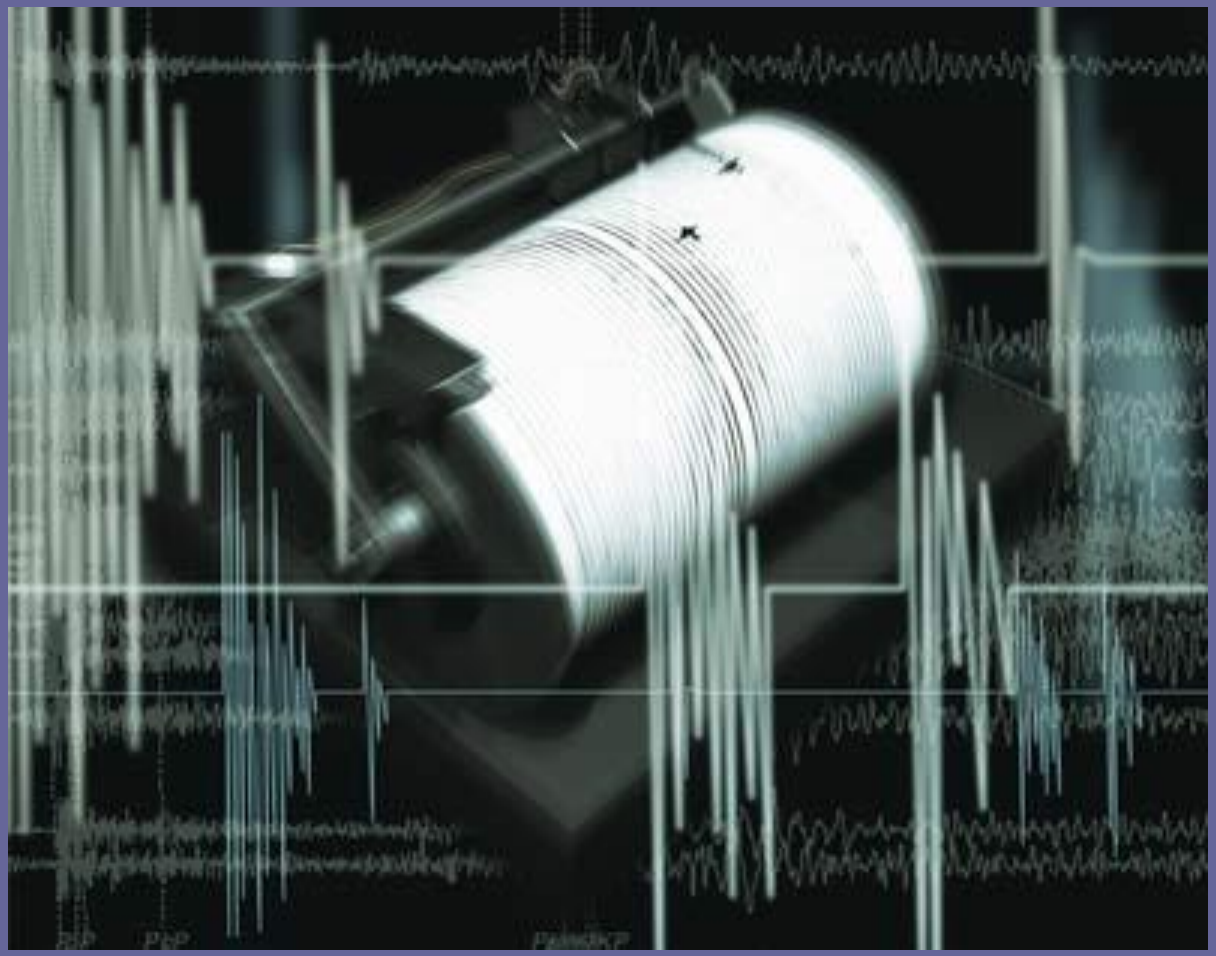
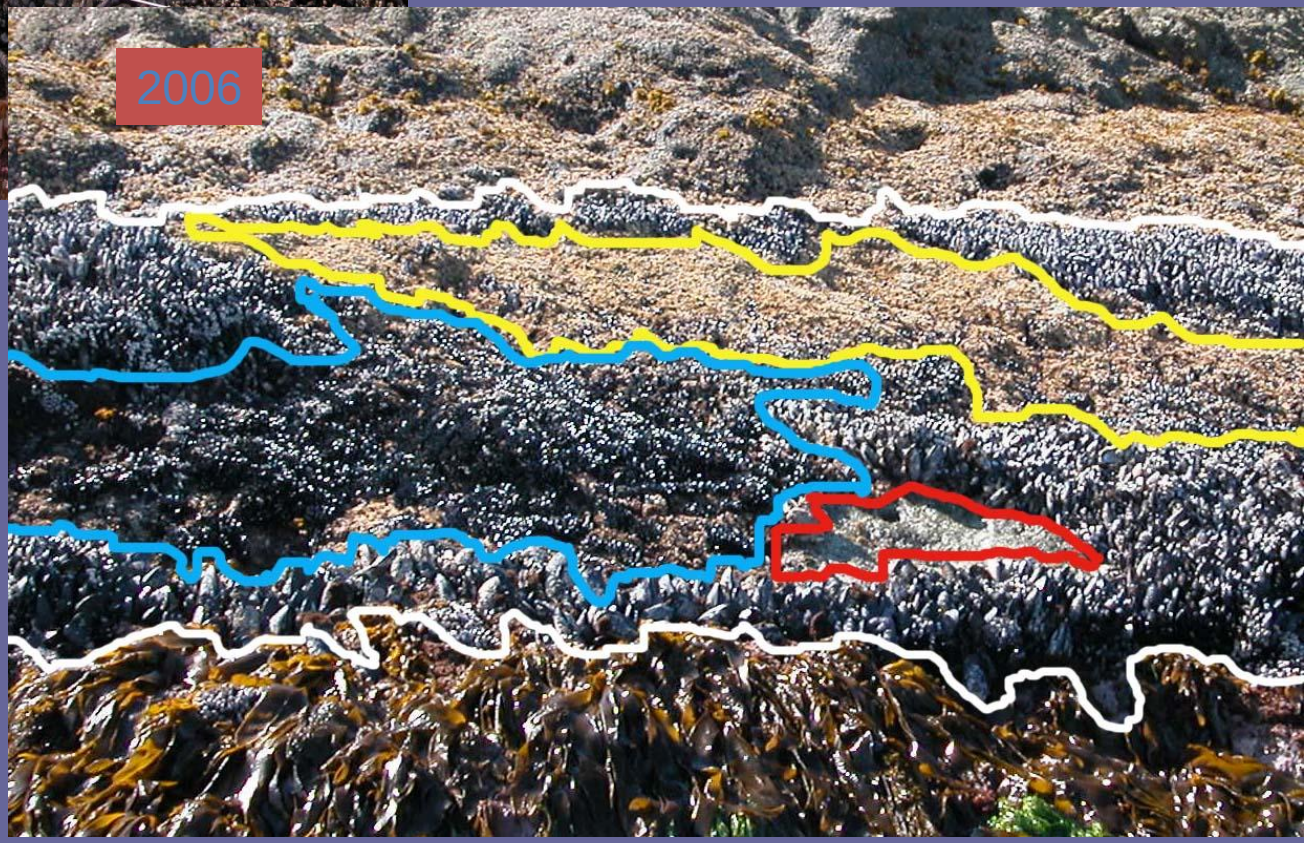


