Puget Sound's nearshore pelagic foodweb: landscape and historical patterns

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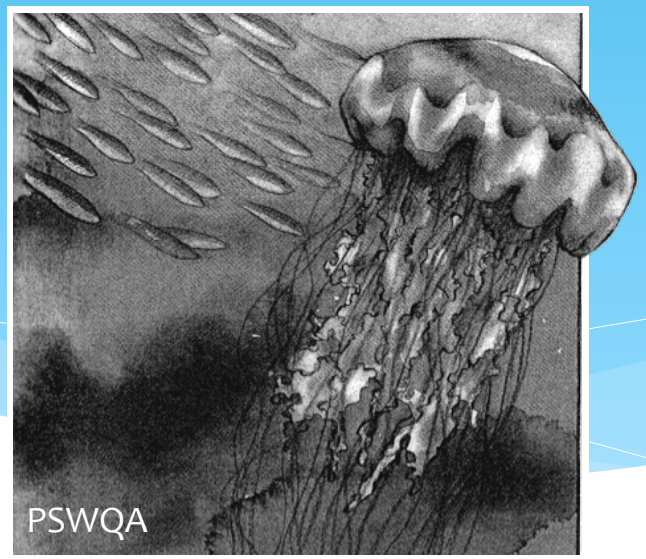

All results preliminary

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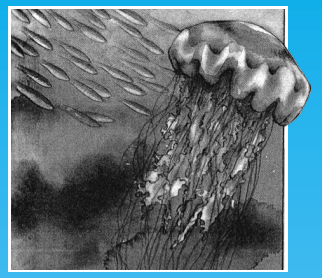
Phil Roni
Alan Lovewell
Dan Lomax
Jen King
Skip Bold
Dan Penttila

And many others!

Alan Lovewell

Background

Puget Sound's pelagic zone: large and understudied foodwebs



Puget Sound Update PSWQA 1993

Home for ESA listed and functionally important species

Chinook salmon

Pacific herring

Heavily altered by humans

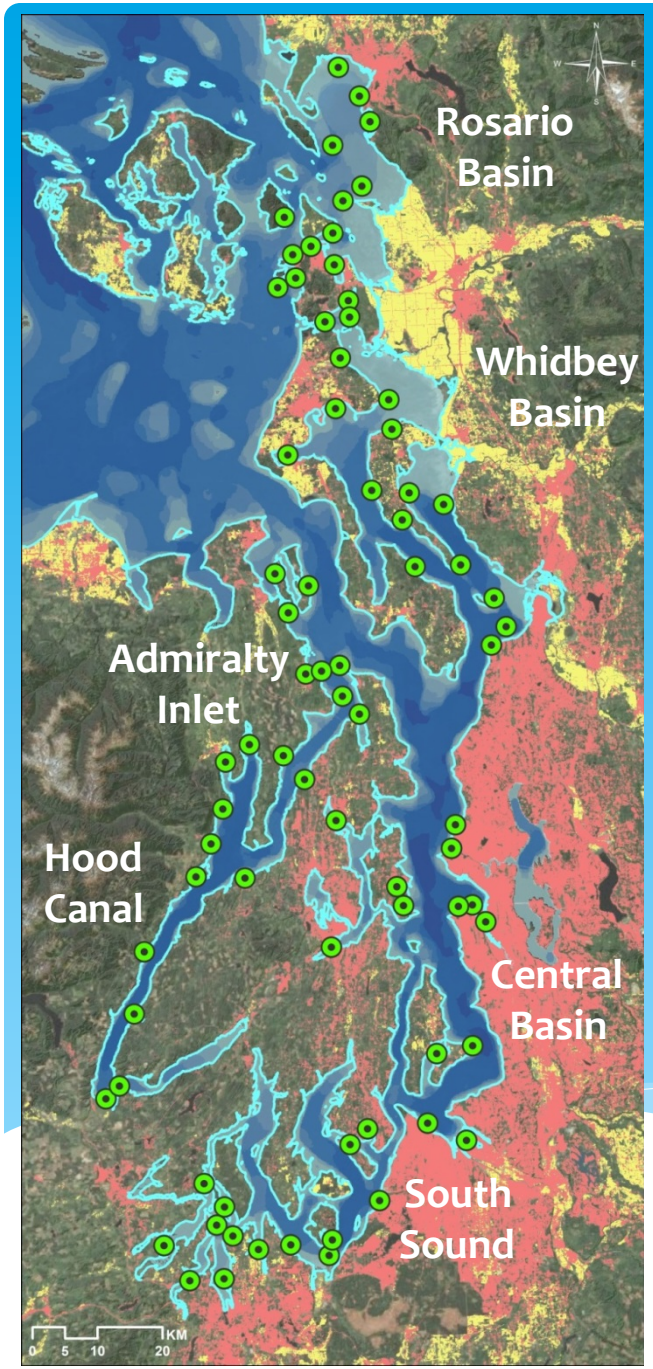
Questions
(based on 2003 patterns*)

1) How do nearshore pelagic foodwebs differ across oceanographic basins within Puget Sound?

2) How have pelagic foodwebs changed over time?

3) What is the effect of land use on nearshore pelagic foodwebs?

* Rice et al. TAFS 140:170–189, 2011; Rice et al. Marine and Coastal Fisheries 4:117–128, 2012

