

Ecological associations between structure-forming invertebrates and demersal fishes on Heceta Bank, Oregon

W Waldo Wakefield

NOAA National Marine Fisheries Service
Northwest Fisheries Science Center
Newport, OR USA

Brian N. Tissot

Environmental Science & Regional Planning
Washington State University Vancouver
Vancouver, WA USA



Oregon State
UNIVERSITY

OSU

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Pacific Marine Environmental Laboratory
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S7: MEQ/FIS Topic Session

Coldwater biogenic habitat in the North Pacific

Co-Convenors:

Glen Jamieson (Canada), J. Anthony Koslow (U.S.A.) and Jin Yeong Kim (Korea)

This session welcomes presentations that describe:

- 1) distributions of deepwater biogenic habitat in the PICES regions;
- 2) threats to biogenic habitat species in the area;
- 3) the ecological role of biogenic structures as habitat for commercial and other species; and
- 4) the management measures applied or developed to conserve these species and the habitat they provide.

Groundfish Survey Approaches

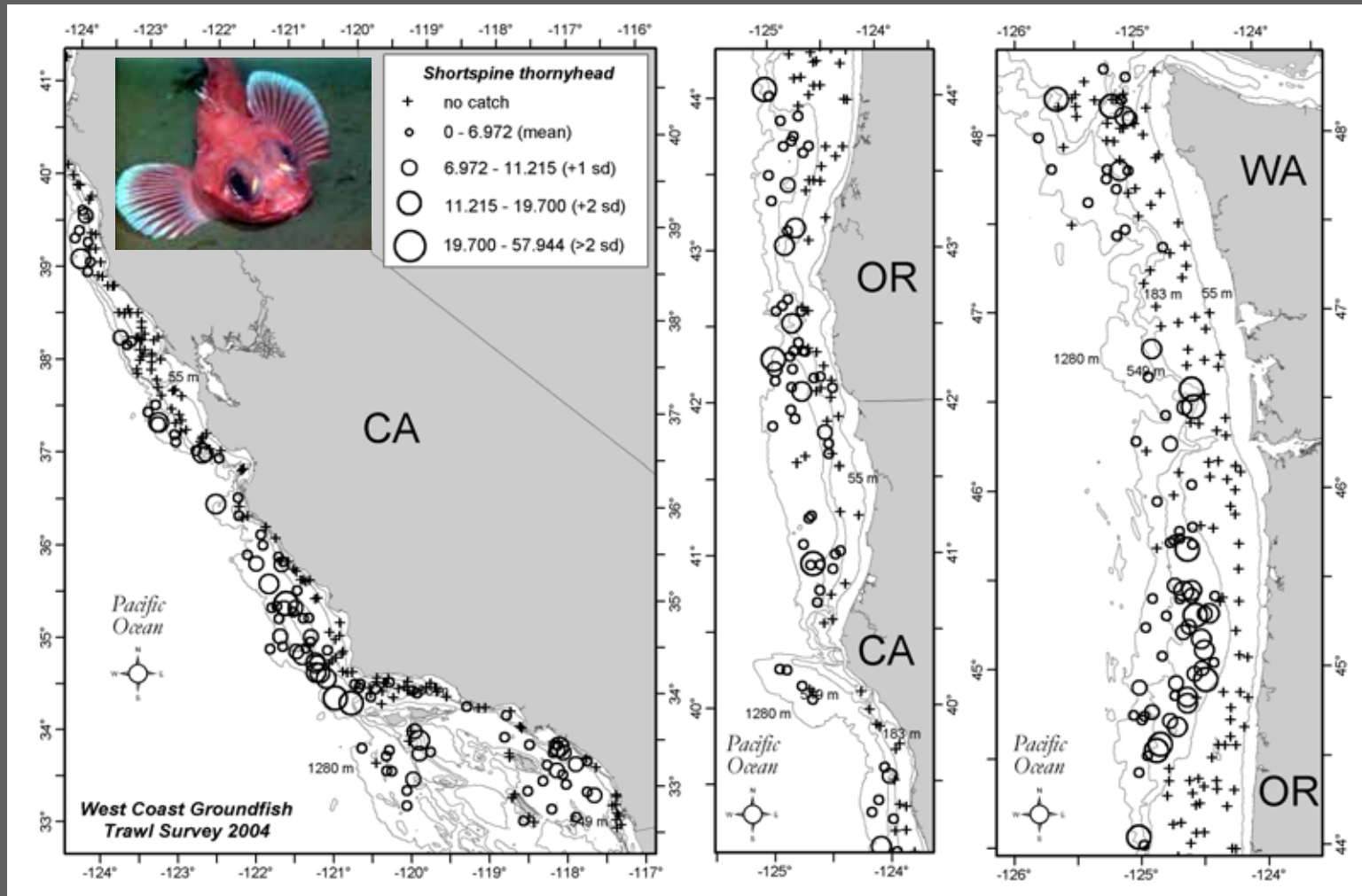


Swept-Area Bottom
Trawl Surveys



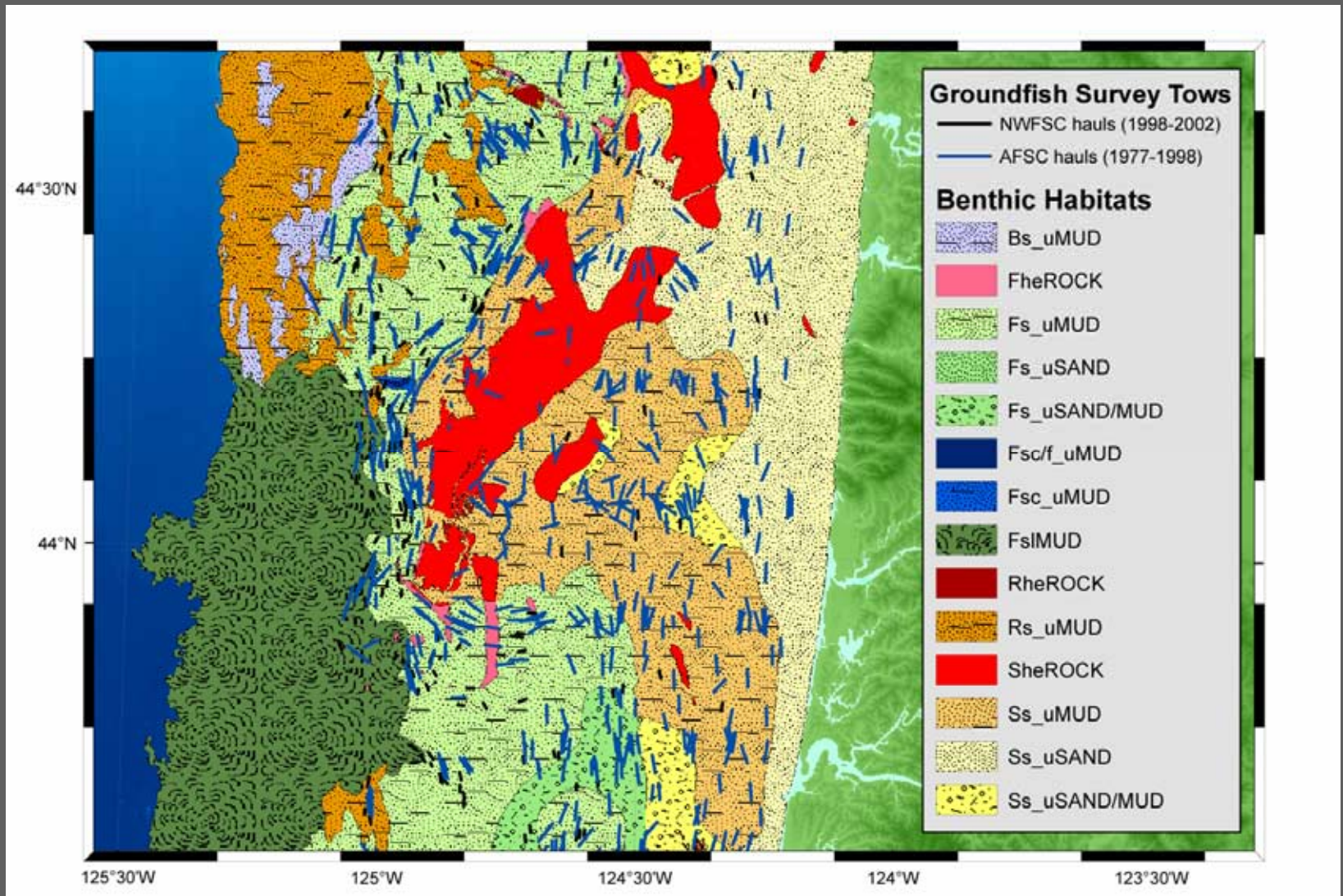
Groundfish Survey Approaches

Calculate CPUE for key groundfish species along the West Coast



NMFS NWFSC Survey Group

Limited in scope by trawlable habitat ➡ rocky habitats largely unsurveyed



Interim Seafloor Lithology Maps for Oregon & Washington v.1.0
Goldfinger et al. 2003, Active Tectonics & Seafloor Mapping Laboratory Pub. 02-01
College of Oceanic & Atmospheric Sciences – OR State Univ.

