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Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

Apr 30th, 3:30 PM - 5:00 PM

Pacific Herring Spawns Provide Temporal Subsidies to Nearshore Ecosystems

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<https://cedar.wvu.edu/ssec/2014ssec/Day1/80>

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Pacific Herring Spawns Provide Temporal Subsidies to Nearshore Ecosystems

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(2) Hakai Beach Institute, Calvert Island, BC, Canada

(3) School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC, Canada



Gladstone
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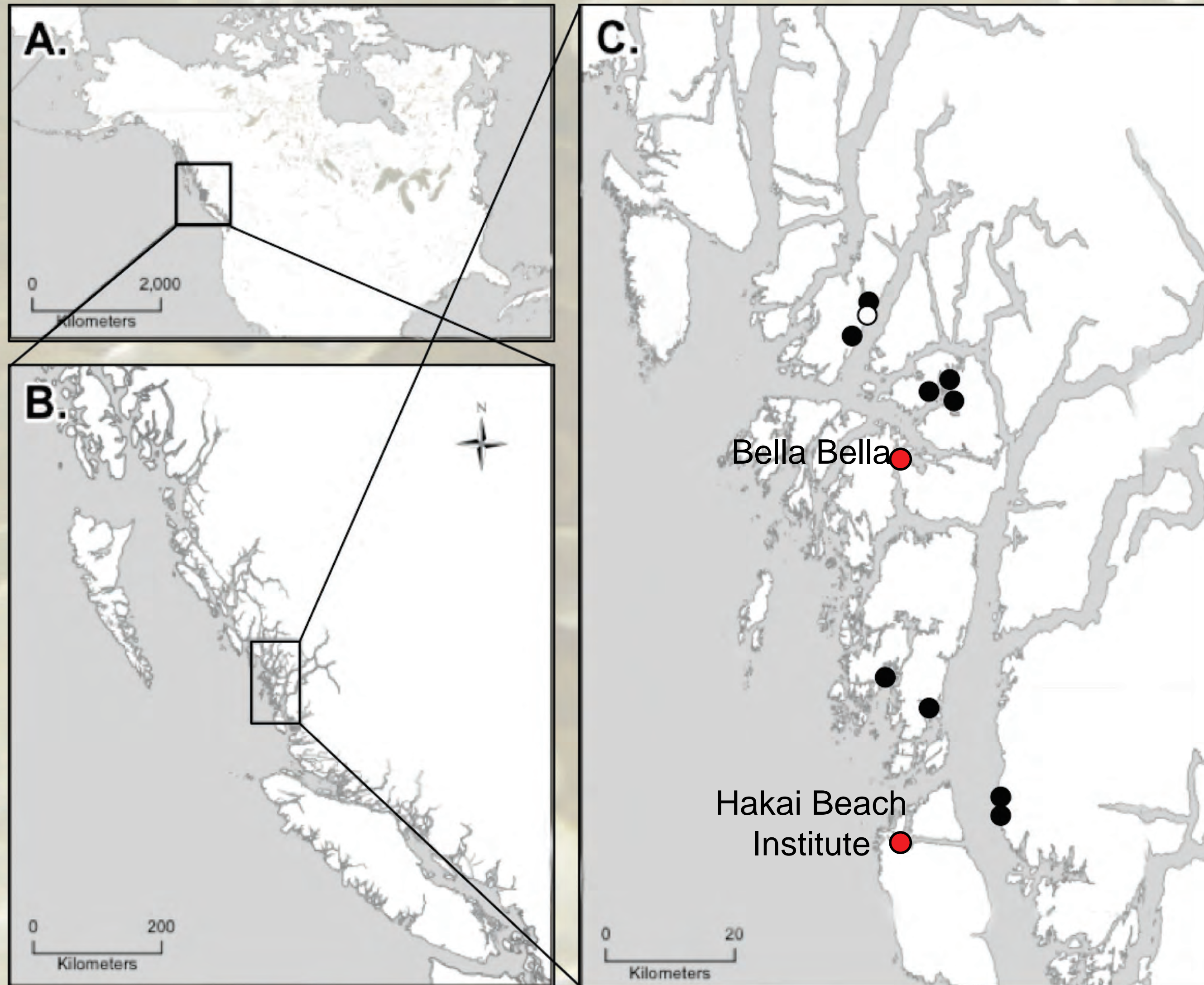


