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Lessons from long time-series of benthic invertebrate communities in the southern Salish Sea, and an expansion of parameters to assess nutrient loading and climate change pressures

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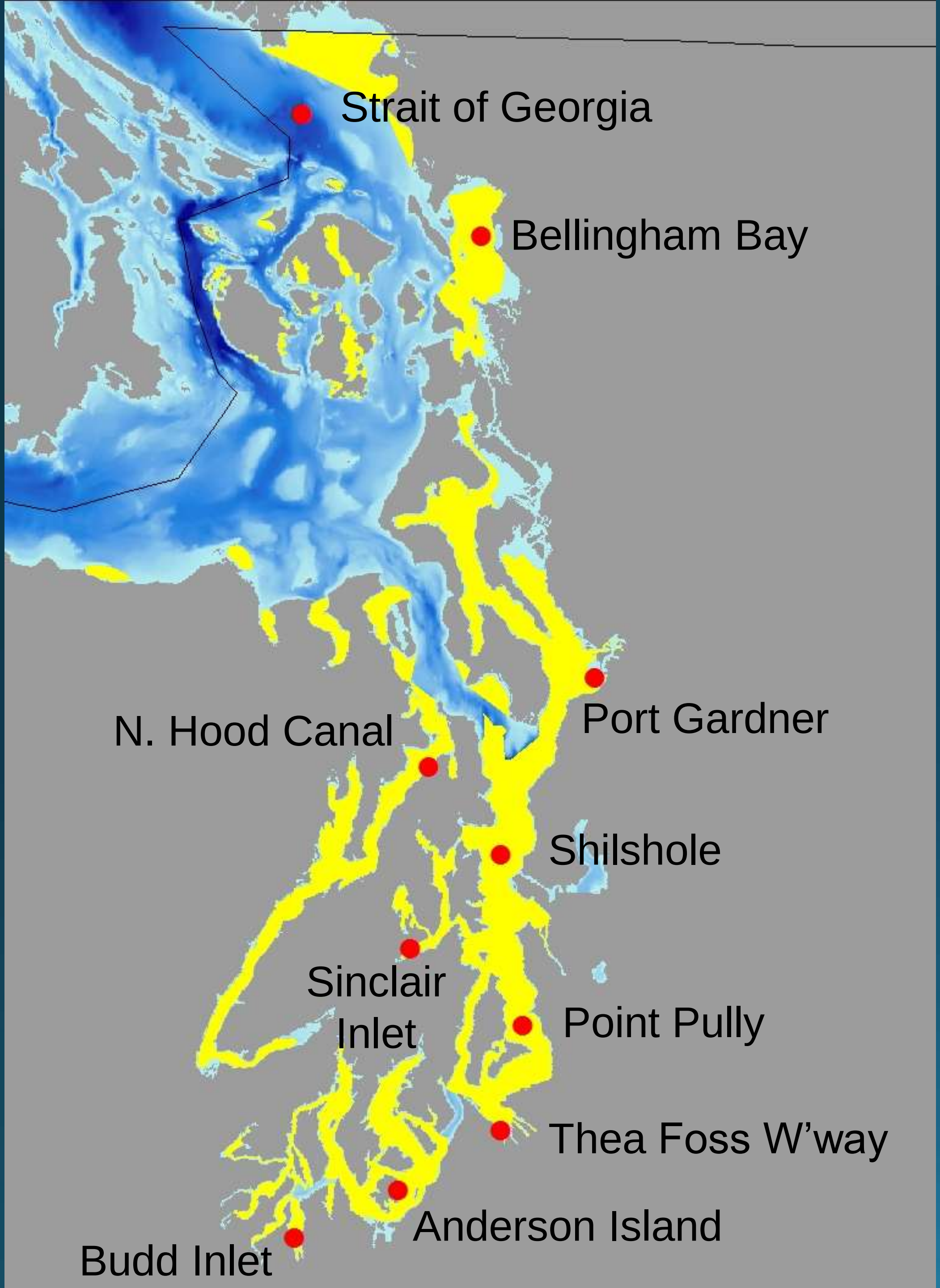
Puget Sound Sediment Monitoring Program

Lessons from long time-series of benthic invertebrate communities in the southern Salish Sea

Valerie Partridge*, Margaret Dutch, Sandra Weakland, Dany Burgess, and Angela Eagleston