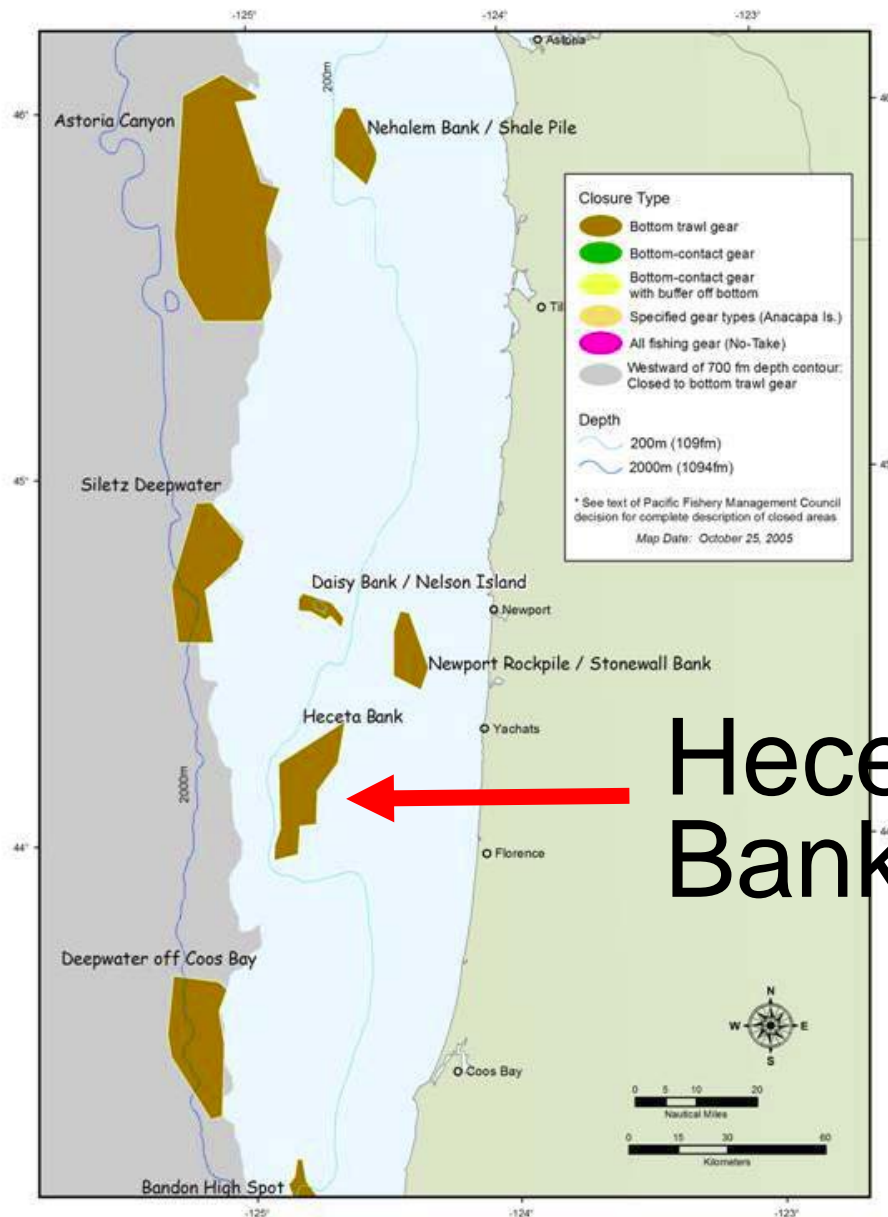
Study Area

- Deep-water rocky bank
- Most seaward portion of the continental shelf off the Pacific Northwest.
- 30 nm long by 10 nm wide
- 70 – 205 m water depth



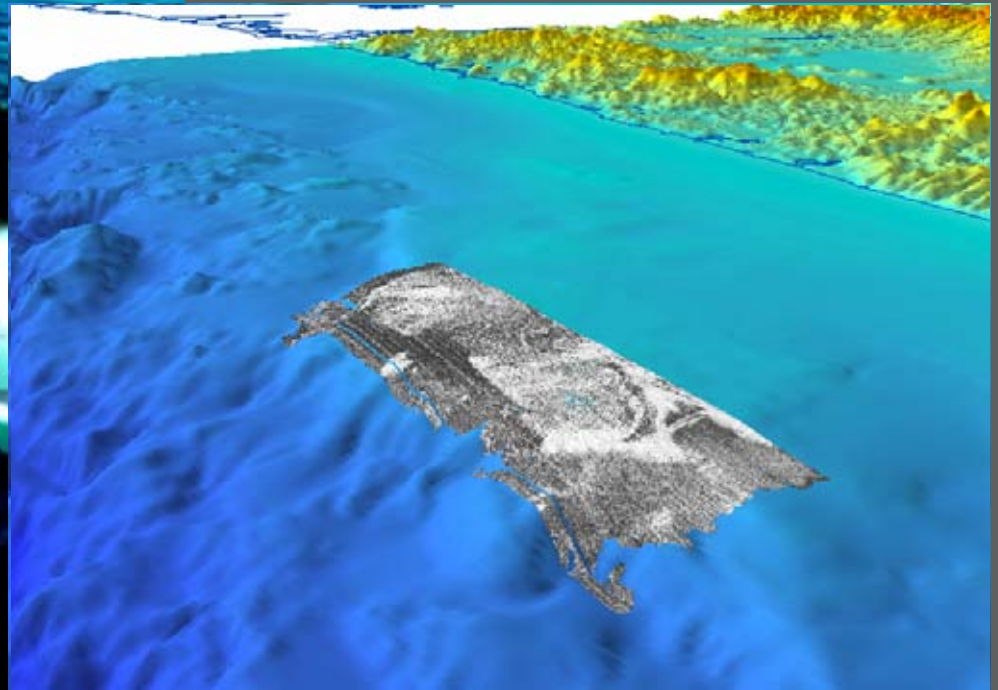
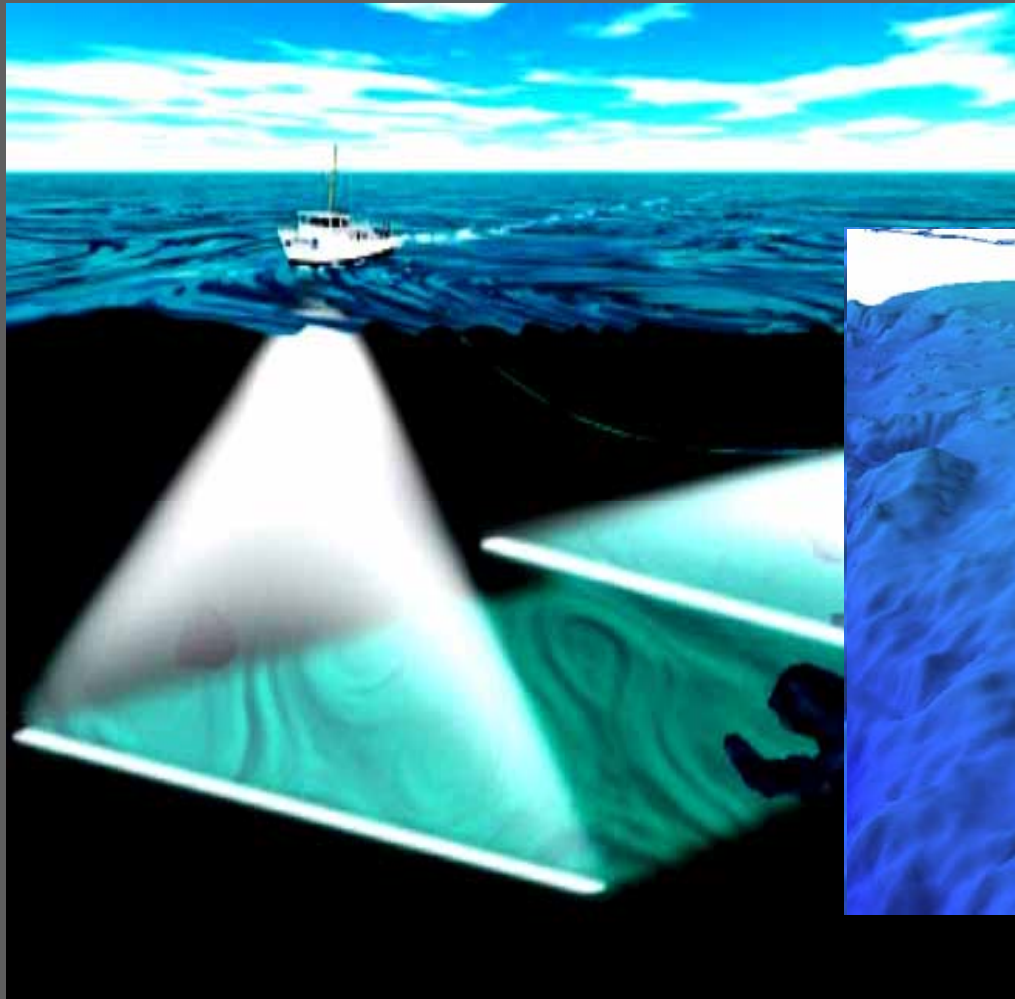
Ecologically
important areas
with gear
closures

