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Spatial-temporal changes in kelp extent in the Gulf Islands and Southern Vancouver Island: a remote sensing approach

Alejandra Mora-Soto

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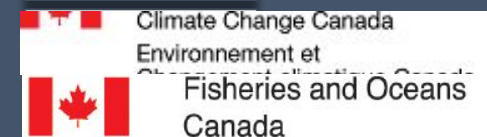
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Spatial-temporal changes in kelp extent in the Gulf Islands and Southern Vancouver Island: a remote sensing approach

Alejandra Mora-Soto, Sarah Schroeder, Lianna Gendall, Alex Guyn,
Gita Narayan, Maycira Costa

Salish Sea conference, 26-28 April 2022

We acknowledge and respect the ləkʷəŋən peoples on whose traditional territory the university of Victoria stands and the Songhees, Esquimalt and SENĆOTEN speaking people, the WSÁNEĆ nations whose historical relationships with the land continue to this day. Additionally, our work take us all across the coast and we acknowledge with respect the many ongoing relationship the multiple nations have with the land and ocean along the coast of British Columbia.



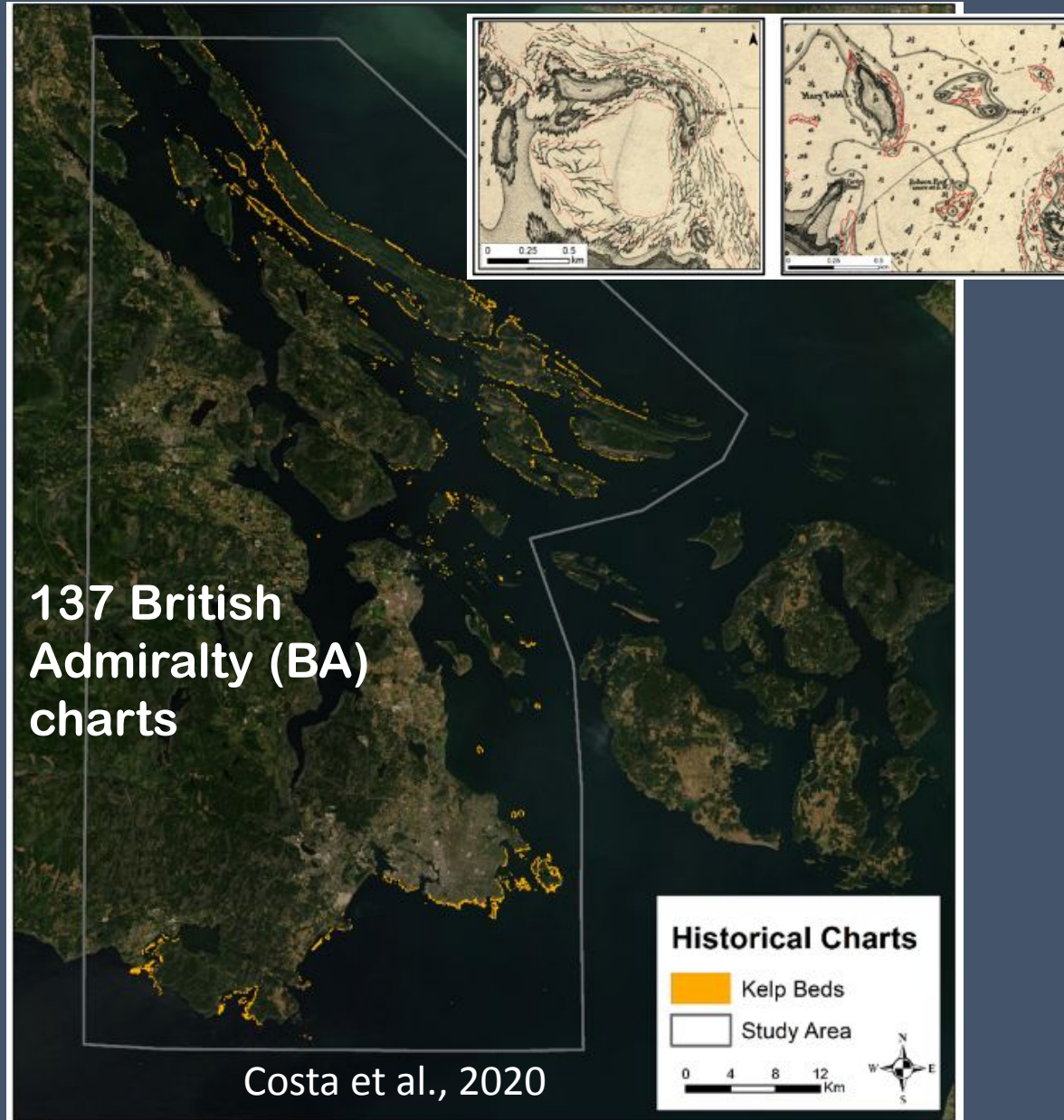
Background and objectives

Goal:

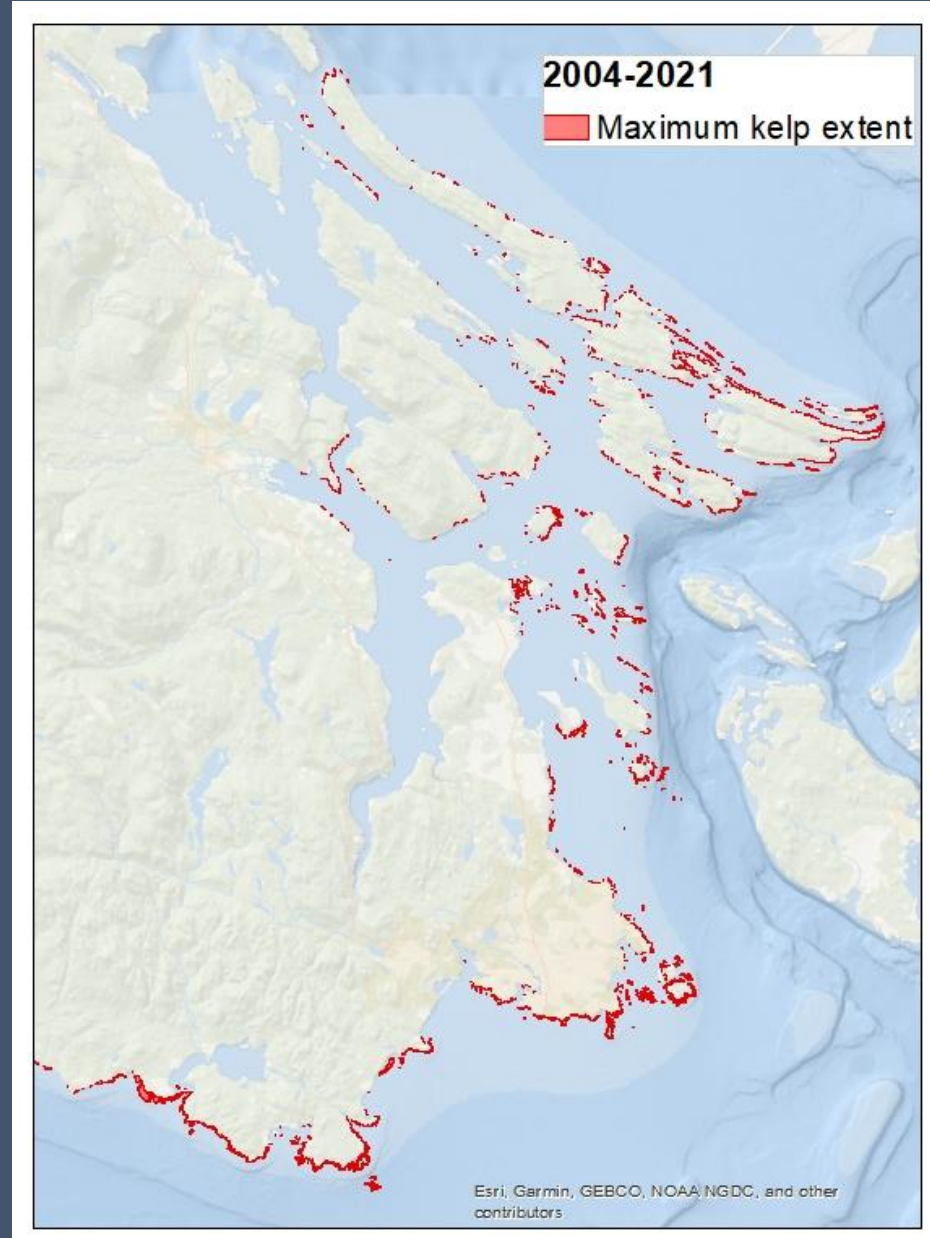
To determine the long-term spatial-temporal resilience of canopy-forming kelps, in response to local and regional environmental drivers along the coastlines of the Southern Vancouver Island and the Gulf Islands.