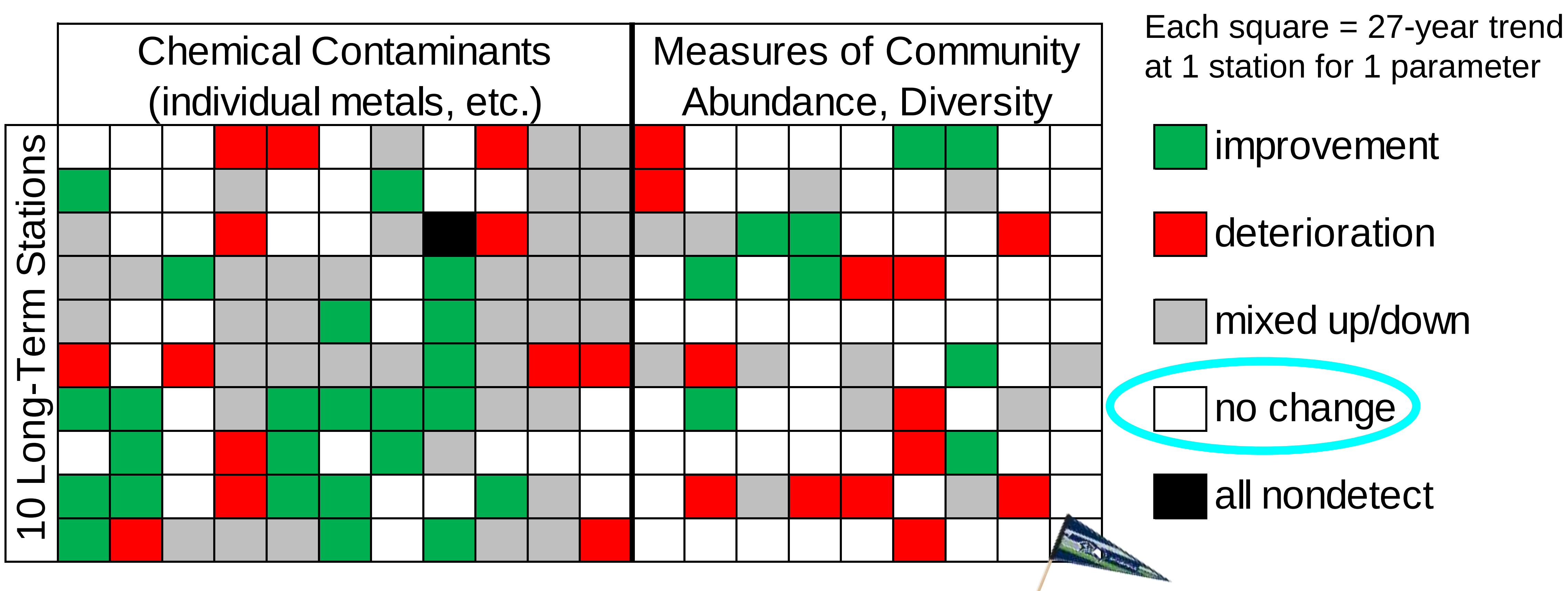
10 Long-term stations

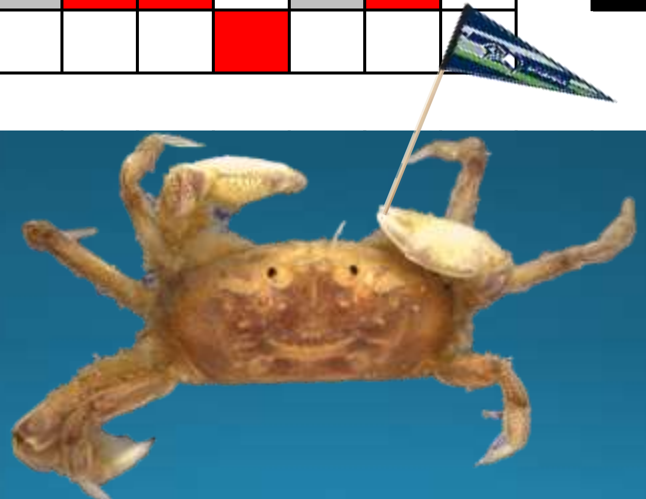
- Sampled annually 1989 - 2015+
- Variety of habitats
  - depth
  - grain size
  - human influence
- Distinct benthic communities

What have we learned in ~30 years?

- Trends are complex
- Some communities remarkably stable; others unstable/impaired
- Context important
  - both spatial and temporal

Complex trends over time

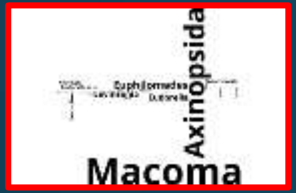


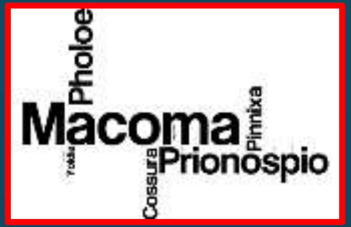


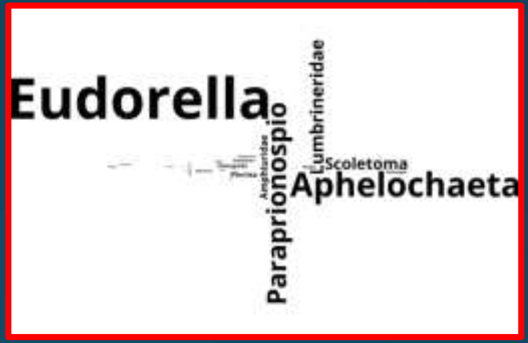
Communities differ in species, abundance