Heceta
Bank



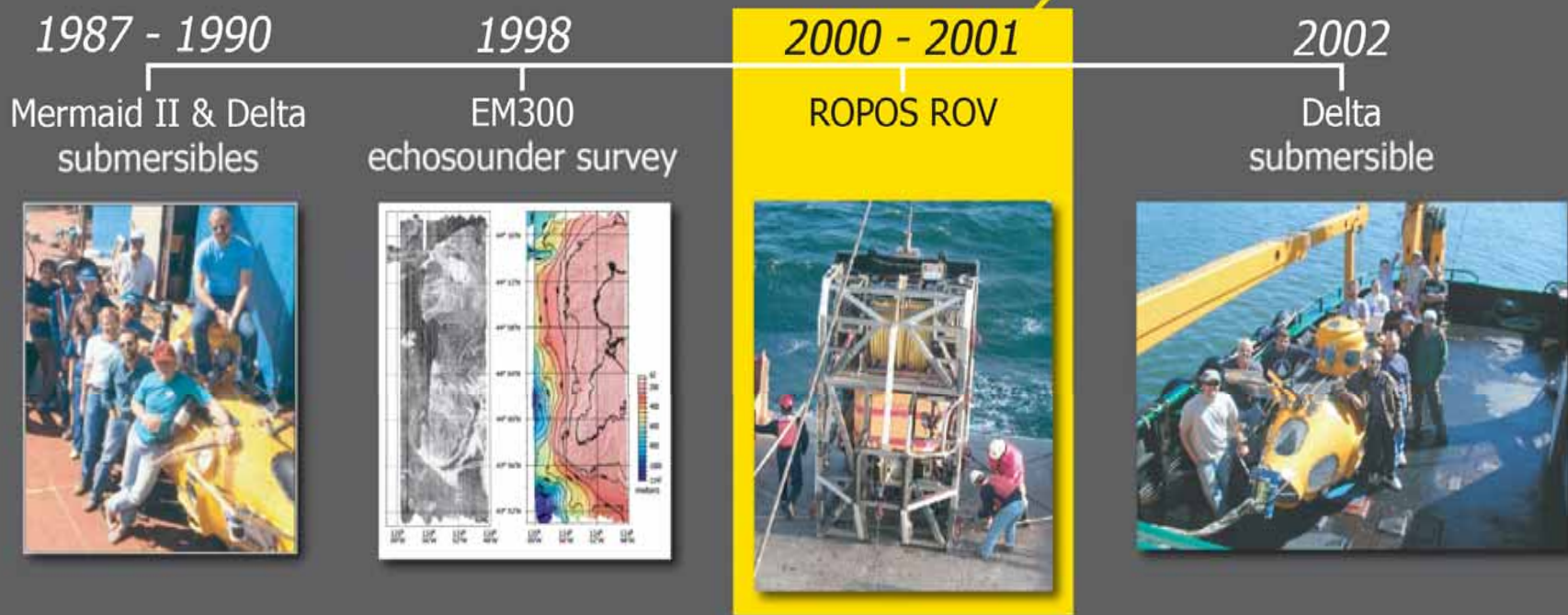
Seafloor Mapping

Both multibeam and sidescan echosounders



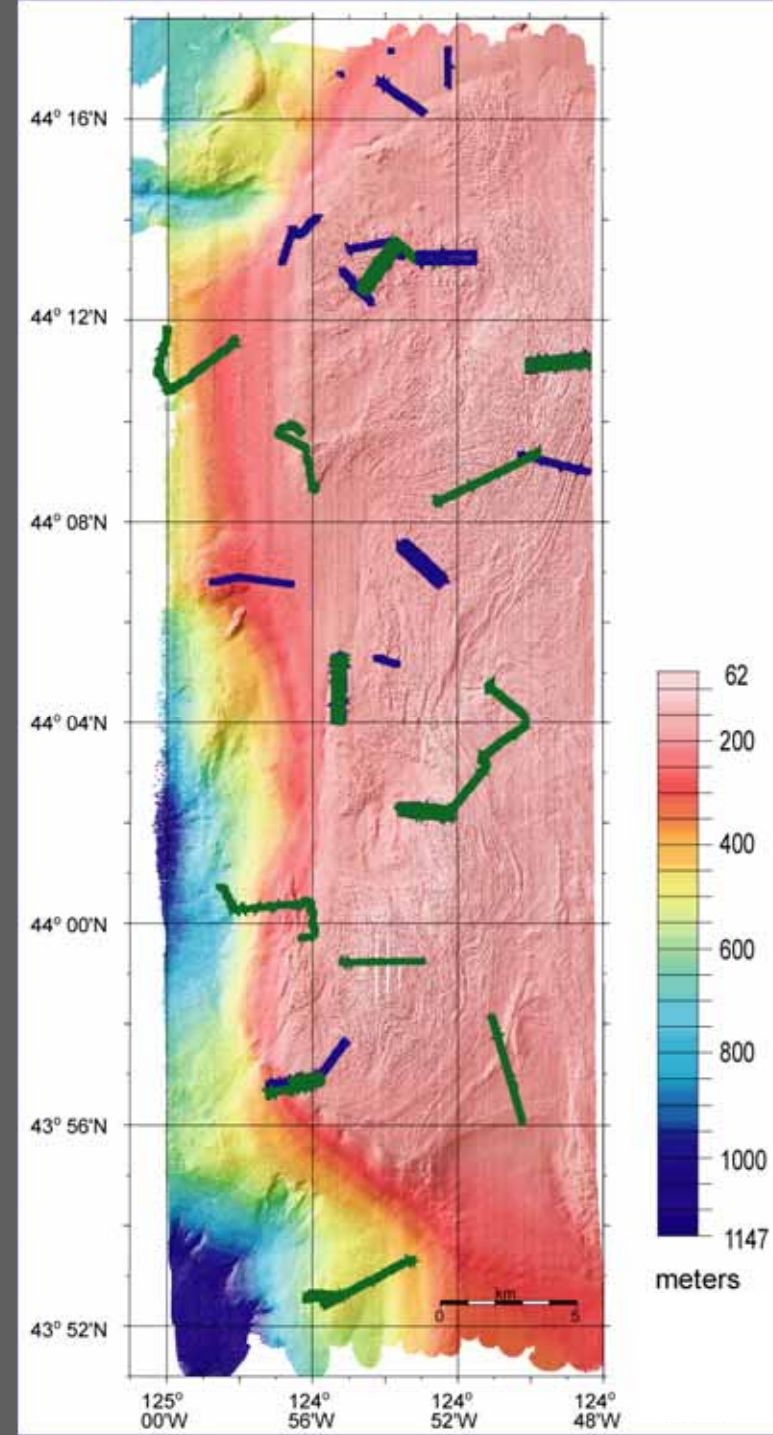
Case Study: Background

Investigations on Heceta Bank: a look at the past decade



Direct observation surveys and mapping efforts

- **1987:** *Mermaid II* submersible
10 dives examining fish-habitat relationships (Pearcy et al. 1989)
- **1988 – 1990:** Historical *Delta* submersible surveys
43 dives at 6 stations
(Hixon et al. 1991, Stein et al. 1992)
- **1998:** EM300 echosounder survey
High-resolution bathymetry (5-m gridded data) and backscatter imagery of bank
- **2000 & 2001:** *ROPOS* ROV
Repeat 5 historical stations & explore 13 new sites on the bank



Habitat Classification

Binary habitat classification system (after Hixon et al. 1991)

First letter

Primary substrate
> 50% FOV

Second letter

Secondary substrate
>20% FOV

Example: MC >50% mud, >20% cobble

Definition: habitat patches >30 sec. (min patch length ~450-650 m)

increasing relief

R: rock ridge



B: boulder



>25.5 cm

C: cobble



25.5 – 6.4 cm

P: pebble



6.4 – 0.4 cm

S: sand



2 – 0.06 mm

M: mud

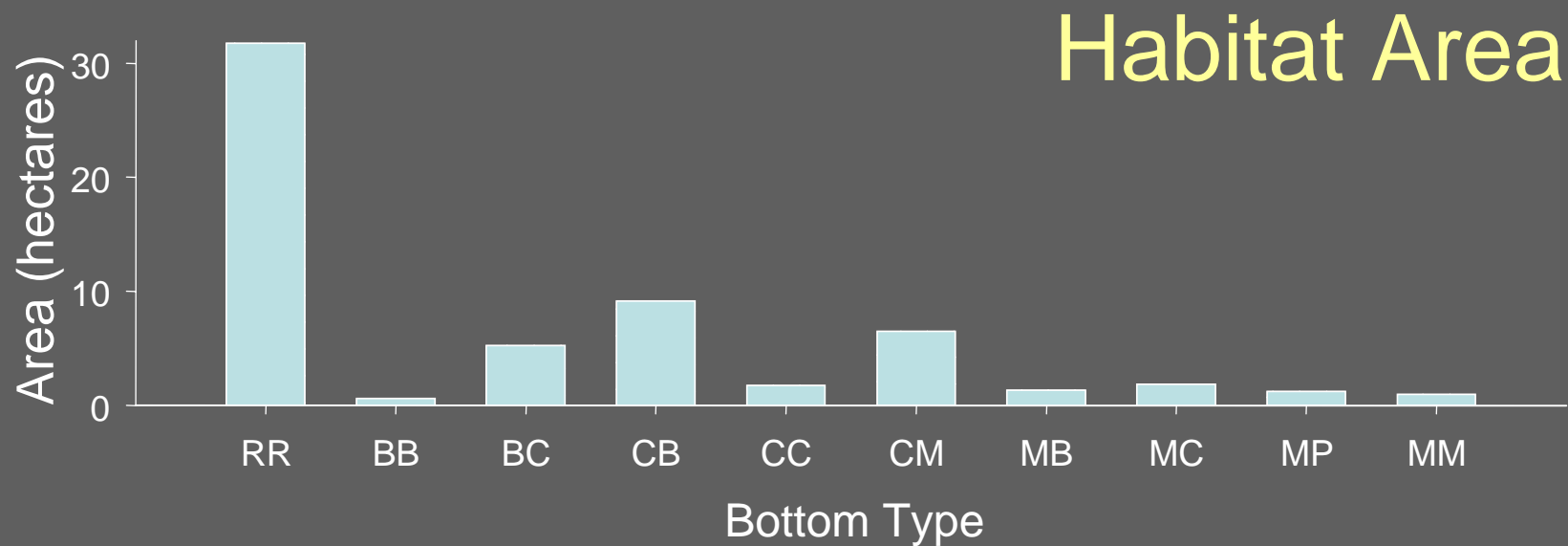
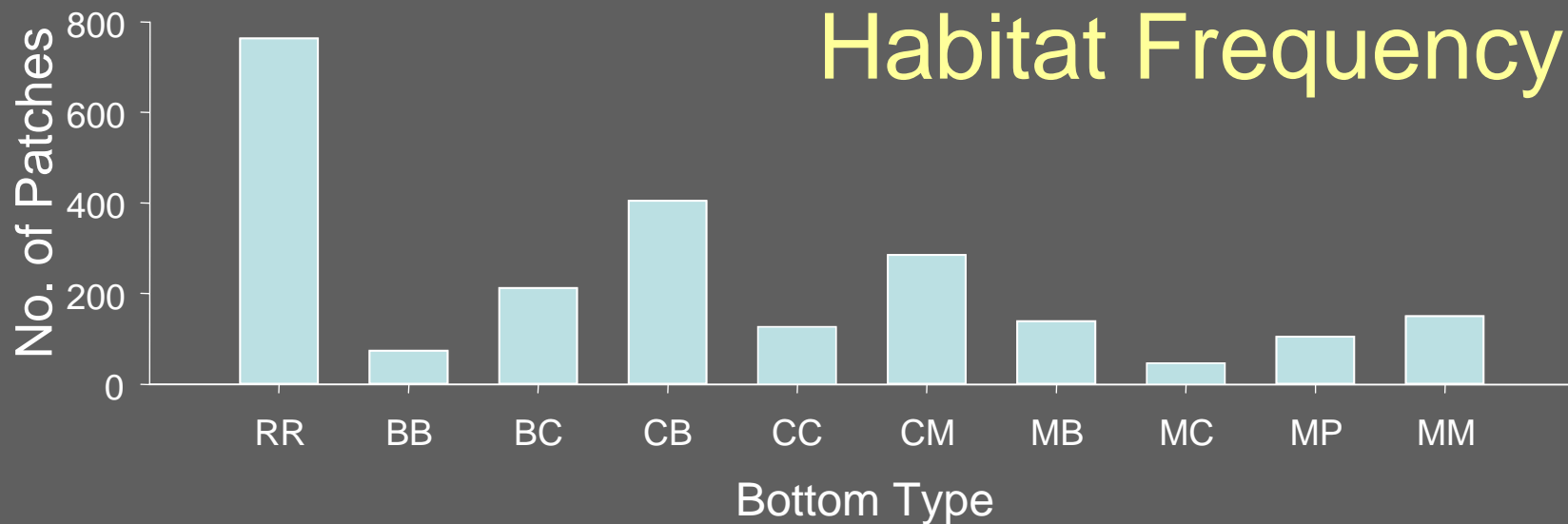


