May 1st, 3:30 PM - 5:00 PM

Changes in Kelp and Other Seaweeds Following Elwha Dam Removal

Stephen P. Rubin
Geological Survey (U.S.), srubin@usgs.gov

Helen Berry
Washington (State). Department of Natural Resources

Nancy Elder
Marrowstone Marine Field Station

Ian Miller
Washington Sea Grant Program

Jeff Duda
Geological Survey (U.S.)

See next page for additional authors

Speaker
Stephen P. Rubin, Helen Berry, Nancy Elder, Ian Miller, Jeff Duda, Melissa M. Foley, Jonathan A. Warrick, Matt Beirne, Mike McHenry, and Rob Pedersen

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[1]USGS Western Fisheries Research Center
[2]WA Department of Natural Resources
[3]USGS WFRC Marrowstone Marine Station
[4] WA Sea Grant, Port Angeles WA
[5]USGS Pacific Coastal and Marine Science Center
[6]Lower Elwha Klallam Tribe
[7]USEPA Region 10 Environmental Cleanup Office

USGS science for a changing world

Sea Grant Washington

Washington State Department of Natural Resources www.dnr.wa.gov

Nearshore Vegetation

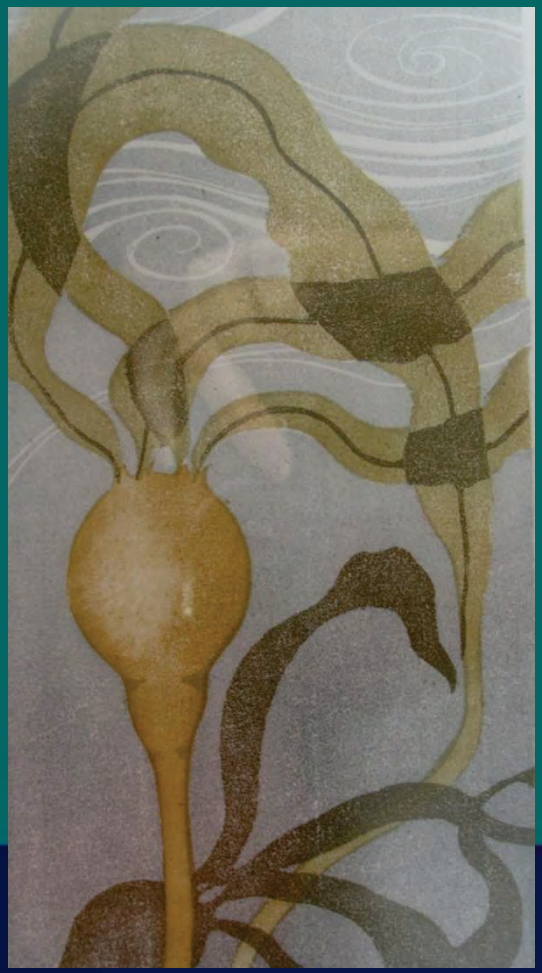
- Diverse algae and seagrasses
- 3-D structure
- Important food source to local and distant ecosystems

Expected Changes

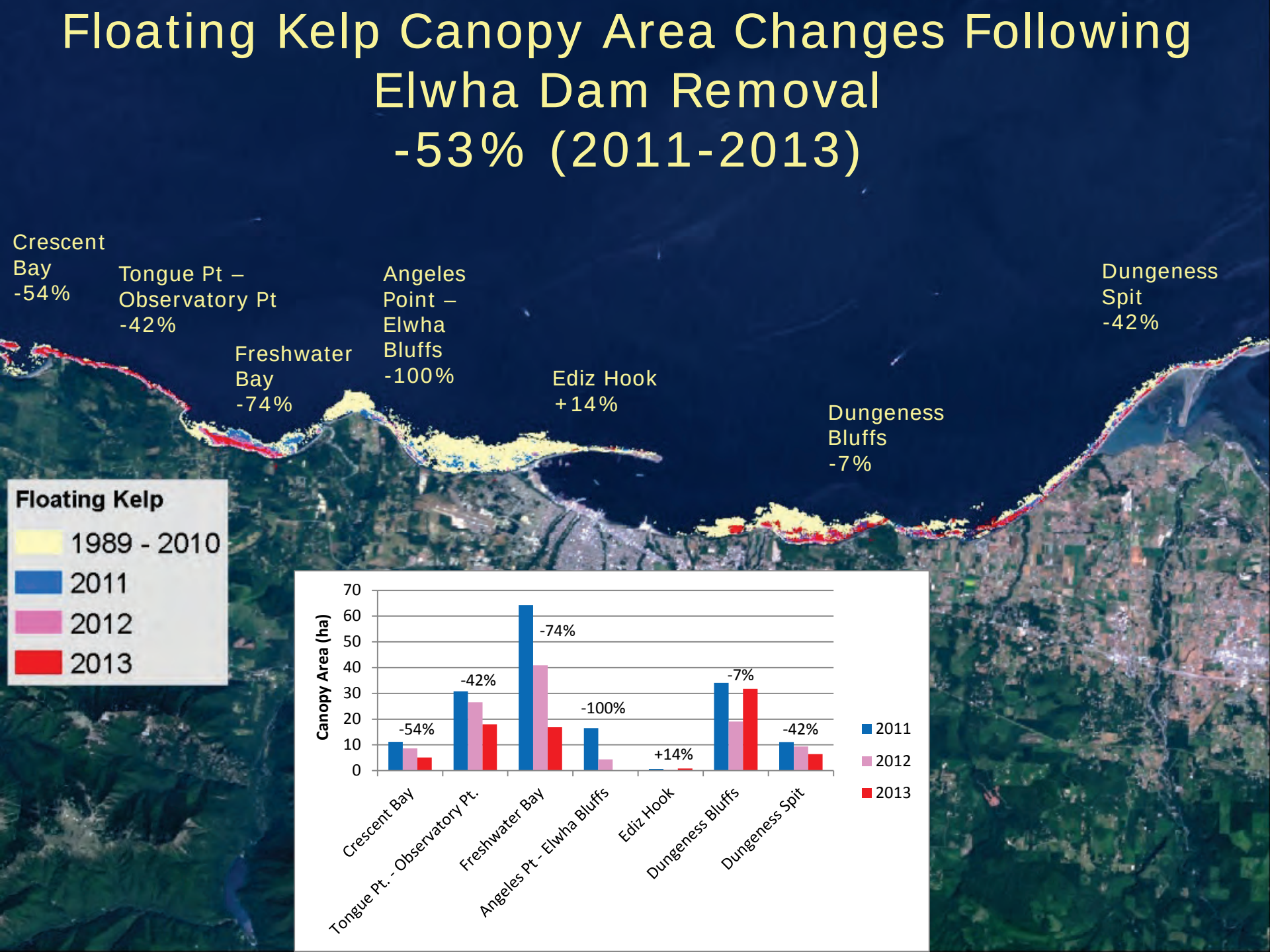
- Long-term
  - Shift toward soft sediment species
- Short-term
  - Turbidity
  - Scour
  - Burial

Floating Kelp Monitoring Methods (Since 1989)