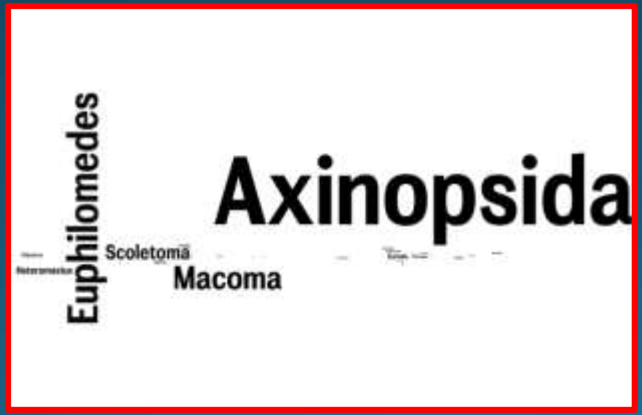
Box size ~ Total abundance

Font size ~ Species abundance









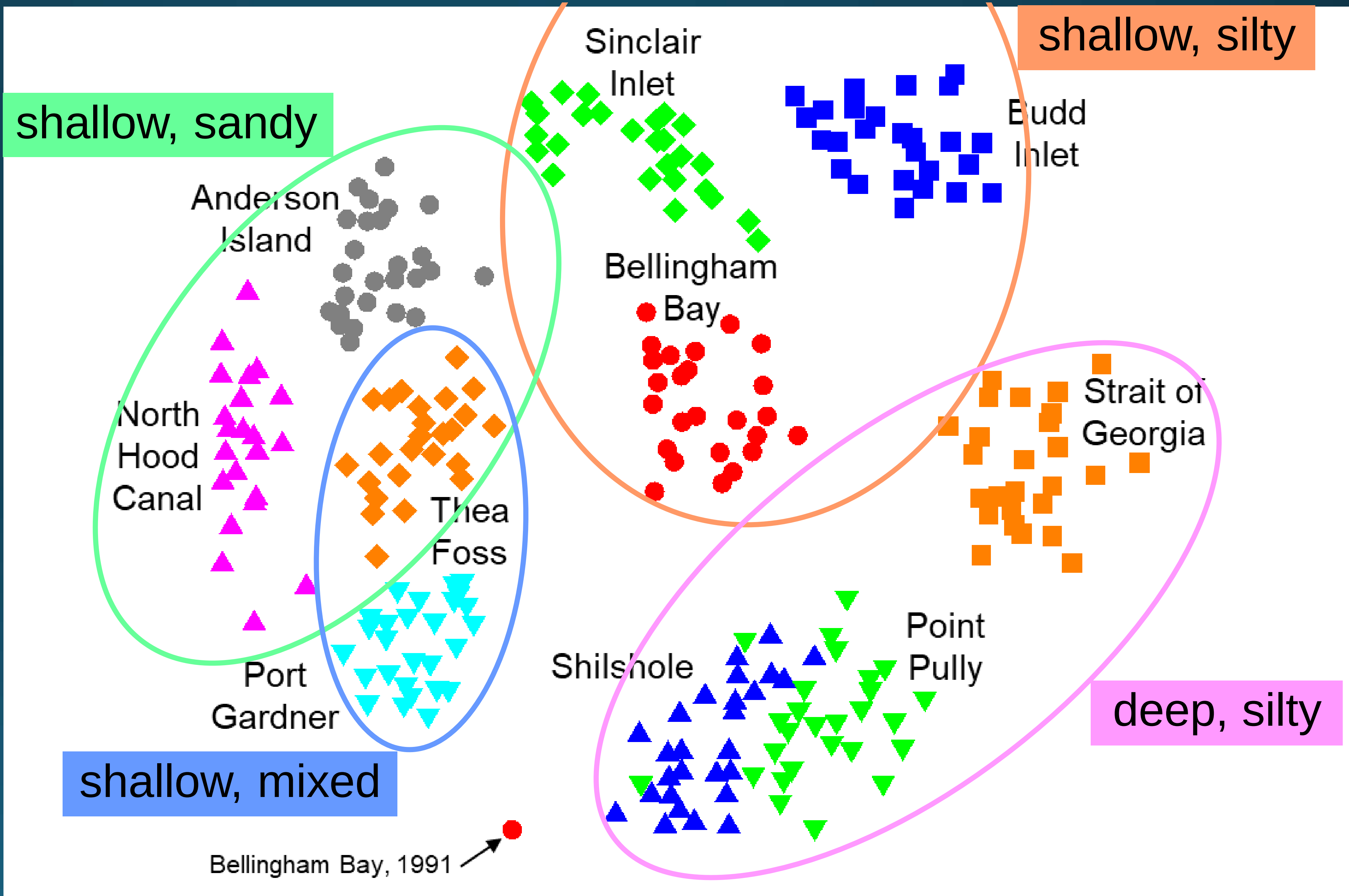
Community similarities

Each symbol =
1 station in 1 year

Closeness = similarity
(both species & abundance)

Years within stations

Stations within habitat types

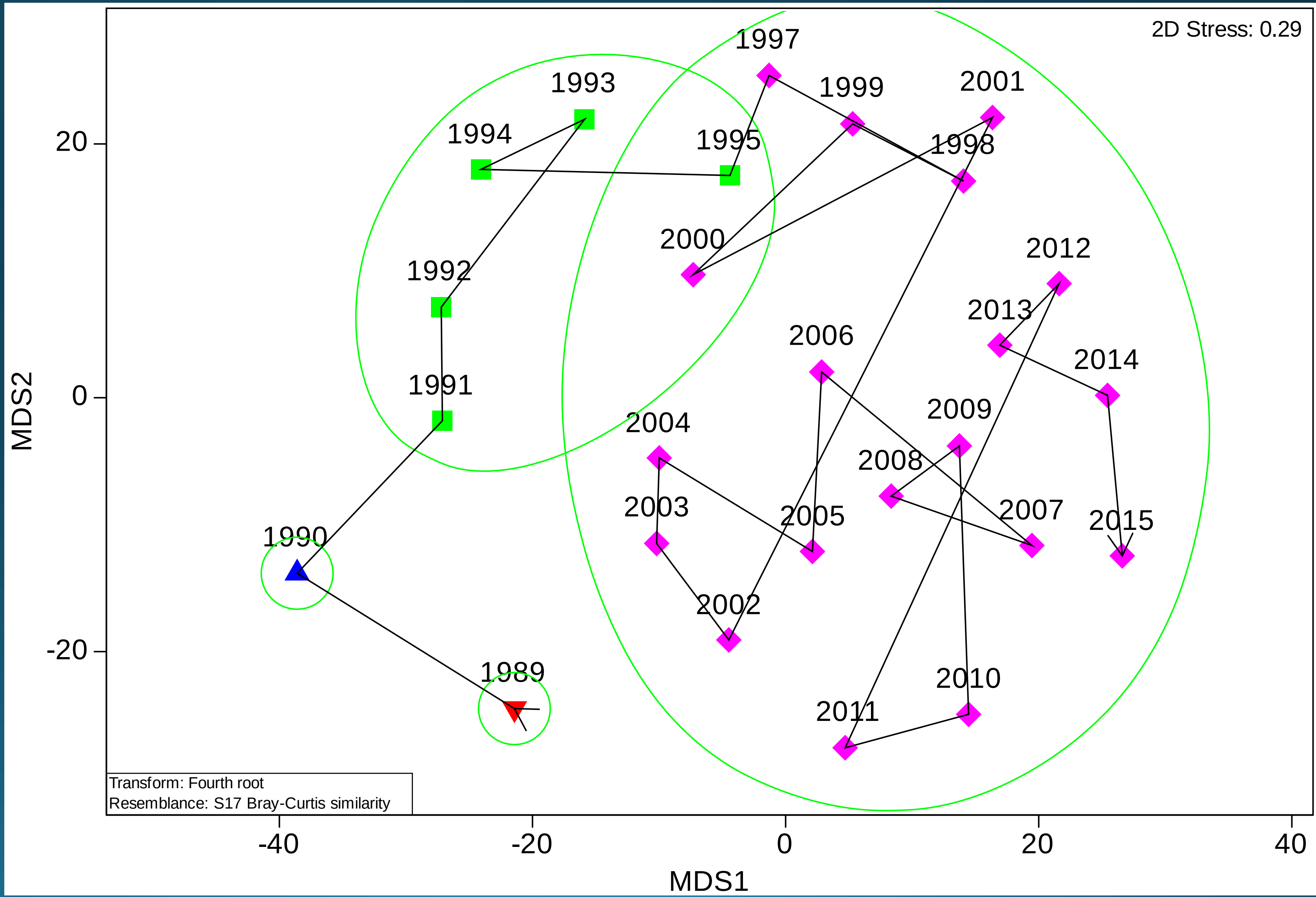


Community shifts over time

Example: Thea Foss Waterway

Statistically similar years have same symbol

Community shifts possibly related to cleanups?