Coastal Marine Ecology
and Conservation Lab

Hakai
Beach Institute

Tula
Foundation

The 'Silver Wave' Moves North

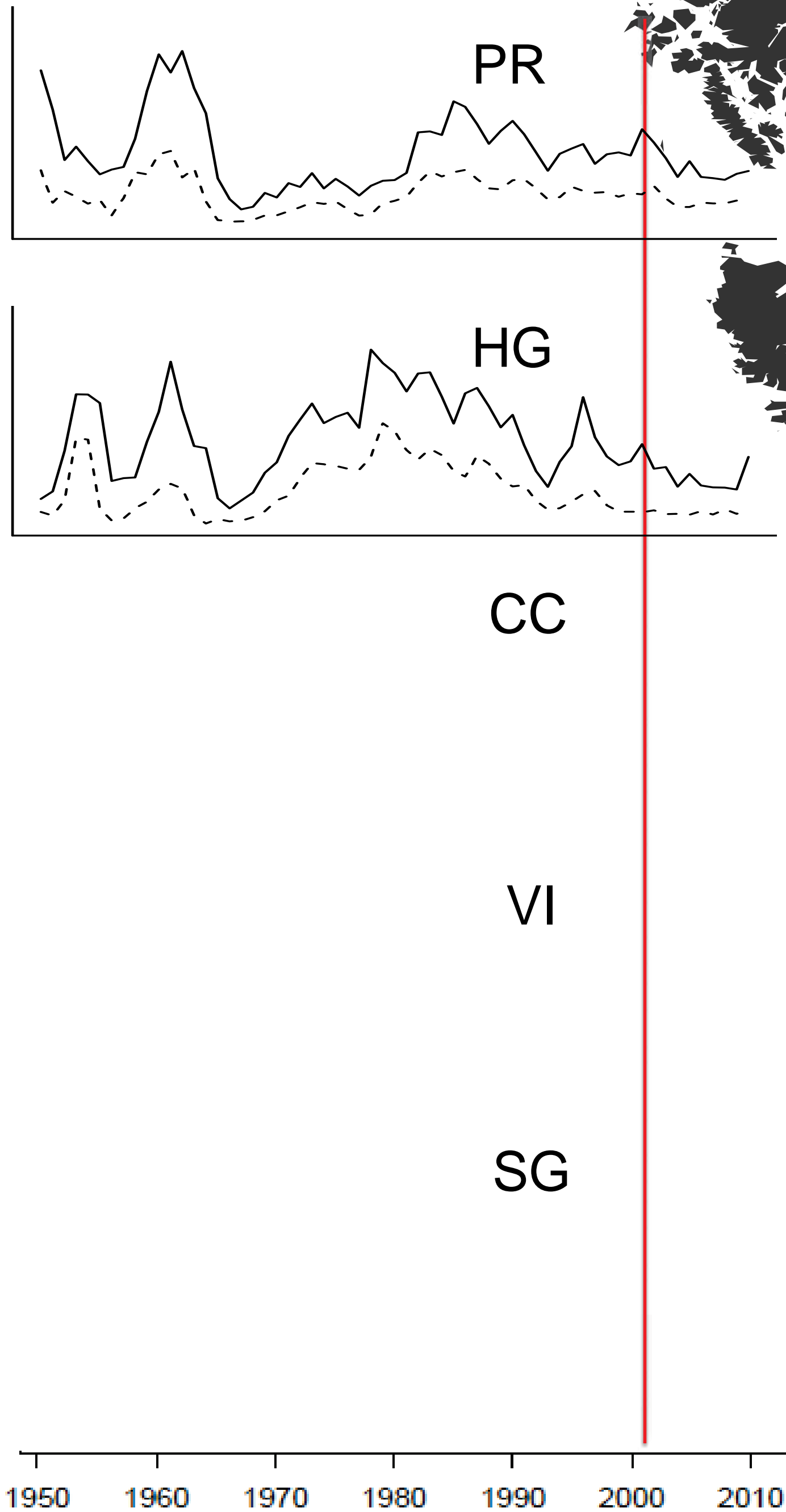




Reg Moody photo

Trends in BC

Biomass



PR

PR

HG

HG

CC

CC

VI

VI

SG

SG

Luke Rogers

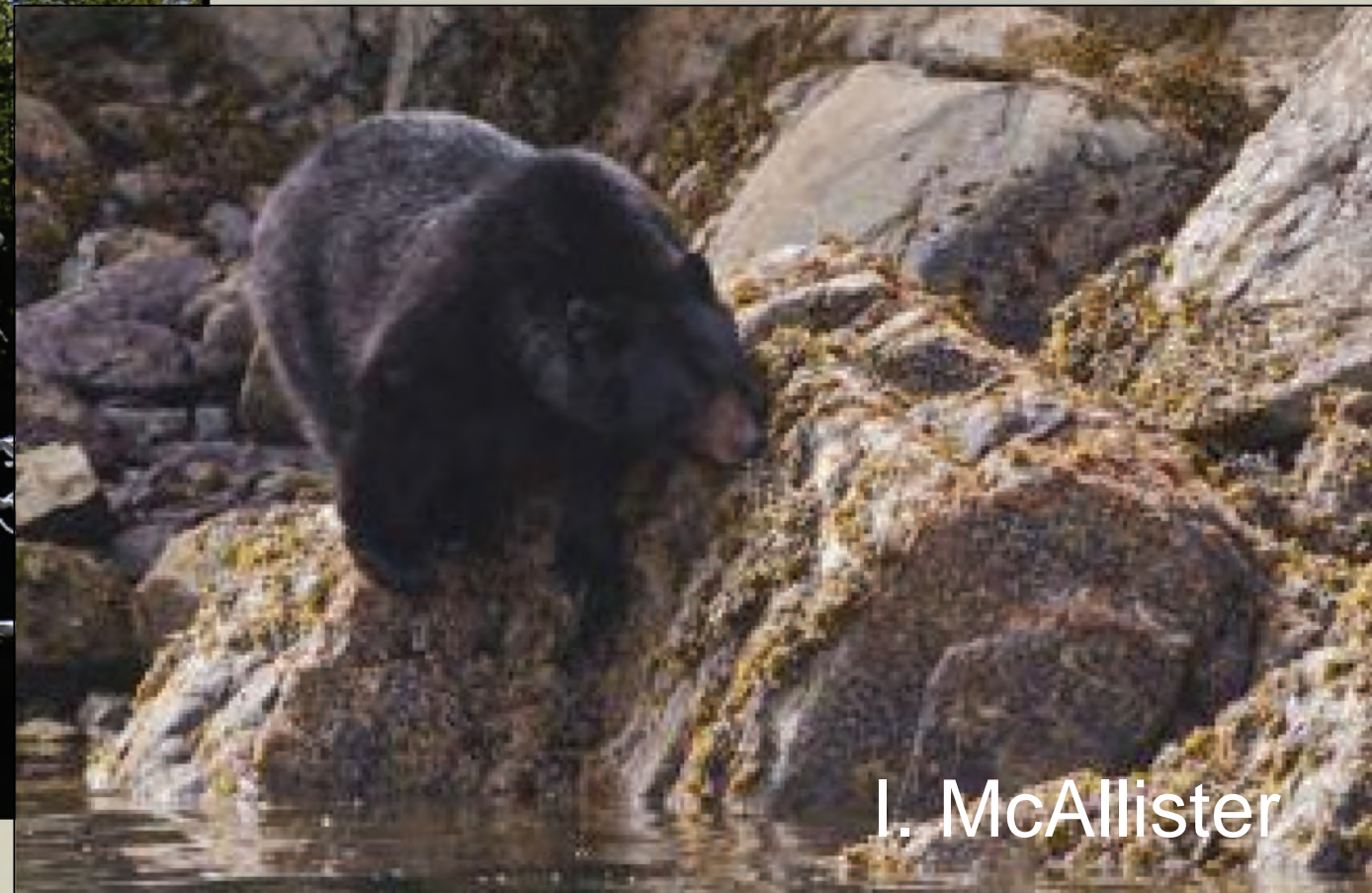
Effects on Social-Ecological Systems



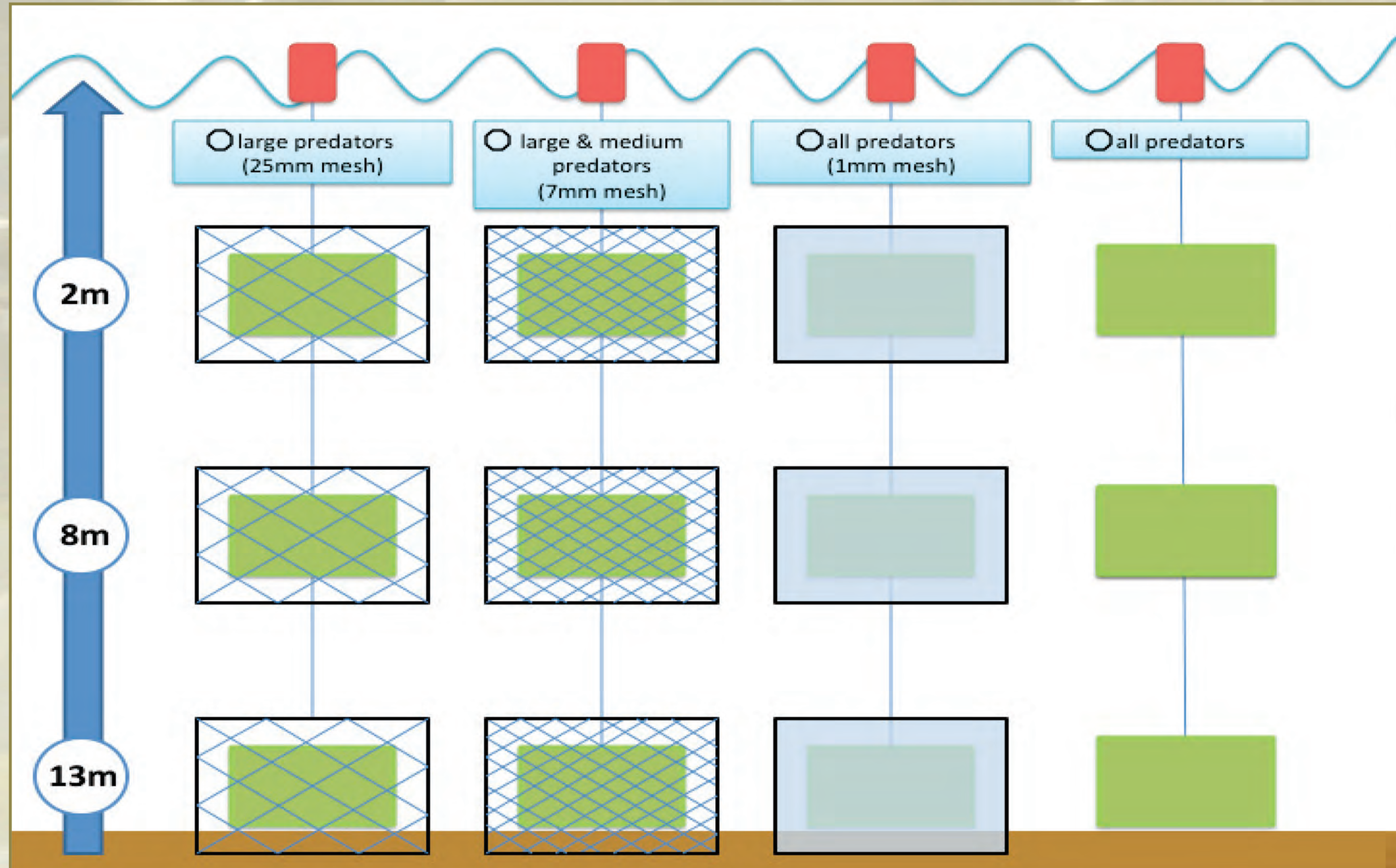
Effects on Social-Ecological Systems

A cross-system subsidy:

- seasonal
- large biomass flux
- understudied

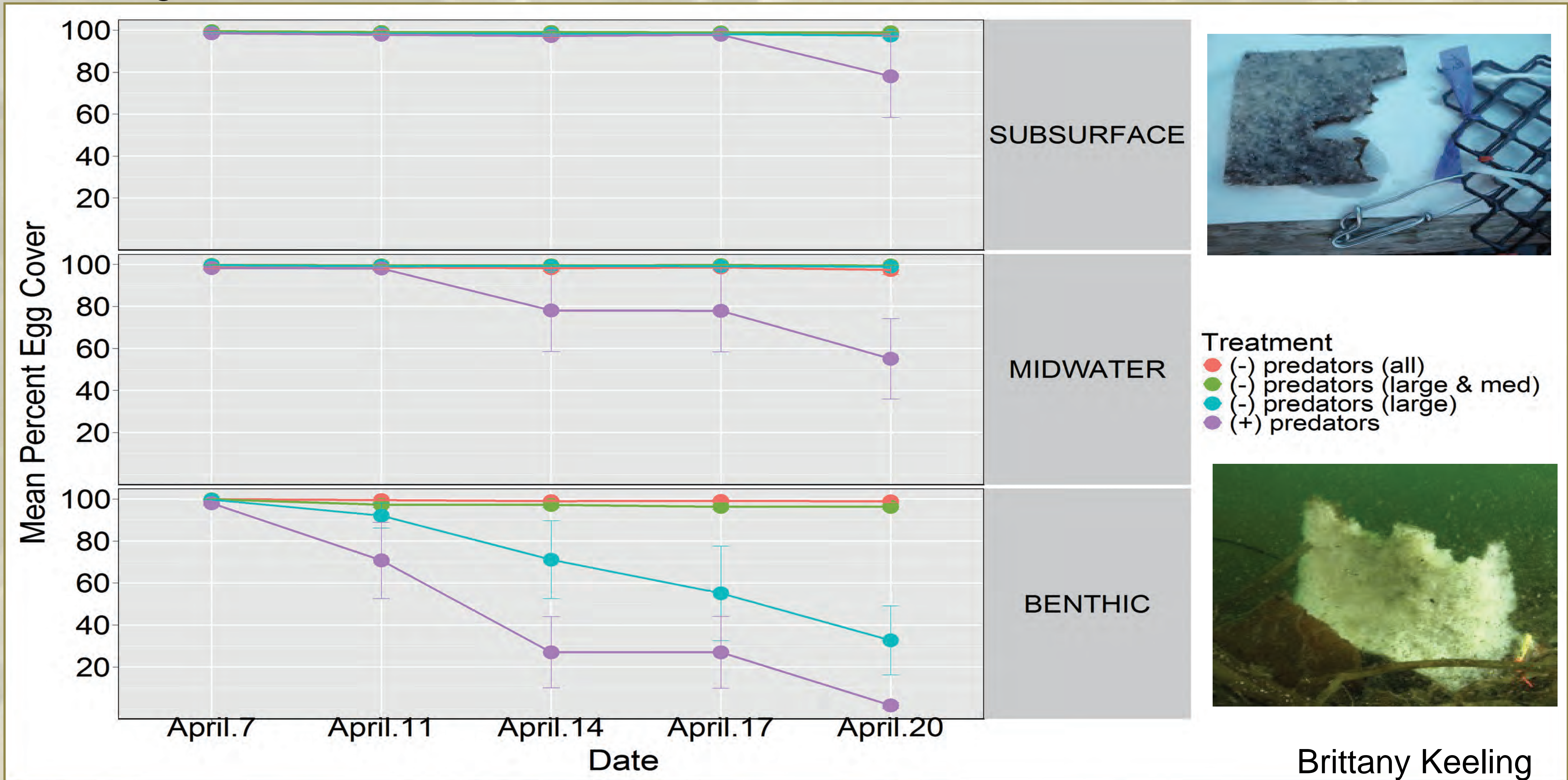


Egg Loss: Habitat vs. Predation



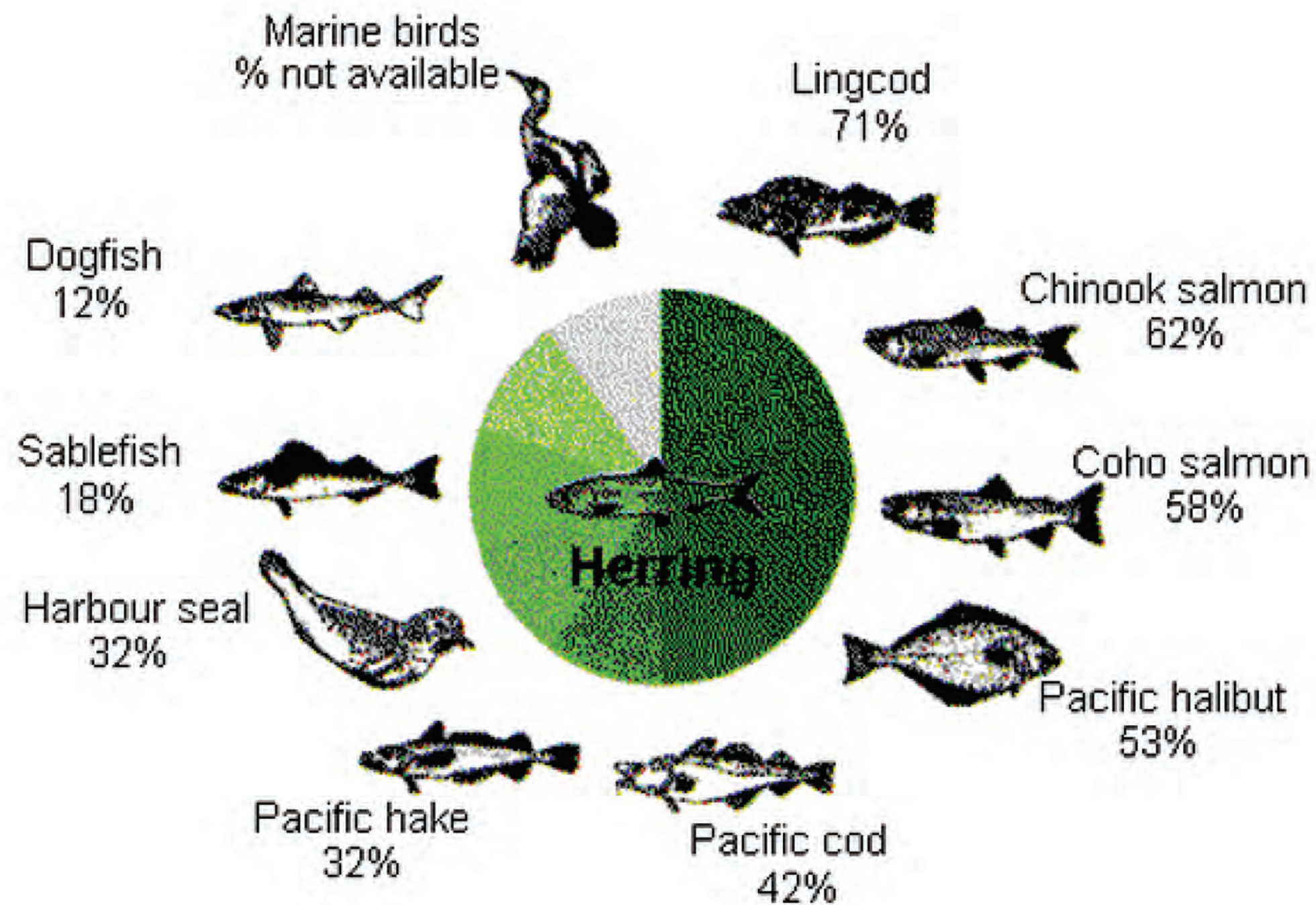
Egg Loss: Habitat x Predation

B. Keeling *Master's thesis*



Temporal Subsidies to Rockfish Spp.

Importance of adult Pacific herring in predators' diets -- West Coast Vancouver Island



Source: Fisheries and Oceans Canada, Nanaimo, B.C.