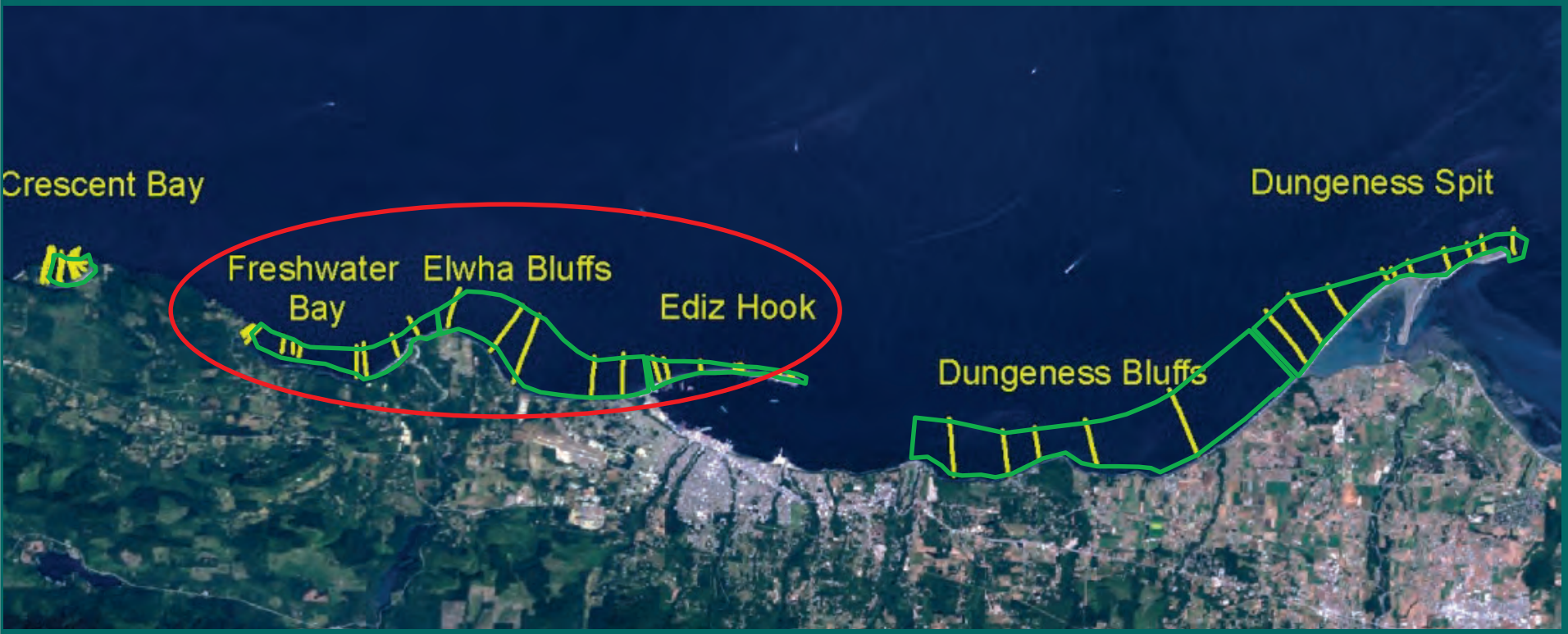
Near-vertical aerial photography collected from small plane during a late summer low tide (7500’ MSL) with Nikon D200 digital 35mm DSLR camera. Hand delineated onto 1:12K basemaps



Floating Kelp Canopy Area Changes Following Elwha Dam Removal
-53% (2011-2013)



Underwater Transects Surveyed in 2010*, 2012 & 2013 from shallow to -15 m



* Thanks to Clallam County (Cathy Lear) and MRC (Jim Norris) for 2010 imagery.

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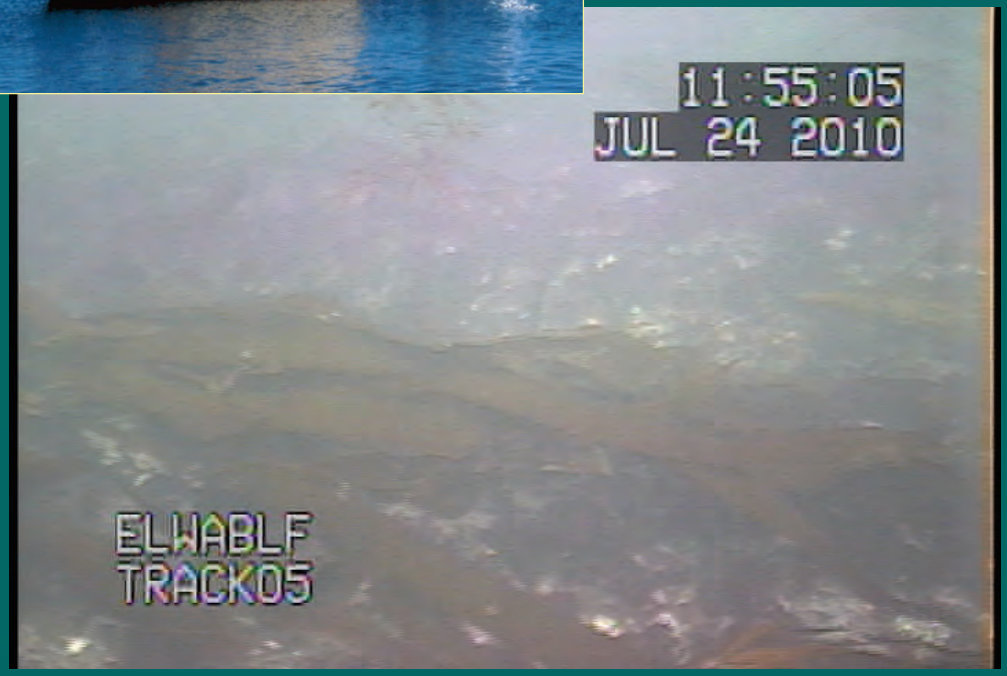
Underwater Video Classification

- Vegetation Types
  - All macrovegetation
    - All kelp
      - Stipitate kelp
      - Prostrate kelp
      - Floating kelp
    - Non-kelp red/brown algae
    - Green algae
    - Seagrass
- Cover classes
  - Really Low <15%
  - Low 15-33%
  - Medium 33-66%
  - High 66-85%
  - Really High >85%



