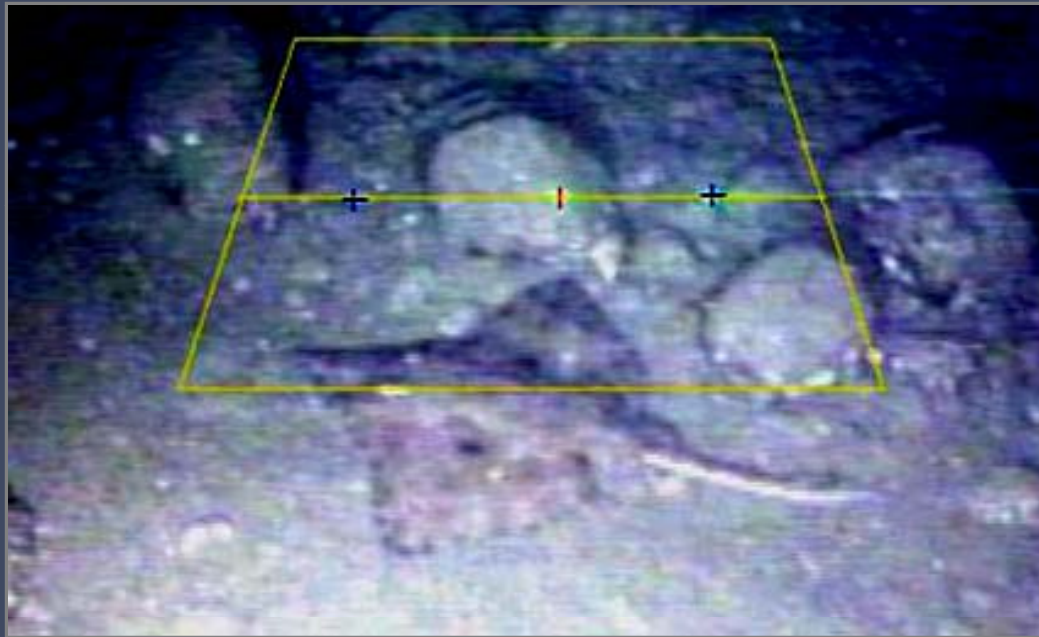


# Groundfish habitat associations from video survey with a submersible off the Washington state coast



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Washington Cooperative Fish & Wildlife Research Unit

April 20, 2005

# Background

## Pacific Coast groundfish populations:

- Include a diversity of species (rockfish, flatfish, hexagrammids)
- Are a major resource in commercial and recreational fisheries
- Have experienced significant declines



## Management concerns:

- Magnuson-Stevens Act (amended 1996)  
mandates designation of Essential Fish habitat for all managed species
- Limited knowledge of habitat use for groundfish populations