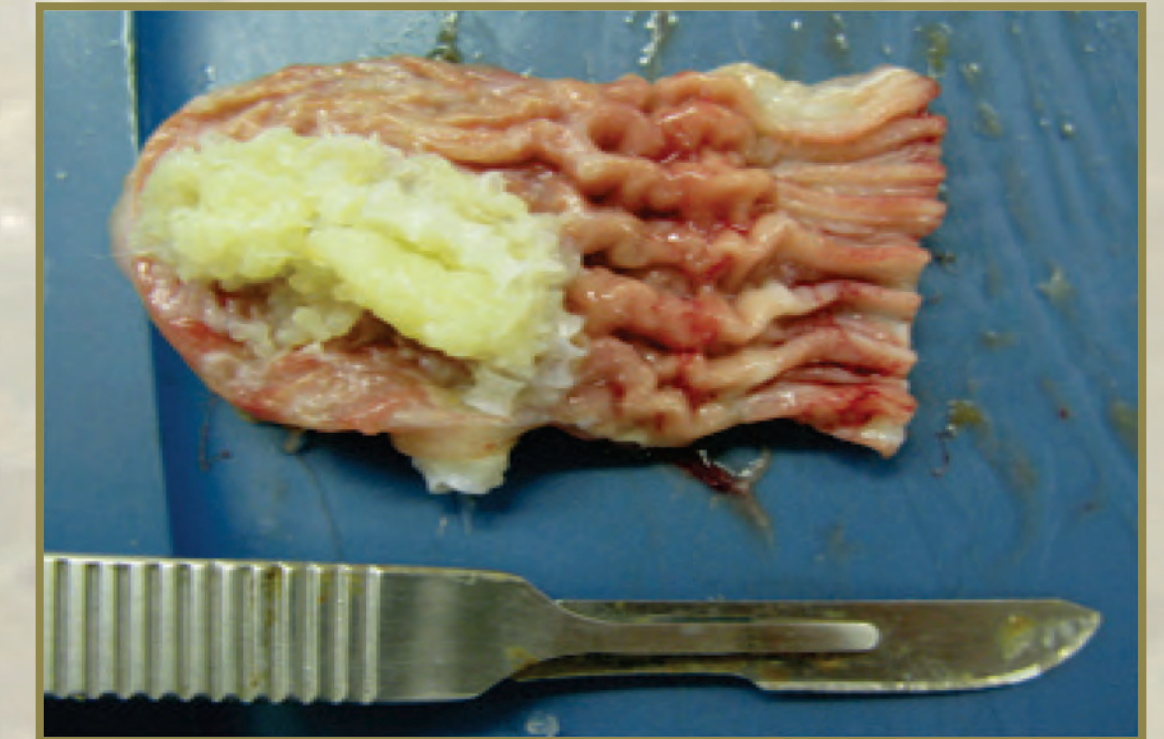
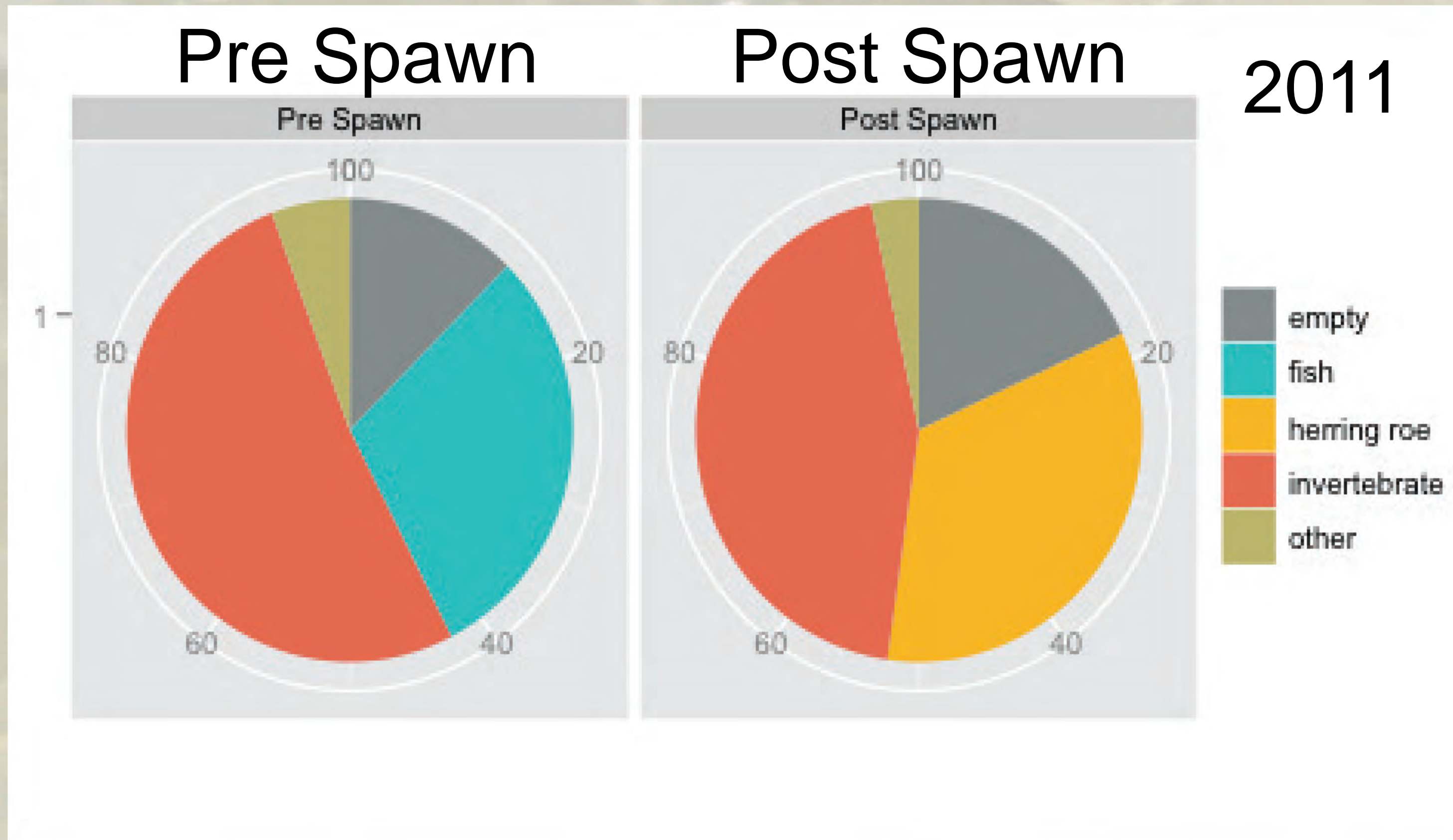


Sebastes maliger
(Quillback) &



Sebastes caurinus
(Copper)

