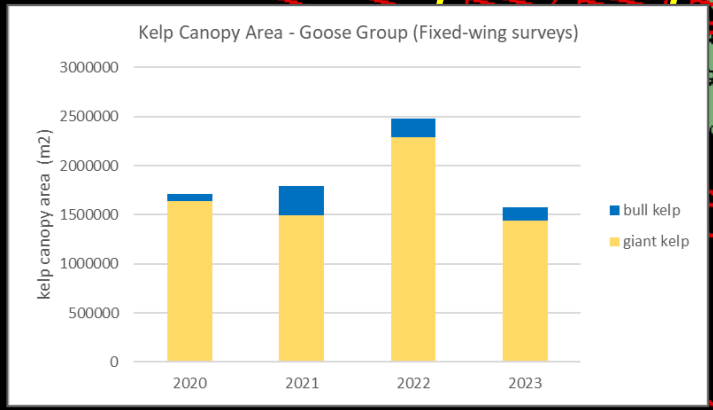
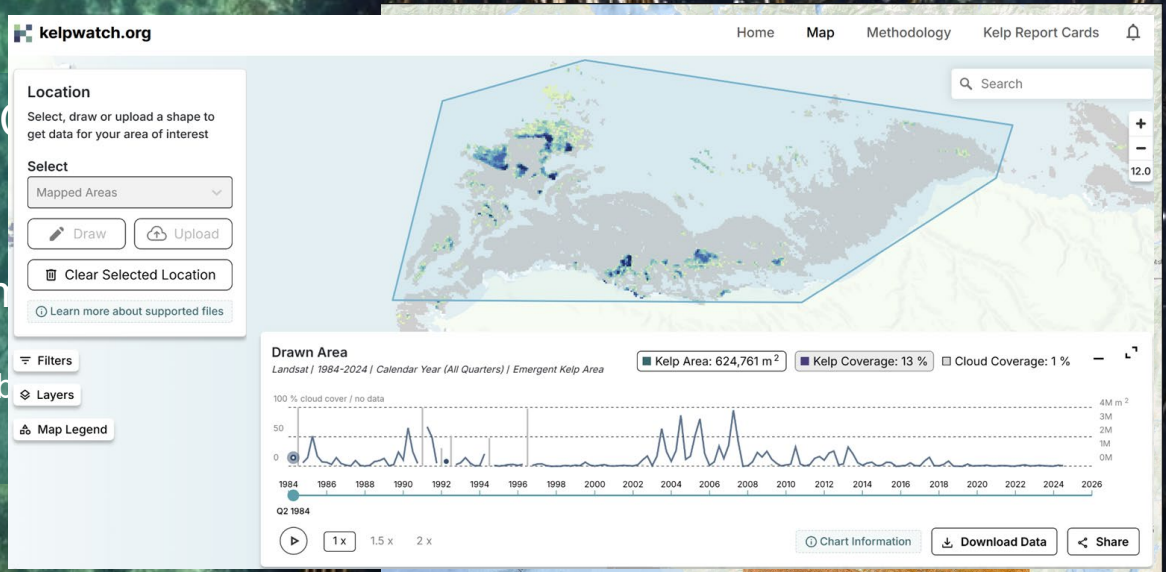






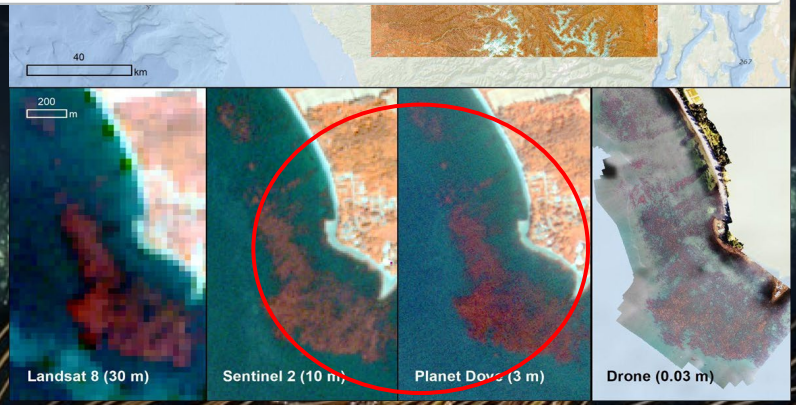
Main takeaways

- First look at first (part of) BC dataset
- See regional differences in
- Leverage high-resolution in
  - Validate Landsat products
  - Understanding species distrib dynamics



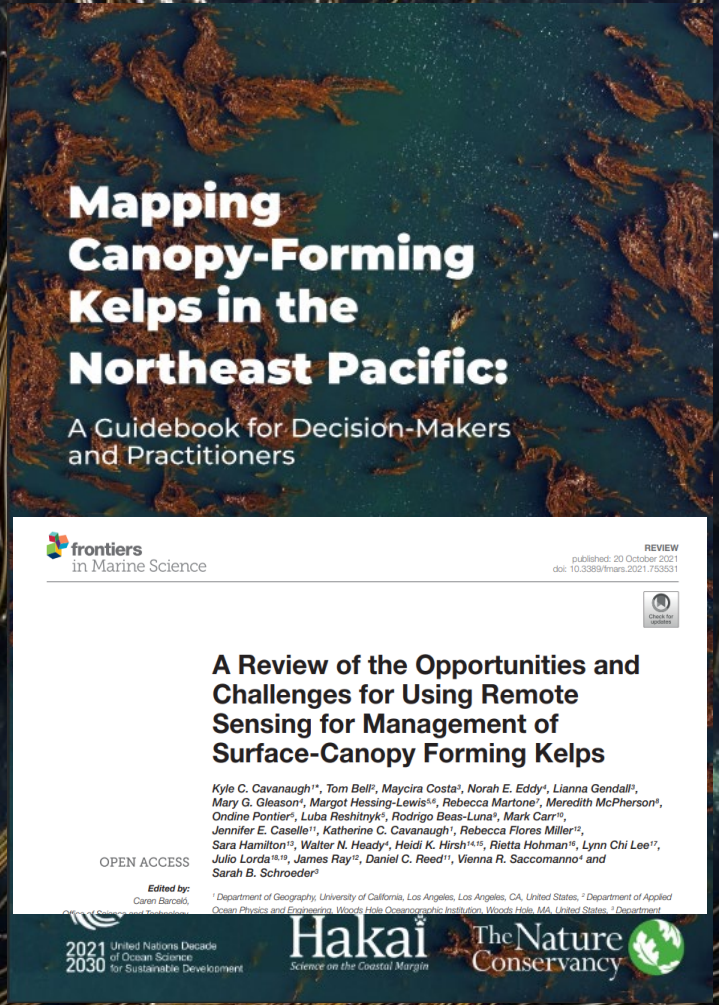
Future work

- 6 months - complete the BC Landsat time series
- Collaborative research to examine drivers across BC - group publication
- Higher spatial + temporal resolution needed
  - CSA proposal with UVic Spectral lab & MaPP (pipeline + platform for Sentinel 2, PlanetScope kelp data)
- Data on KelpWatch



Recommendations

- Sharing knowledge
  - Support Communities of Practise
  - 7th annual International Kelp Mappers Meeting
    - UVic Spectral Lab & Hakai
    - Kelp Mappers Guidebook + publication
- Continue to learn and engage in conversations about EO data and indigenous data sovereignty
- Mobilizing data + tools
  - Highlight and support the use of expert/community data products
  - Accelerate the creation and dissemination of EO-derived datasets for biodiversity status
    - E.g. KelpWatch + Kelp Report Cards



Thank you!
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