Disturbances

- Occur in all natural communities

- Disturbance events have received intense study because of their economic and ecological consequences

Before disturbance



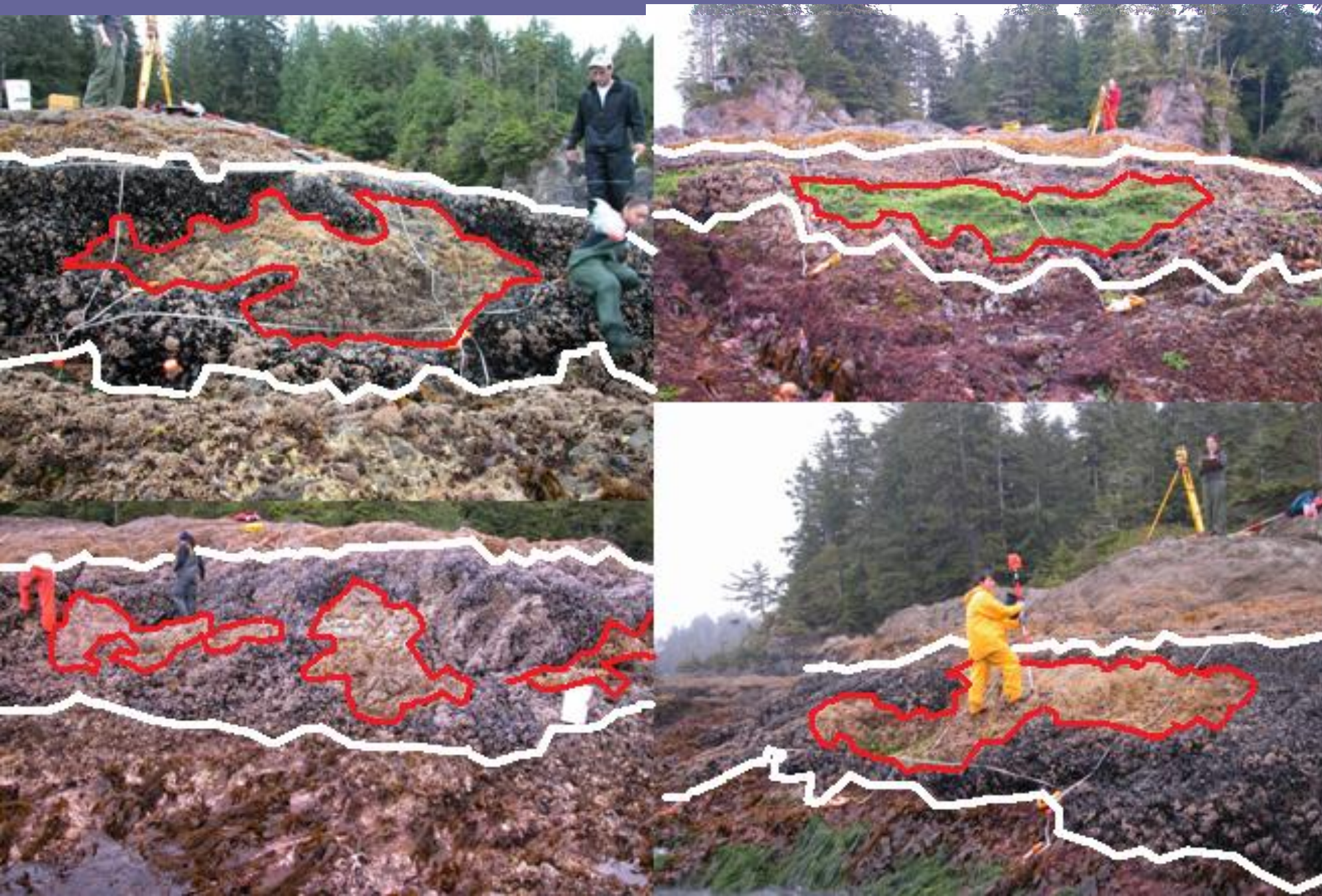
After: patchwork of disturbance

The prior view of disturbance in mussel beds

- Disturbances generate random mosaics of different succession states in continual flux
- Frequency and size of gaps depend only on the extent of the external forcing (wave energy).