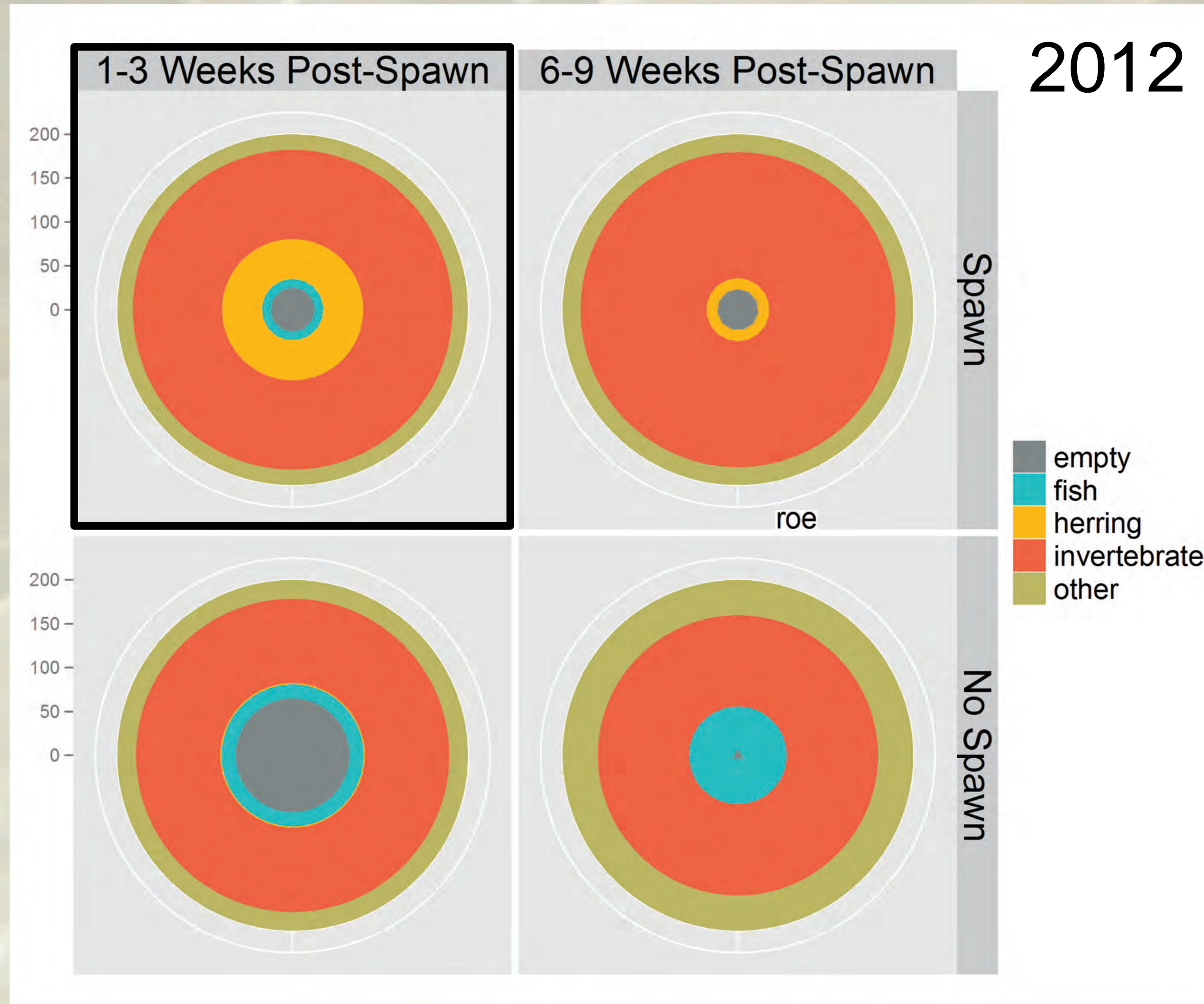
Rockfish Dietary Switch



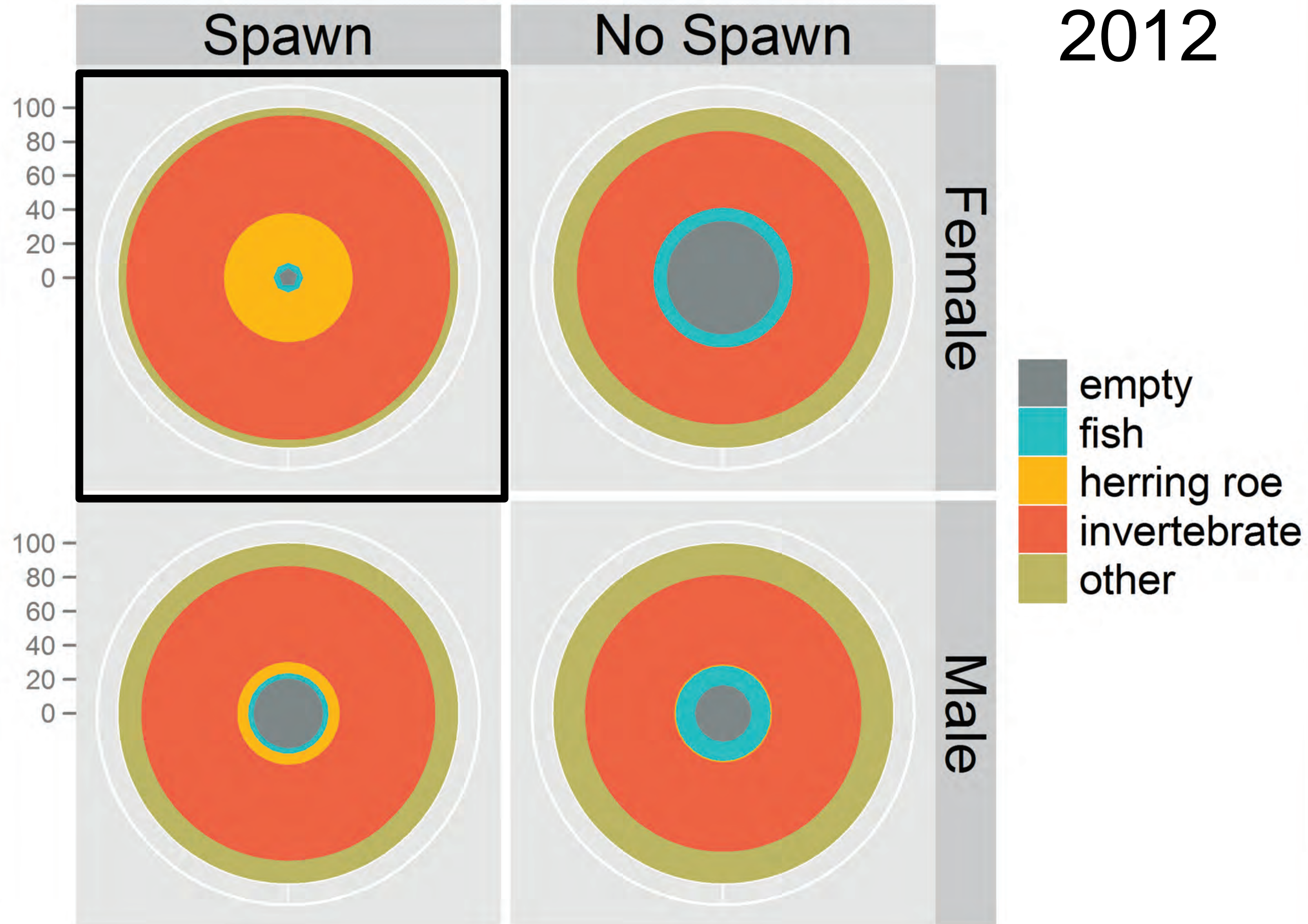
Rockfish stomach contents:
roe on algae / sac roe

Fish: $30 \pm 15\%$ \rightarrow 0%
Roe: 0% \rightarrow $34 \pm 12\%$

Temporal Trends in Rockfish Diet



Sex-dependent Trends



Herring roe:

Female spawn 29 ± 10 %

Male spawn 7 ± 3 %

Female no spawn 0 %

Male no spawn 0.7 ± 0.7 %

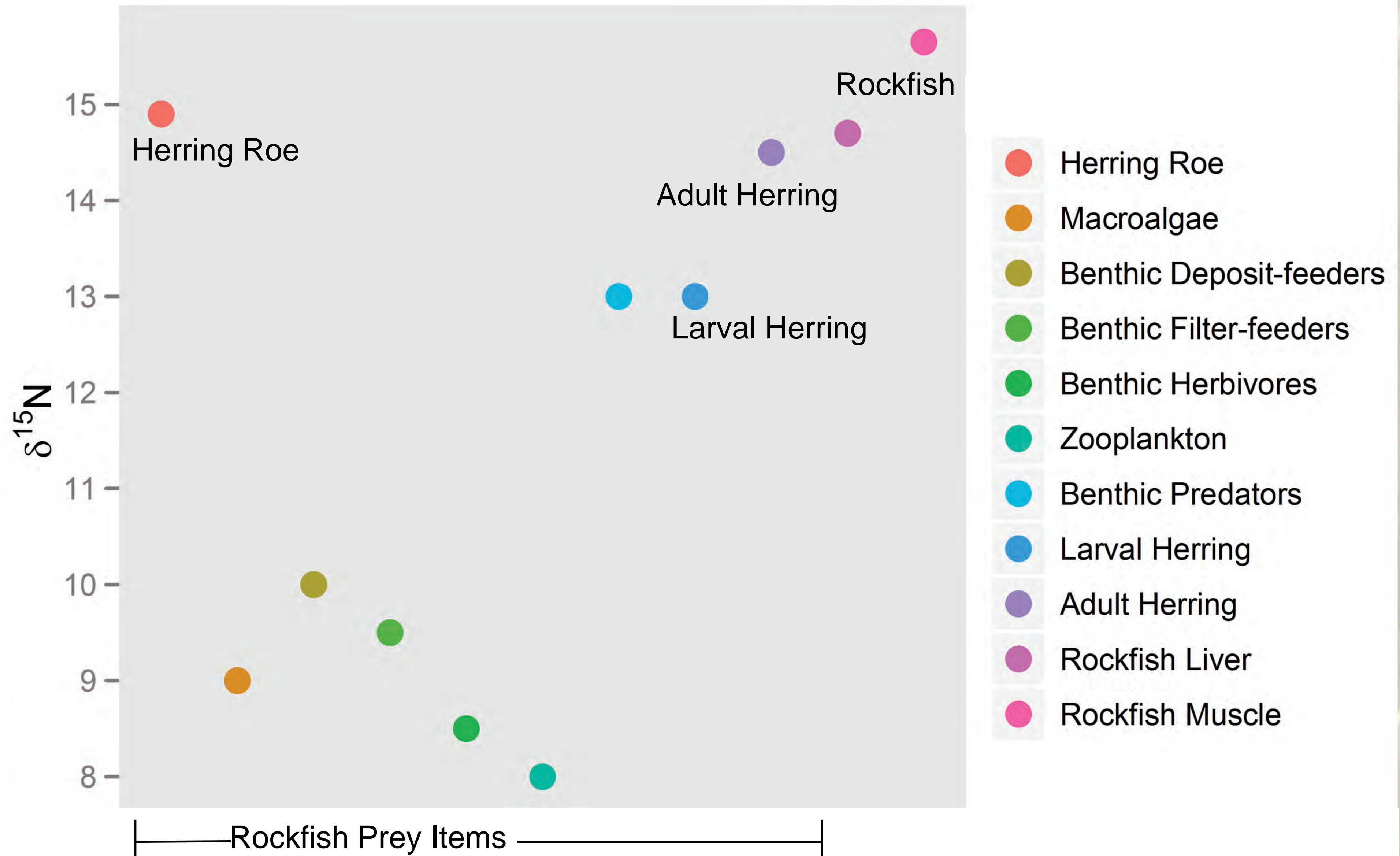
Isotopic Effect?