Mapping Unit ~ 1 m^2

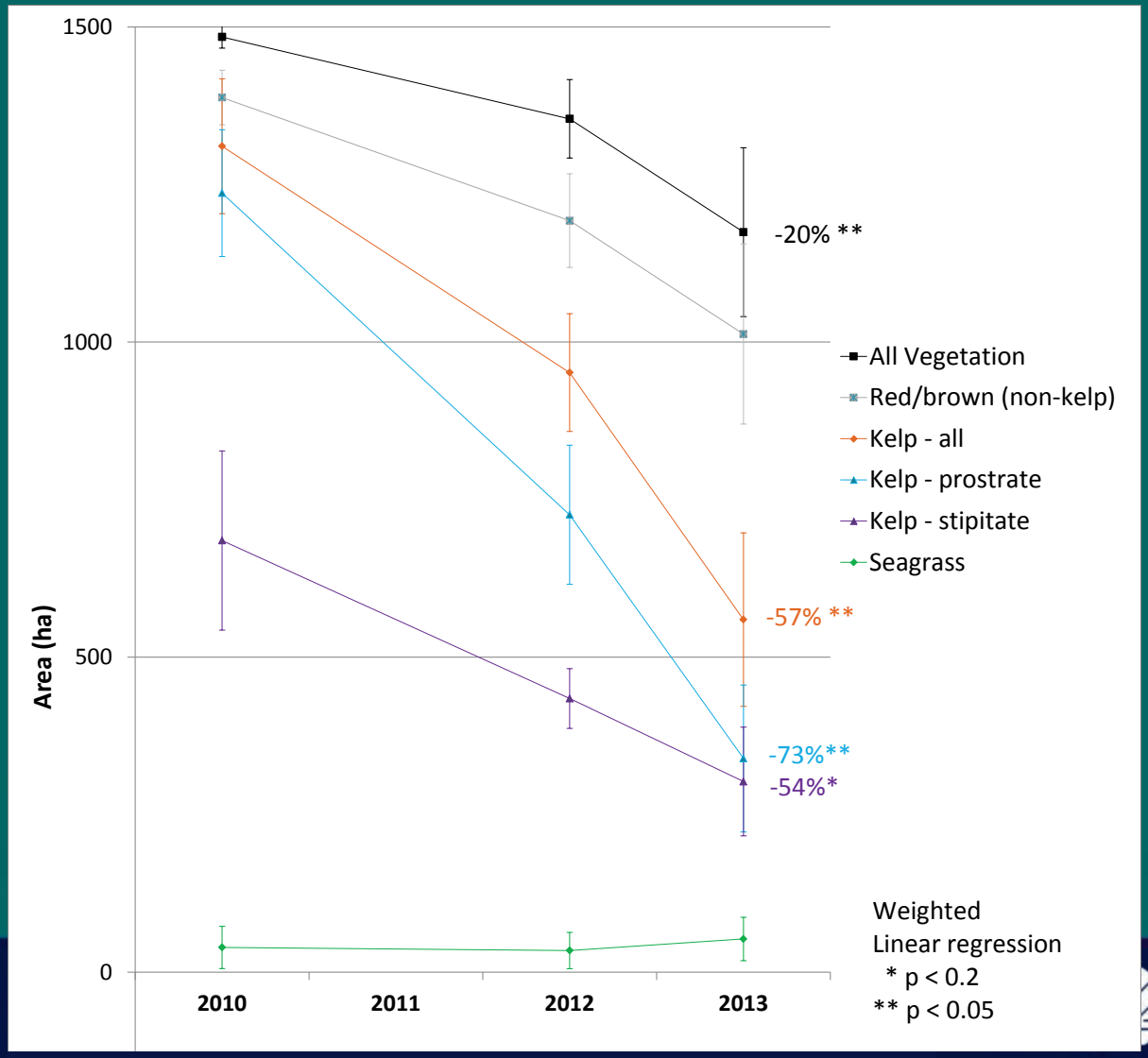
2010

2012

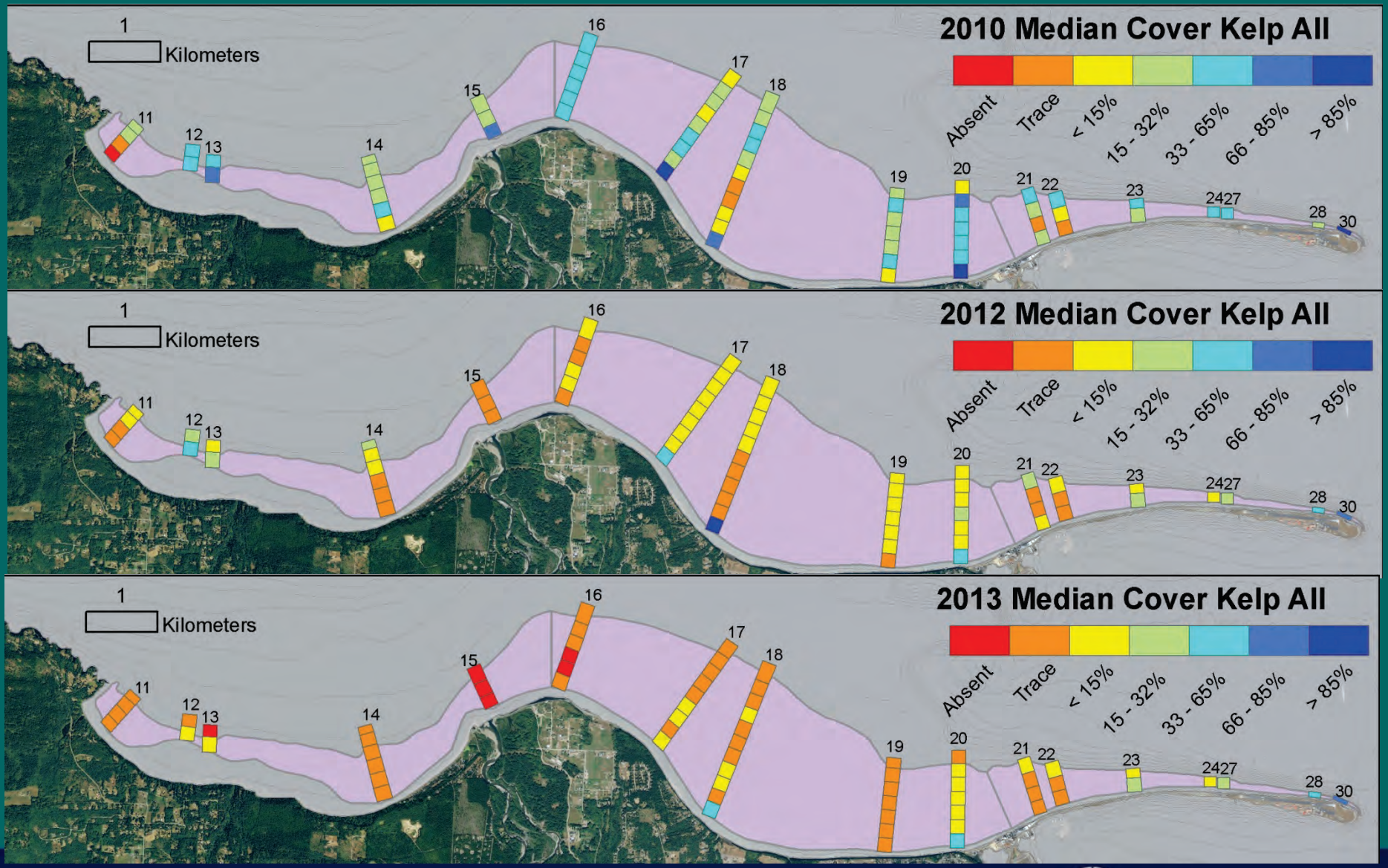
2013

Directly east of the Elwha River mouth, -8 m (MLLW).

Major Decrease in Area with Vegetation Present, 2010-2013



Strong Gradient



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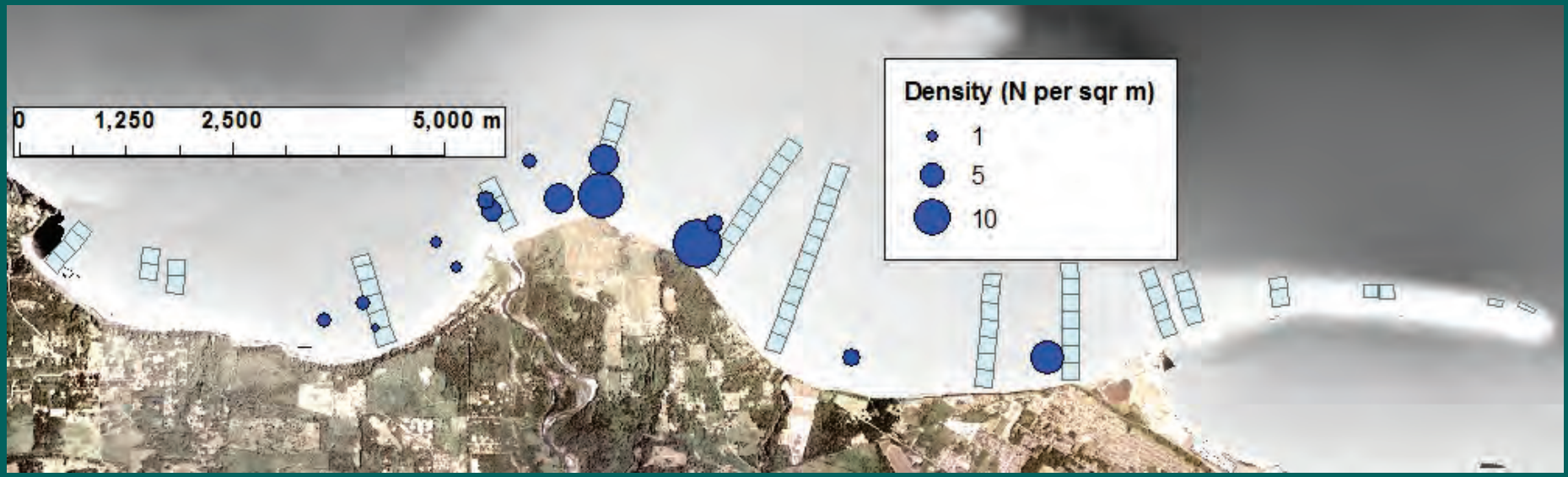
Dive surveys