<.06 mm

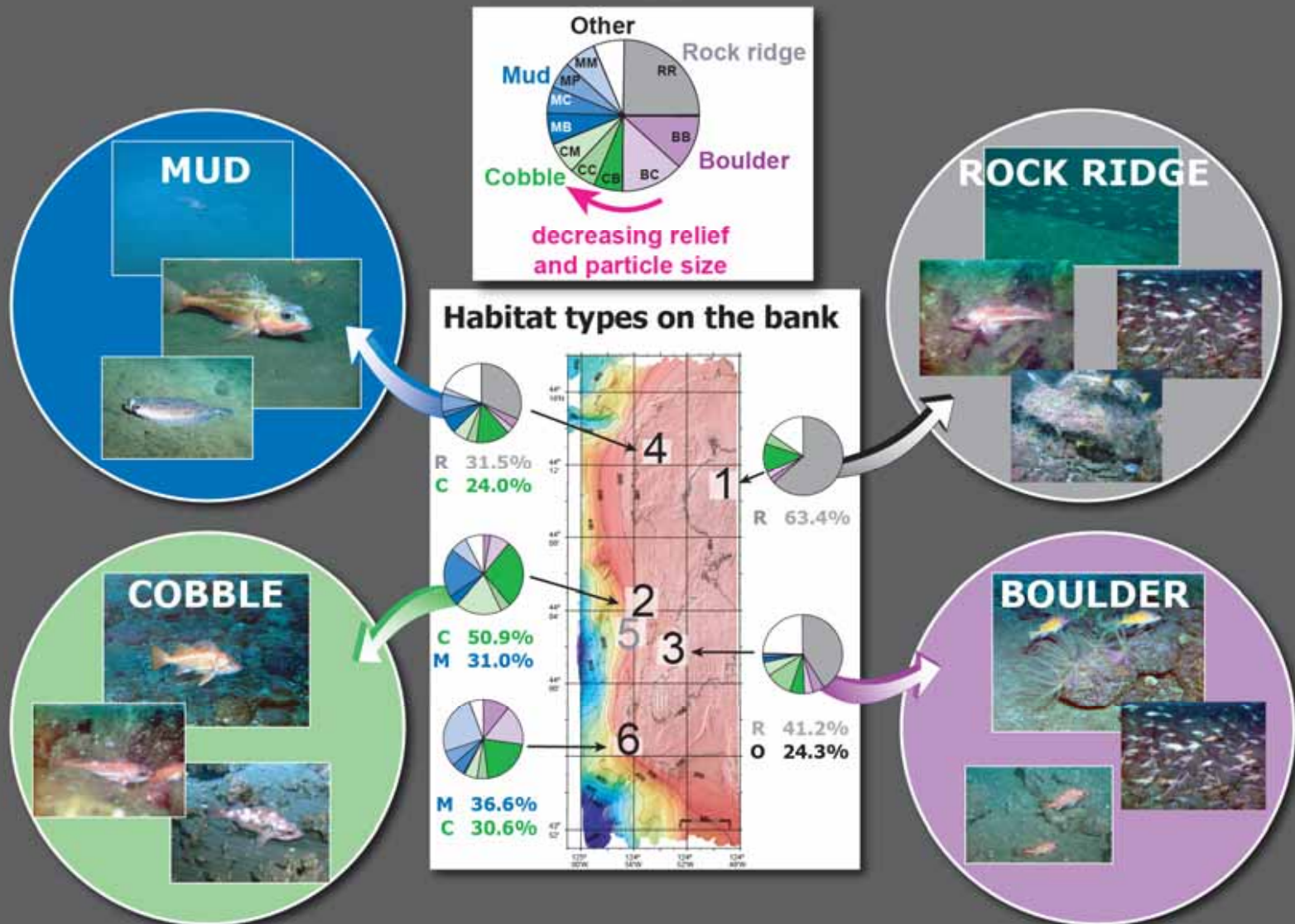
decreasing particle size

Fish Density by Habitat Type

1. A total of 37 habitat types were combined into 10 dominant habitat types.
2. Examine the distribution of those habitats across the bank.
3. Determine habitat-specific abundances for groundfish species.

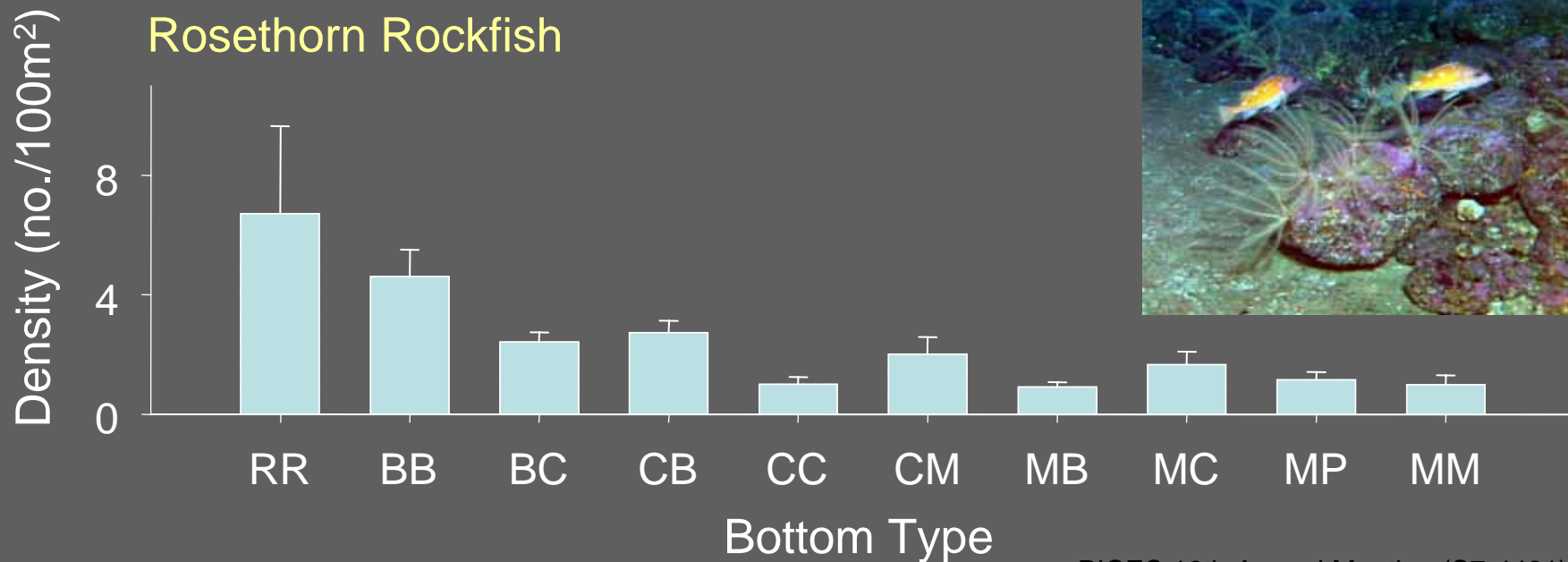
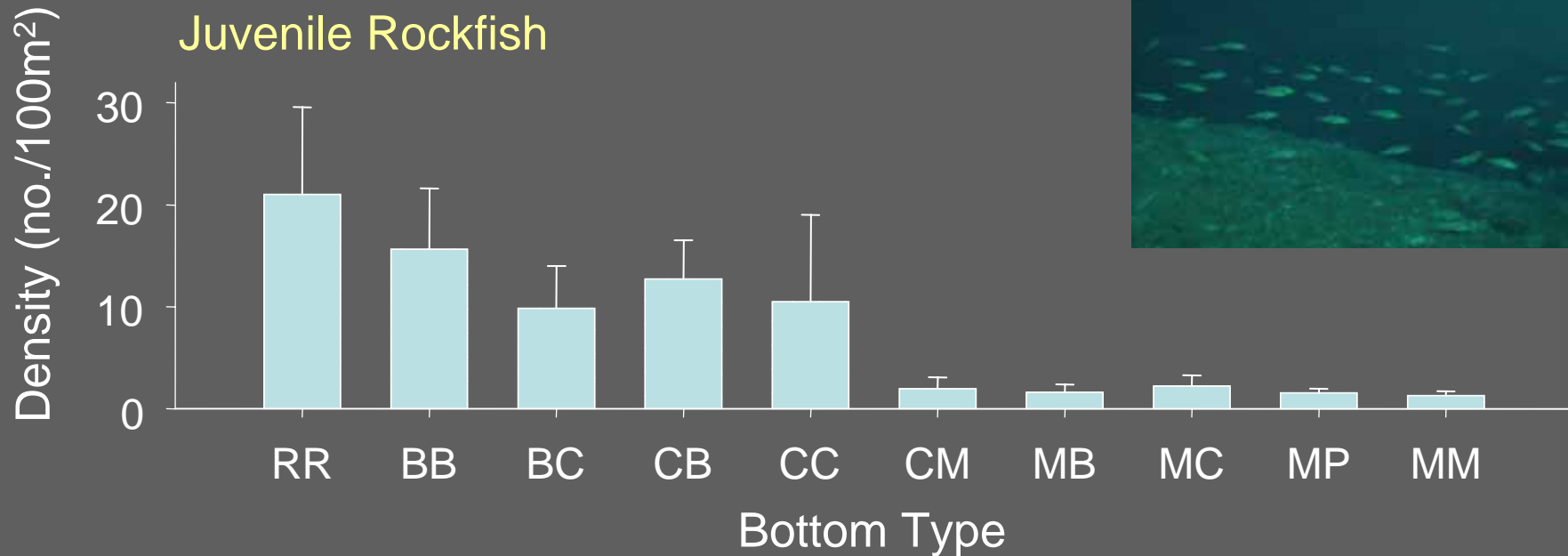