Our observations

Predictable Patterns of Disturbance



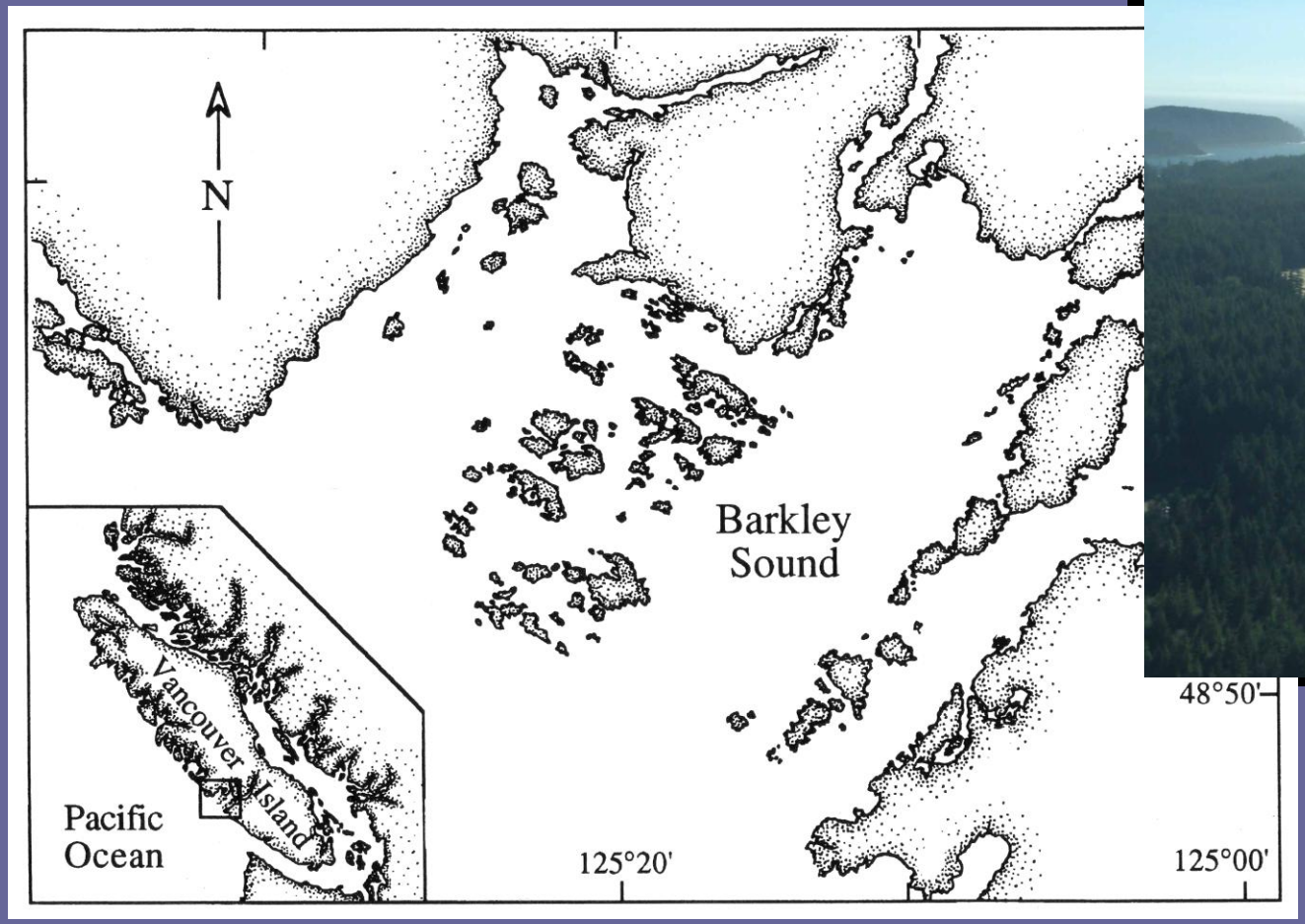
Alternative View

- Mussel bed succession states do not occur in random mosaics generated solely through external wave forcing, but are strongly influenced by processes intrinsic to the mussel bed assemblage
- Different steady-state structures develop in specific sub-regions of the topography, and they are susceptible to disturbance to different degrees.
- Therefore, each mussel bed is an array of disturbance regimes

What shapes the structure of the mussel bed?

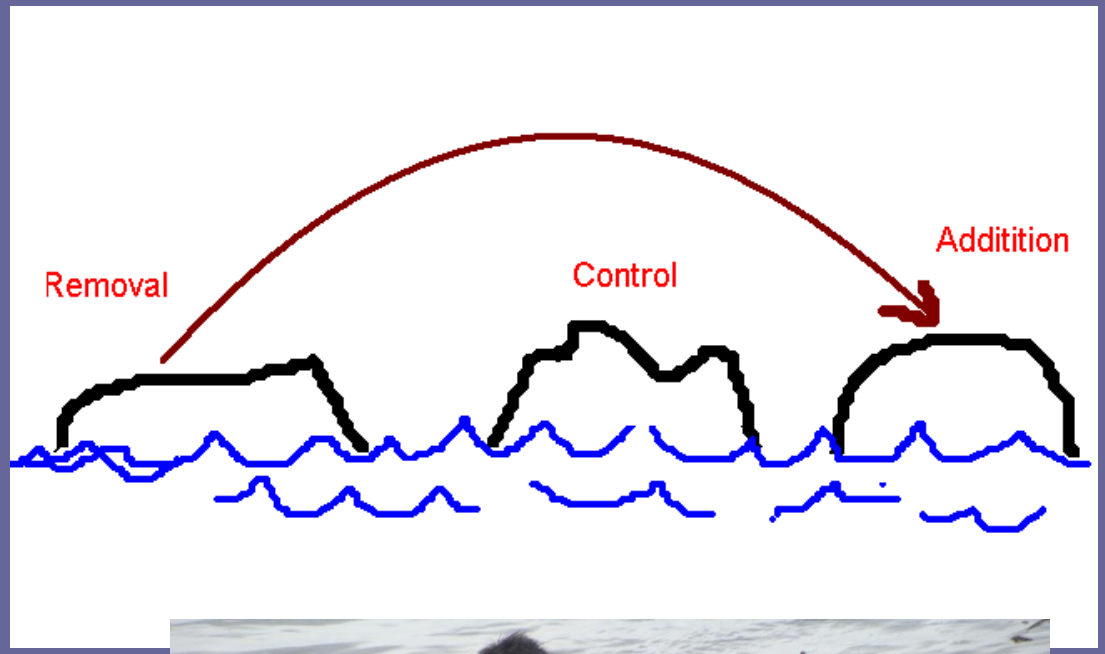
(Upper and lower boundaries, thickness an layering between the boundaries)

Barkley Sound, BC



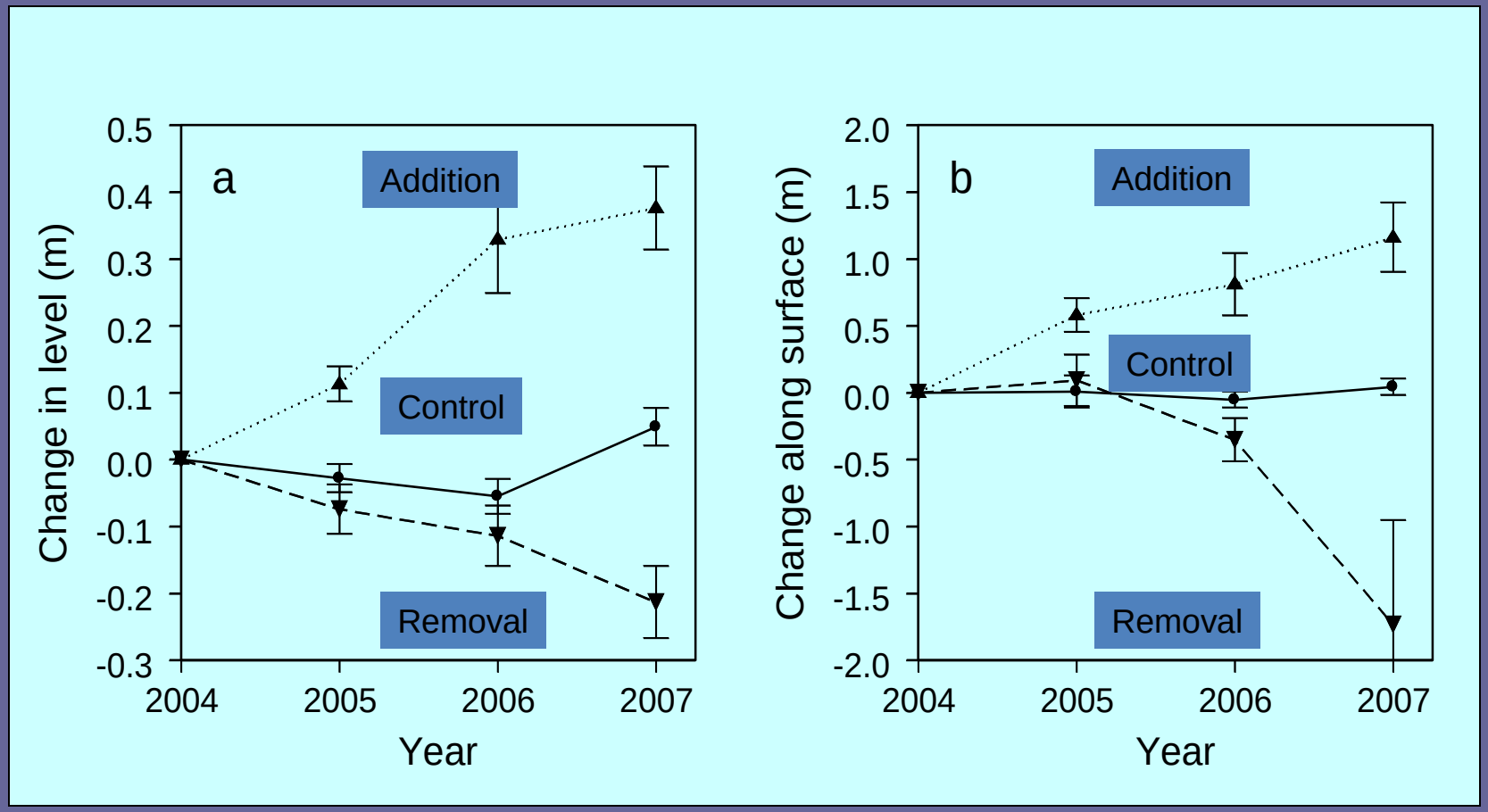
Upper limits set by exposure at low tide.
Lower limits set by predatory sea stars