Functional feeding guilds - stable community

- Integrate what/where/how organisms eat
  (Macdonald et al., 2010, 2012)

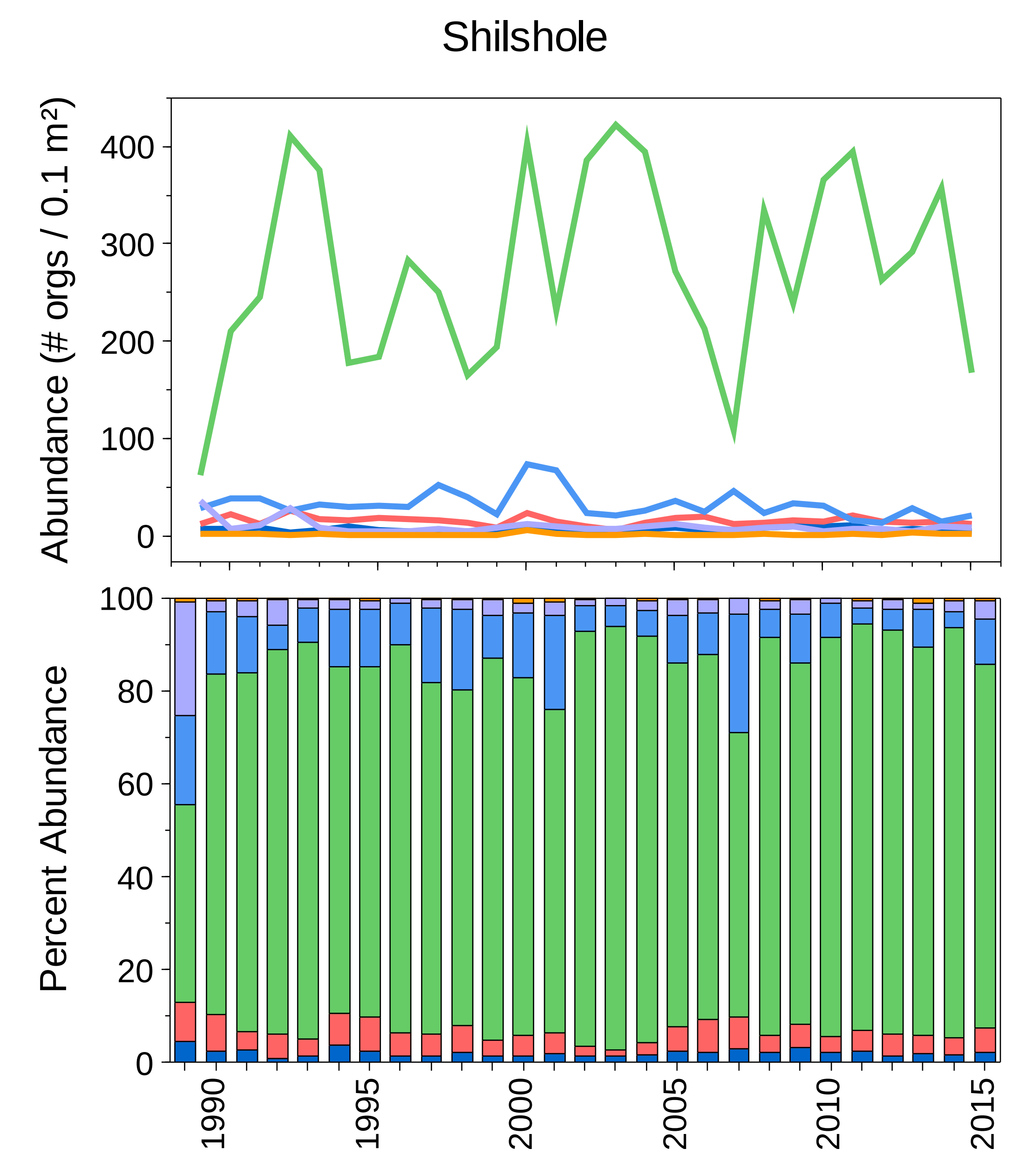
Within feeding guild

- Abundance varies
- Species composition varies

Across feeding guilds