# Background

## Benthic groundfish habitat studies:

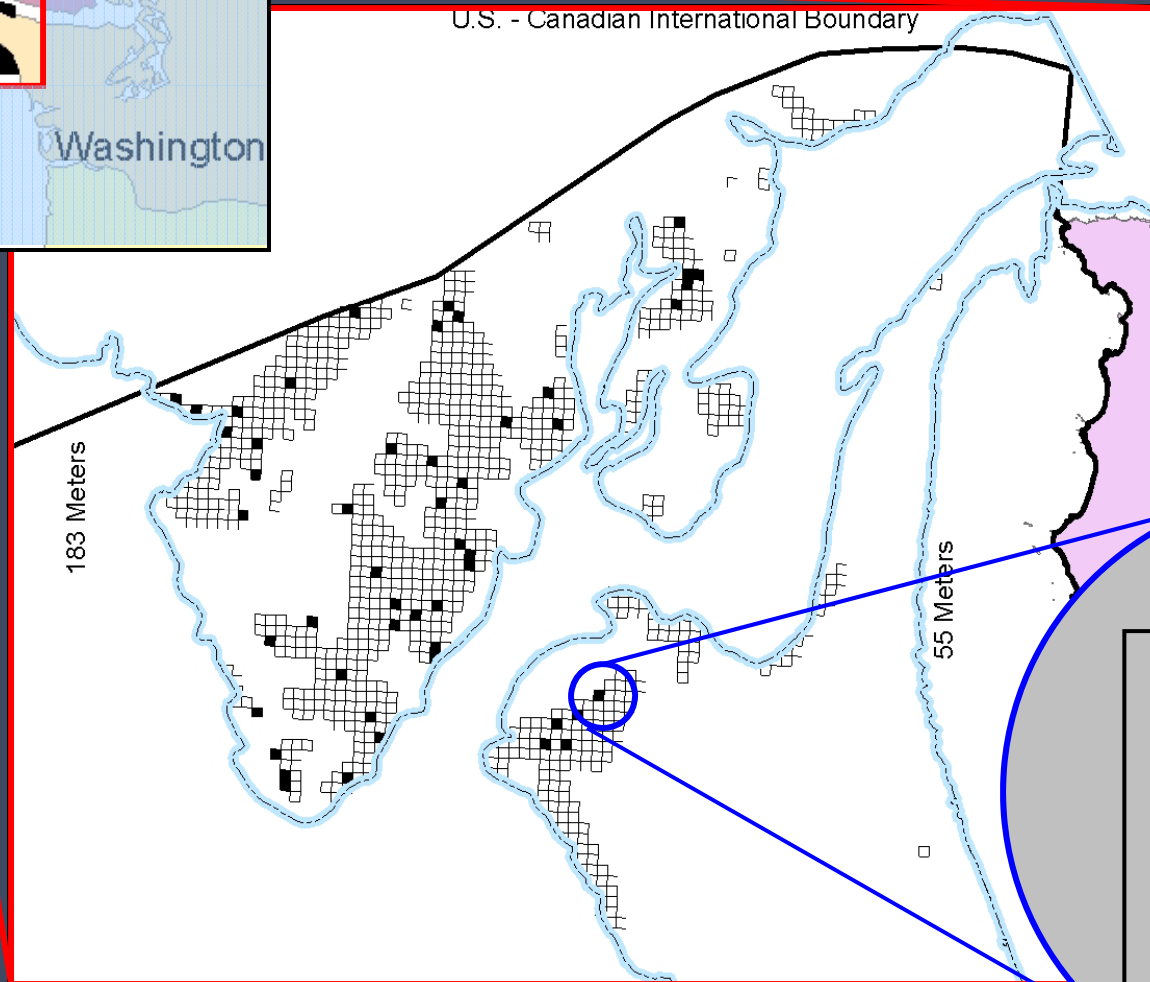
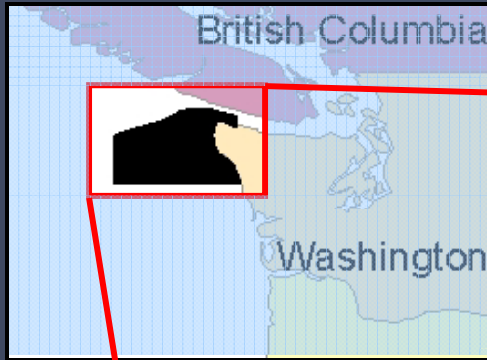
- California, Oregon, Alaska, British Columbia coasts
- Describe relationships between groundfish and substrate types
- Provide information for survey design, essential fish habitat, and management plans

## Washington coast continental shelf:

- Need more information on fish habitat outside of Puget Sound
- August 2002 visual survey in 'untrawlable' areas



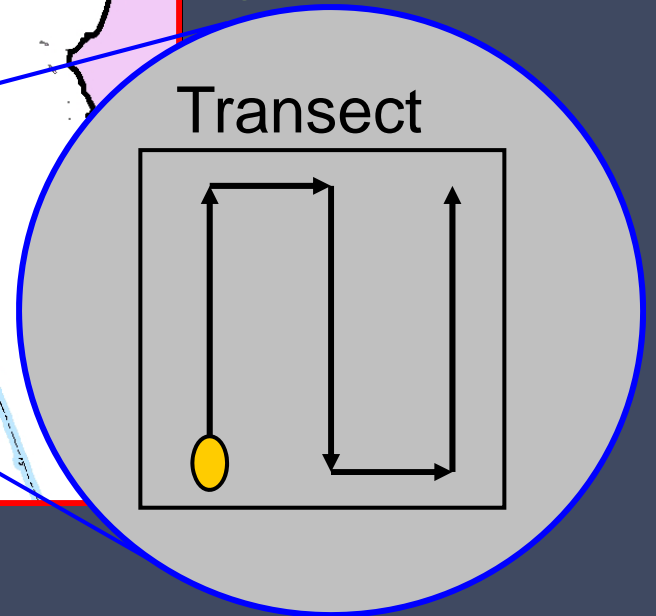
# Survey site



Designated untrawlable areas: **gridded areas**

Sample stations: **grid cells**

Surveyed sample stations: **shaded grid cells**



# Survey Methods



## August 2002 Survey:

- Visual strip-transects using *Delta* submersible
- Sampled 50 stations
- All dives during daylight
- Depths between 102 to 225m