- **Identify and count plants in 30 m x 1 m swaths**
- Transect endpoint markers on seafloor:

- Two transects per site
- Seasonal window: Late July-early September
- Surveys conducted annually at 17 sites:
  - 1 site: 2009-2013
  - 4 sites: 2010-2013
  - 9 sites: 2011-2013
  - 3 sites: 2009 (GPS only, no endpoint markers), 2012-2013

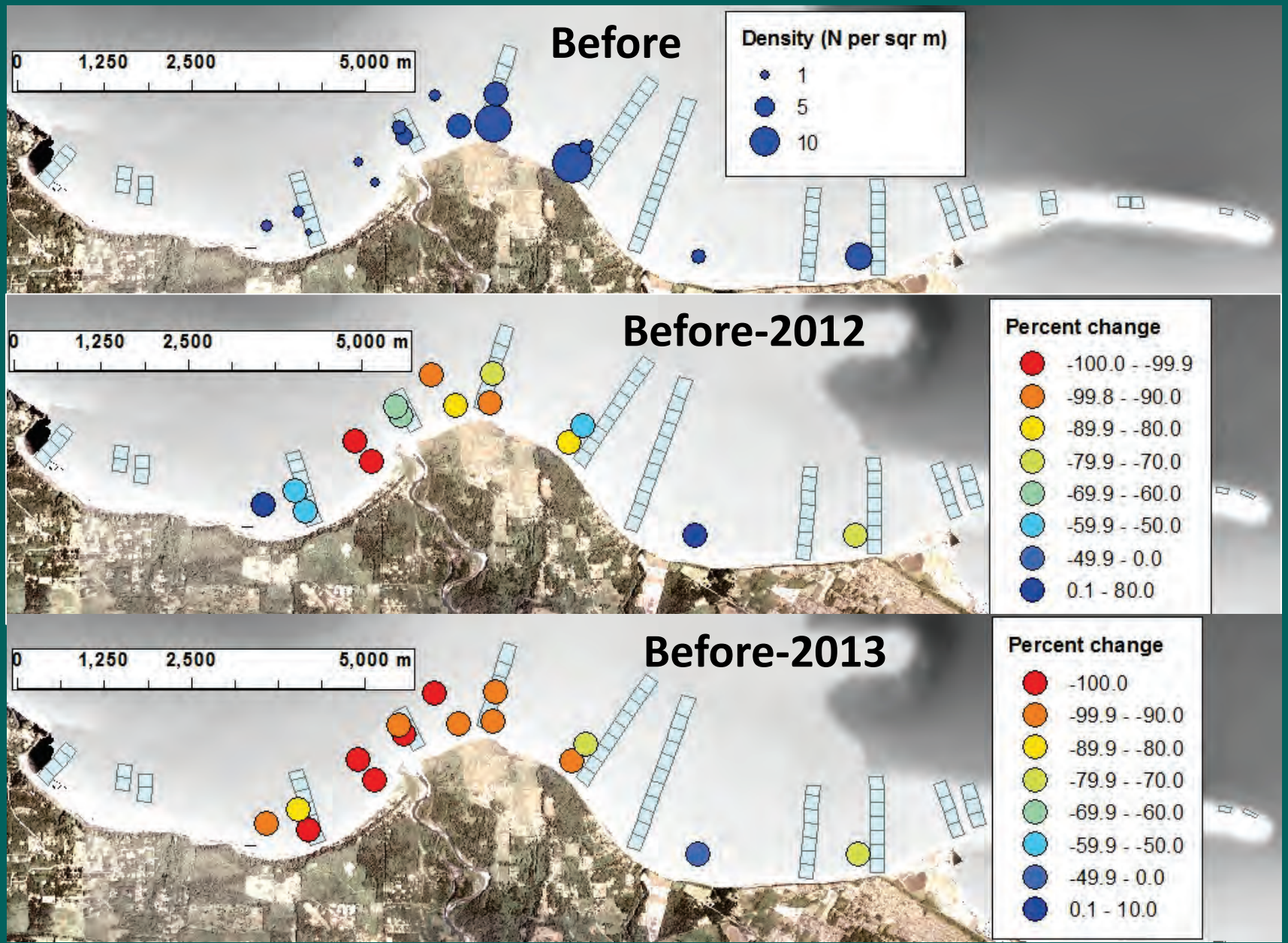
All kelp