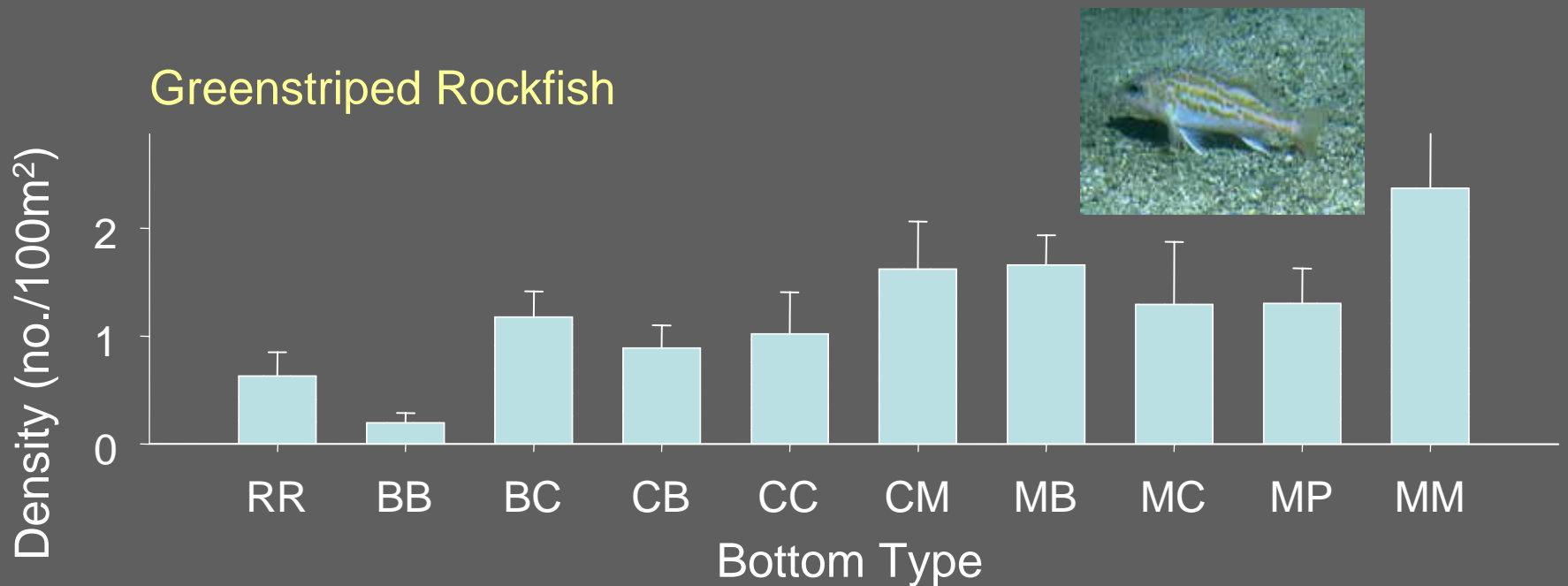
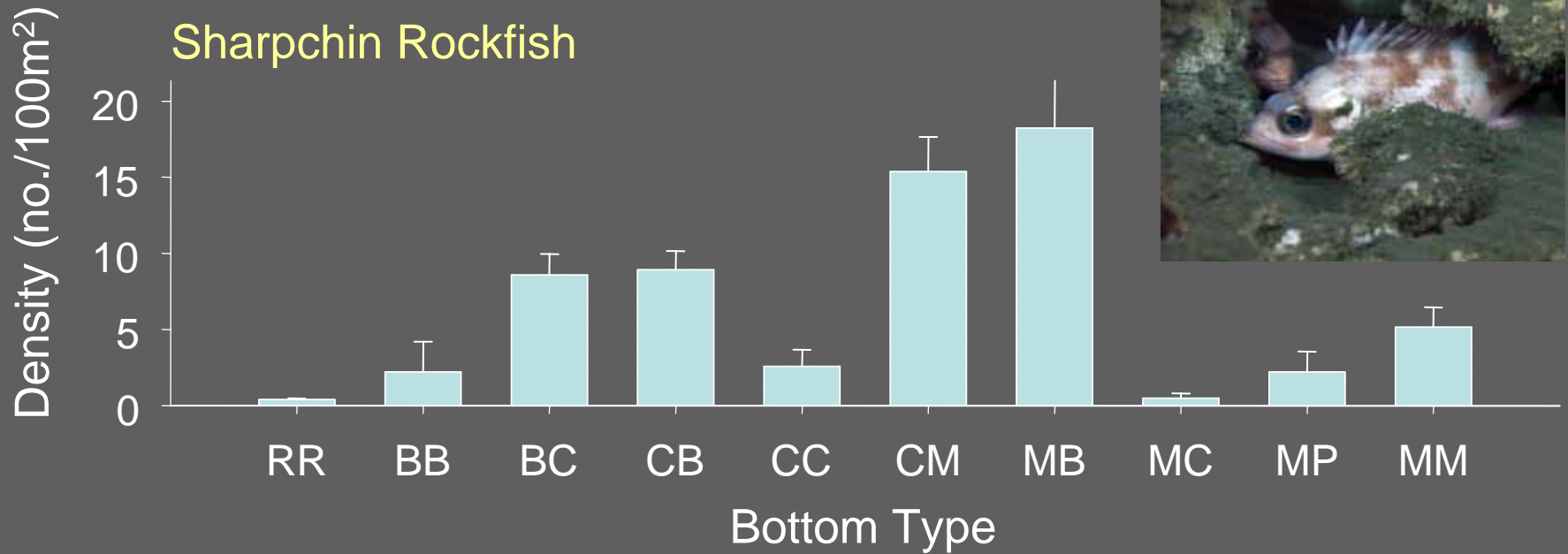
RESULTS: ROPOS Surveys 2000 / 2001



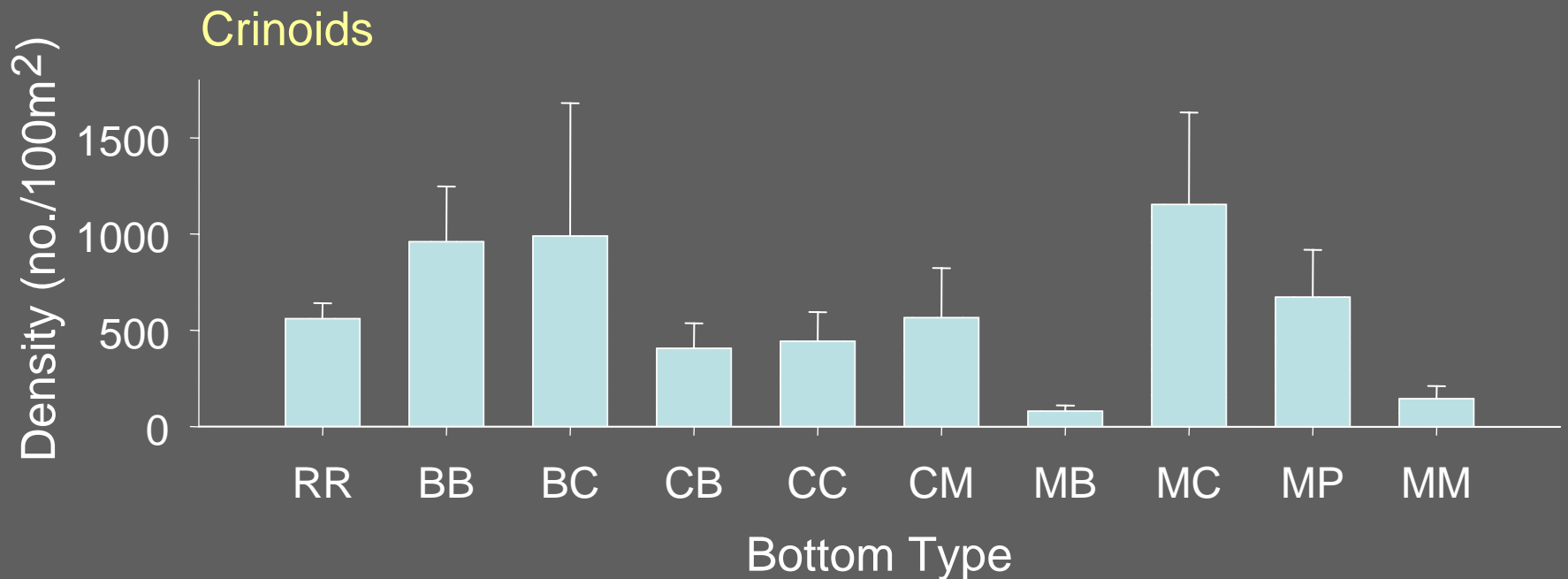
Direct Counts of Common Demersal Fishes Enumerated on Bank

Fish Taxa	N	%	Cumulative %
pygmy/Puget Sound rockfish	19682	31.1	31.1
sharpchin rockfish	14513	22.9	54.0
unidentified juvenile rockfish	11911	18.8	72.8
unidentified rockfish	6113	9.6	82.4
rosethorn rockfish	2713	4.3	86.7
yellowtail rockfish	1917	3.0	89.7
Dover sole	1063	1.7	91.4
greenstriped rockfish	959	1.5	92.9
redstripe rockfish	512	0.8	93.7
unidentified small flatfish	365	0.6	94.3
spotted ratfish	317	0.5	94.8
unknown hagfish	303	0.5	95.3
unidentified fish	288	0.5	95.7
unidentified mottled sculpin	279	0.4	96.2
unidentified mottled poacher	269	0.4	96.6
<i>** additional 45 taxa</i>	2155	0.4	100.0
Total number counted (61 taxa)	63359		