Rockfish Muscle Tissue



Relative Roe in Diet: Mixing Models



Herring Spawn as a Temporal Subsidy

- un-quantified trophic linkages
- may have strong, but pulsed, temporal effects
- may influence key population processes
 - weight gain pre-migration (Anderson et al. 2009)
 - female weight gain (Bond & Elser 2006)



Herring Spawning Substrate



Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs.
Pikitch et al. 2012. Lenfest Ocean Program

little fish
BIG IMPACT

Cultural



Economic

Ecological

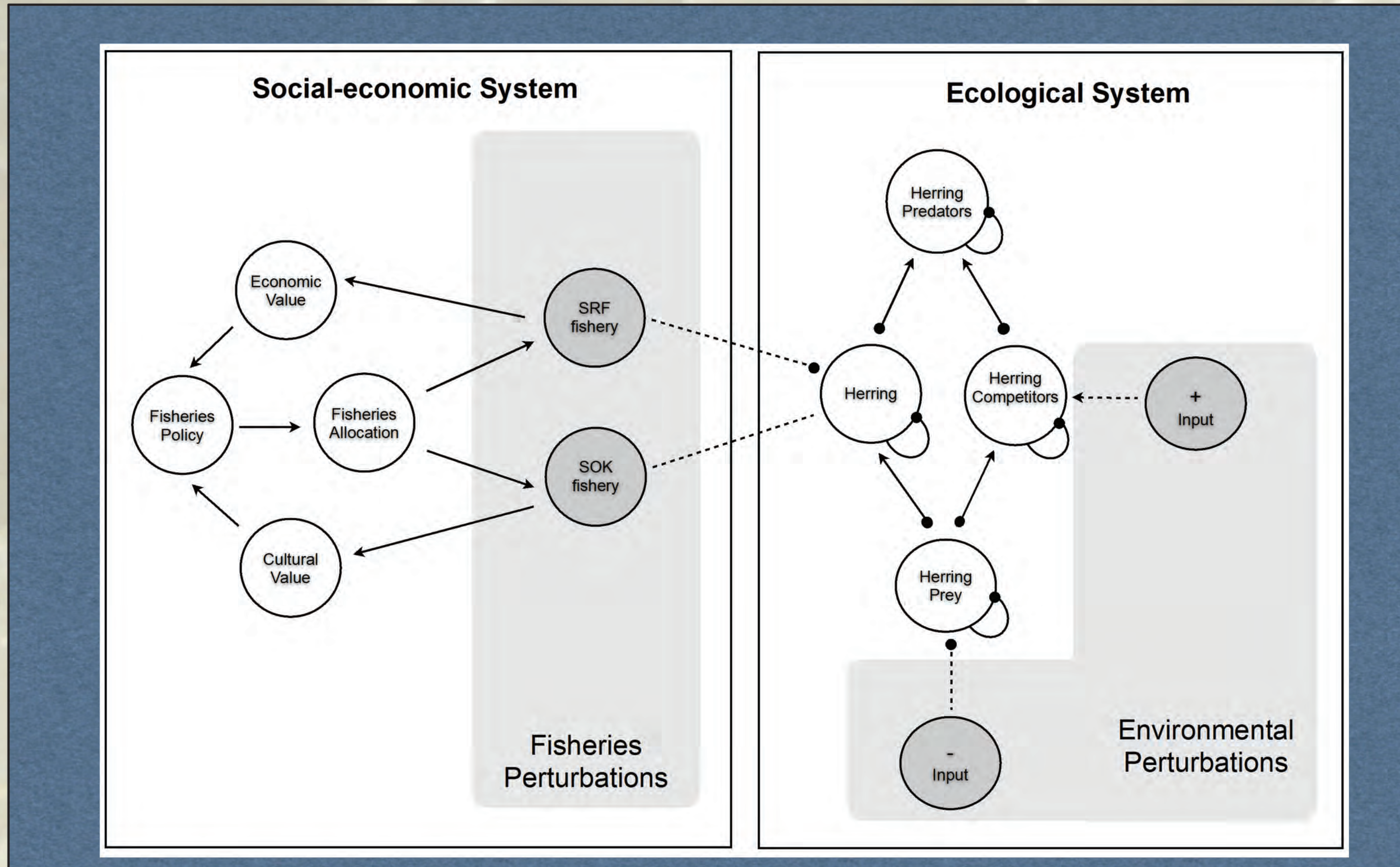


Photo: Rand McMeins



Photo: Gene Anthony

Coupled social-ecological system models



An Interdisciplinary Approach

A photograph of Eleni Petrou, a woman with dark hair, wearing a blue and red jacket, smiling and holding up a long, thin, light-colored object, possibly a piece of driftwood or a fishing lure, in a boat. Other people are visible in the background of the boat.

Eleni
Petrou

S-03D. Poster 802. Shifting baselines in Puget Sound: population abundances of Pacific herring and its use by Native Americans over the millenia. Thurs, 5-6

A photograph of Iain McKechnie, a man with a beard and a brown beanie, wearing a red jacket, smiling on a boat. The background shows a forested shoreline and green water.

Iain
McKechnie

S – 10H. Talk 665. The Herring School: Long-term perspectives on Herring in the Salish Sea and Beyond. Fri, 1:30-1:45

Acknowledgements & Collaborators



Gladstone
Reconciliation
Society



SIMON FRASER UNIVERSITY
THINKING OF THE WORLD

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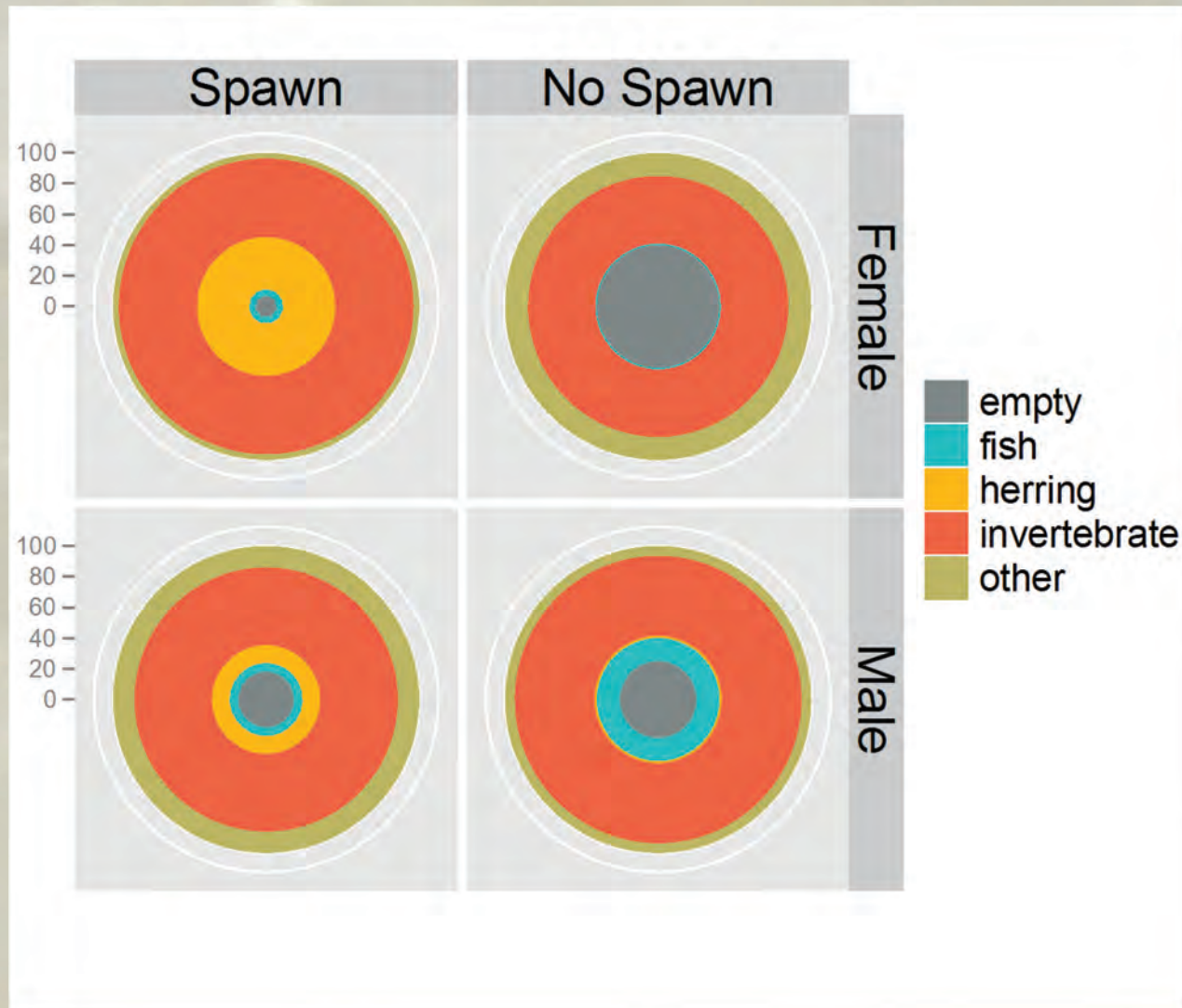
Tula
Foundation