% Abundance ~ constant

→ functions conserved

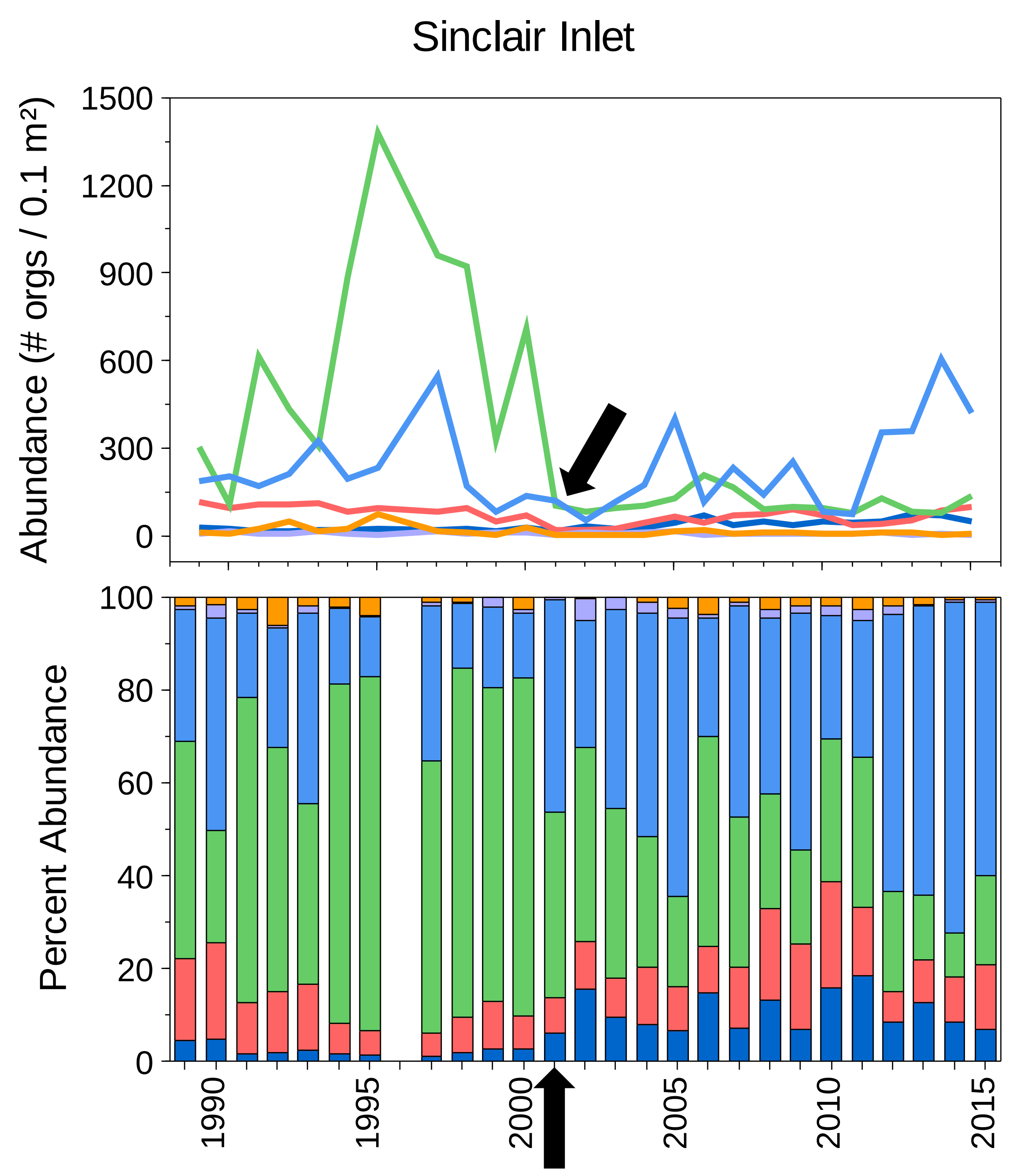


Functional feeding guilds - known impacted site

Disturbance → community changed
- abundance
- species

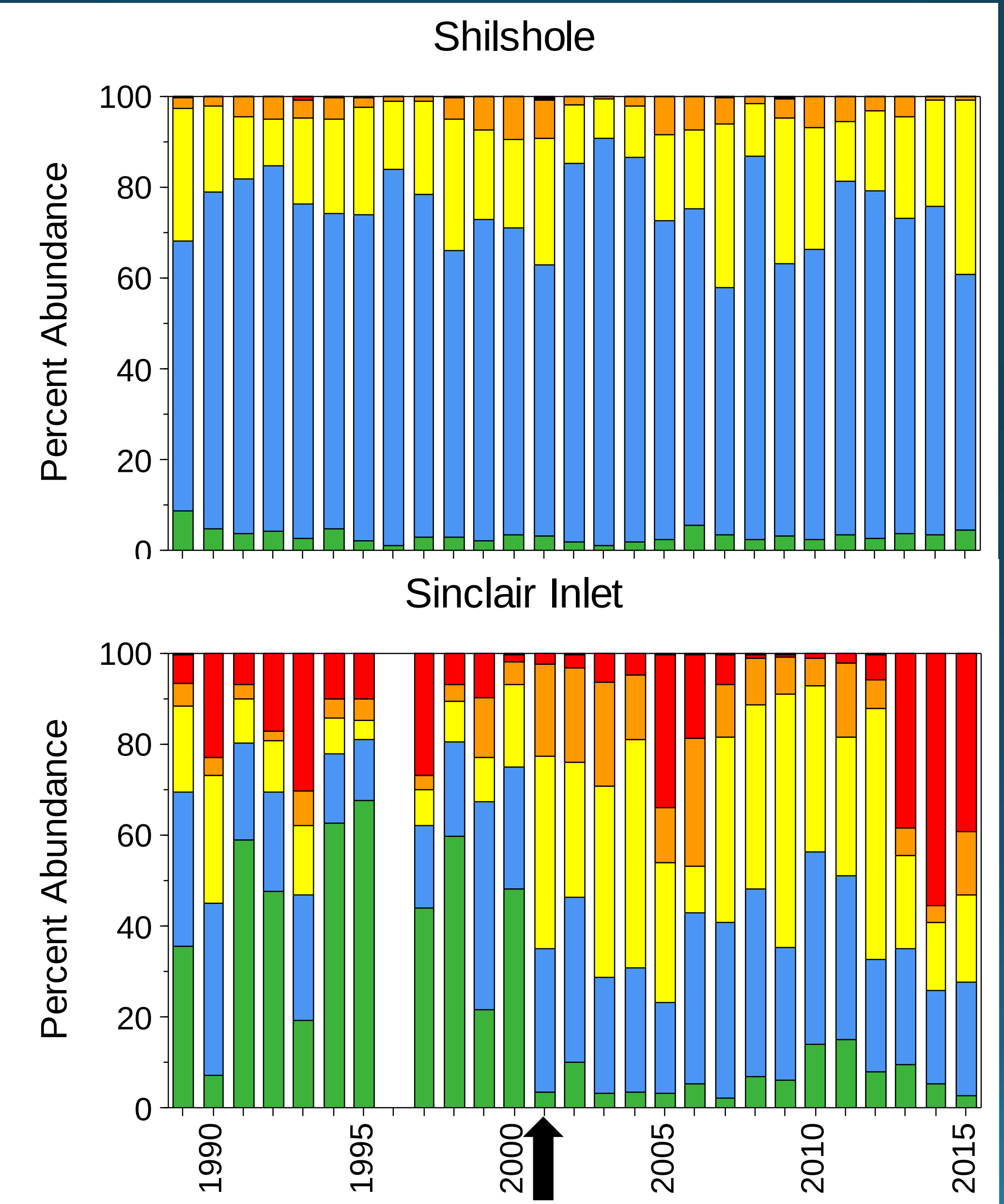
→ Feeding guilds continue to change