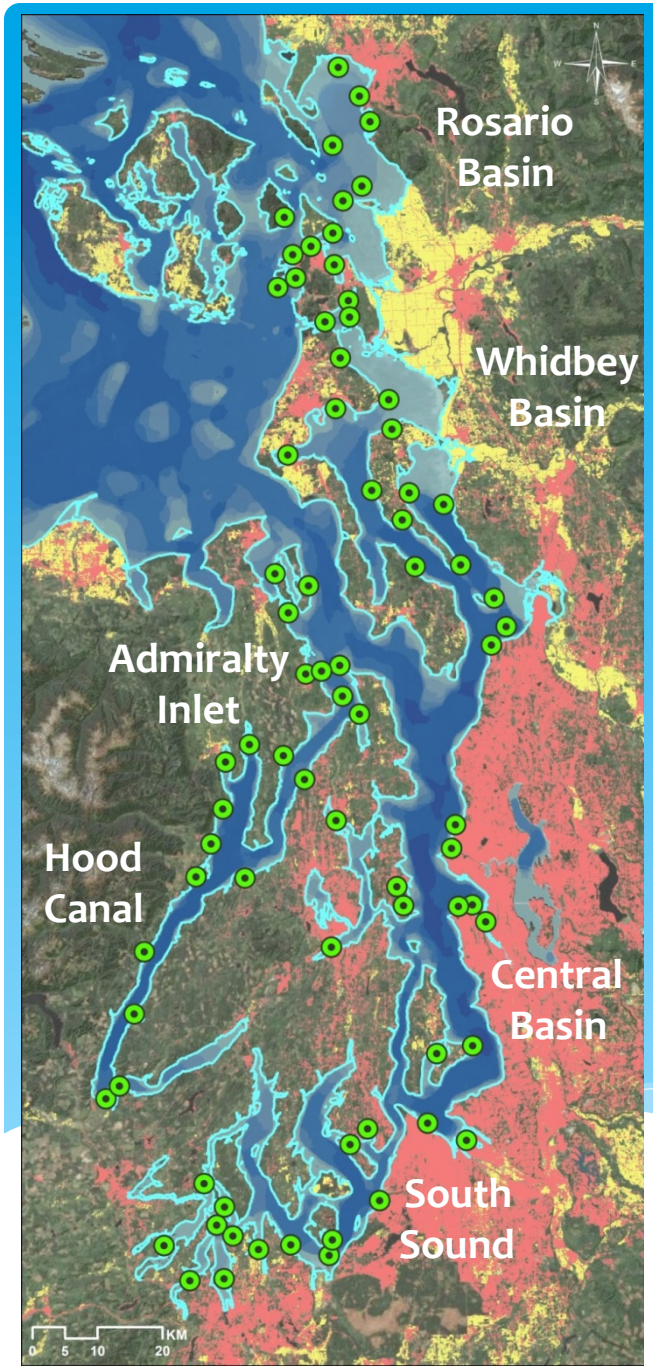


Sampling design

- All major basins
- Four geomorphic types
- Regression design incorporating land use
- Monthly April-October

Sampling for:

Water column metrics (Temp, salinity, DO, pH, PAR)
Dissolved inorganic nutrients (N, P, Si)
Chlorophyll A
Microbial abundance
Bacterial diversity
Heterotrophic microbial production
Small zooplankton
Large zooplankton and larval fish
Forage fish, juvenile salmon (abundance, biomass, growth)
Jellyfish (size, biomass)
Stable isotopes (fish, jellyfish)
Birds and marine mammals



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Sampling for:

Water column metrics (Temp, salinity, DO, pH, PAR)
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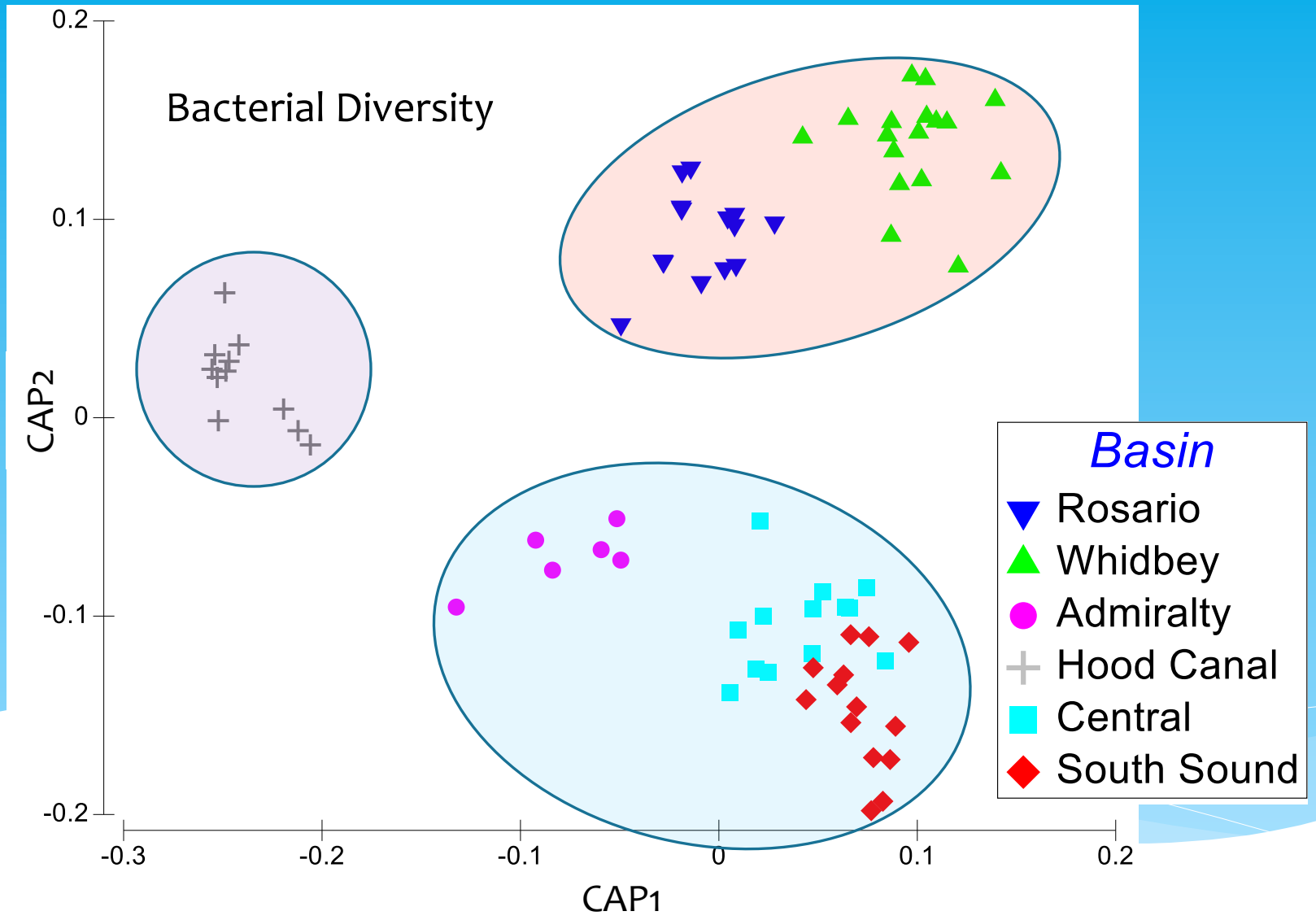
Microbial abundance
Bacterial diversity
Heterotrophic microbial production