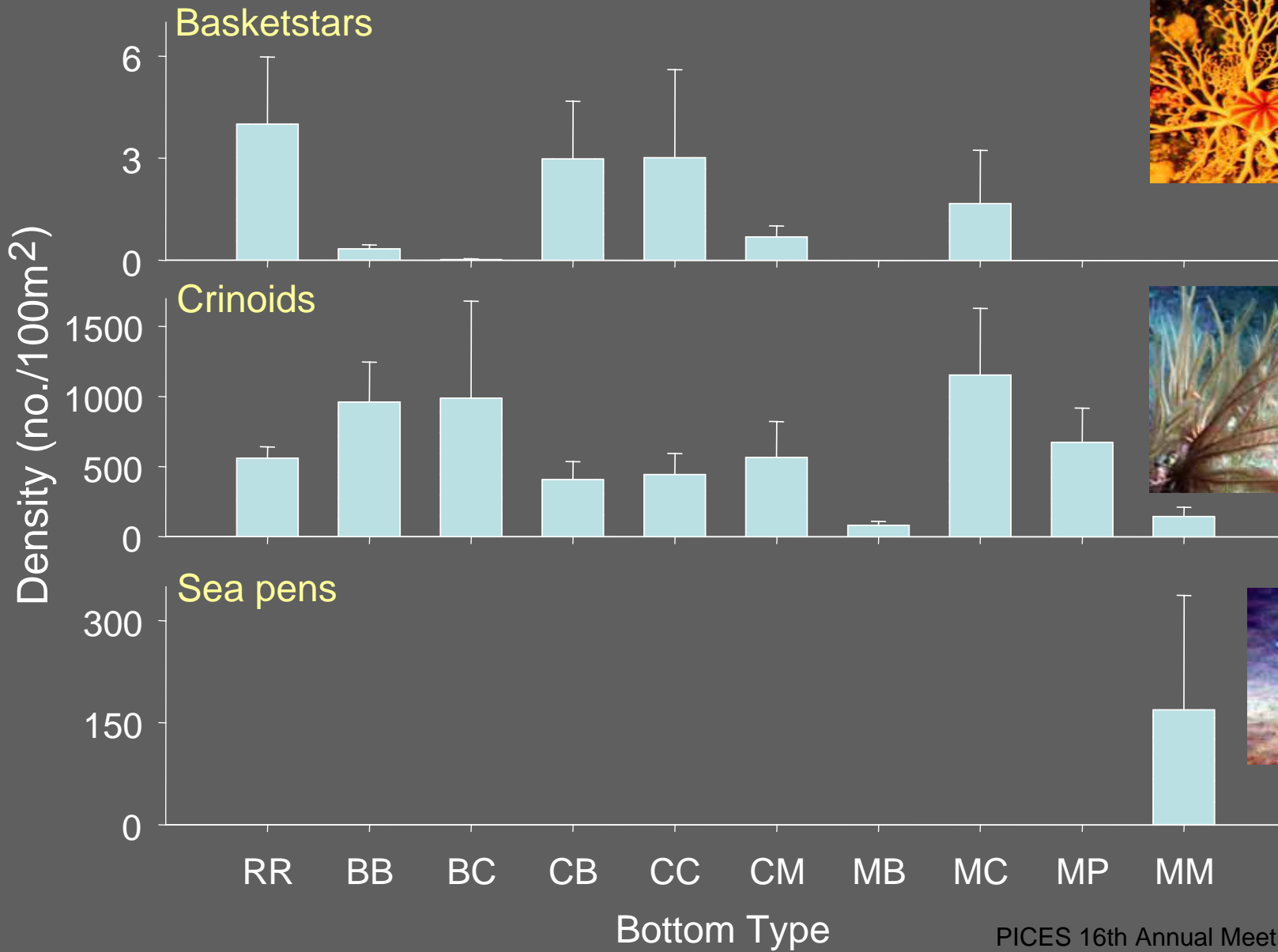




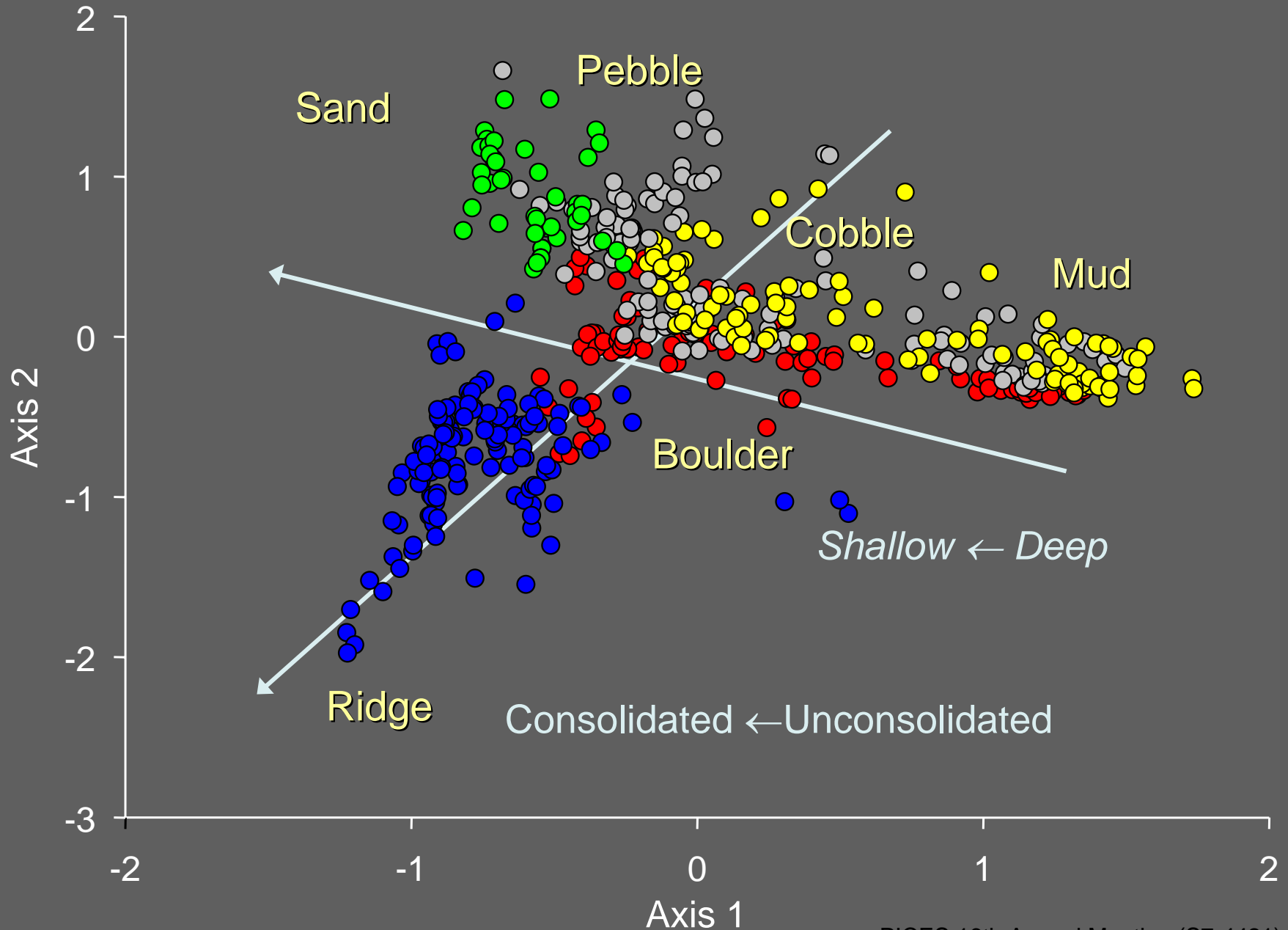
Invertebrate-Habitat Assessment



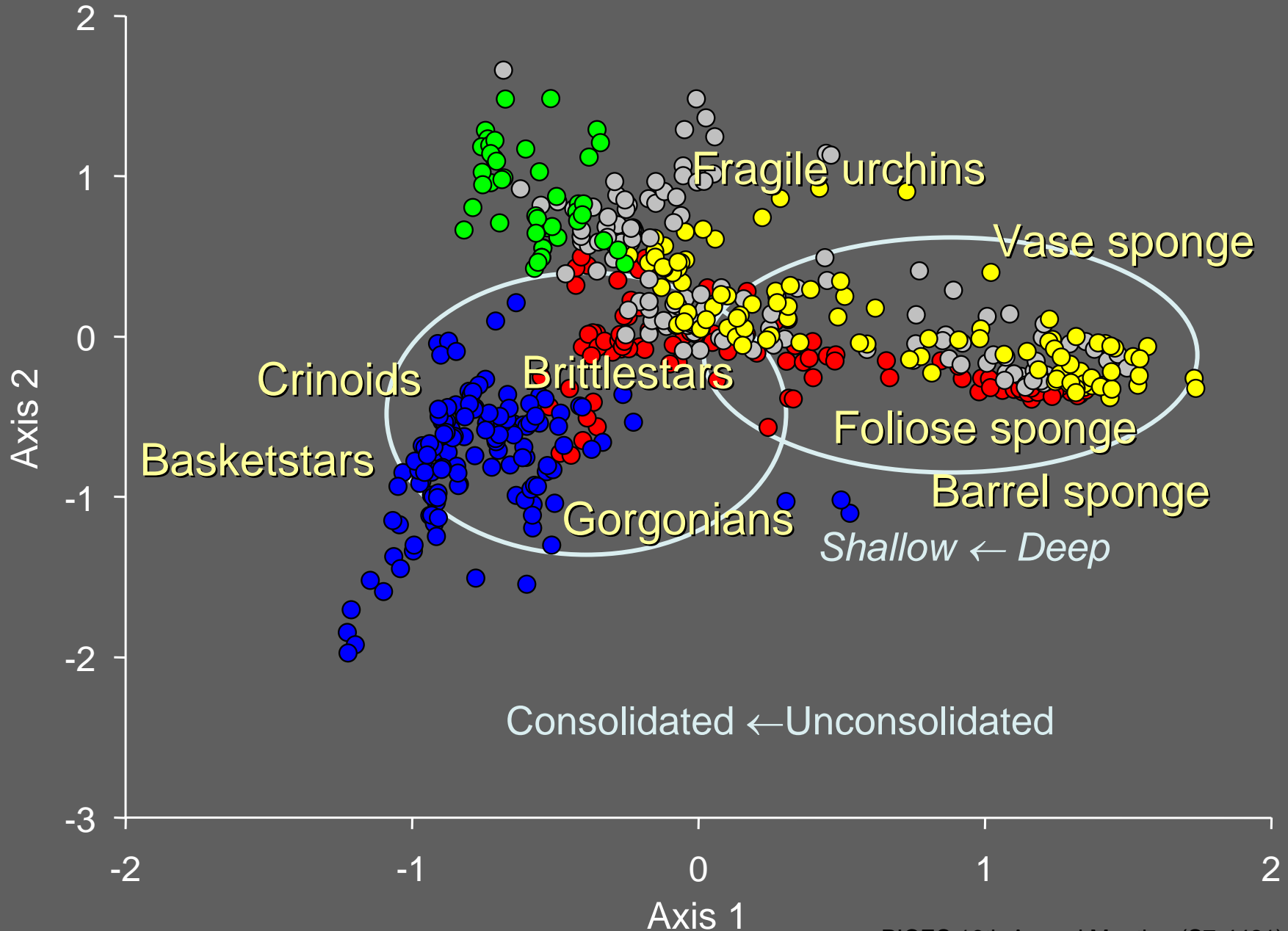
Invertebrate-Habitat Assessment



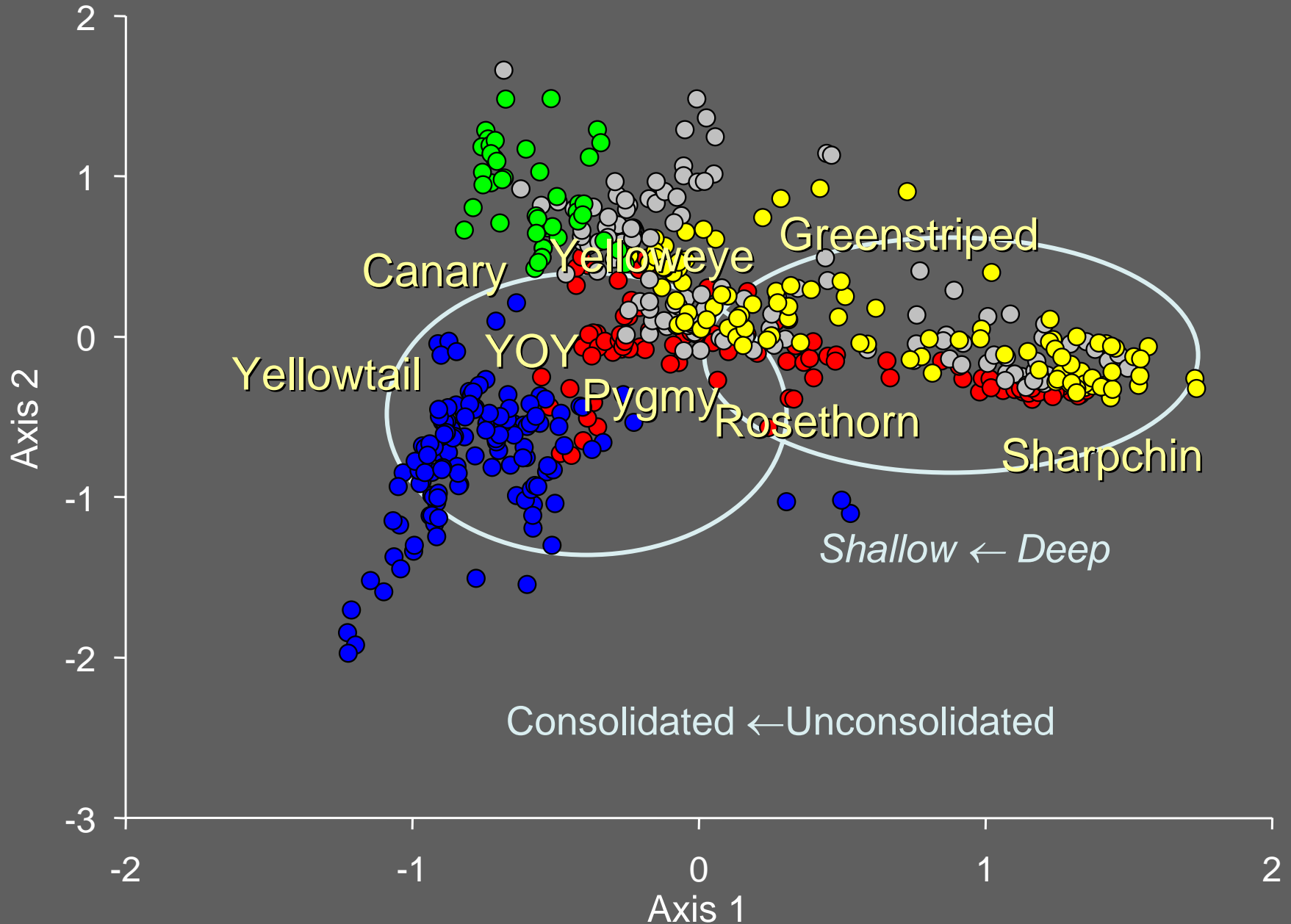
Correspondence analysis: habitats



Correspondence analysis: invertebrates



Correspondence analysis: fishes



Rockfish-invertebrate associations