Historical - 1850s

- 137 British Admiralty (BA) charts



2004-2021 - maximum kelp extent



Kelp Niche- *Nereocystis luetkeana*

Concepts

- Resilience
- Vulnerability



Methodology: Kelp detection with high-res imagery

High-res aerial photography

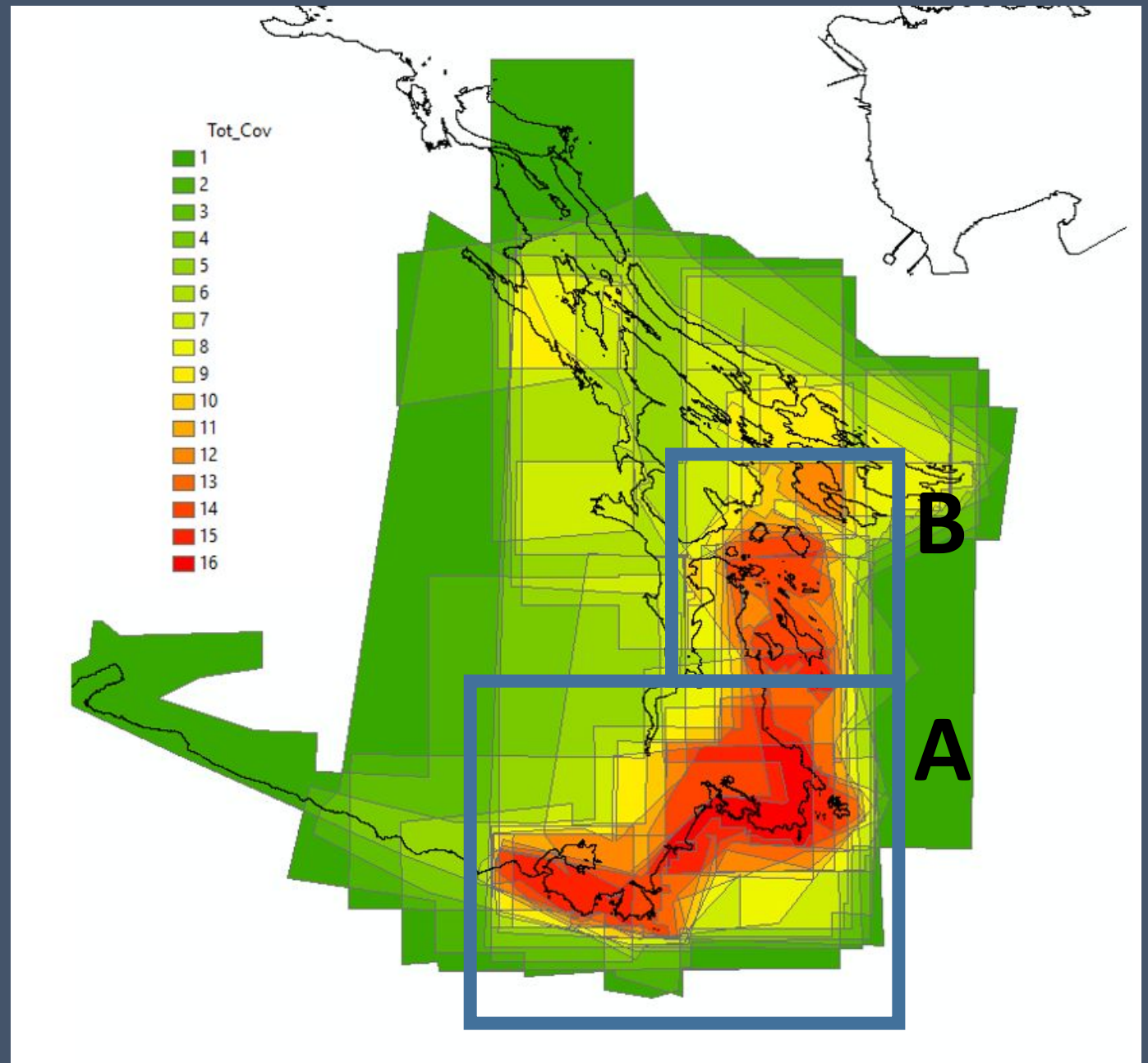
World View 2-3

Spot 6

Planet

Rapid Eye

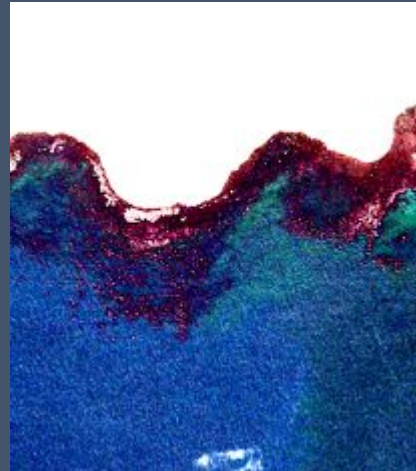
Kompsat



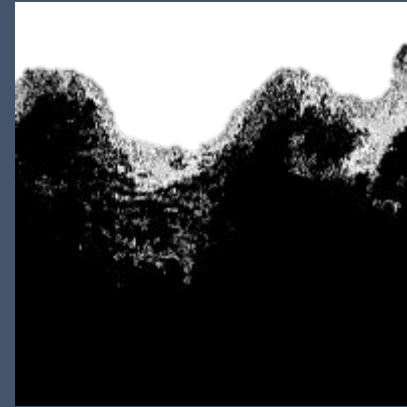
Methodology: Kelp detection with high-res imagery



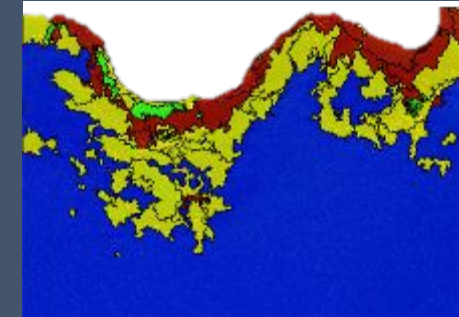
Mask
Deep Water,
Land and
Soft Substrate