## Survey Objectives

- Field test new visual survey gear
- Estimate fish density within untrawlable areas to compare with trawl survey estimates

## Project Objectives

Characterize habitat within 'untrawlable areas'

- Physical substrate
- Benthic macroinvertebrates

Characterize fish-habitat associations

- Community level distribution and associations
- Species specific distribution and associations
- Associations with habitat features
- Associations at different spatial scales



# Habitat characterization

Bottom habitat classification (Stein et al., 1992):

Two-letter code: Primary (>50% of viewed area) substrate

Secondary (>20% of viewed area) substrate

Substrate Types:

Sand/mud

Pebble

Bedrock

Cobble

Boulder

-scattered

-contiguous

-stacked

Ridges

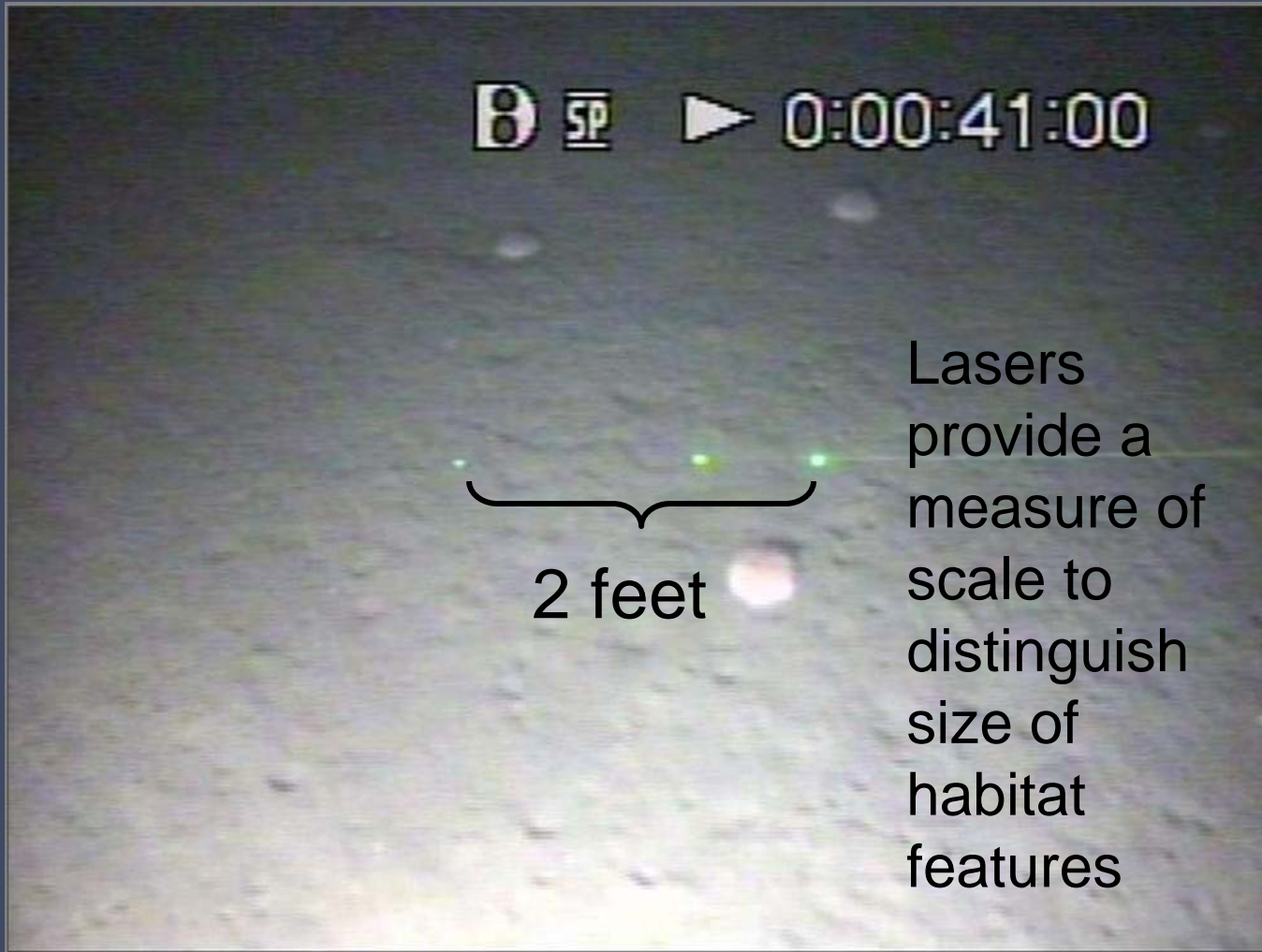


“Trawlable”

“Untrawlable”

Other features: relief, surface complexity or features, number of crevices, slope, biological attributes, invertebrate species/groups

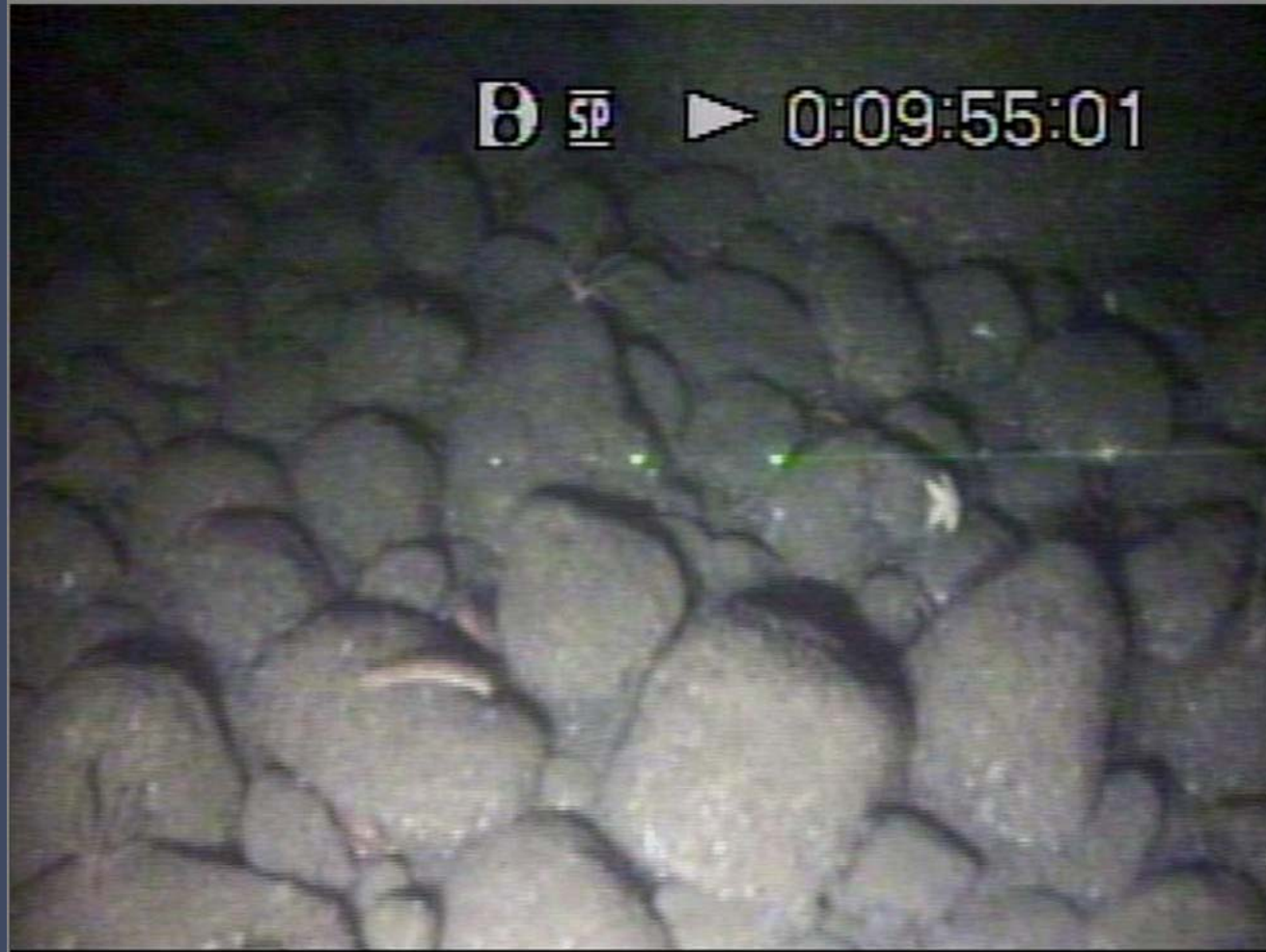
# Flat sand-mud habitat (SM)