Zooplankton
Larval fish
Small pelagic fish (abundance, biomass, growth)
Jellyfish (size, biomass)
Stable isotopes (fish, jellyfish)
Birds and marine mammals

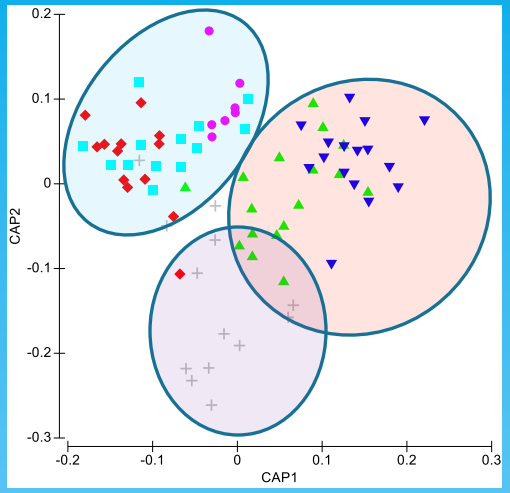
Supplemented with historical data for fish/jellyfish.

Bacteria differ among basins

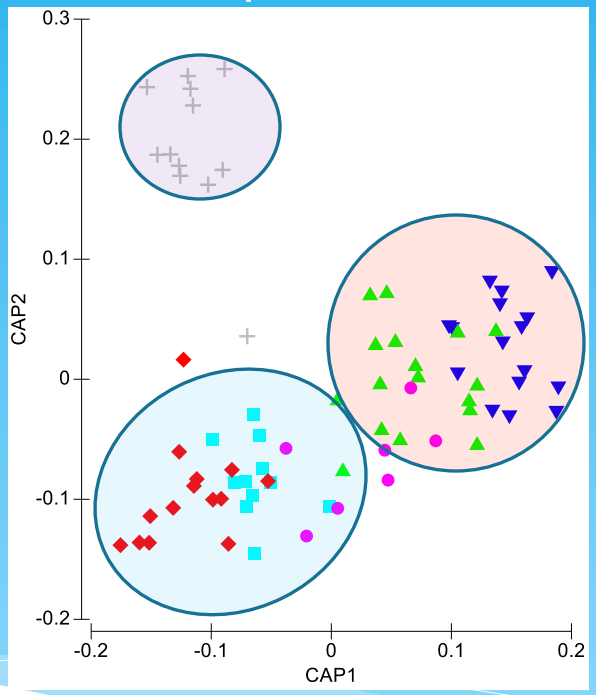