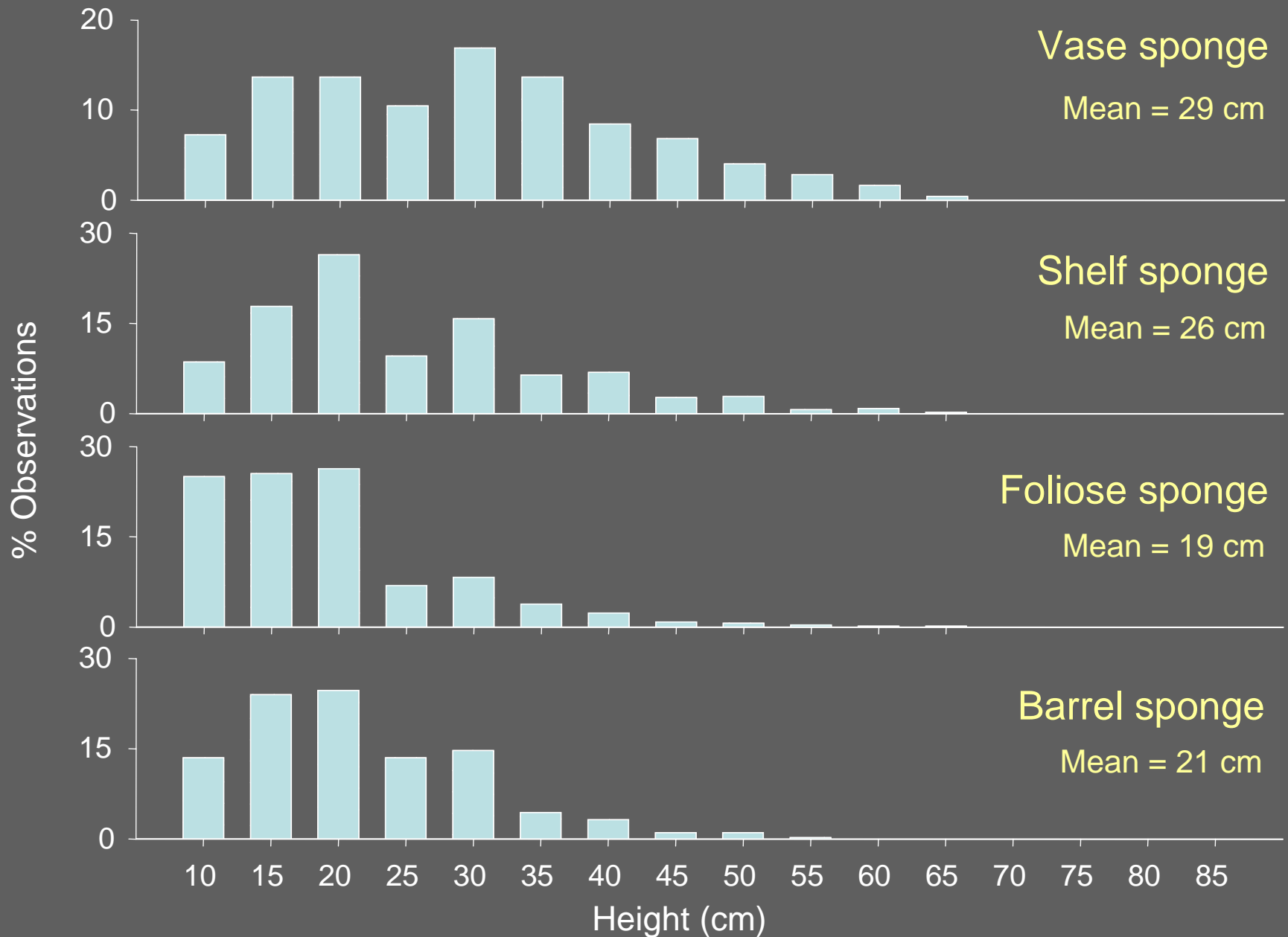
<u>Taxa</u>	<u>N</u>	<u>None</u>	<u>< 1 body length</u>	<u>Contact</u>
Vase sponge	249	93%	3%	4%
Foliose sponge	2770	98%	1%	1%
Barrel sponge	600	96%	3%	1%
Shelf sponge	1974	97%	2%	1%

Associated species: pygmy, sharpchin, rosethorn

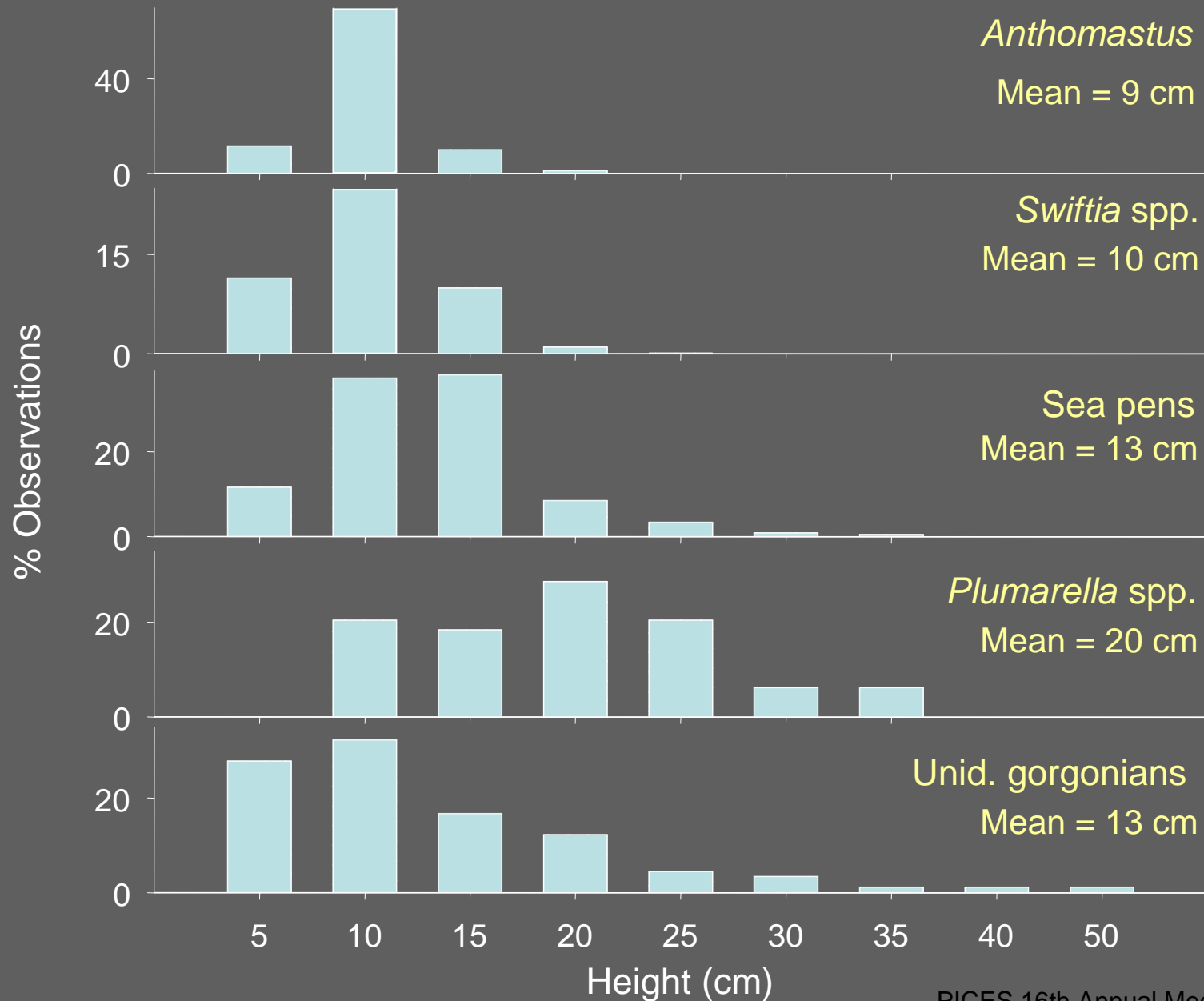
<i>Swiftia</i> spp.	816	99%	n/a	1%
Unid. gorgonians	90	97%	n/a	3%
Sea pens	1259	99%	n/a	<1%