- Density before dam removal



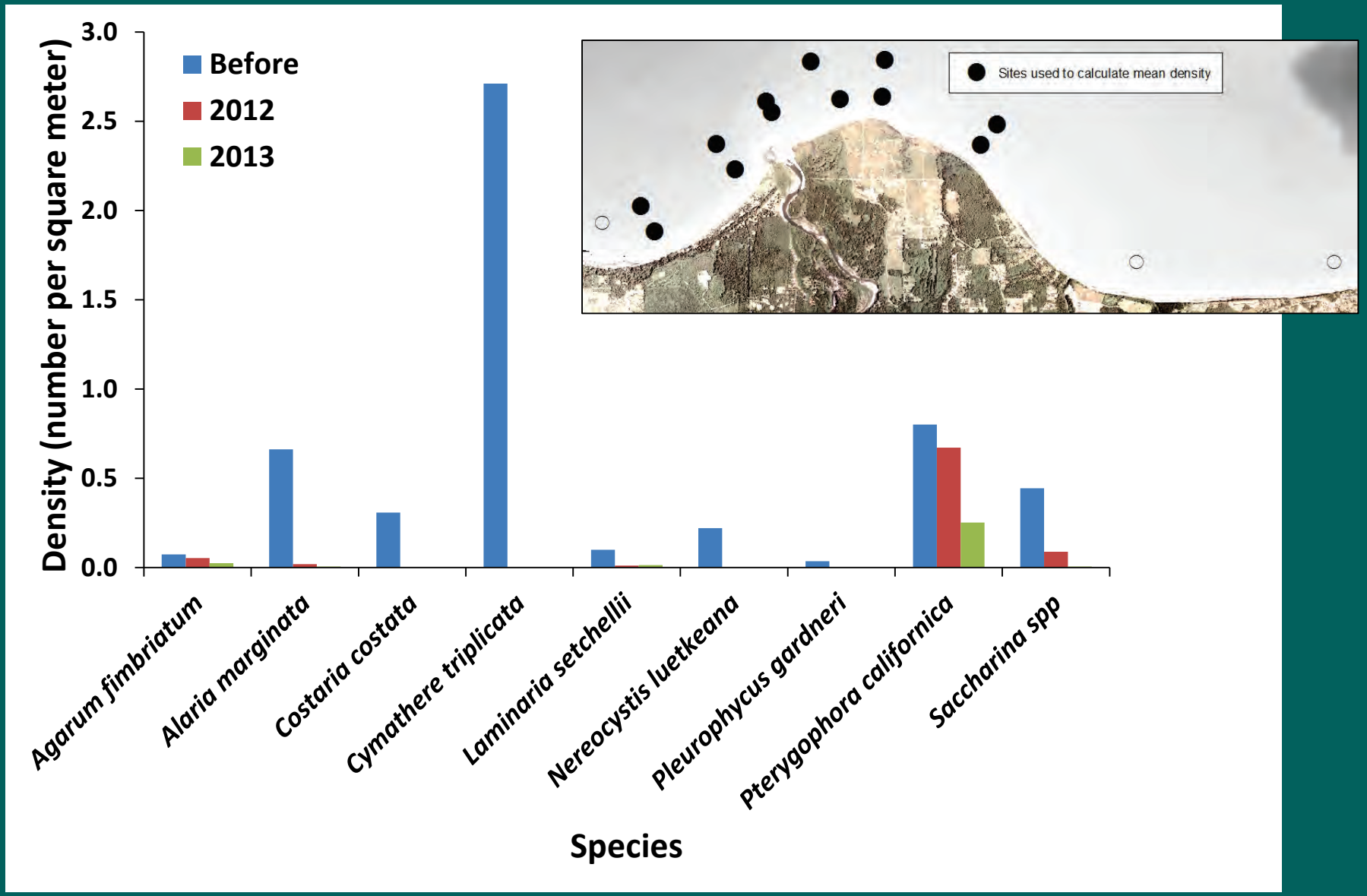
All kelp

- Percent change in density after dam removal



Kelp species

- Density before dam removal and in 2012 and 2013



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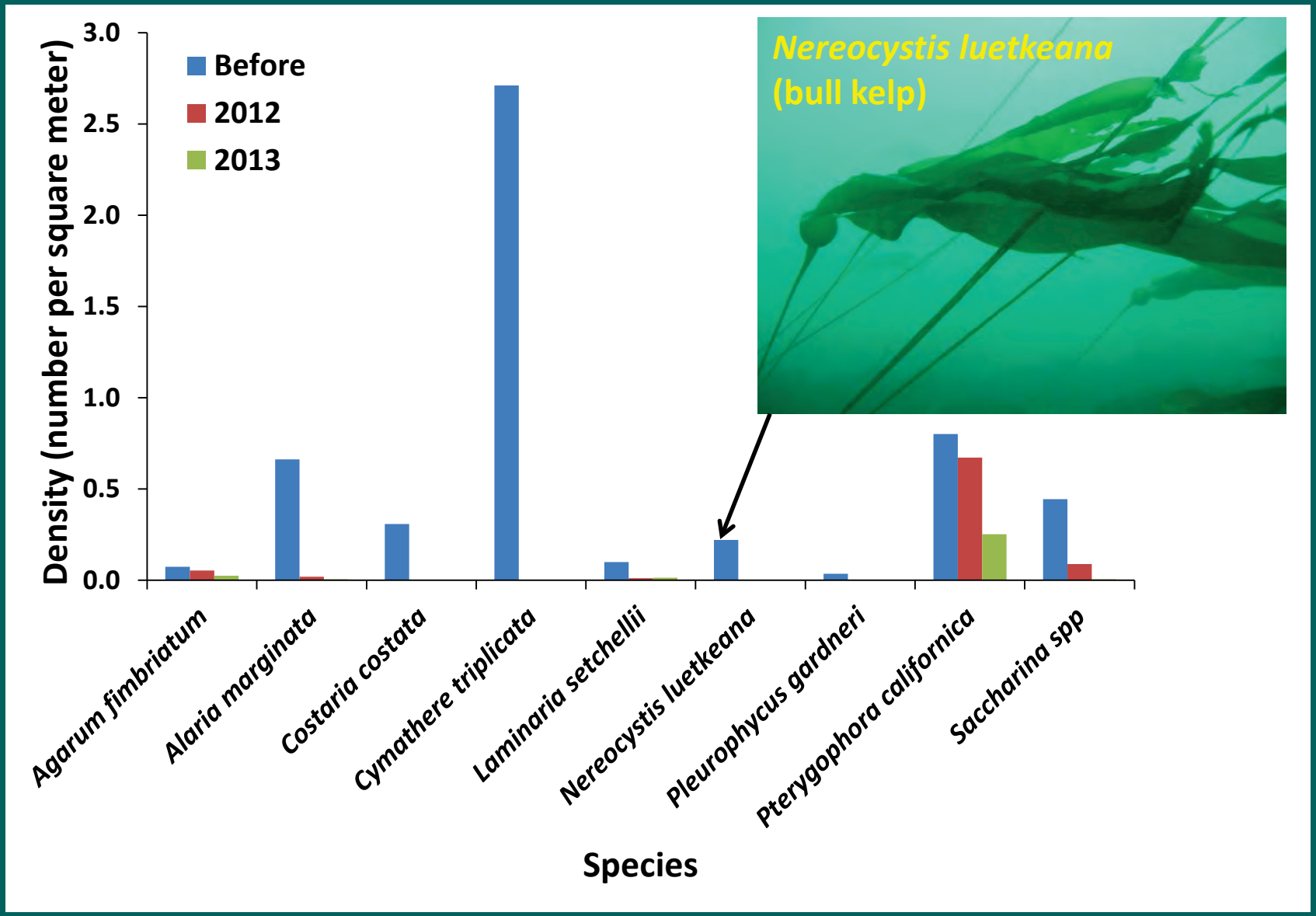

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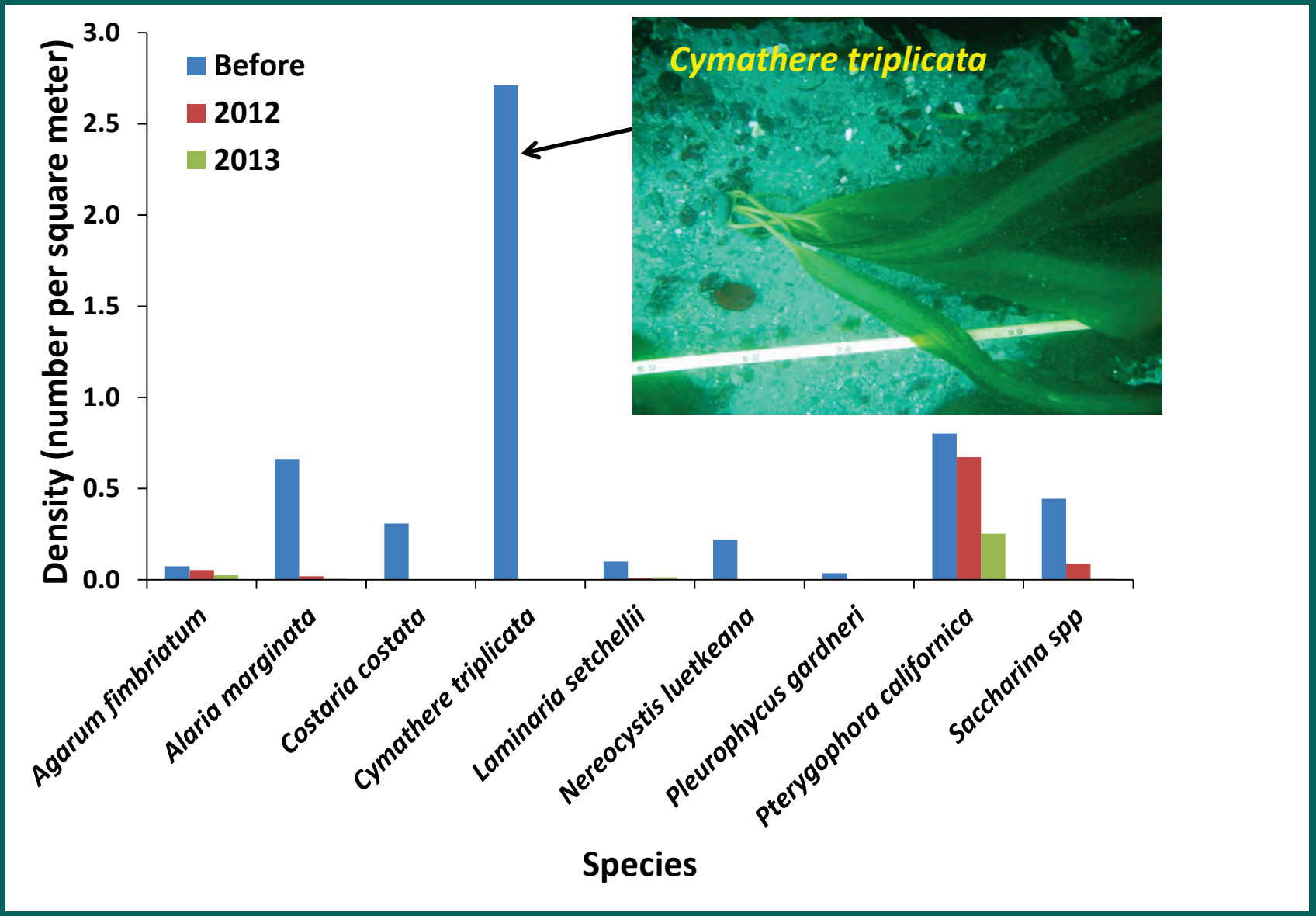