Atmospheric
Correction
or Histogram
Shift



Band Indices
(NDVI, GNDVI,
Re/Y)
+
Stretch Input
Bands



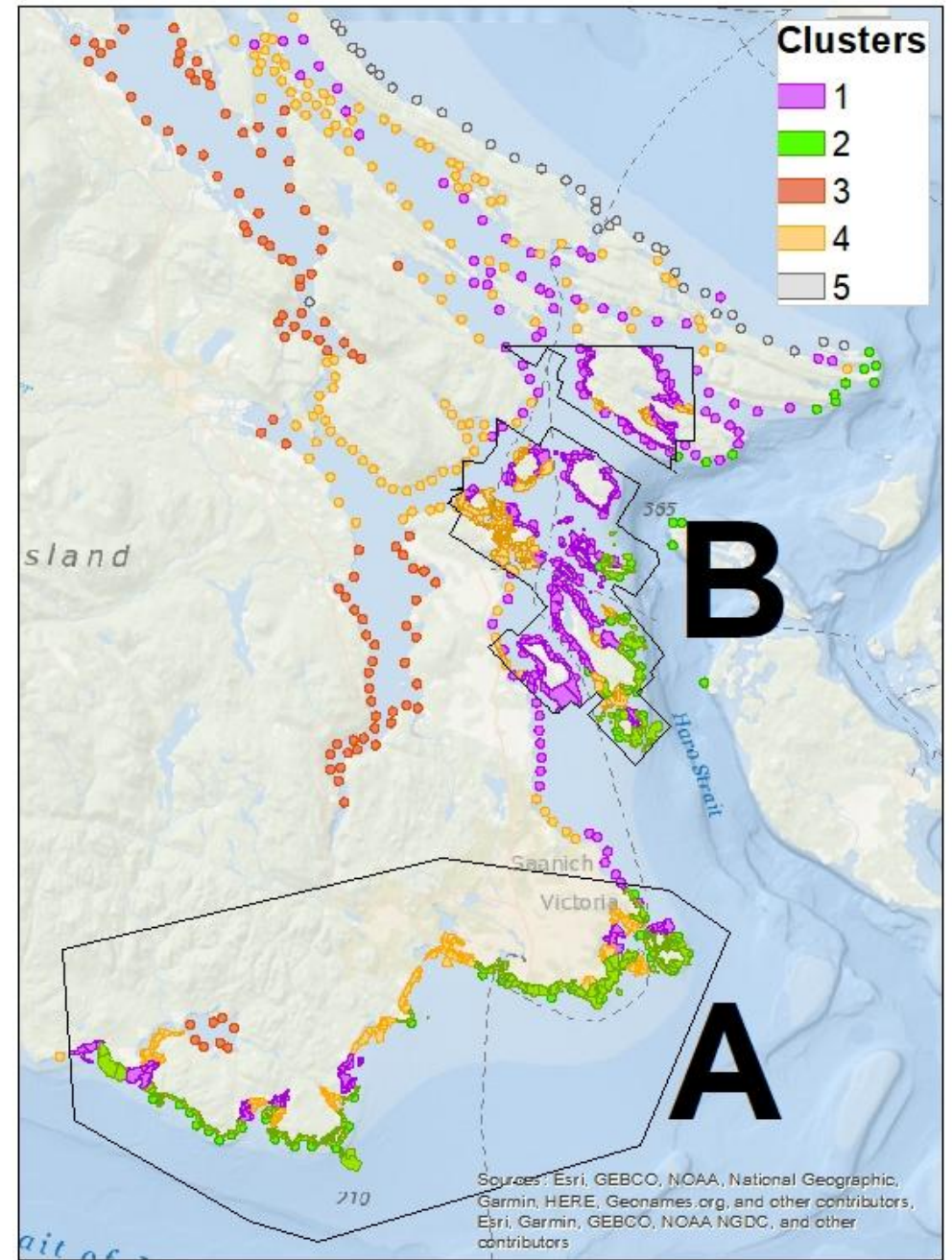
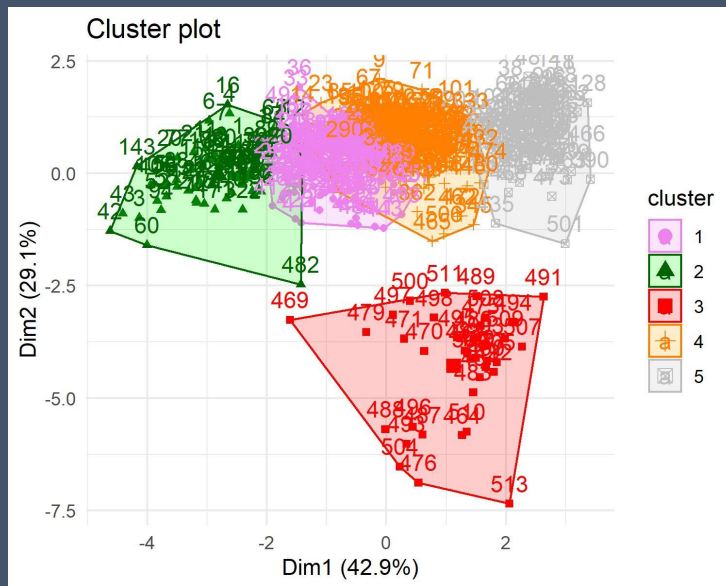
Object Based
Segmentation
+
Nearest Neighbor
Classification

Validation

TIME SERIES ANALYSIS

Cluster analysis

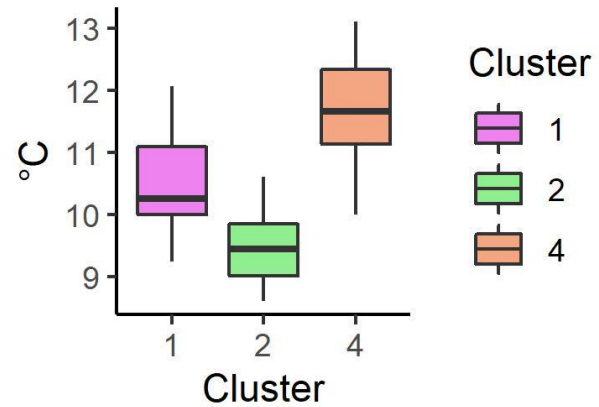
- Wind Density (W/m)
- Landsat- derived Thermal Infrared SST (°C) Spring-Summer
- Fetch (m)
- Tidal Amplitude (m/s)
- Total Suspended Matter (Mg/L) Spring- Summer