Thank You

Model Selection: Time, Site, Sex

1-3 weeks post-spawn

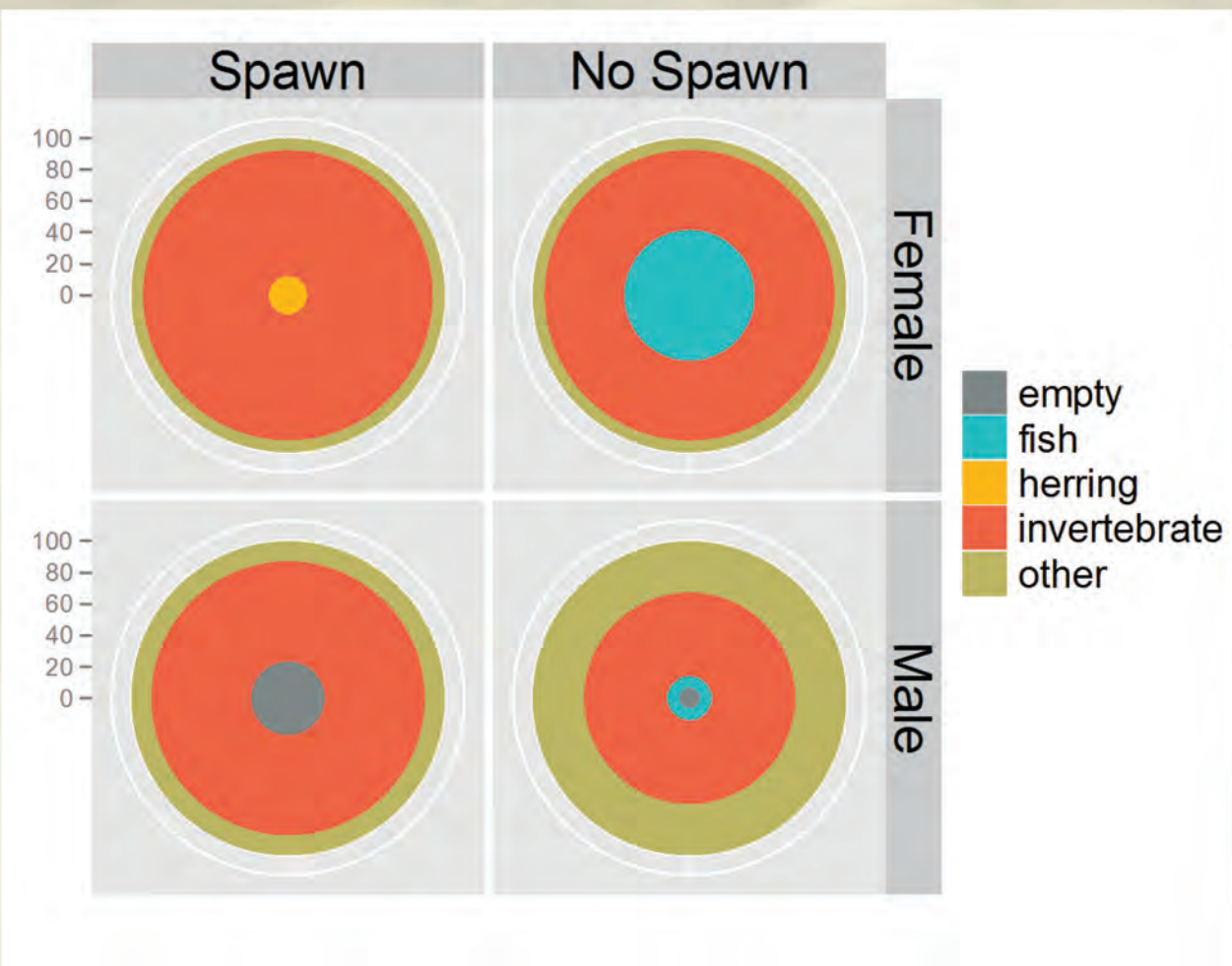


GLM (binomial distribution) models:

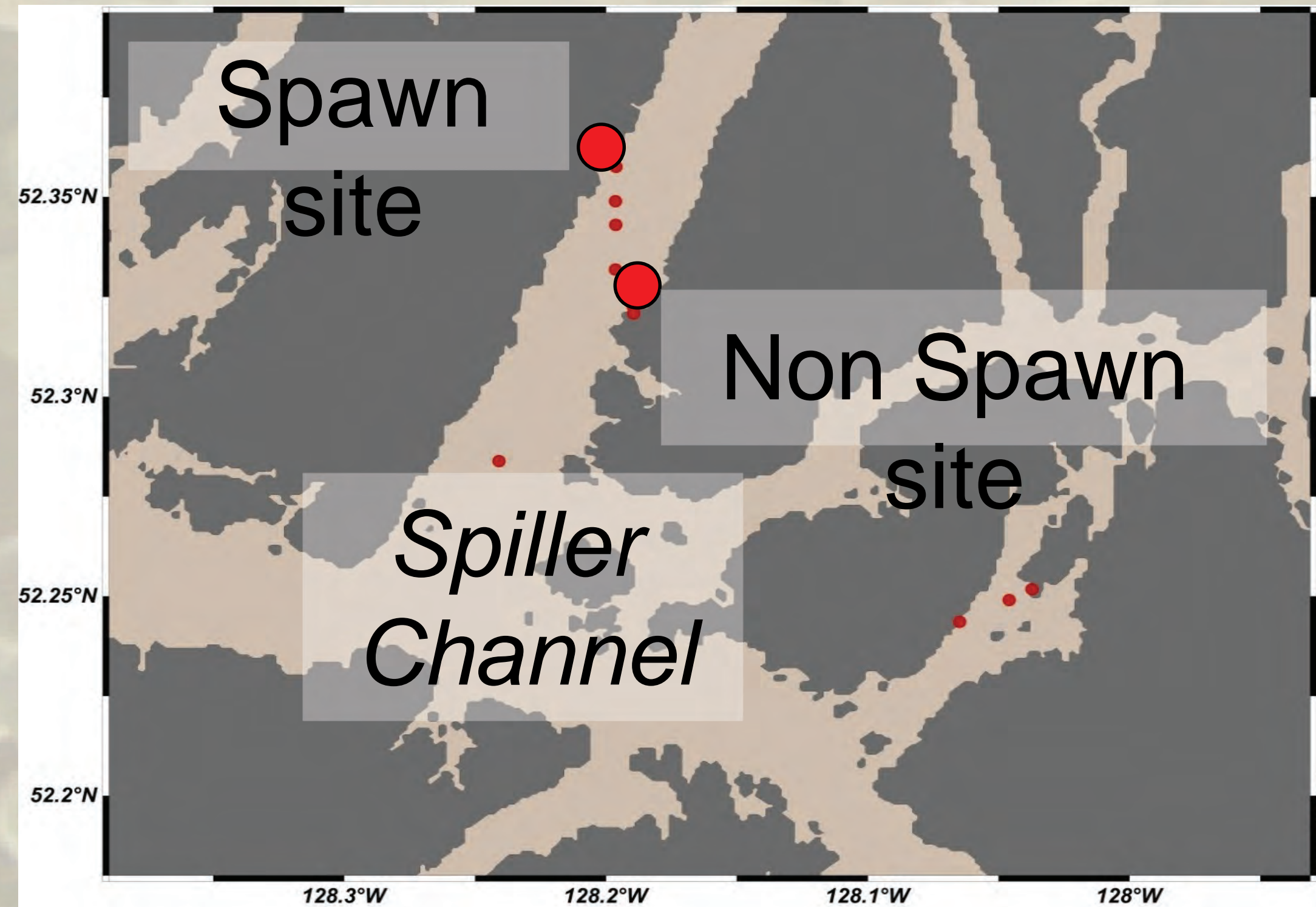
% Roe in Rockfish Stomachs ~ Time * Site * Sex