Foodwebs differ among basins

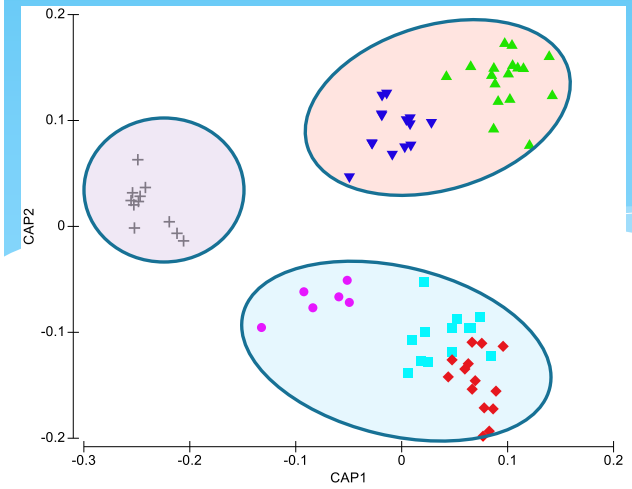
Fish and jellyfish

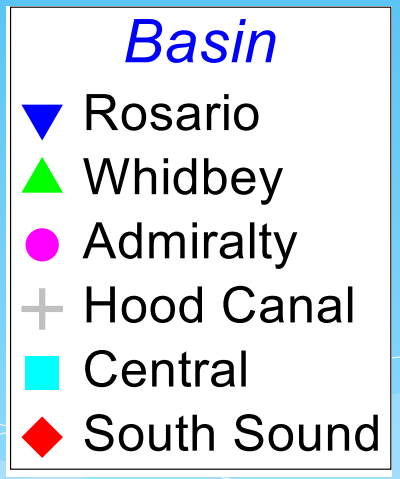


Zooplankton



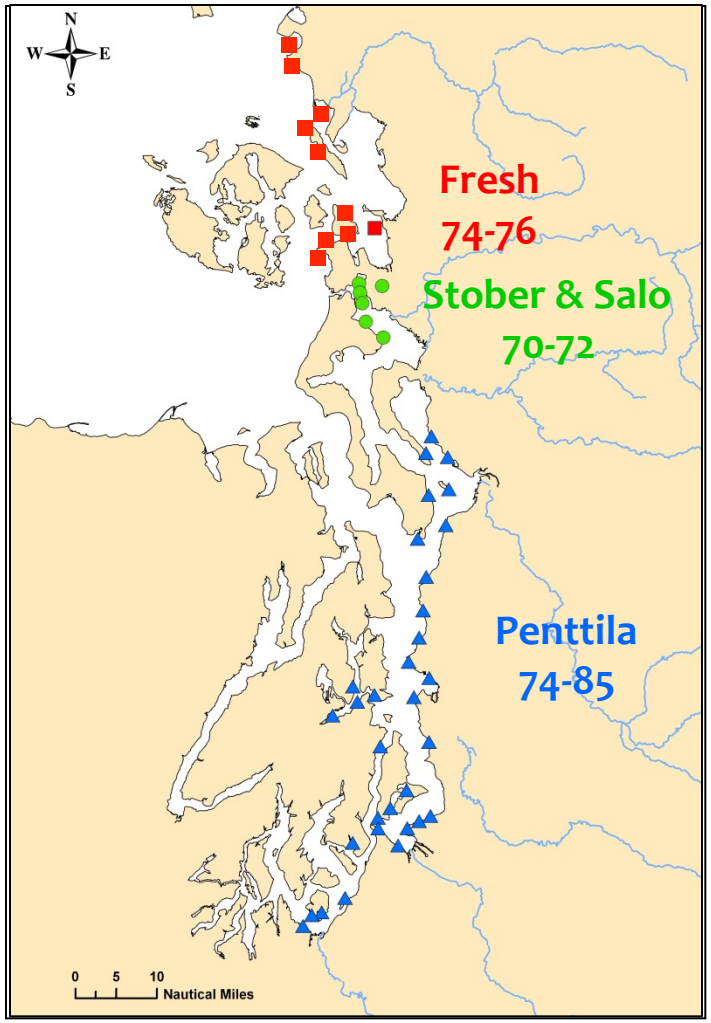
Bacteria



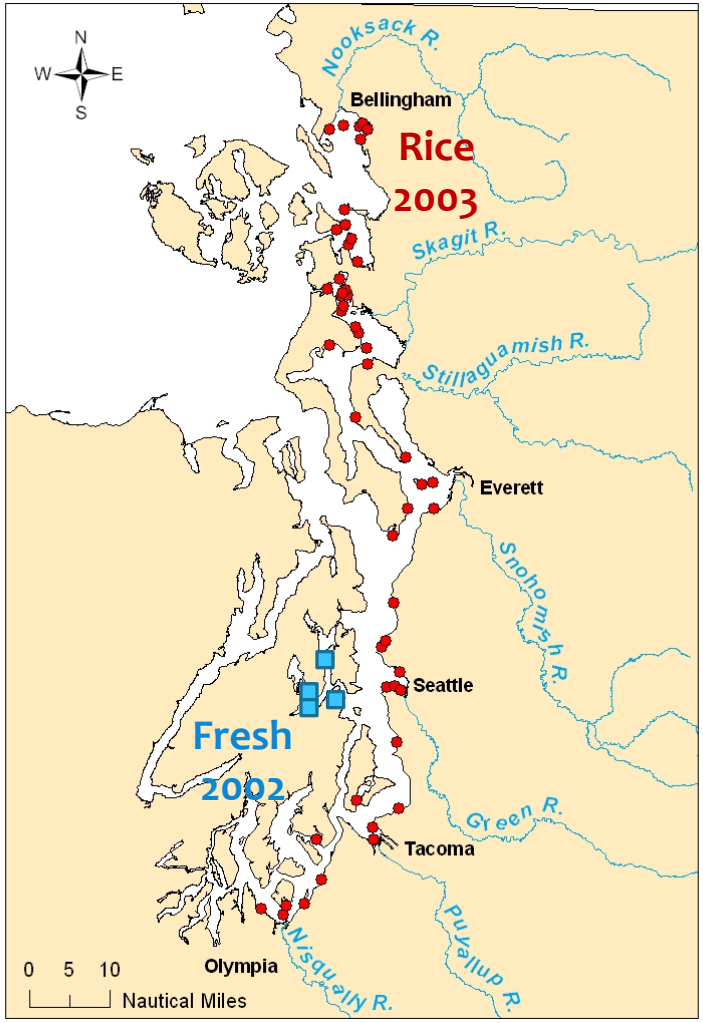


Historical comparisons

1970-1985



2002, 2003, 2011