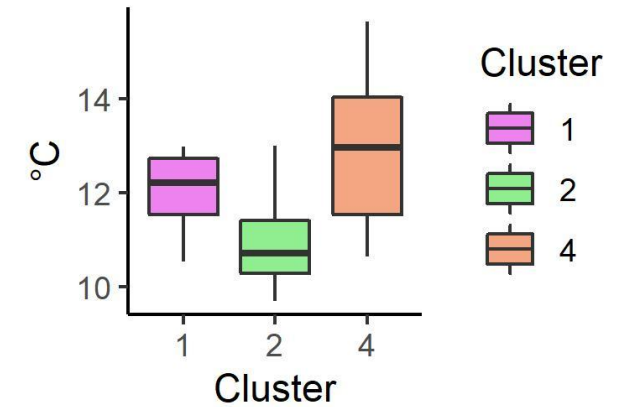
A. Victoria- Sooke



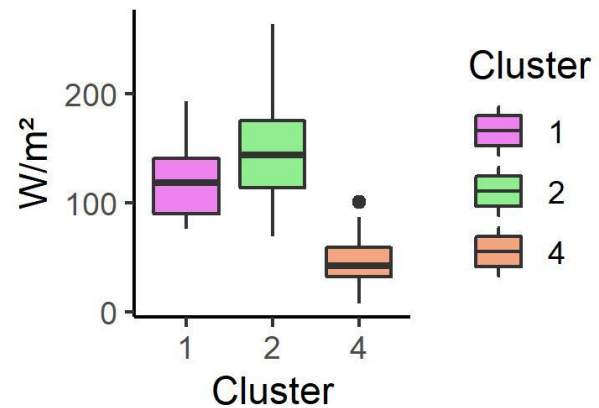
A Spring temperature

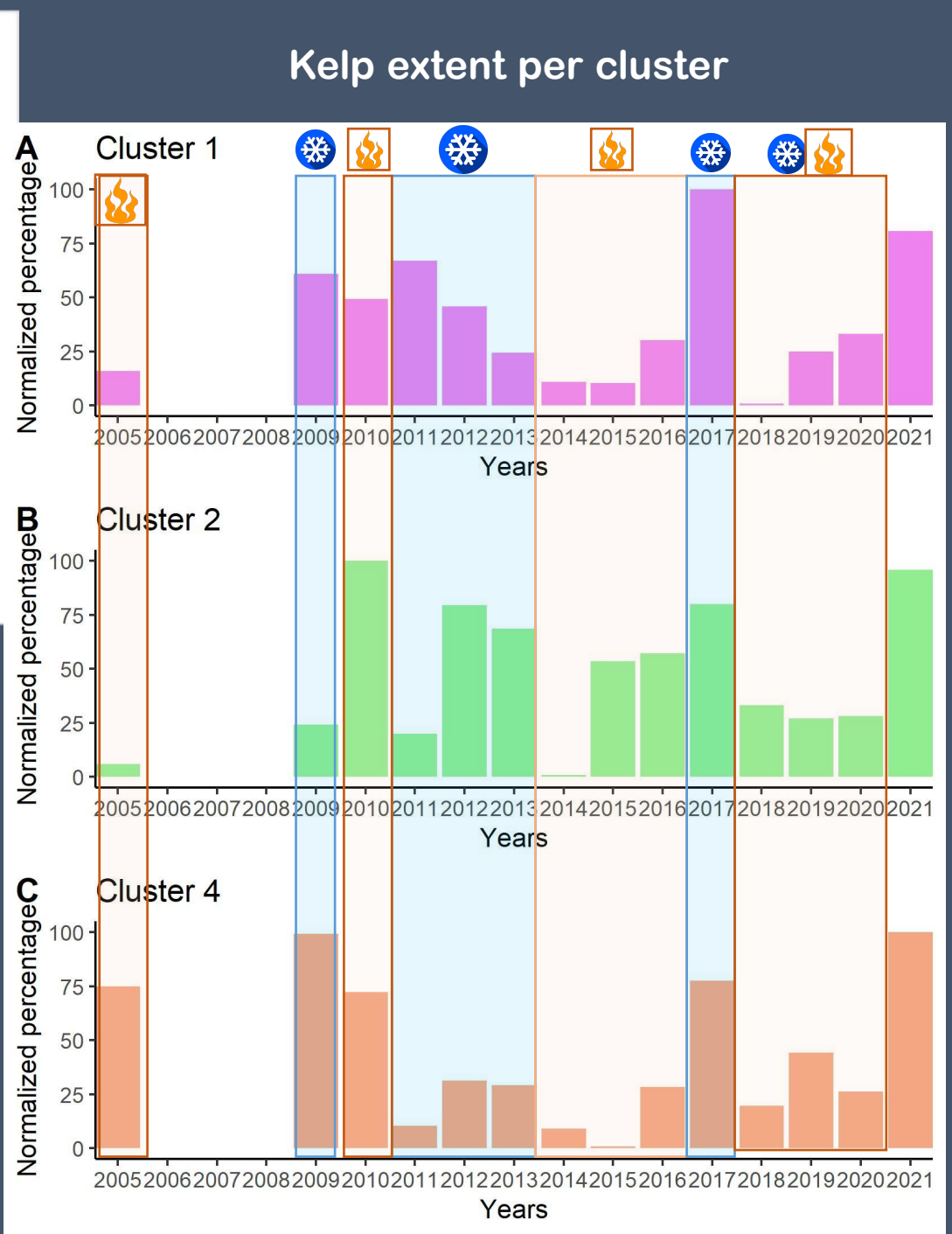
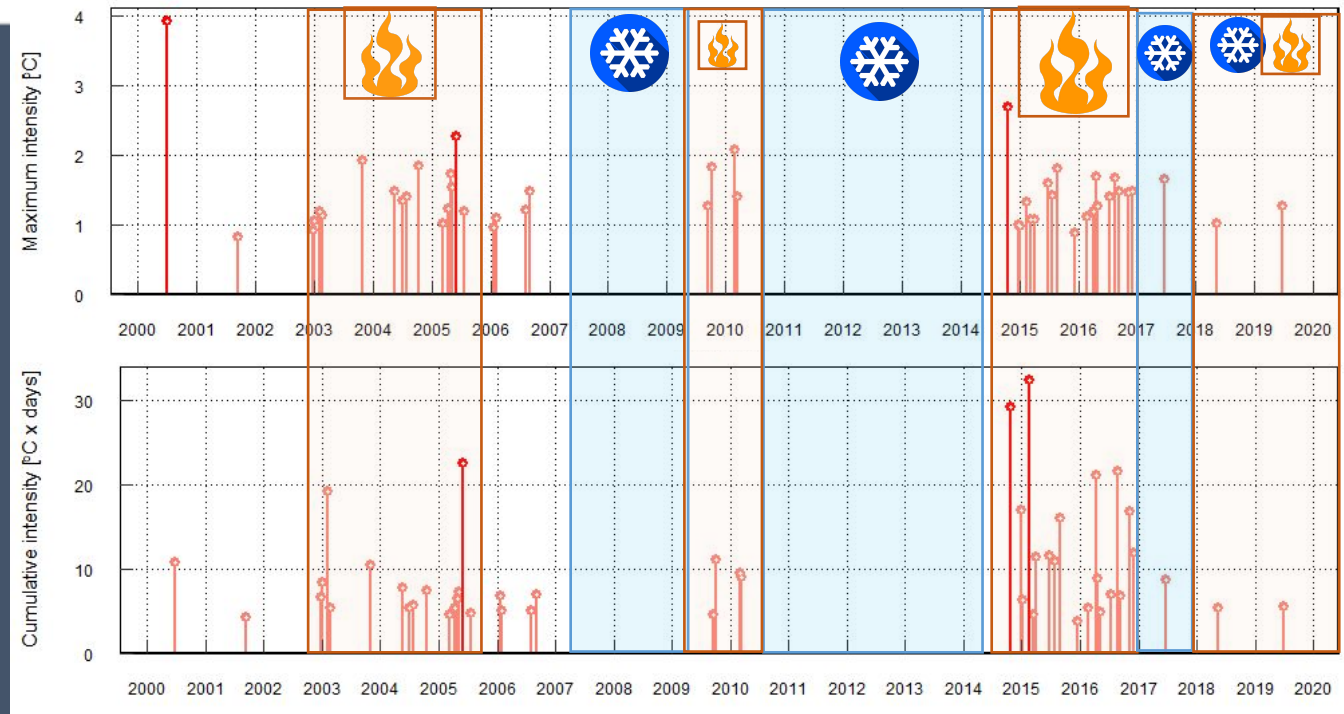
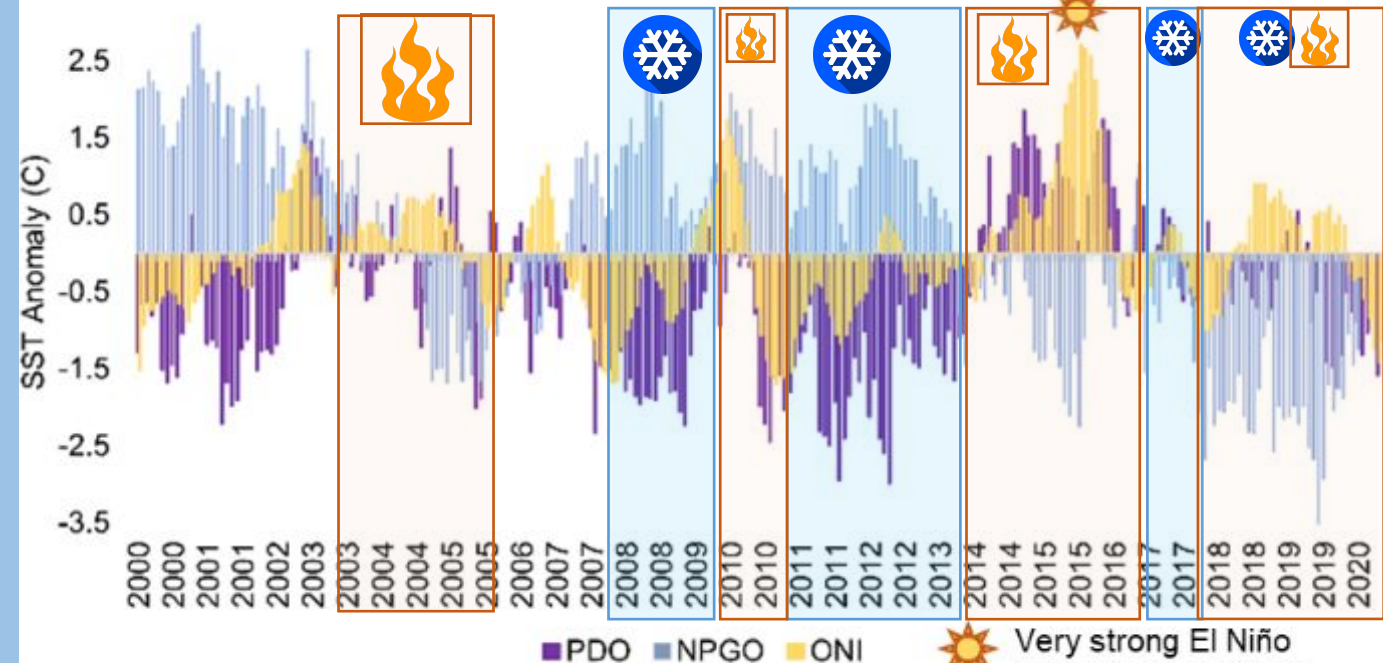