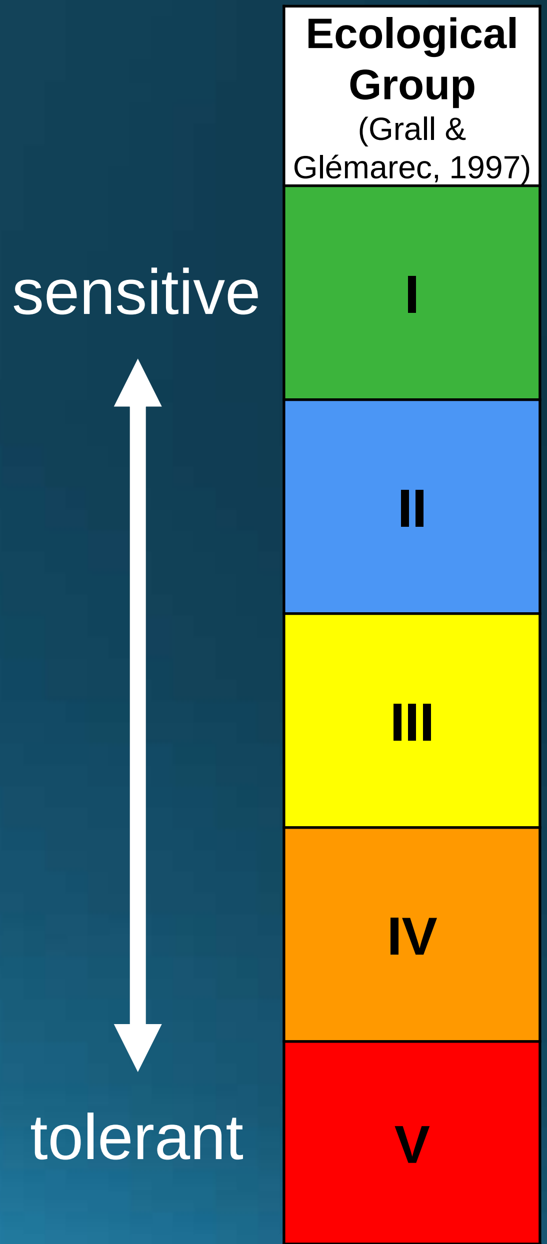
→ Functions impaired



Sensitive – Tolerant Taxa

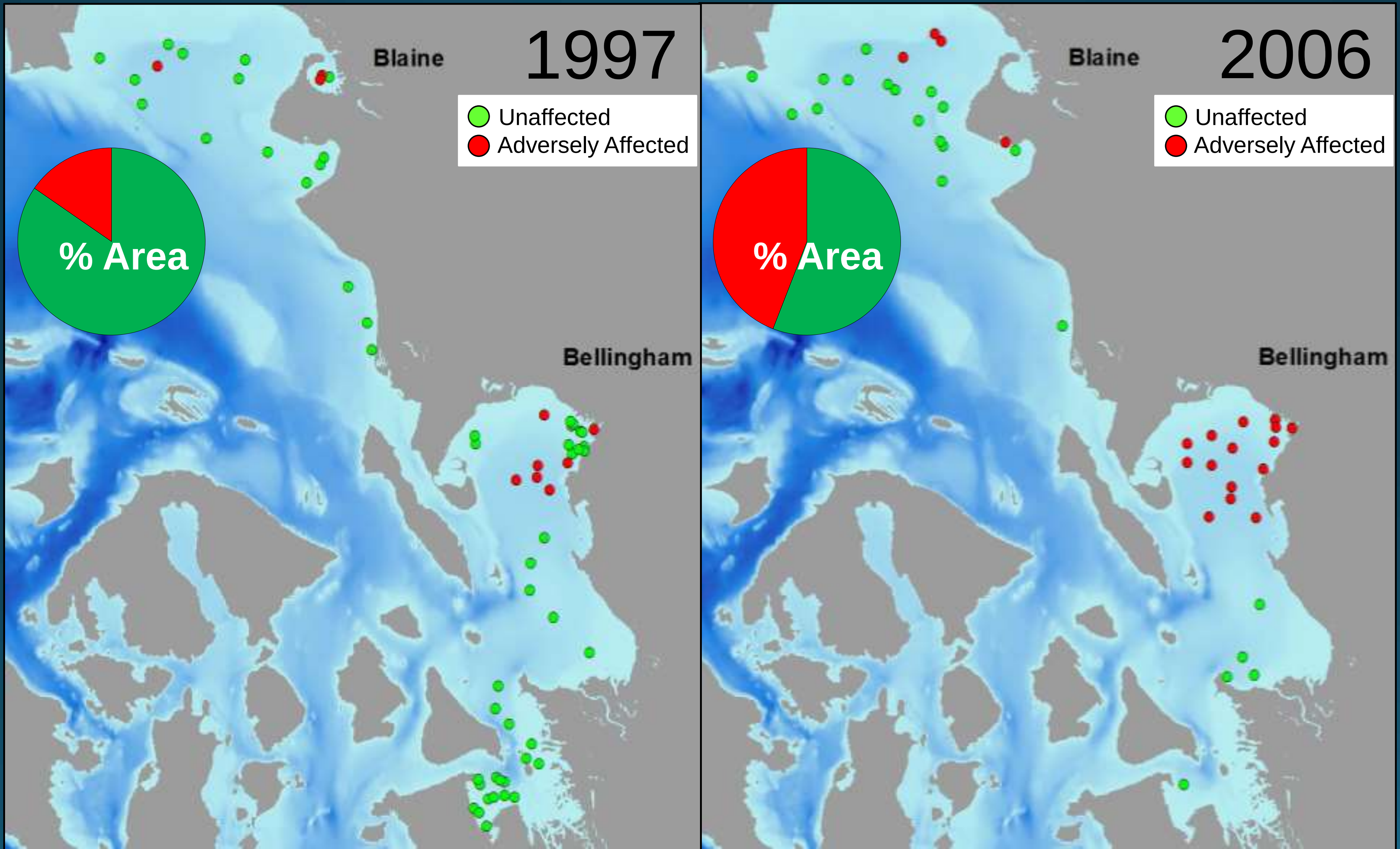
- Basis of multi-metric indices (e.g., AMBI)
- No change where community stable
- Sensitive taxa ↓ , tolerant taxa ↑ in impaired community