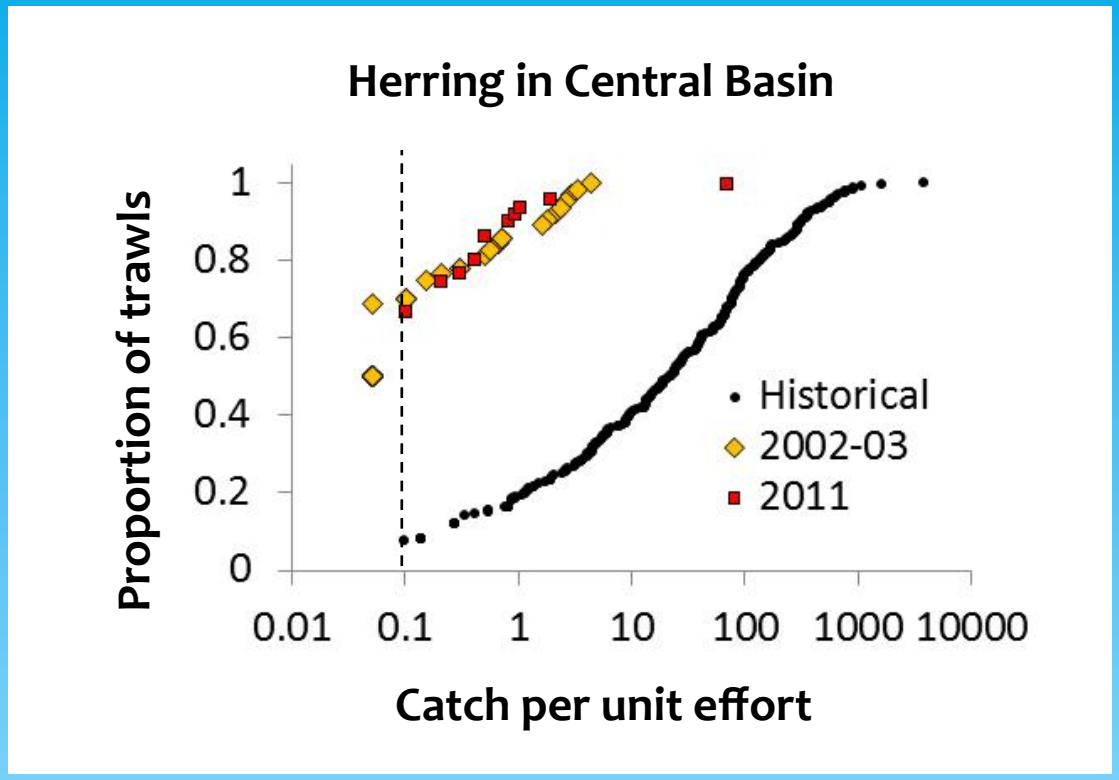
"Rosario" Basin

Whidbey Basin

Central Basin

South Basin

Historical comparisons



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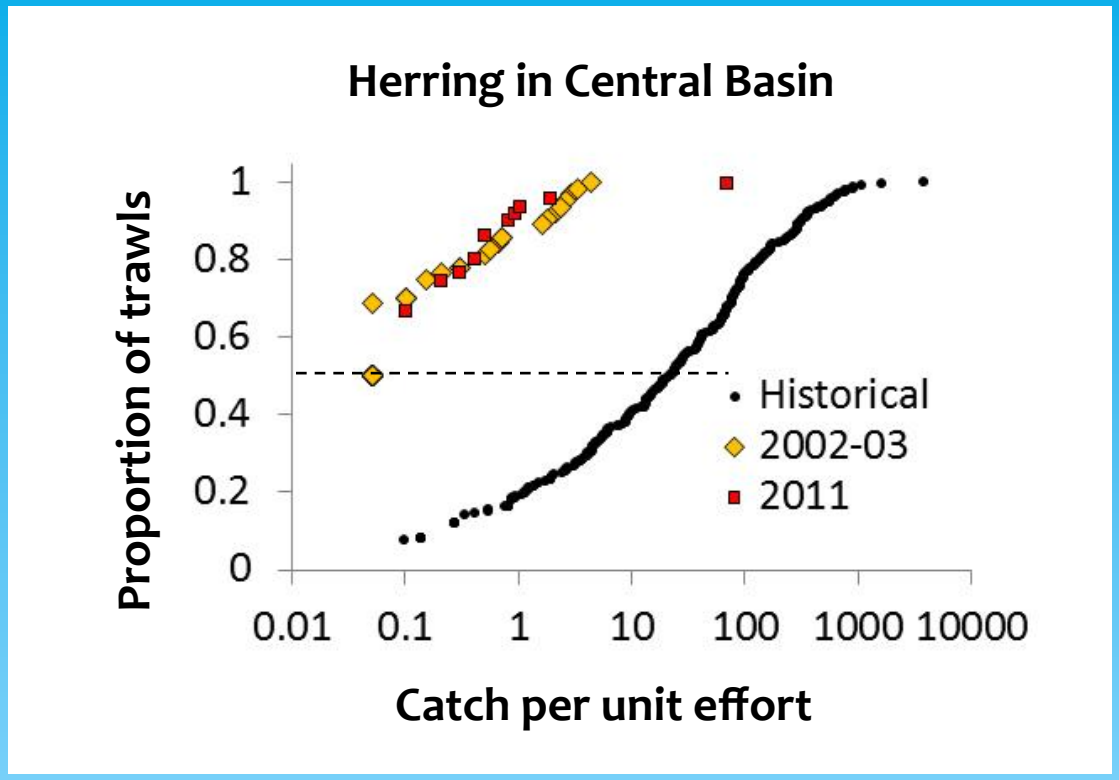

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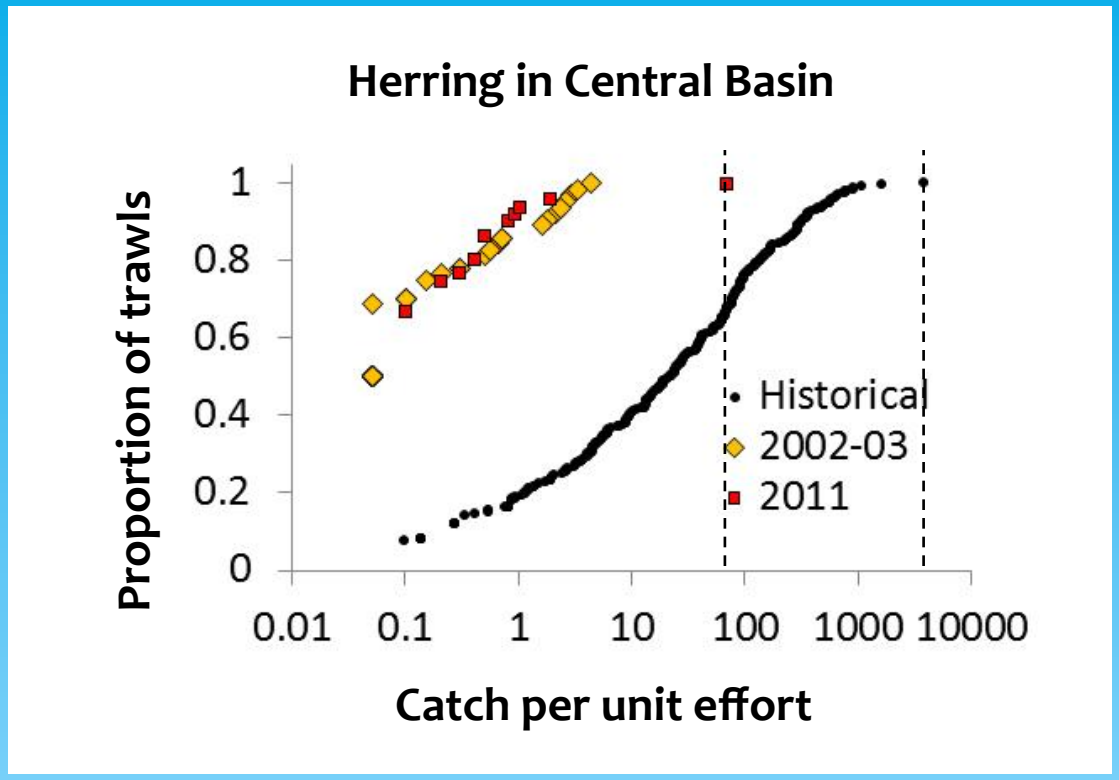