B Summer temperature

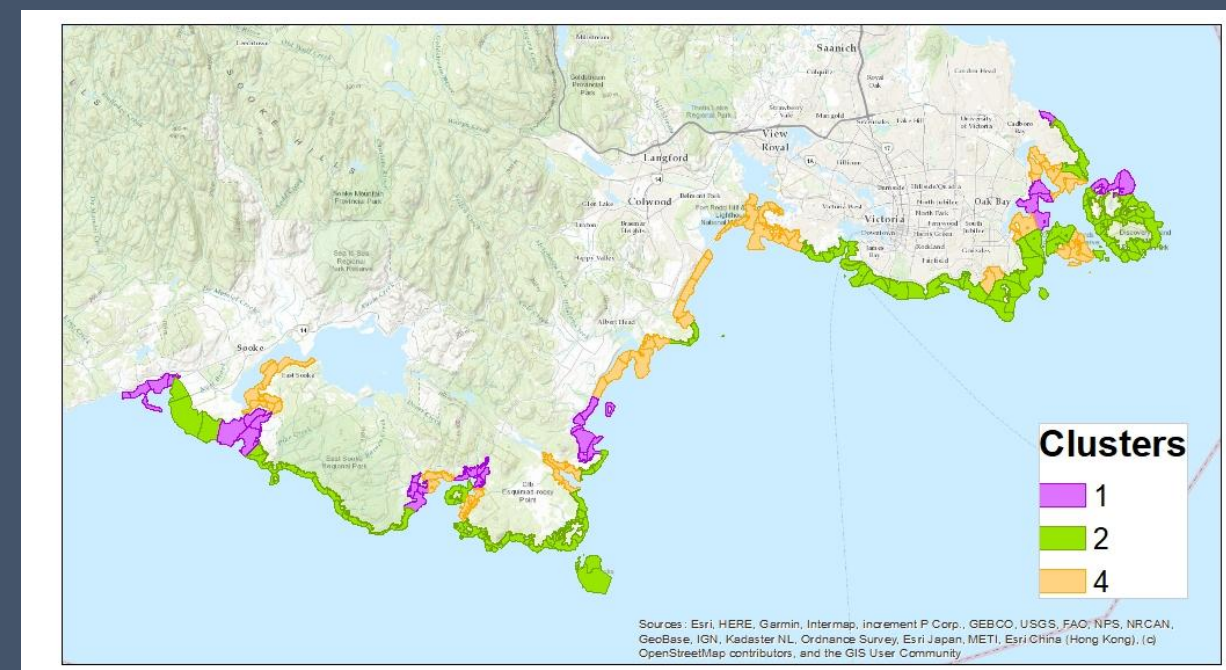
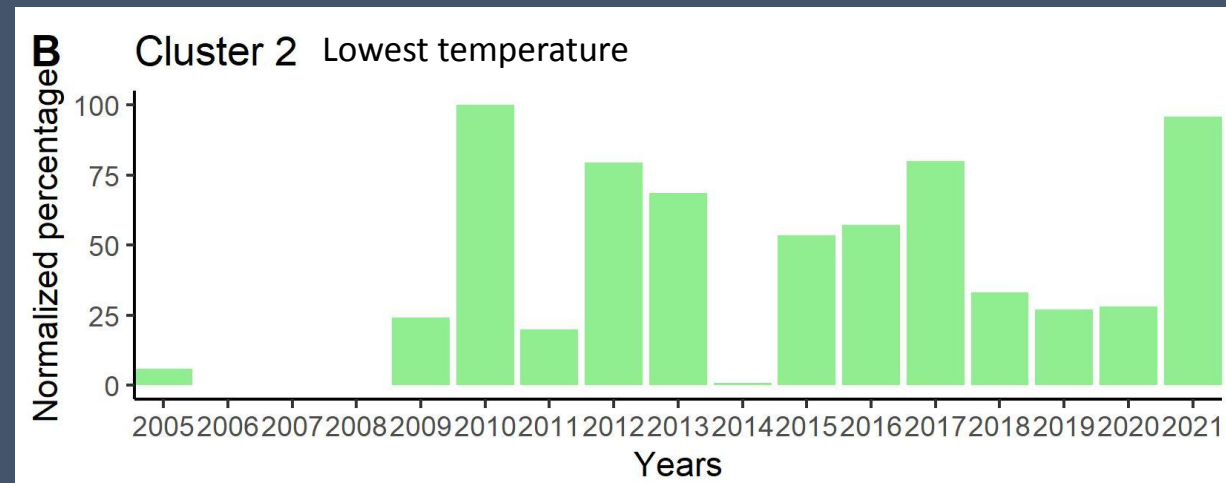
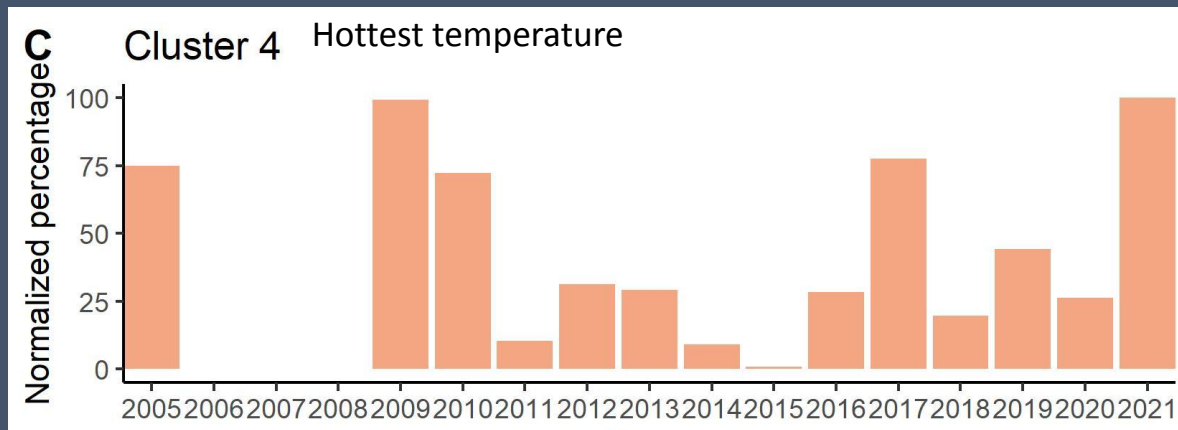
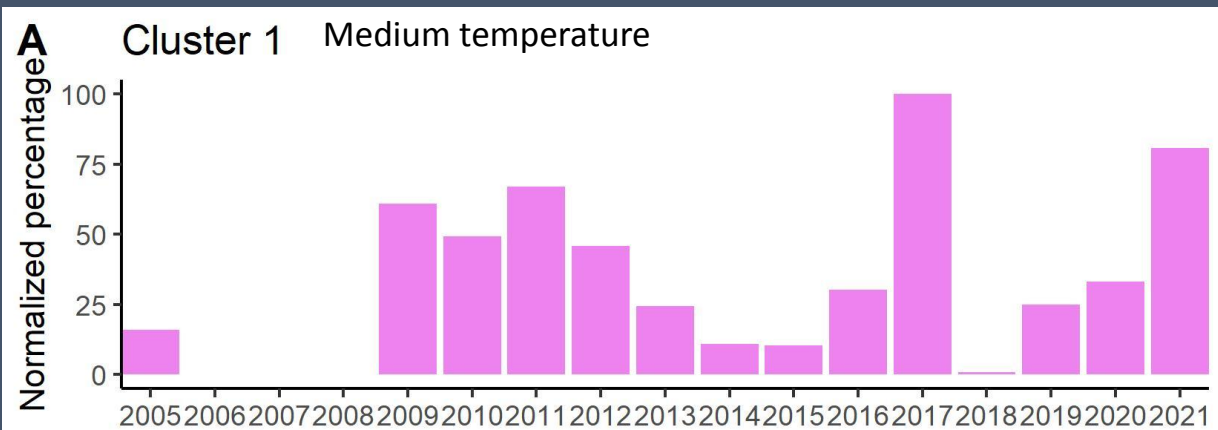