Field experiment demonstrating that sea stars maintain position of lower boundary



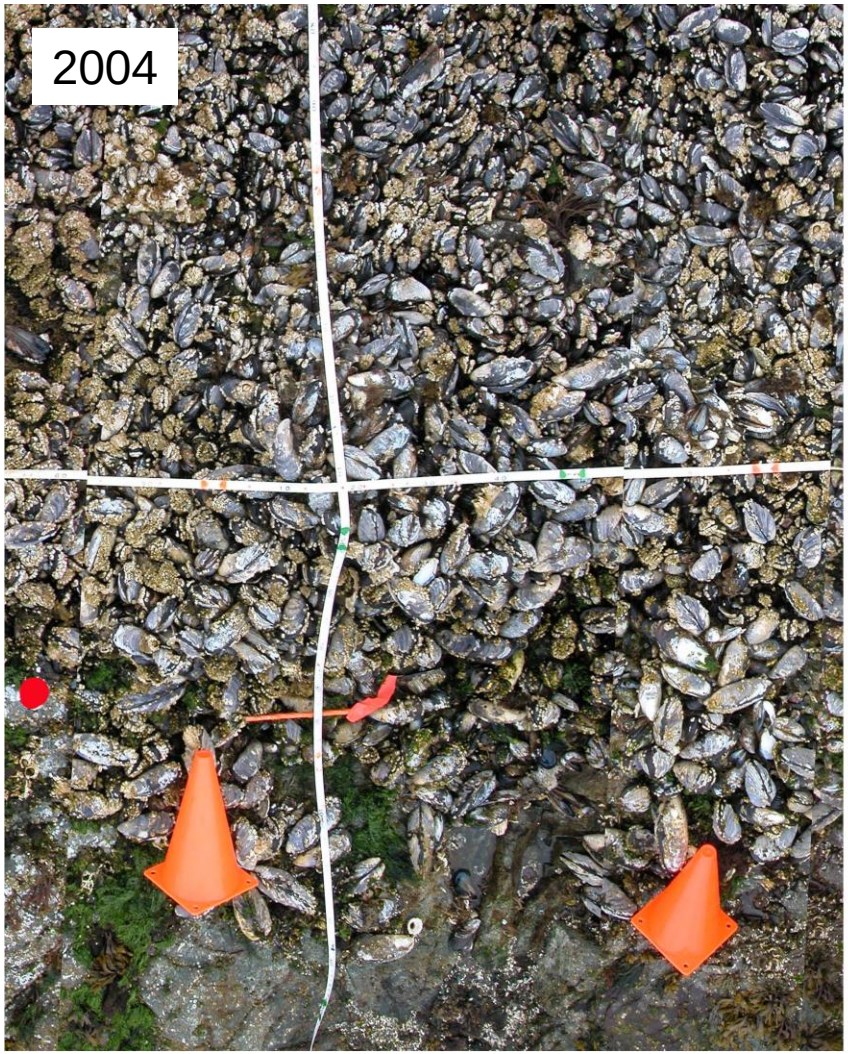
- Five replicates of three sites each arrayed over 12 km2 in Barkley Sound, BC

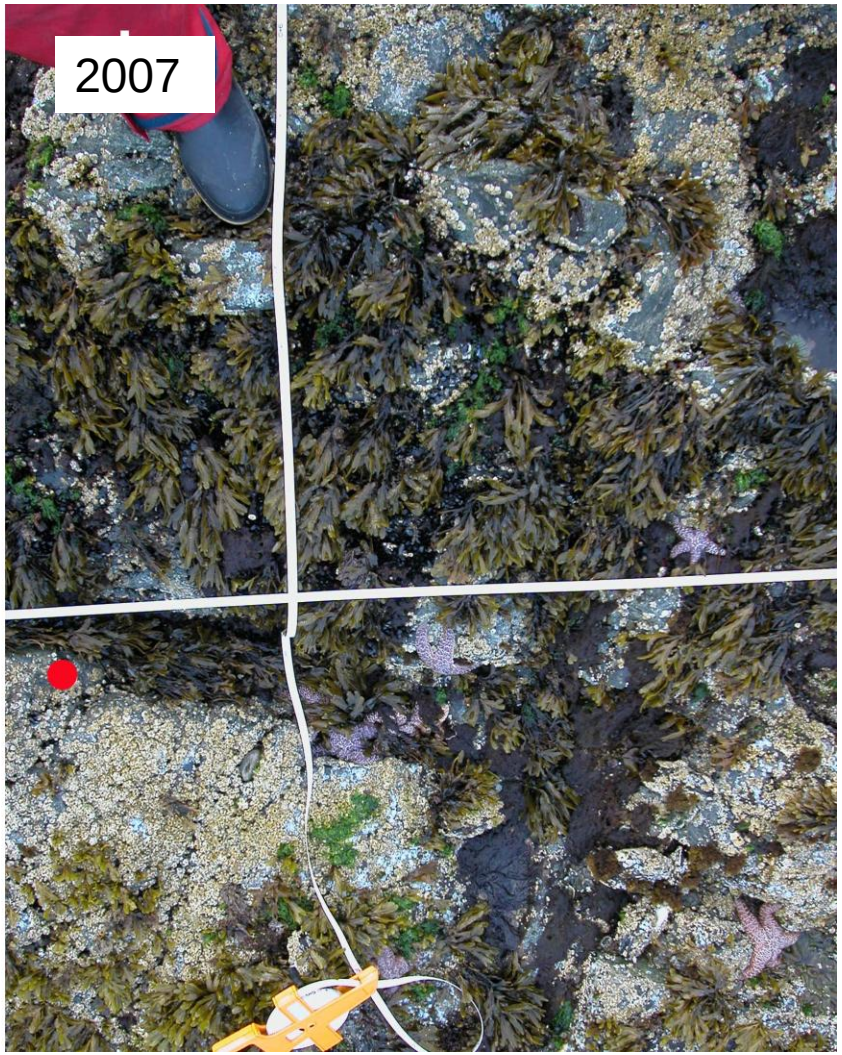
Changes in shore level (a) and along the surface run (b) of lower boundaries