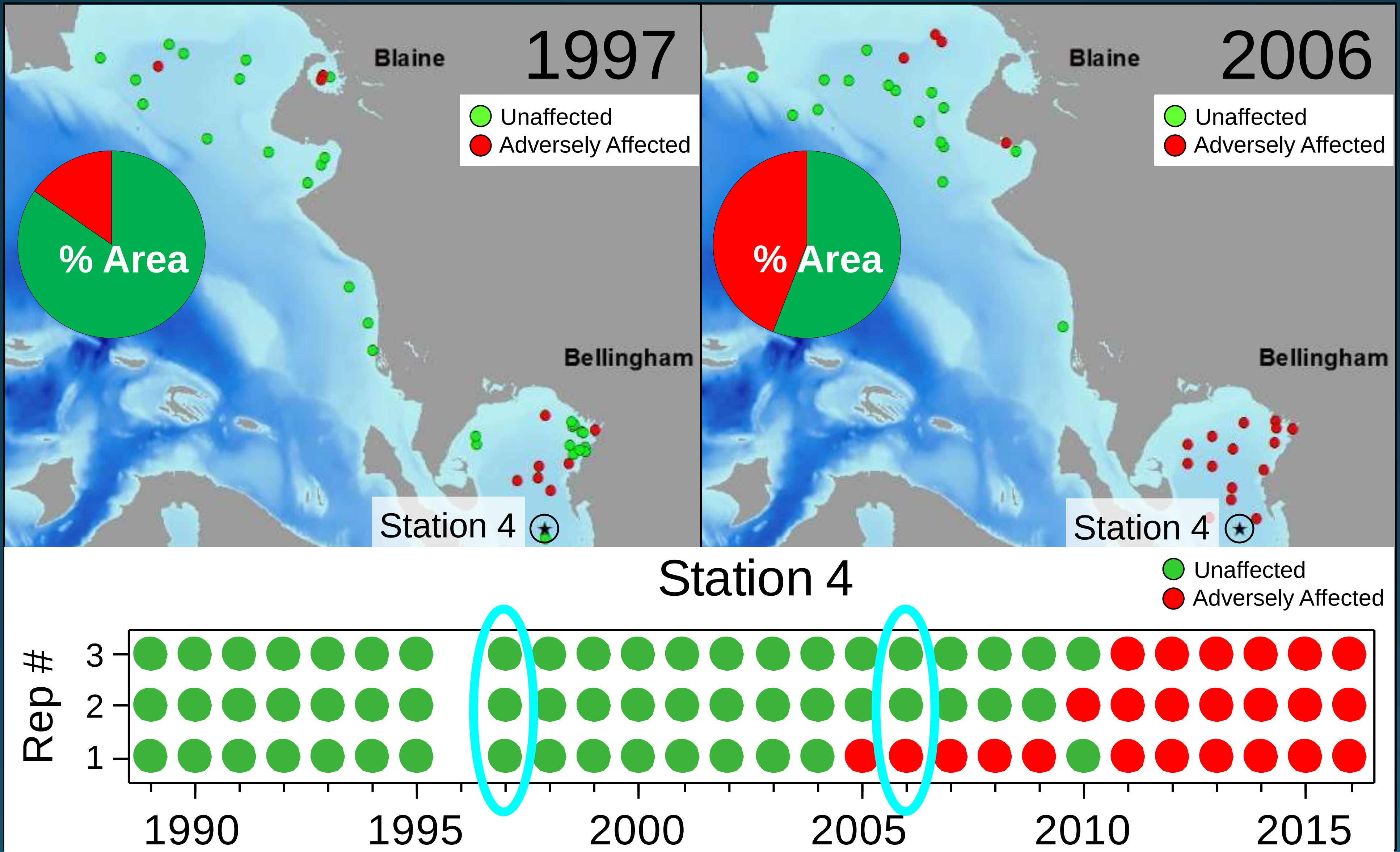


Regional results comparison

Example: Strait of Georgia region



...and Long-Term station



Regional changes vs. long-term trends

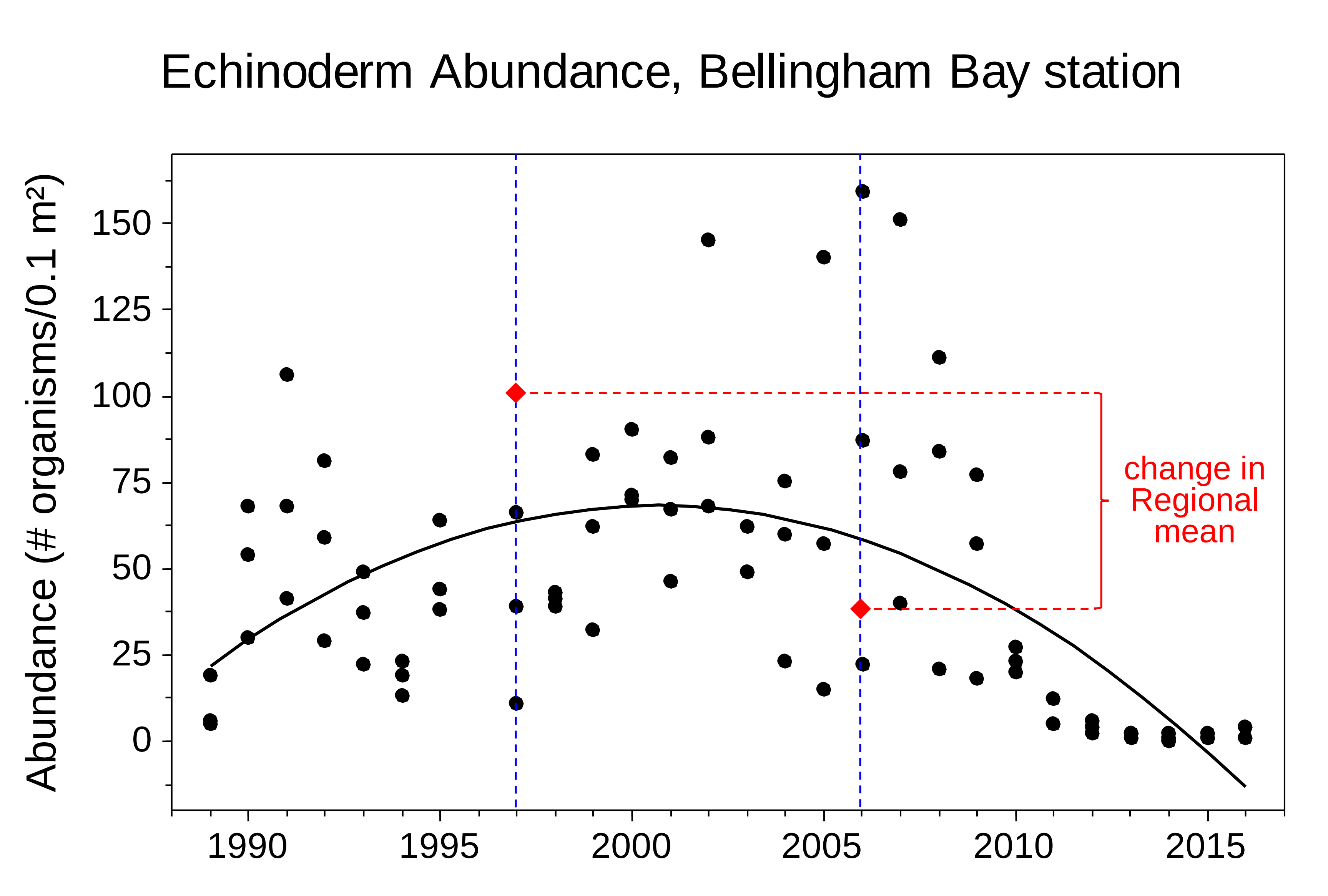
Measures of abundance & diversity

Sometimes different picture

	CHANGE	TREND
	Str Georgia region 1997 vs. 2006	Bellingham Bay station 1989-2015
Total Abundance	▼	▲
Taxa Richness		
Evenness		
Dominance		
Annelids	▼	
Arthropods		
Echinoderms		
Molluscs		
Misc. Taxa		

- improvement
- deterioration