C Wind Power



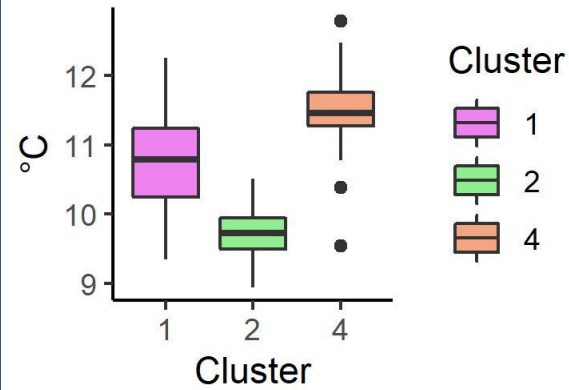


Kelp extent per cluster

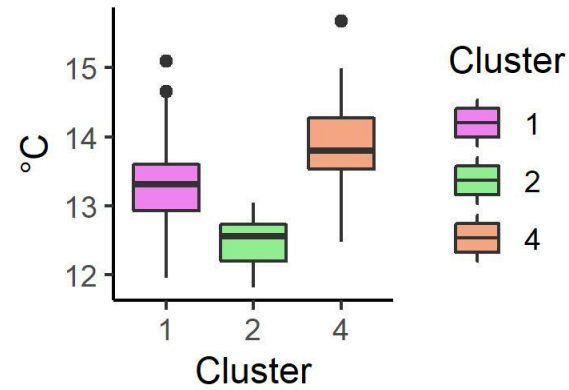


B. Gulf Islands

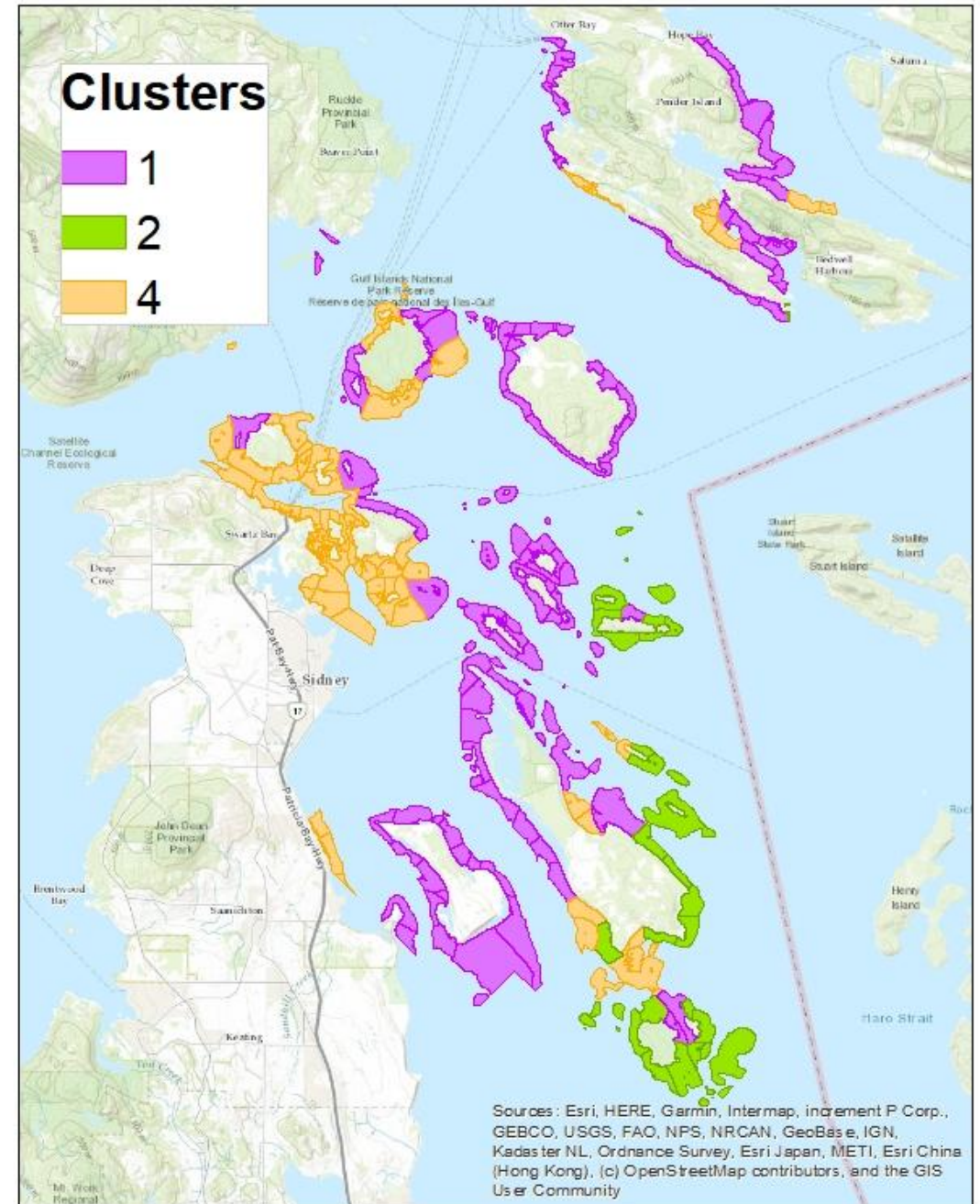
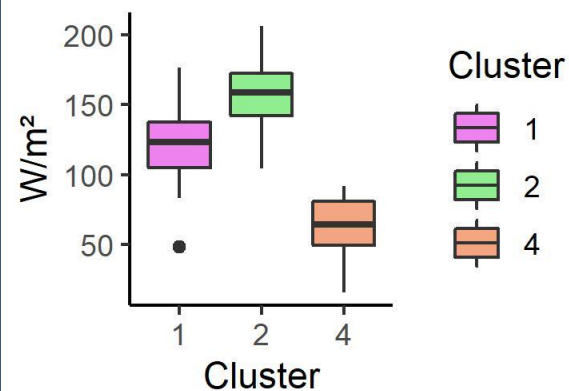
A Spring temperature