Moderately wave-exposed removal site

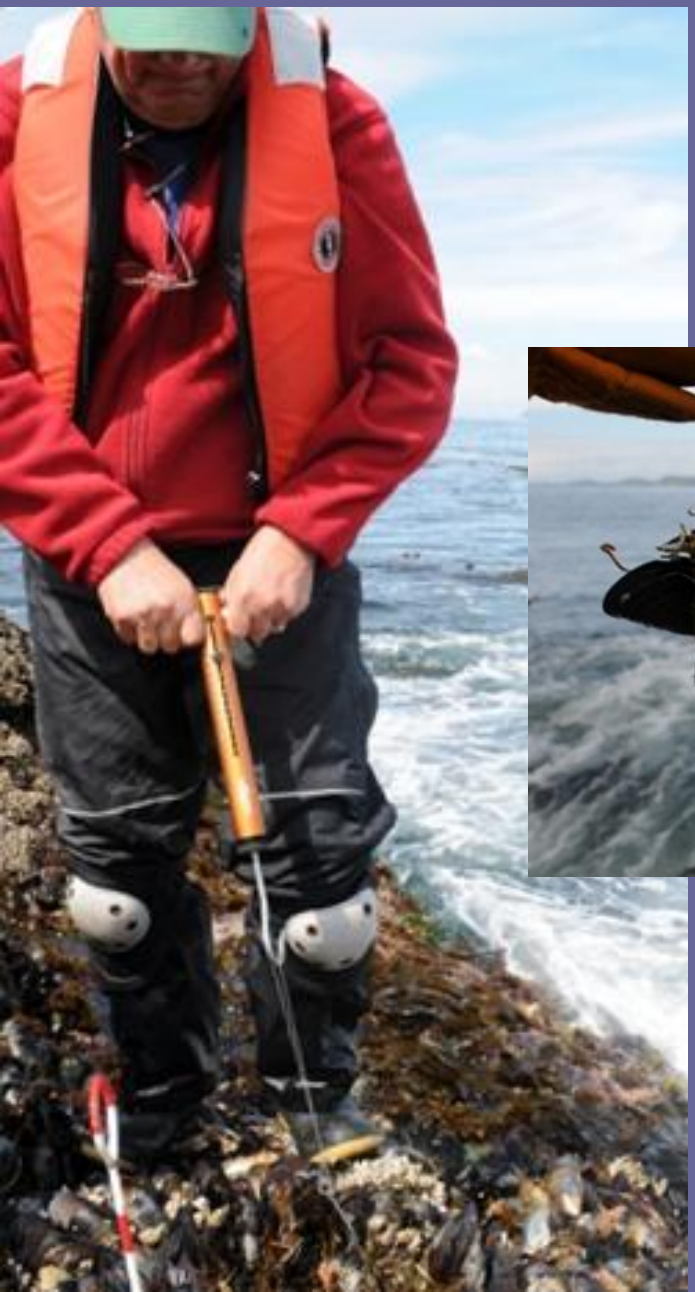
Lower boundary, moderately wave-exposed addition site





Browse zones

The nitty gritty of the thickened zone




Wales

What predicts where large gaps occur?

Wave force alone?

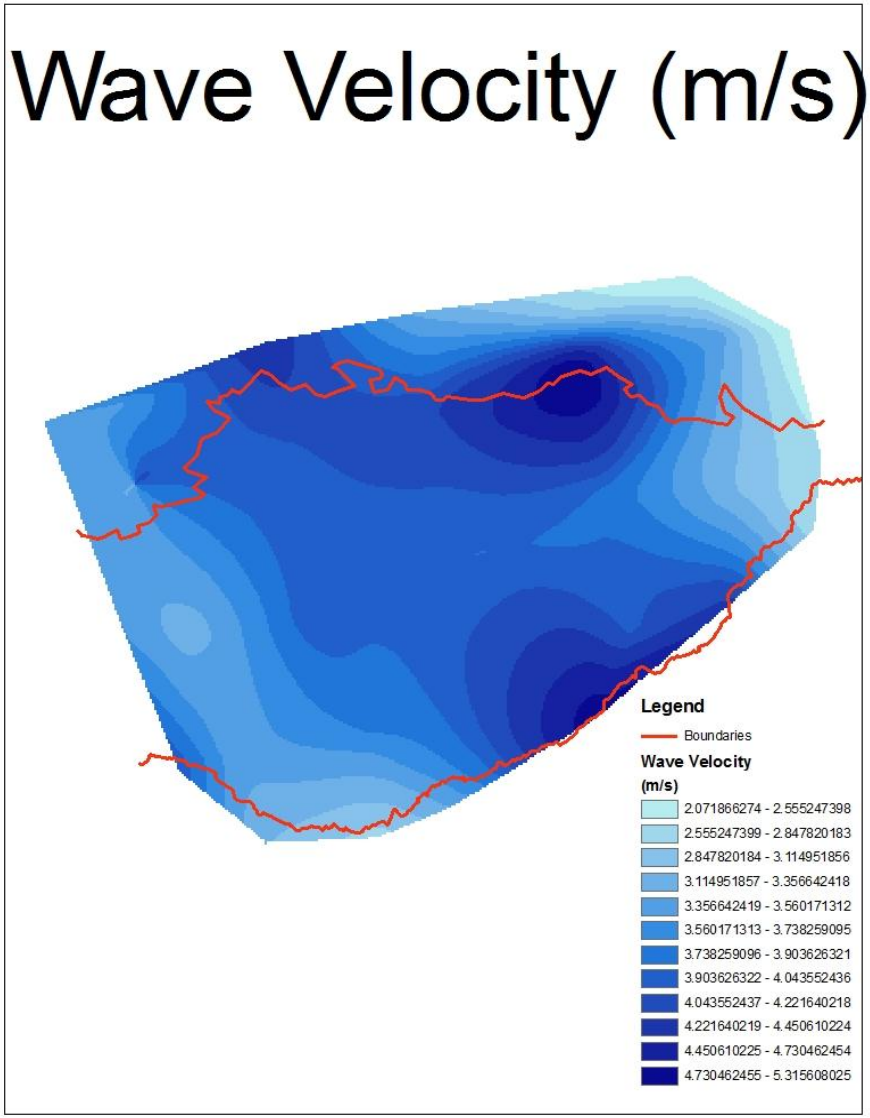
Structure alone?