Associated species: sharpchin, rosethorn

Sponge sizes



Coral sizes

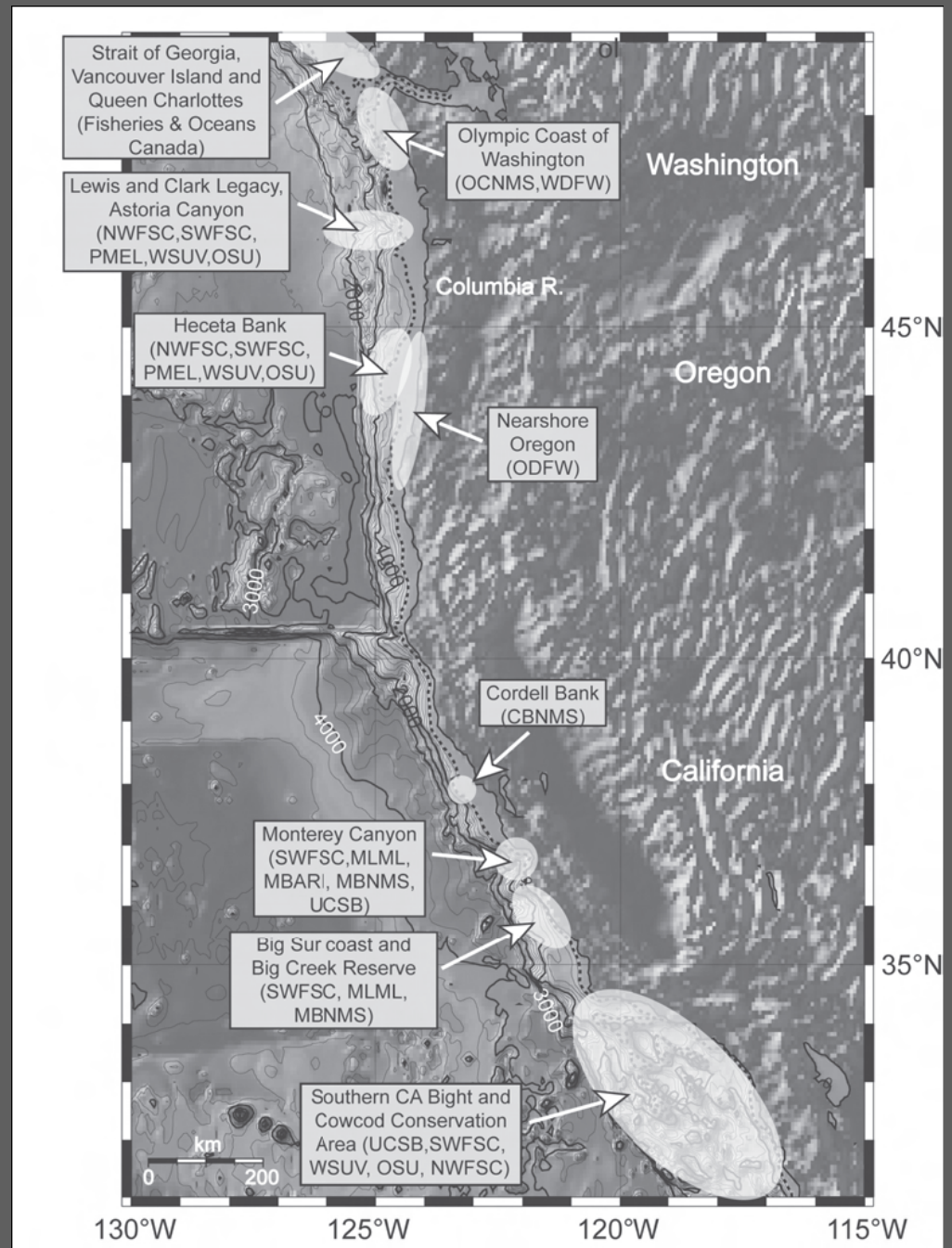


Conclusions

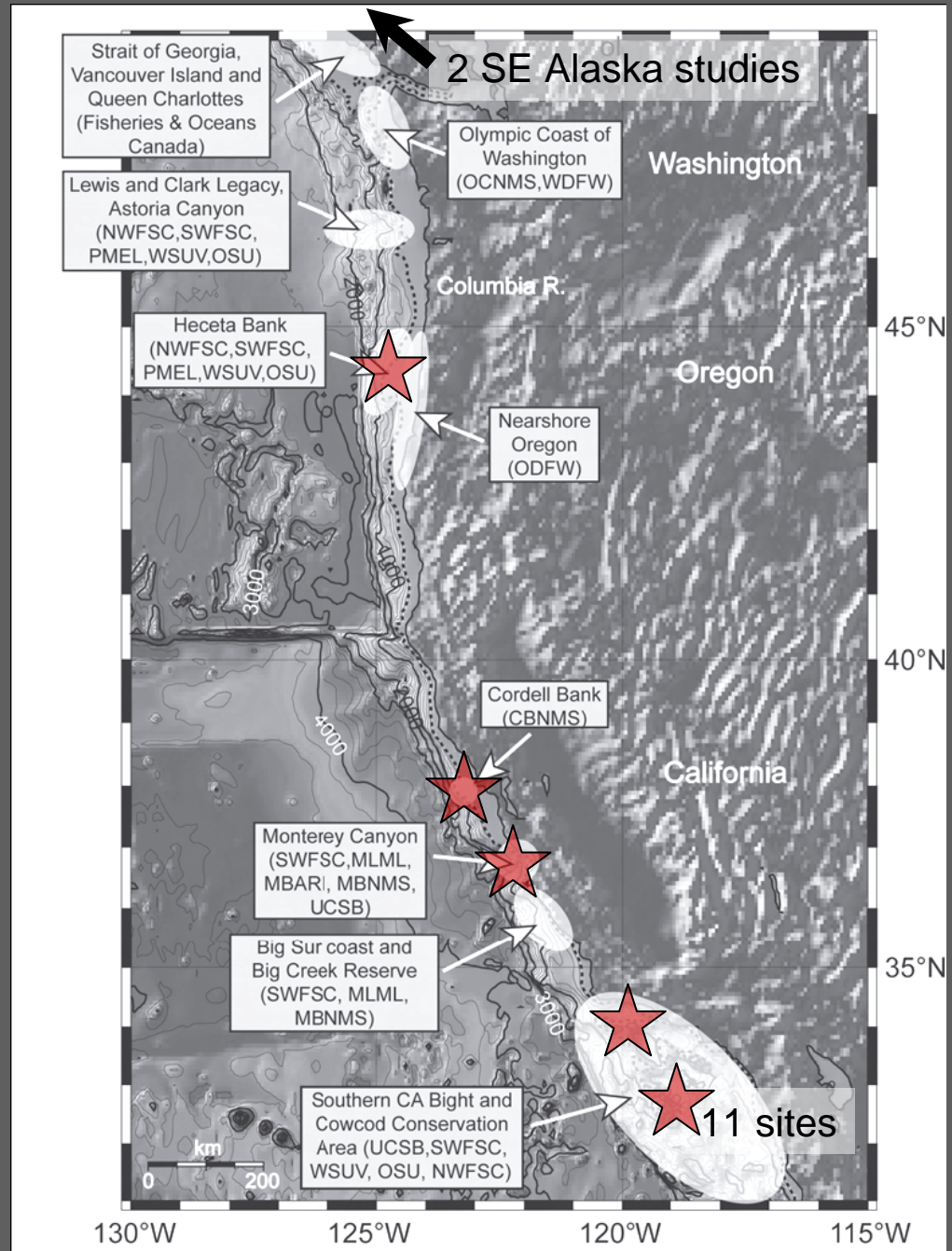
- Species are distributed across distinct habitat types
- Fishes, sponges and gorgonians co-occur in unique communities
- Likely that species co-occur in similar habitats
- For Heceta Bank, few associations were observed, more with larger sponges/corals

When are invertebrates biogenic habitat?

A growing network of sites along the west coast of North America where advanced technologies for seafloor mapping and direct observation are supporting ongoing habitat-based groundfish research.



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When are invertebrates biogenic habitat?

Location	Max. size (m)	Invert density (no.100m ²)	Fish density (no.100m ²)	Level of associations	Habitat
Aleutian Islands, Alaska (Stone, 2006)	> 4	123	349	High (>50%)	High relief
Southeastern Alaska <i>Primnoa</i> gorgonian (Bizzarro et al. in prep)	2.8	1.8	16	High (> 50%)	High-moderate relief
Southern California <i>Antipathes</i> gorgonian ("The Footprint") (Bright et al. in prep)	2.5	-	-	Moderate (13%)	Moderate relief
Carmel Canyon, California (Bianchi et al. in prep)	1	1.0	-	Moderate (~20%)	Moderate-low relief
Cordell Bank, California (Pirtle 2005)	1.5	4.3	28	Low (<5%)	High relief
Southern California (Tissot et al. 2006)	2.5	3.1	25	Low (<5%)	High-moderate relief
Heceta Bank, Oregon (Tissot et al. in prep)	0.6	0.8	13	Low (<5%)	High-moderate relief

When are invertebrates biogenic habitat?

- Size is necessary, but size alone is not sufficient to result in associations
- Density and habitat availability important

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