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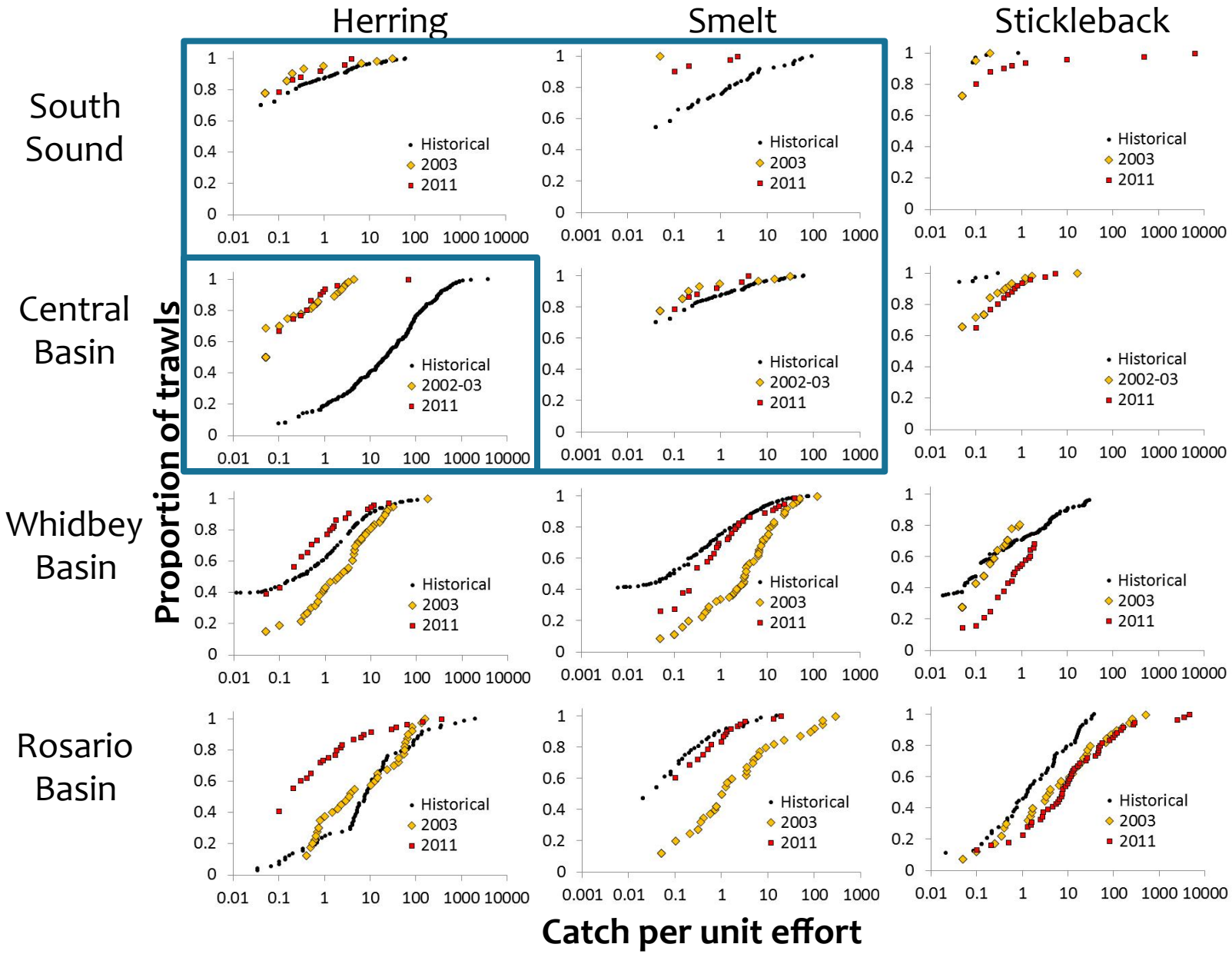

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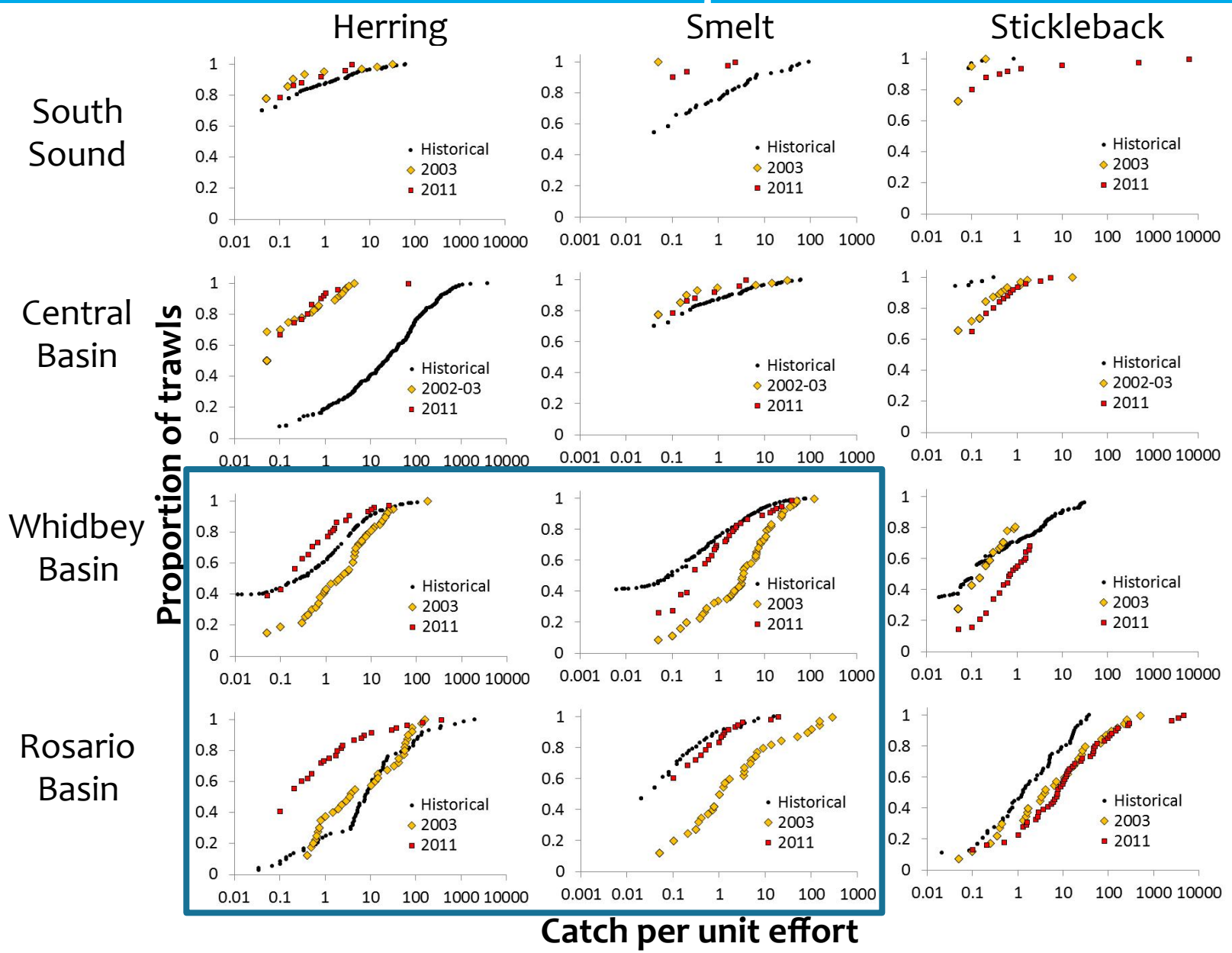