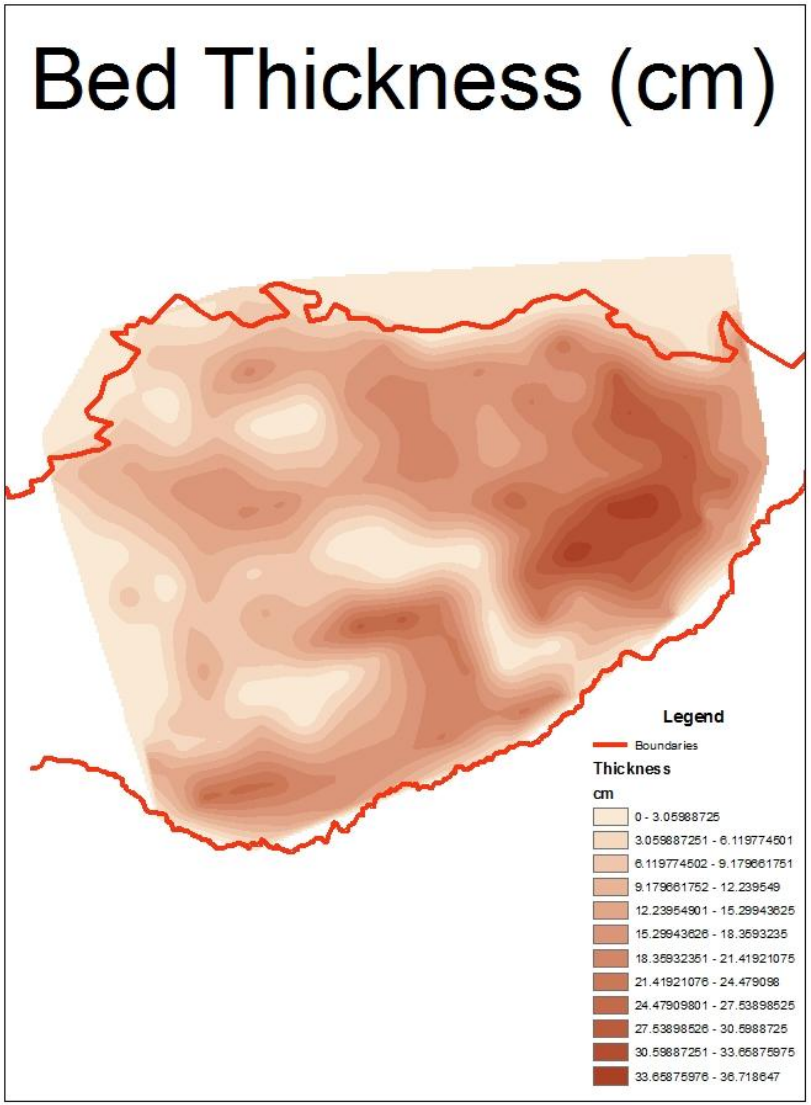
Or some combination of the two?