Kelp species

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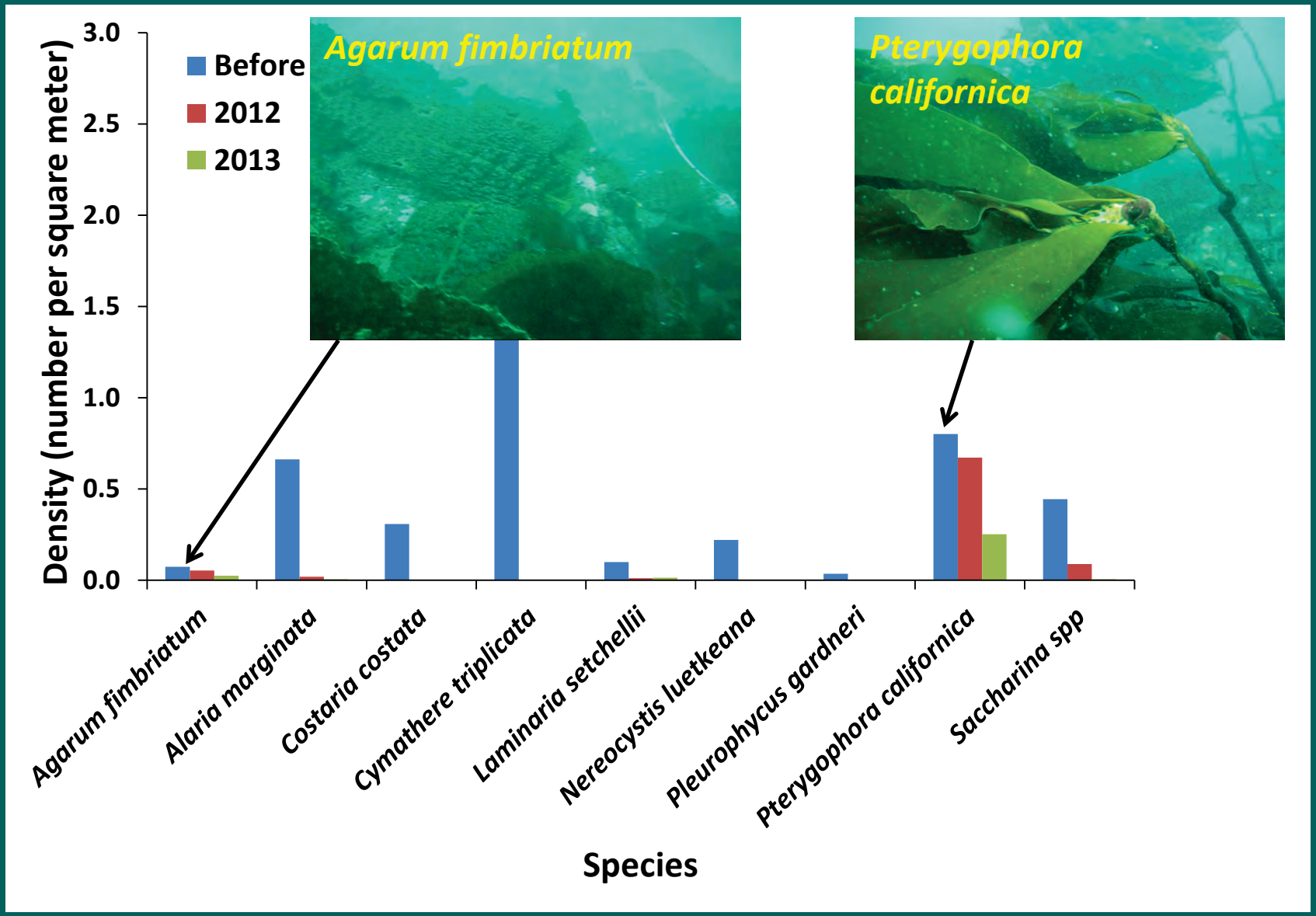
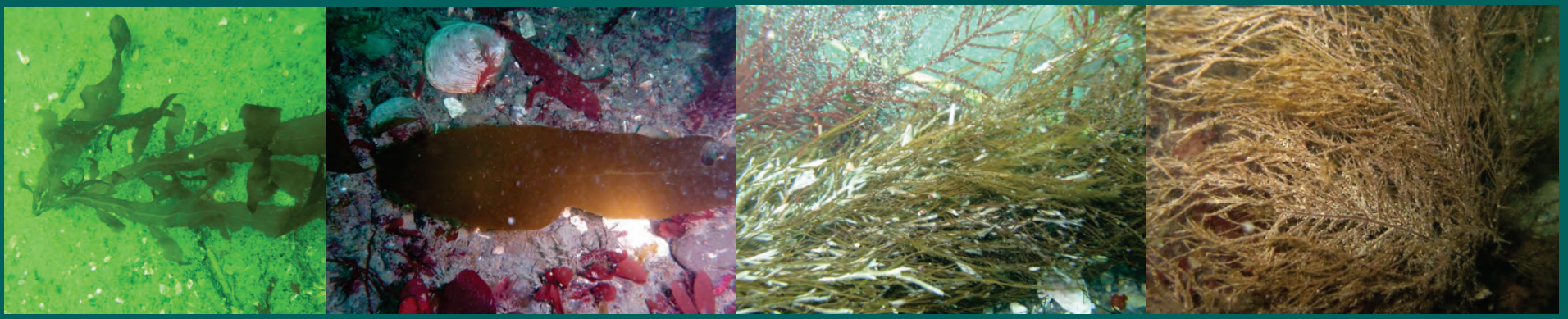
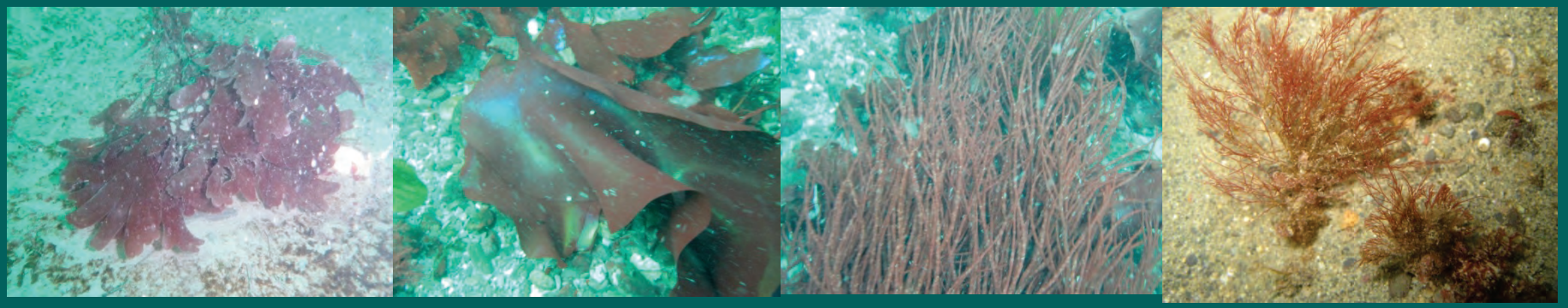


Other seaweeds

- Also decreased after dam removal
- Acid kelp (*Desmarestia* spp):