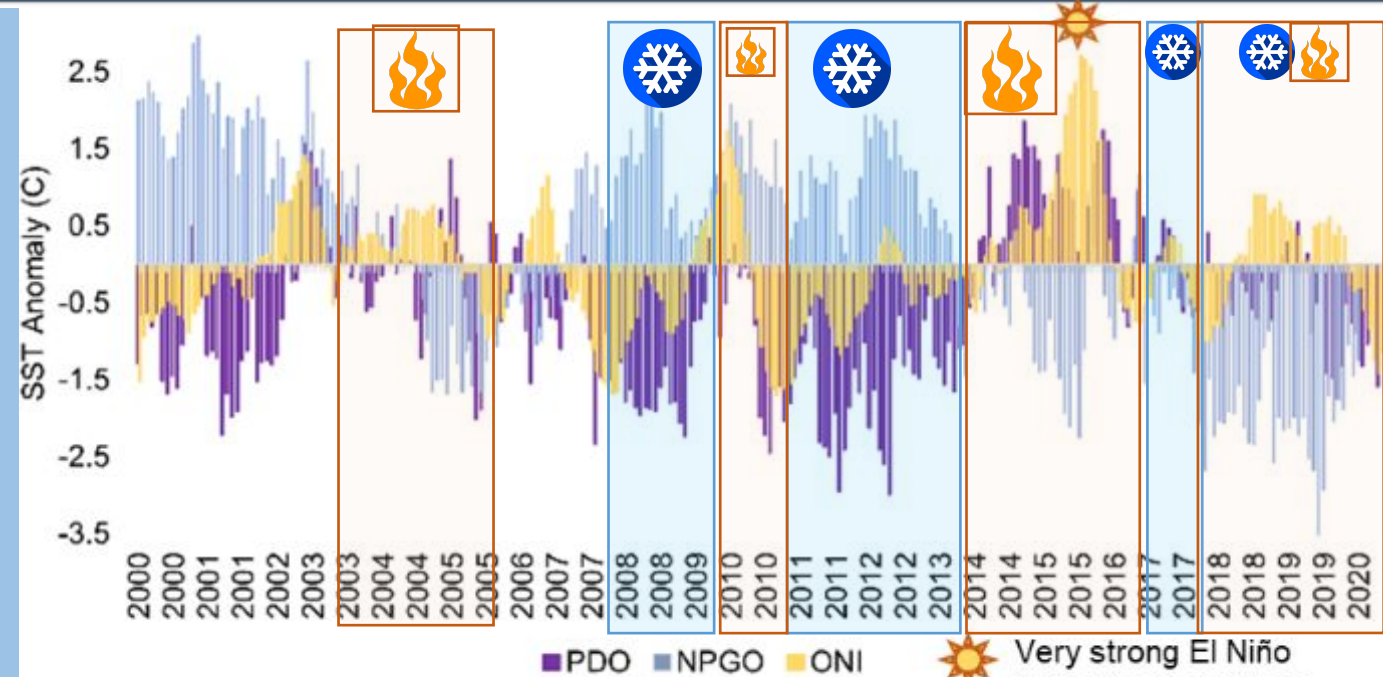
B Summer temperature



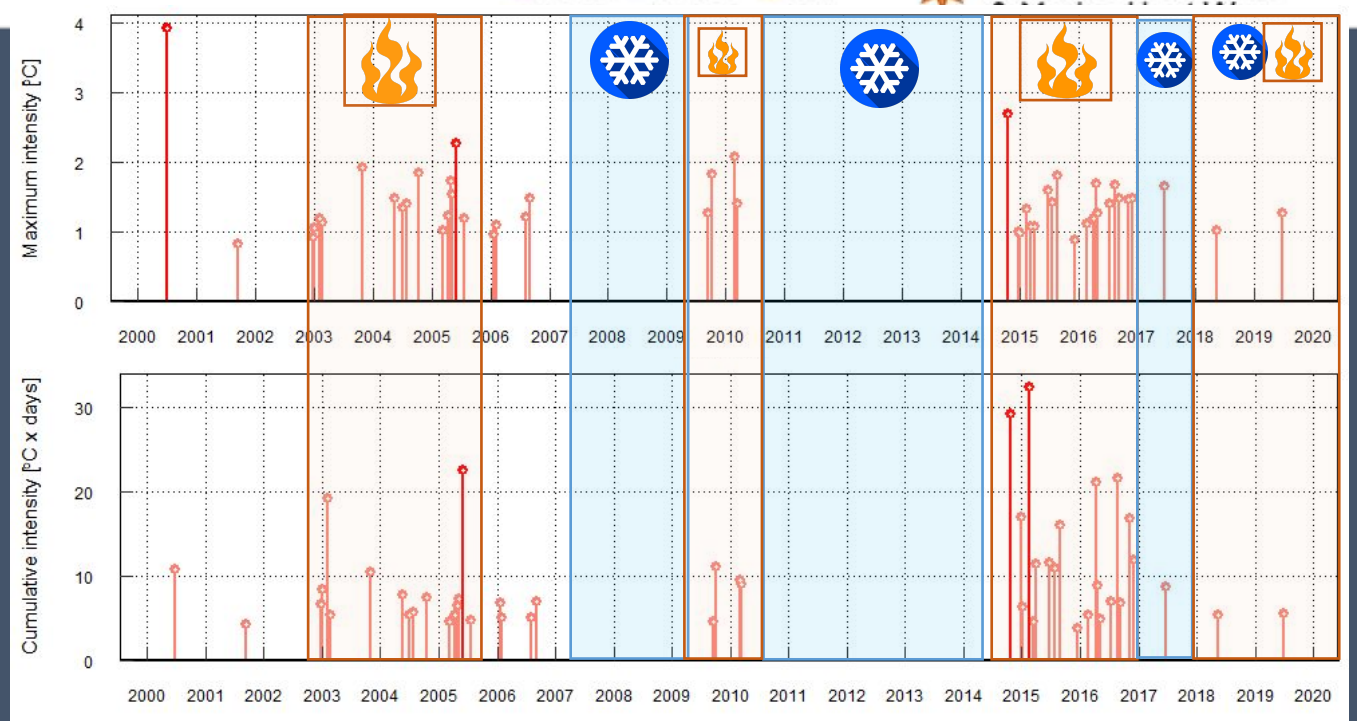
C Wind Power



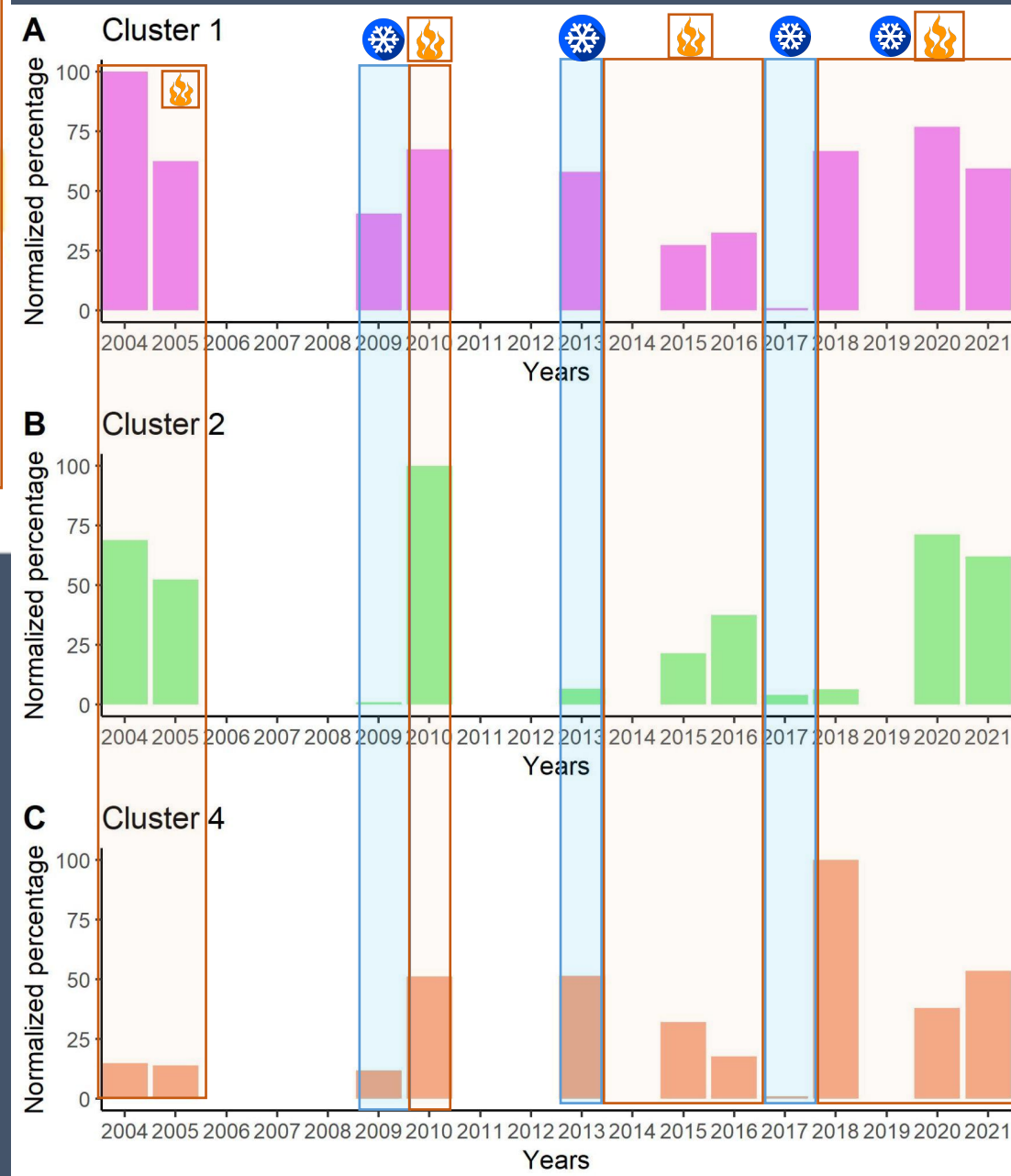
Oceanic Oscillations

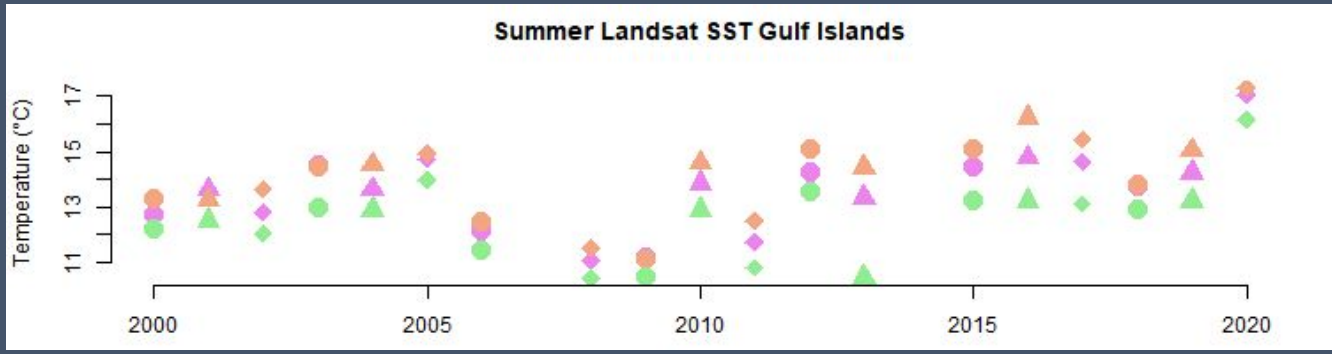
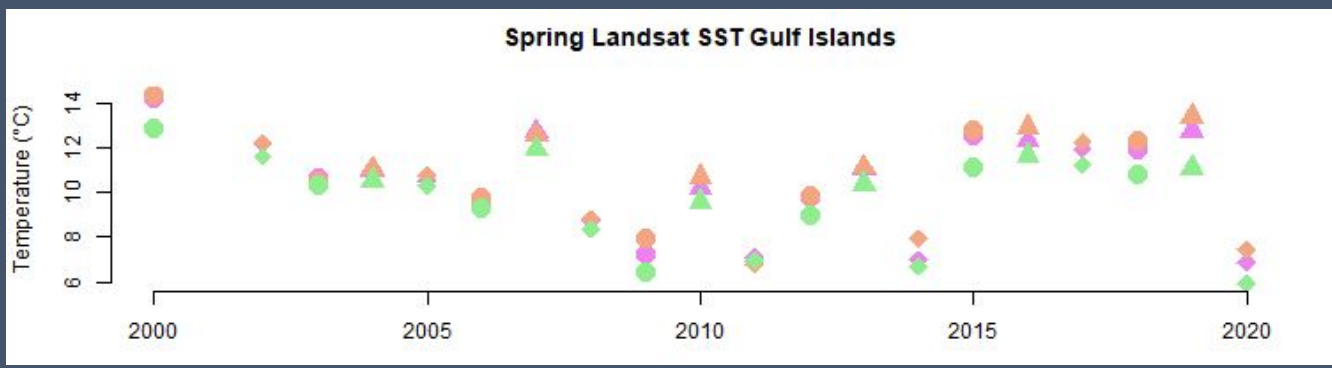
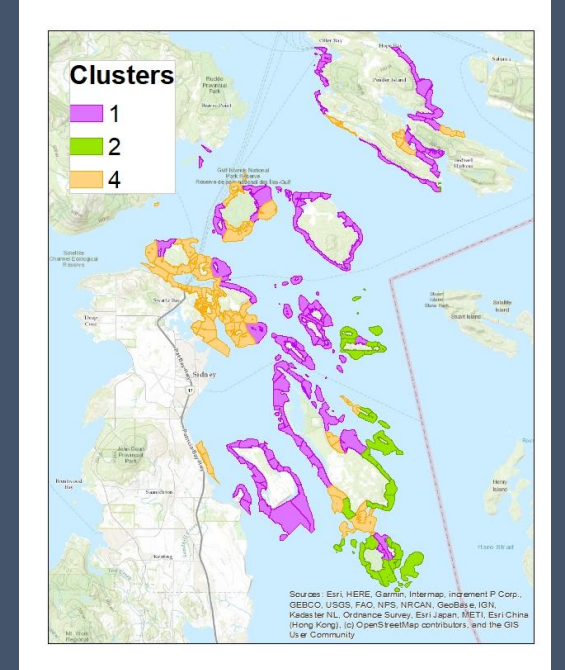
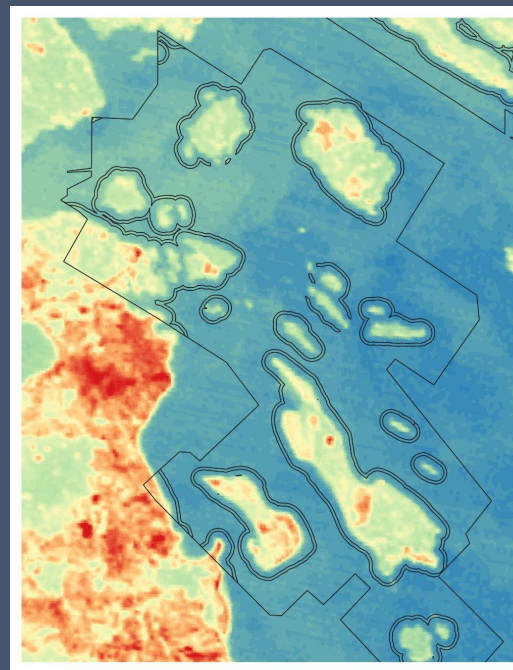
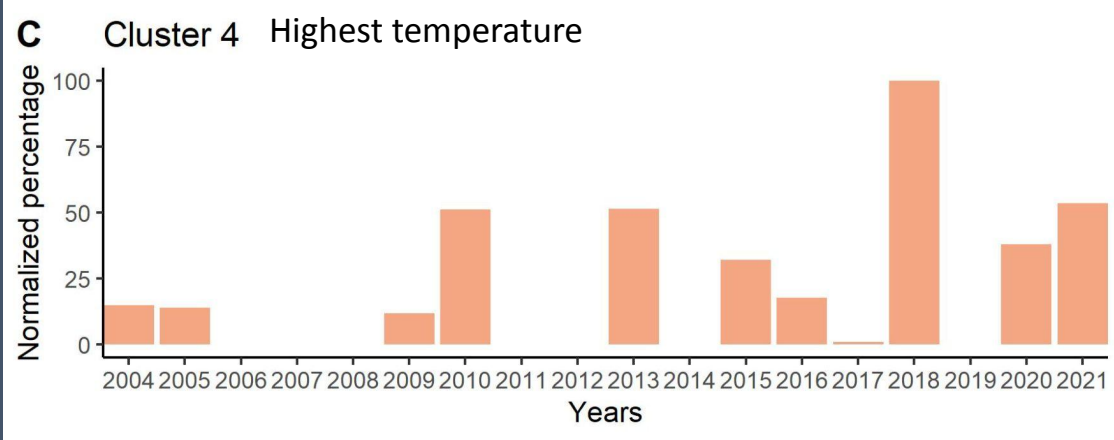