Spatial Design

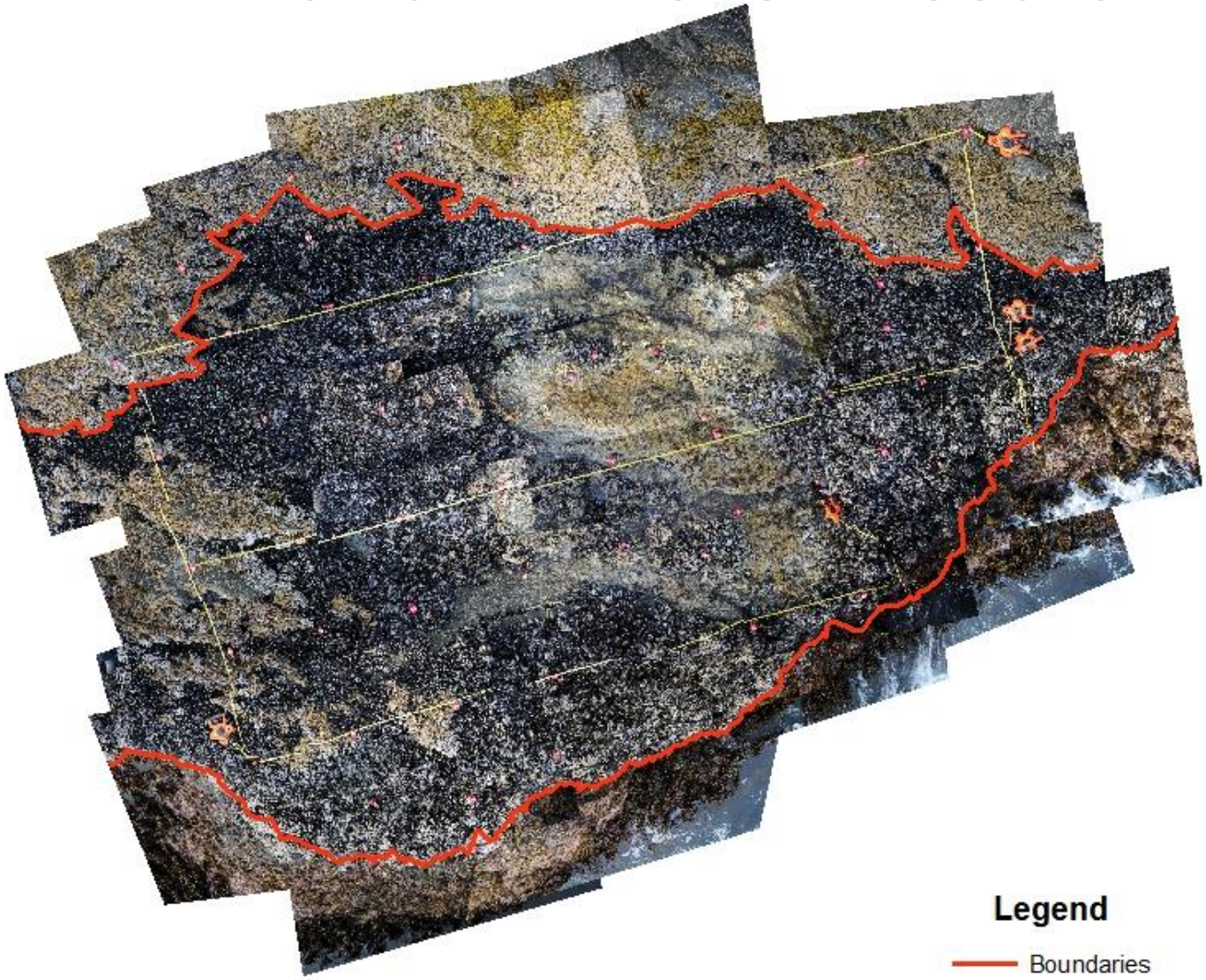
Measuring Max Wave Force

Results – Diana 2

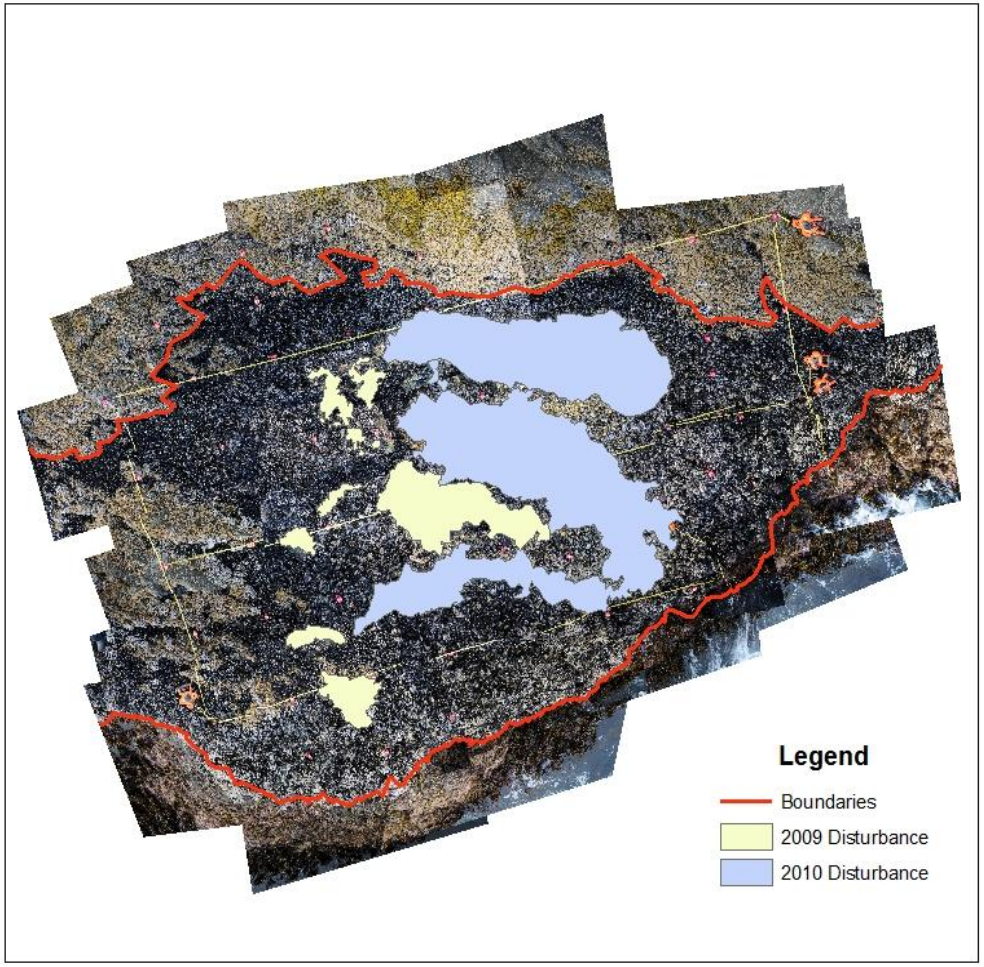


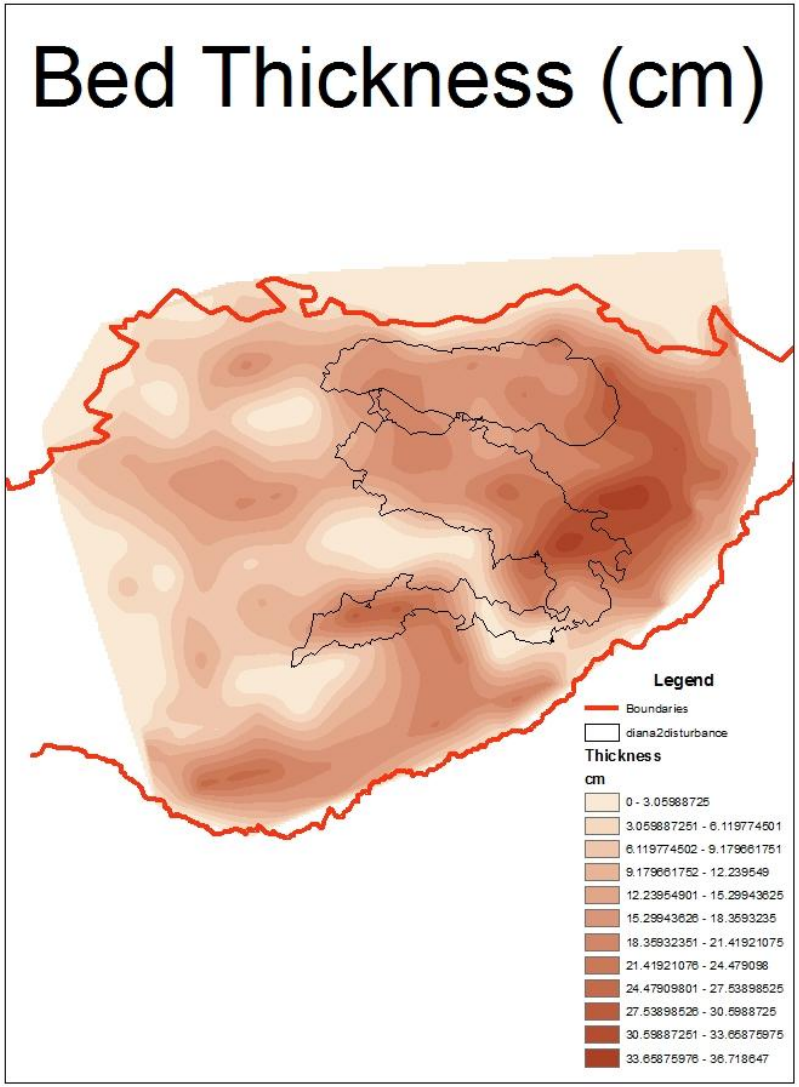


Diana 2 Photo Mosaic



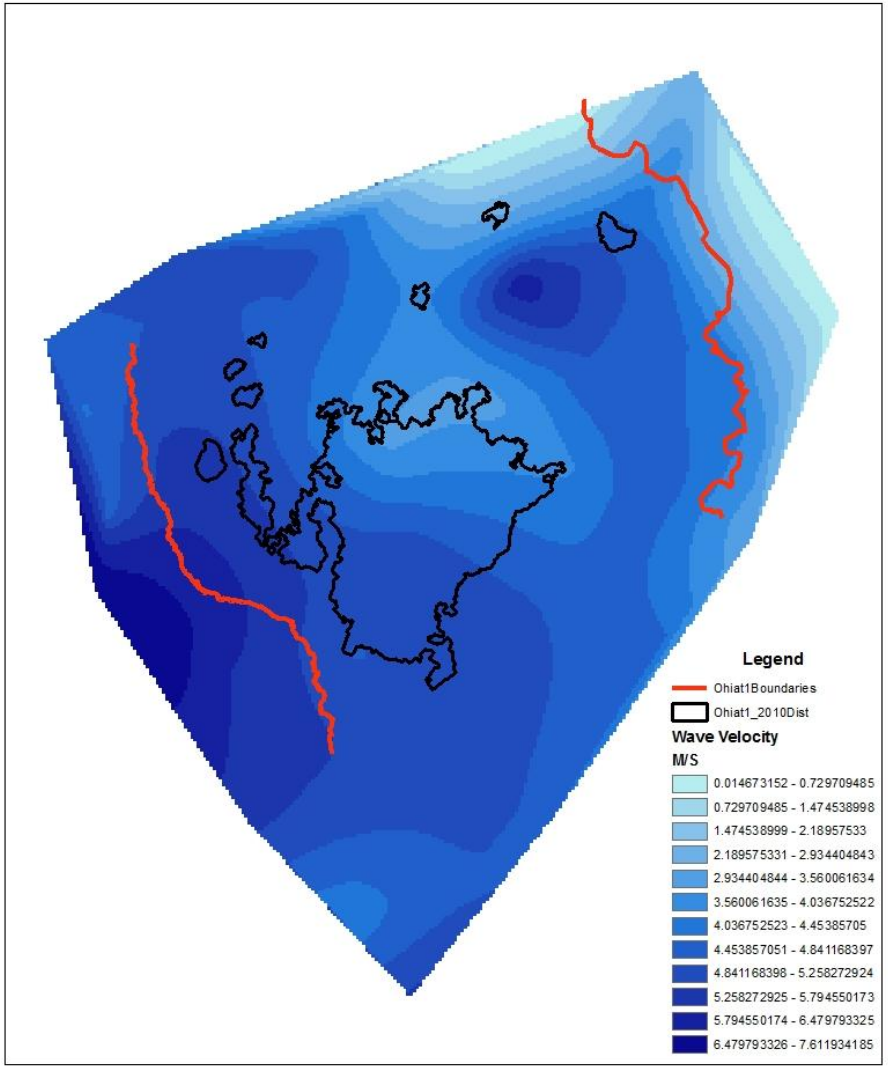
Results – Diana 2



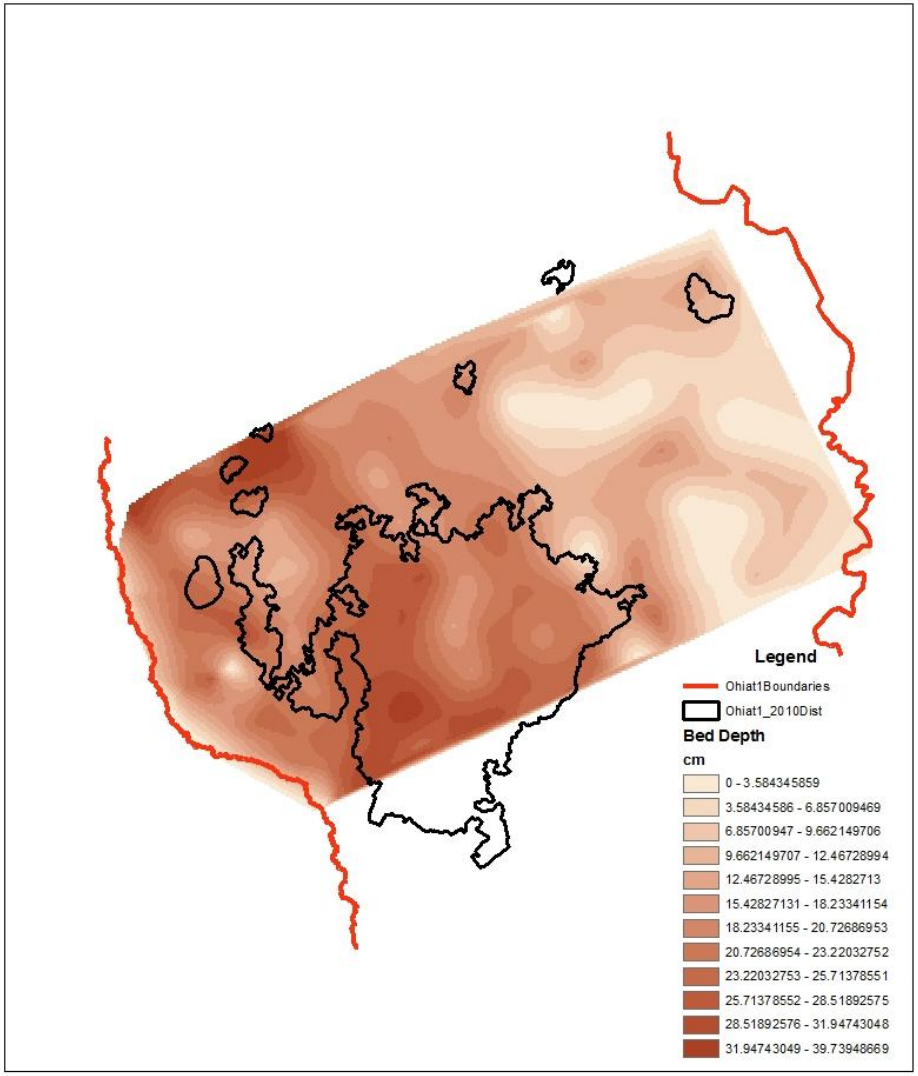


Results – Little Ohiat

Wave Velocity



Depth of Bed



Preliminary Statistical Analyses

- 3-Dimensional Chi-Square (and Logit)
  - Bed Thickness, Wave Velocity, Disturbance
- There is a significant association between:
  - Depth and Disturbance ($p<0.01$)
  - No disturbances were observed in areas where thickness was less than 10cm
- All other associations not significant ($p>0.05$)
- Surprisingly, only structure was a significant predictor of gap formation.

Alternative Views

- Where mussels are controlled by their predators or physical stress (the regions near the boundaries) the mussel aggregation is structurally strong and resists dislodgement.
- Where mussels are not so controlled, they accumulate and suppress one another, establishing the conditions for a disturbance.
- Thus, the presumed competitive dominants ensure the coexistence of subordinate species

- Disturbance in mussel beds does not create a random mosaic driven purely by external forces

- This suggest that a complete understanding of global change impacts will require more that just measures of increasing wave force.

Ciao!