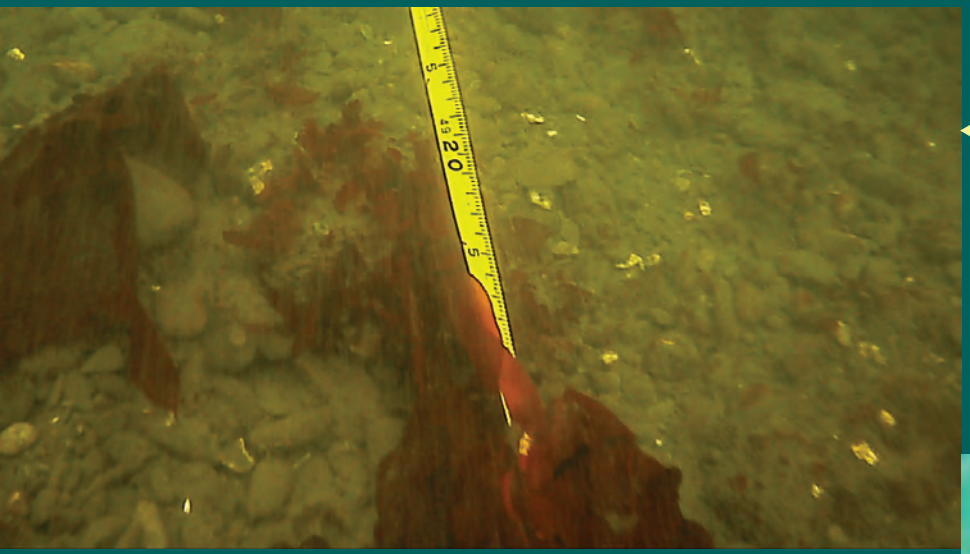
- Red algae (*Rhodophyta*):