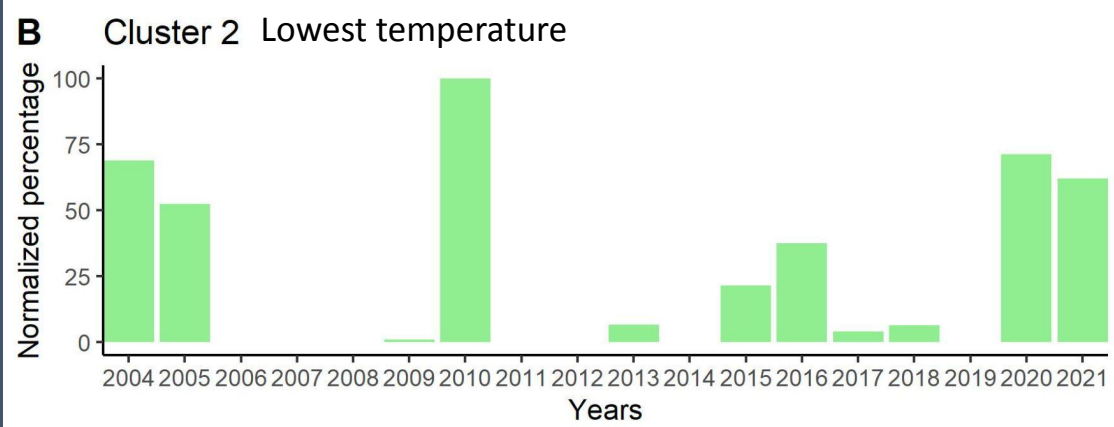
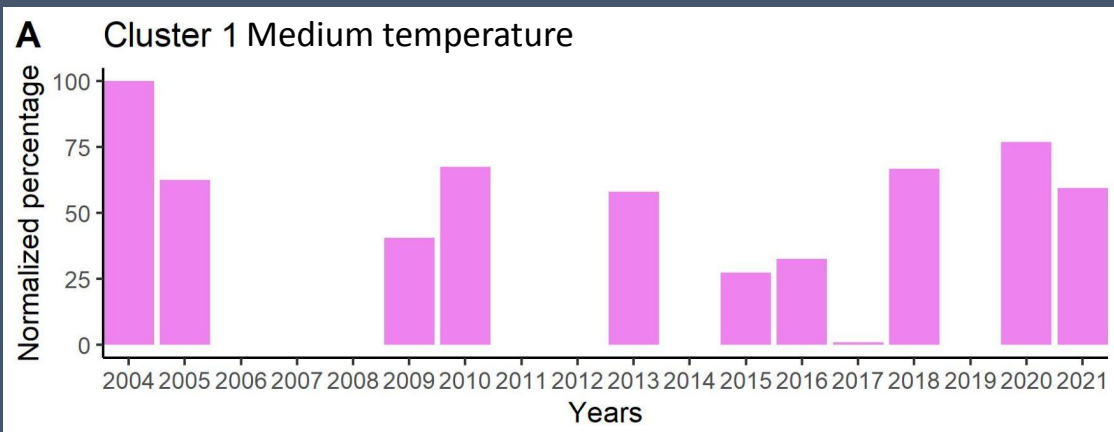


Marine heatwaves



Kelp extent per cluster





Final comments

- Similar conditions to other regions of the Pacific North American Coastline.
- Victoria to Sooke: Most resilient is the coldest cluster
- Gulf Islands: Most resilient are the warmer clusters
- KSSS: Kelp Sentinels of the Salish Sea