- no change
- mixed up/down trend
- ▲ increase
- ▼ decrease

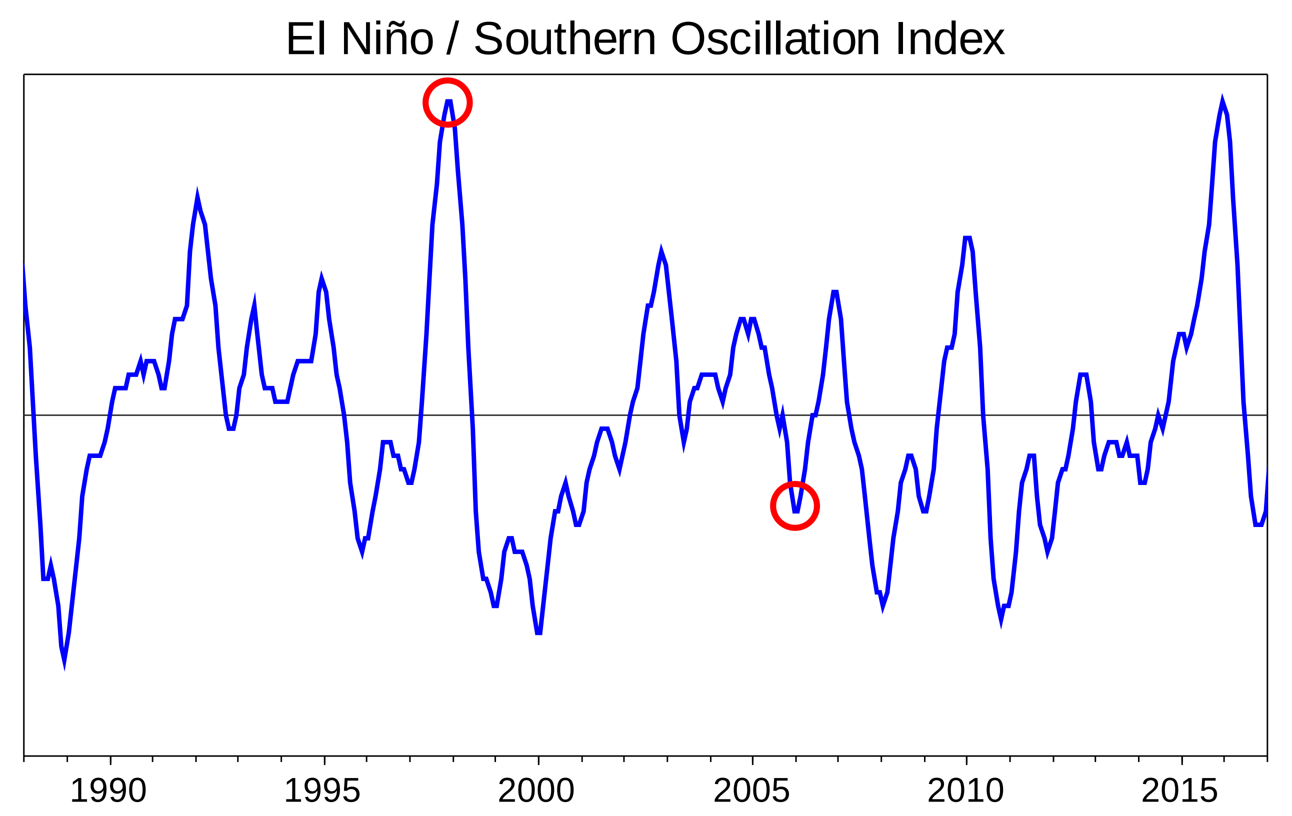
Regional changes vs. long-term trends



Regional changes vs. Long-term trends

- Sample sizes
  - local variability
- Timing
  - natural cycles
  - before vs. after bloom
- Confounding
  - spatial
  - temporal

	Region	LT Station
Space	40+	1
Time	2	27
Replicates	1	3



A few more thoughts

- Regional vs. Long-term
  - Complement each other
  - Best of both $\rightarrow$ new design

- Unique, very important dataset