- Kelp + acid kelp + red algae = total vegetation

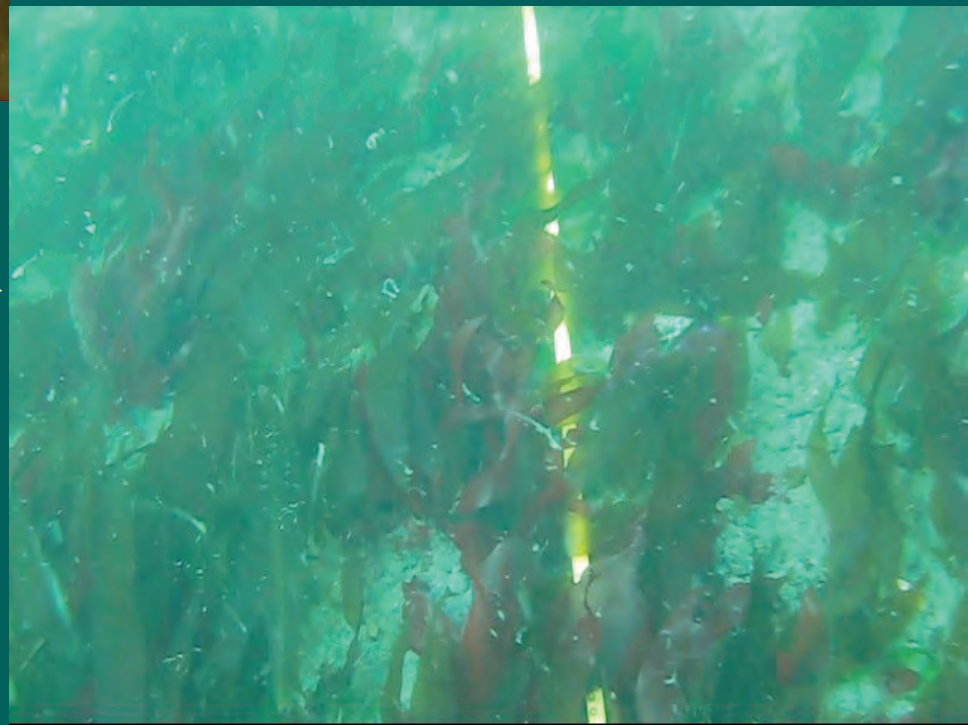
Unseasonal recruitment

- Juveniles appeared in late August 2013



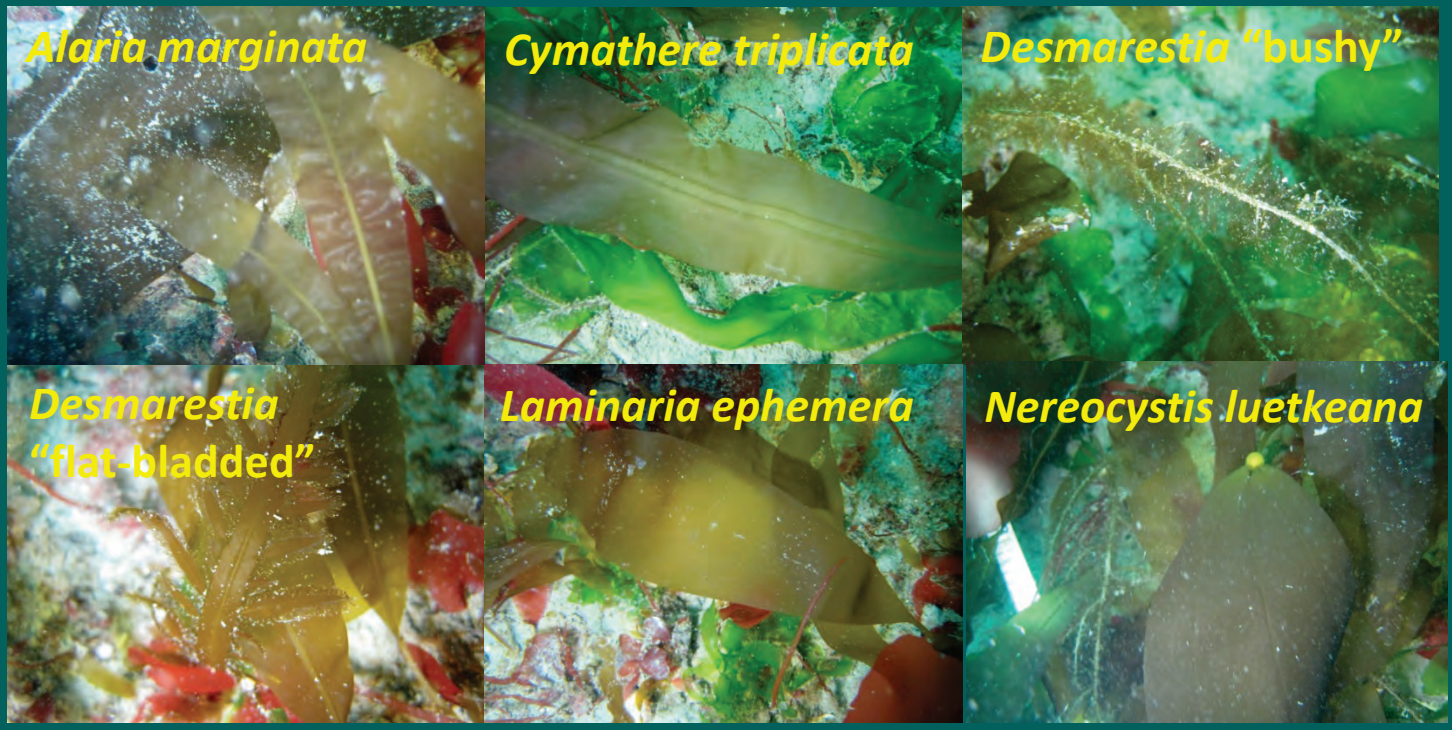
← Not present August 16

Present August 30 →

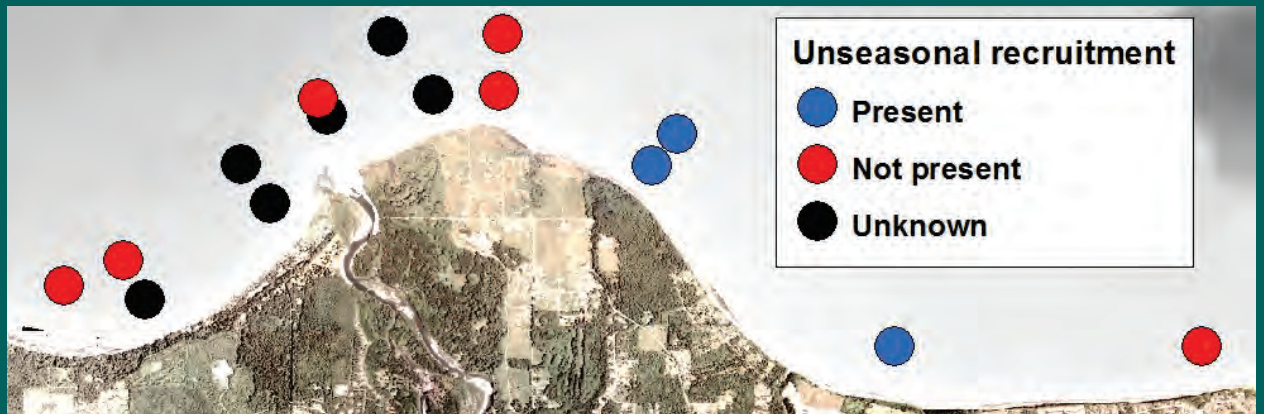


Unseasonal recruitment

- Species that typically recruit in spring:



- Present at three sites:



Physical drivers

- Not “permanent” burial

2012: 15 sites

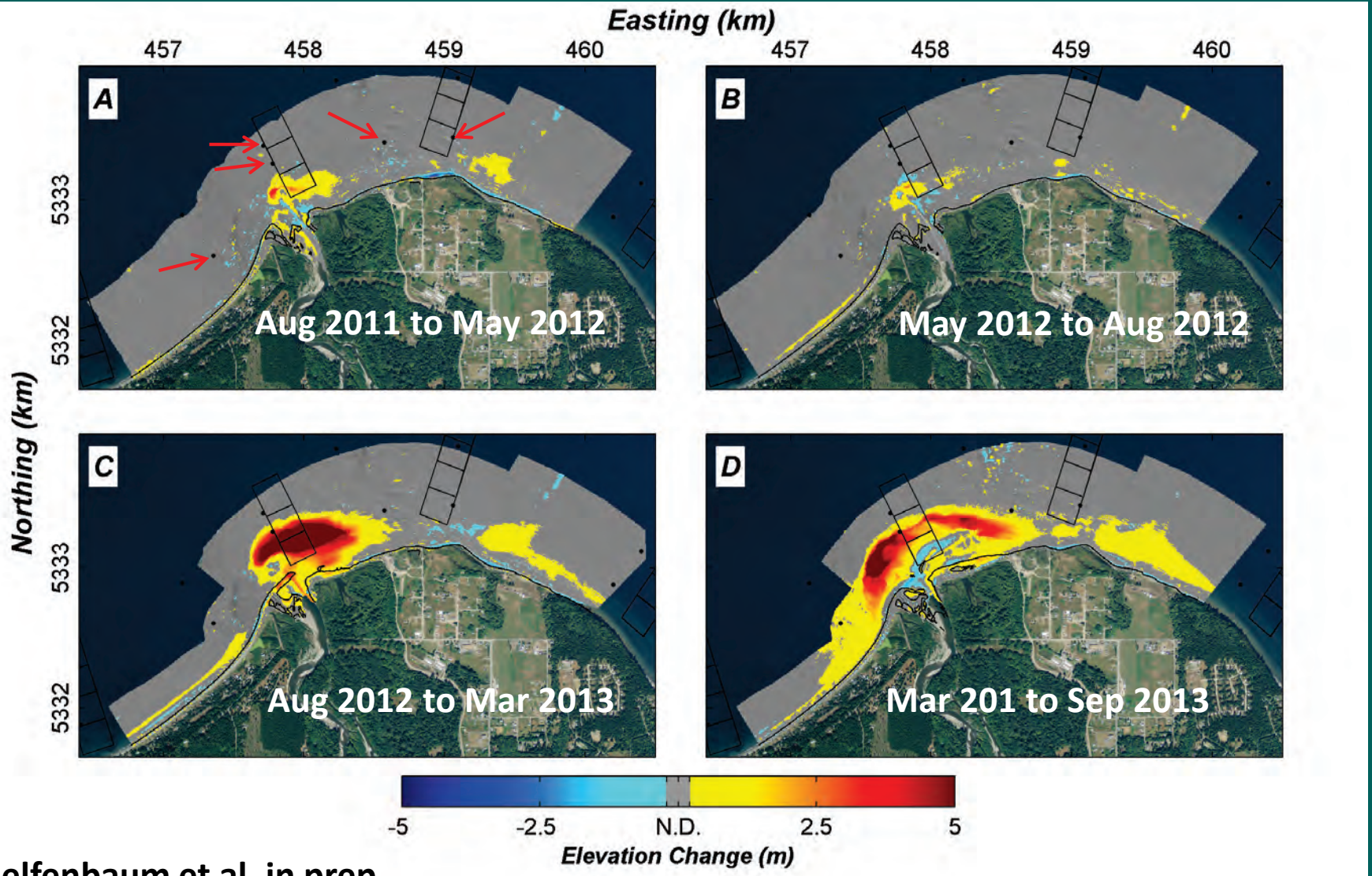
2013: 11 sites

2012: 0 sites

2013: 4 sites

Physical drivers

- Not “permanent” burial



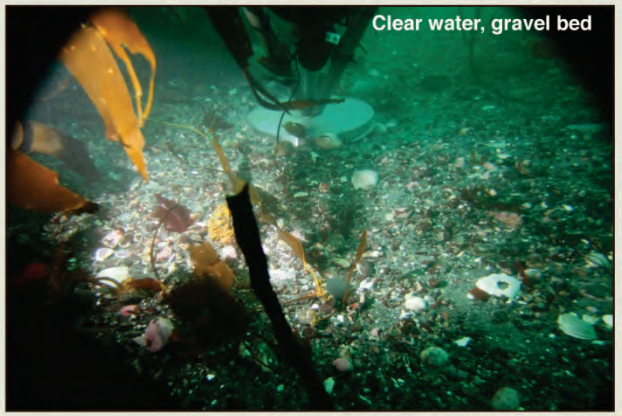
Gelfenbaum et al. in prep.

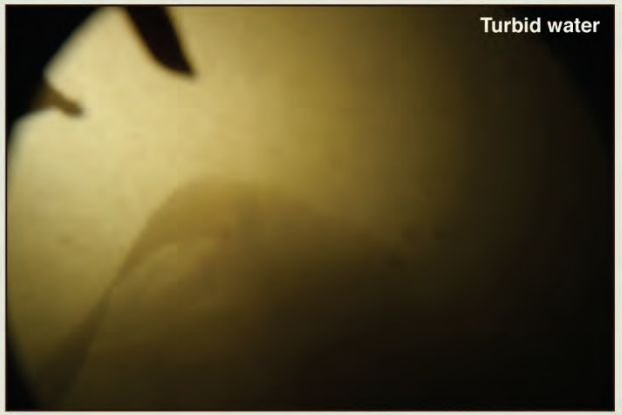
Physical drivers

- Ephemeral deposition
- Scour ("sandblasting")
- Light reduction

Coastal water and seafloor changes near the Elwha River delta during dam removal.

Photos obtained from a USGS tripod placed ~1 km (0.6 mi) offshore of the river mouth in ~ 10 m (33 ft) water depth. The patterns shown in these photos alternate as a fucntion of coastal conditions (currents and waves) and river sediment discharge.





Photos from Jonathon Warrick

Chance to learn

- How does sedimentation affect kelp and other seaweeds?