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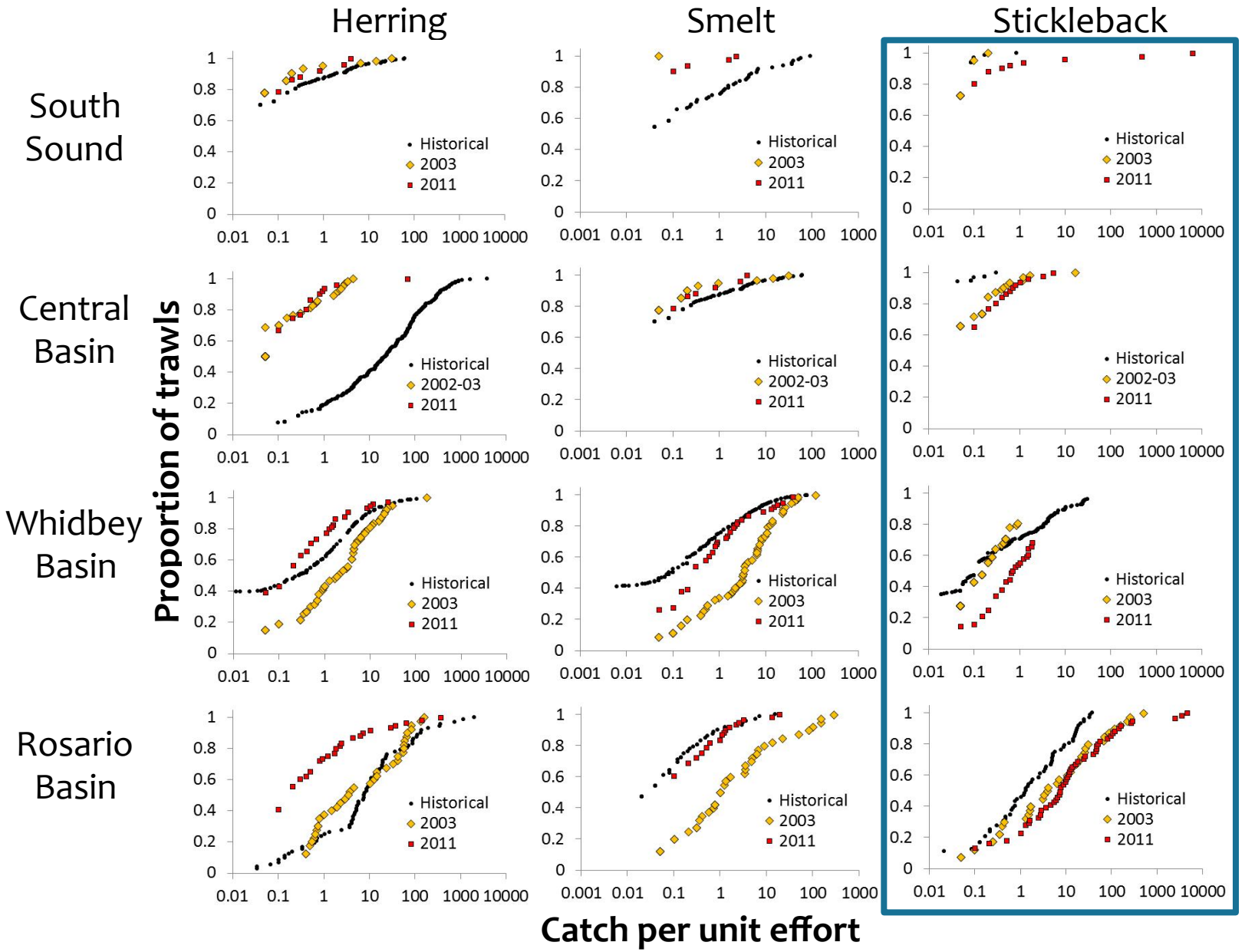
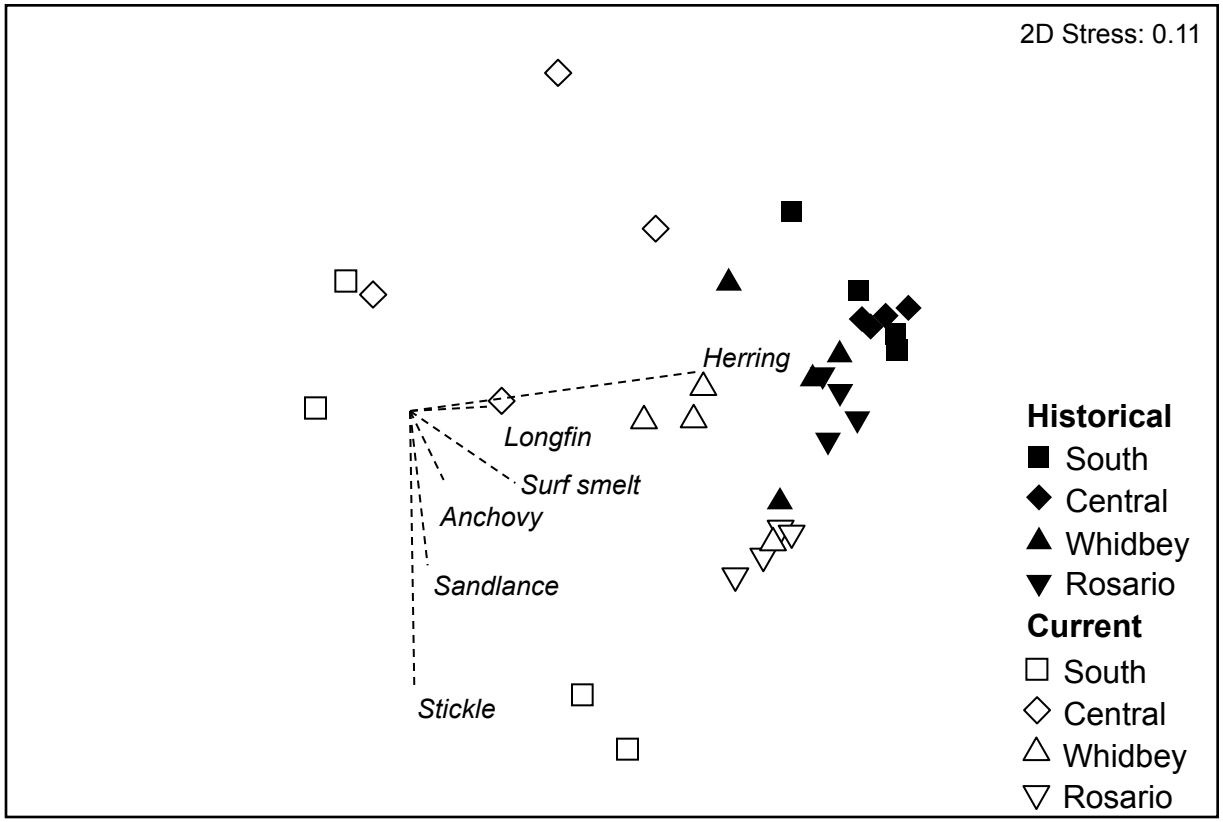
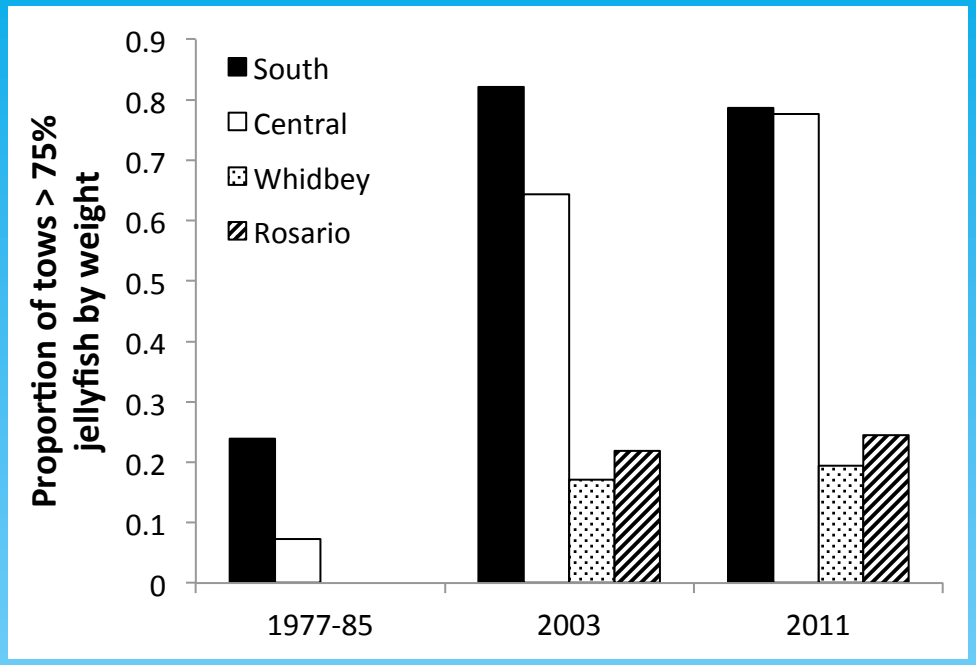




	South	Central	Whidbey	Rosario
South	***0.979***	0.031	0.01	***0.531***
Central	0.177	***0.74***	***0.375***	***0.719***
Whidbey	***0.417***	***0.469***	0.26	-0.063
Rosario	***0.563***	***0.813***	0.427	***1***

Historical comparisons



- Large aggregations of jellyfish increased 3-9x (incomplete spatial coverage)
- Use same principles to examine historical patterns for:
  - Larval fish
  - Zooplankton

Summary

1) How do nearshore pelagic foodwebs differ across oceanographic basins within Puget Sound?

- Strong differences among basins, three foodwebs within Puget Sound
- Implication: Different reference points and management over space

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3) What is the effect of land use on nearshore pelagic foodwebs?

- Subtle site-level effects may accumulate to influence foodwebs
- Implication: Challenge of managing cumulative effects

Future directions

- **Relate biological patterns to abiotic variables**
- **Further explore historical patterns (other data sets; night tows)**
- **Fecal coliform signals across Puget Sound (Linda Rhodes)**
- **Variation in zooplankton feeding groups across Puget Sound**
- **Variation in individual condition of fish across estuaries (Josh Chamberlin)**