	K	AICc	Delta_AICc	AICcWt
Site x Time	4	48.11	0.00	0.57
Full model	6	50.30	2.19	0.19
Site	2	50.82	2.71	0.15
Time	2	52.85	4.74	0.05
Sex x Time	4	55.06	6.95	0.02
Sex	2	55.87	7.76	0.01
Intercept only	1	57.63	9.52	0.00

6 & 9 weeks post-spawn

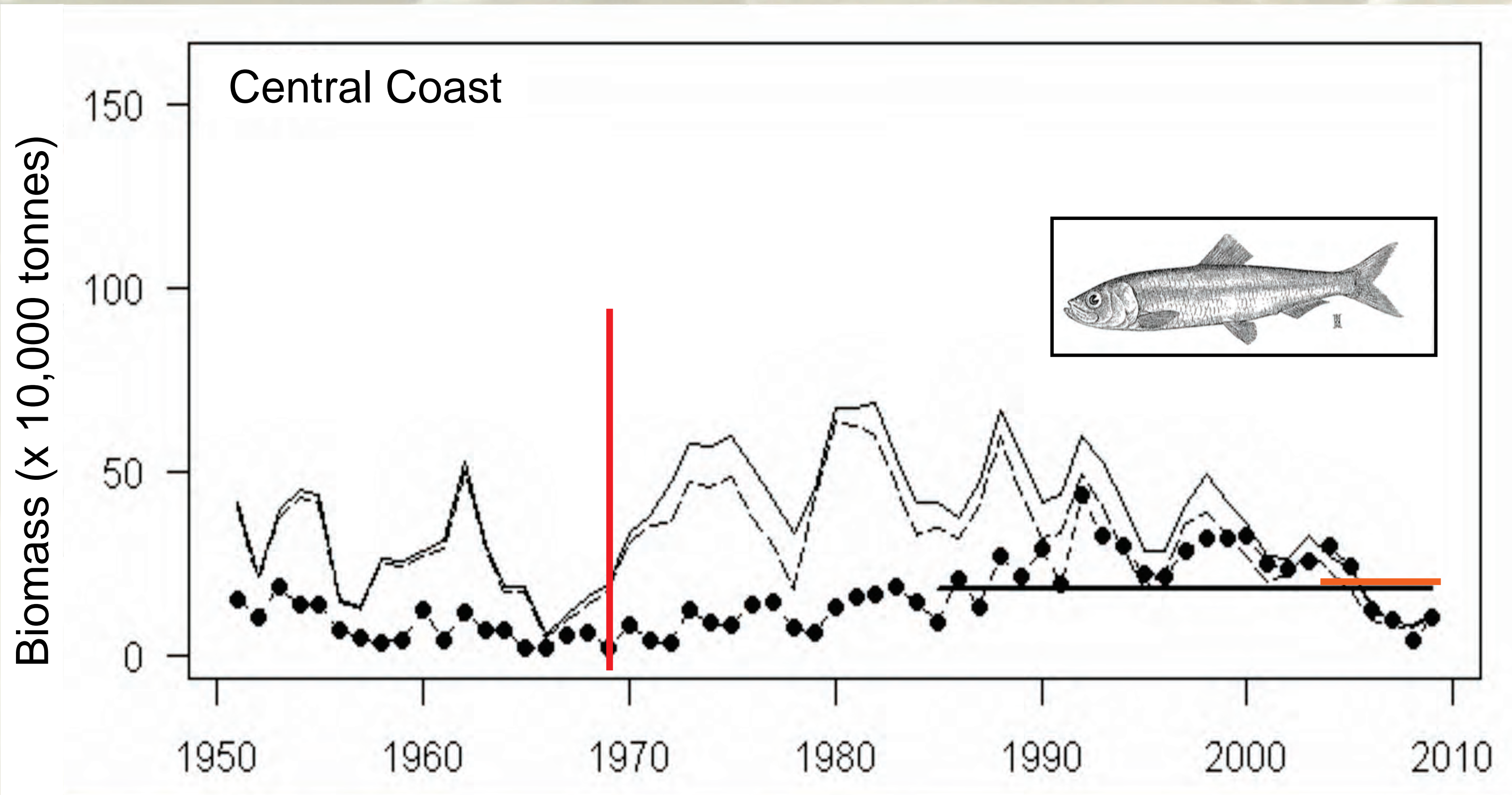


Rockfish Roe Predation study

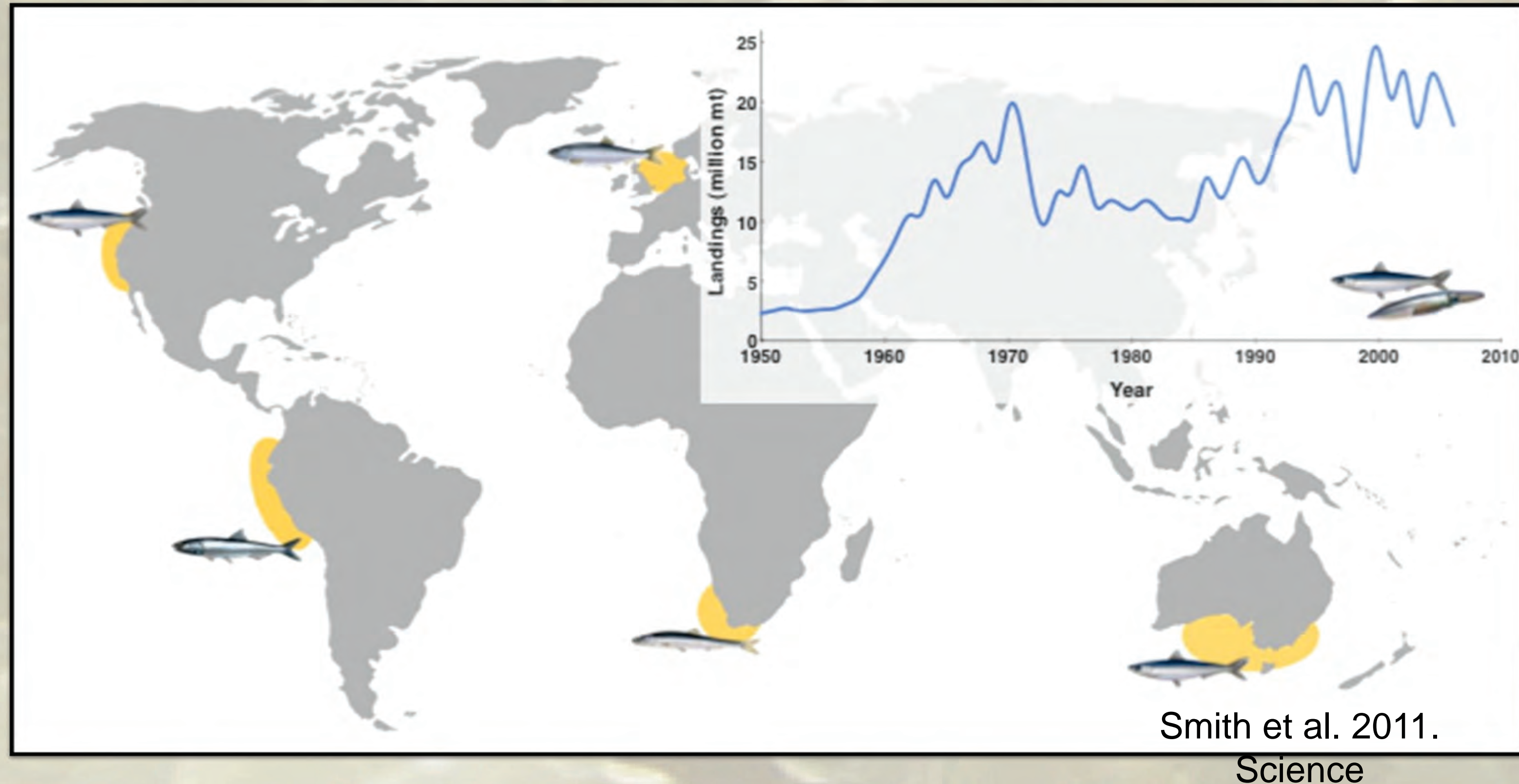


Fish Team: Mel Brown, Carl Wilson, Hudson Jackson (not shown), Stefan Dick, Brittany Keeling, Margot Hessing-Lewis, Clark Housty

Pacific herring in Canada



Low trophic level fisheries are key ecosystem linkages



- Increased catch in the past 60 years
- 30 % global fisheries production
- Changes in low trophic levels affect many other species of fish, mammals and birds

Hakai Network's Herring School

- Marine ecology
- Oceanography
- Fisheries science
- Archaeology
- Genetics
- Anthropology
- Management: governance & co-management