# Cobble-scattered boulders (CB1)



# Stacked Boulders (BB3)



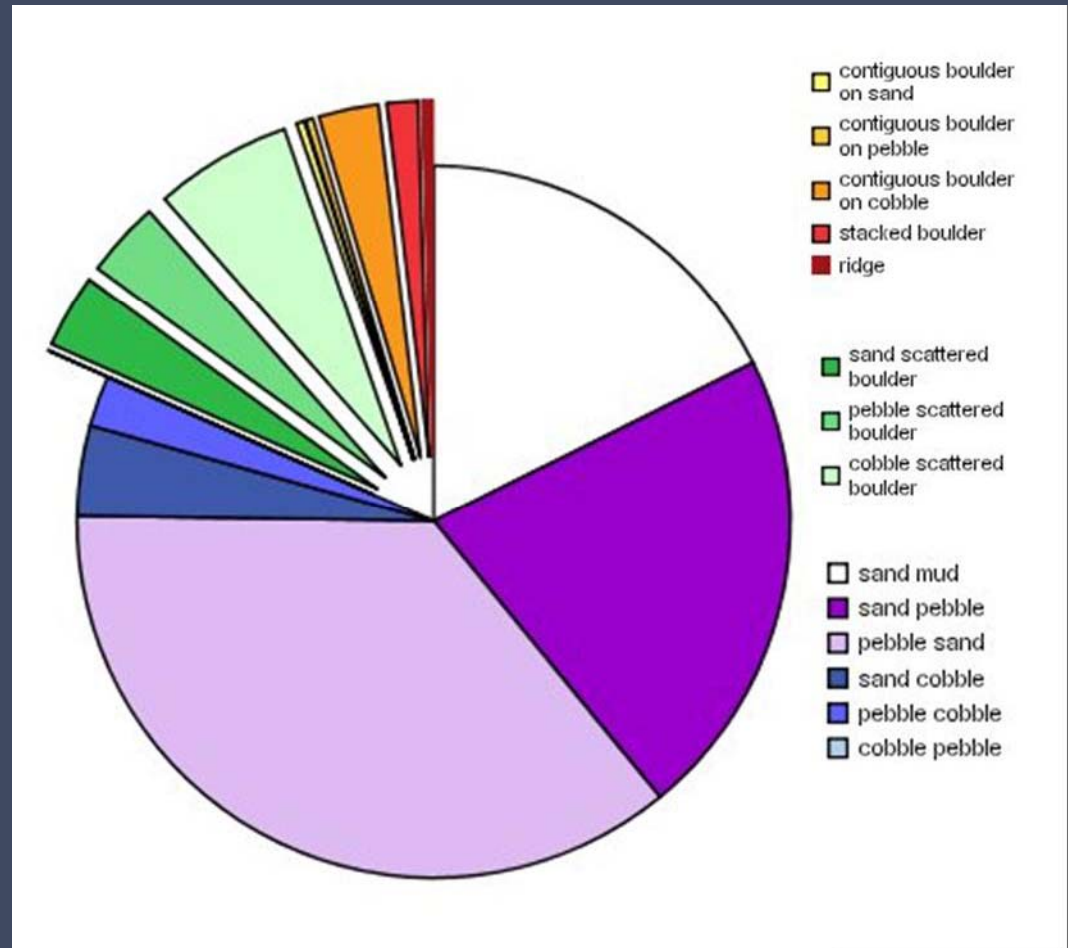
# Habitat Characterization

Dominated by low complexity habitat :

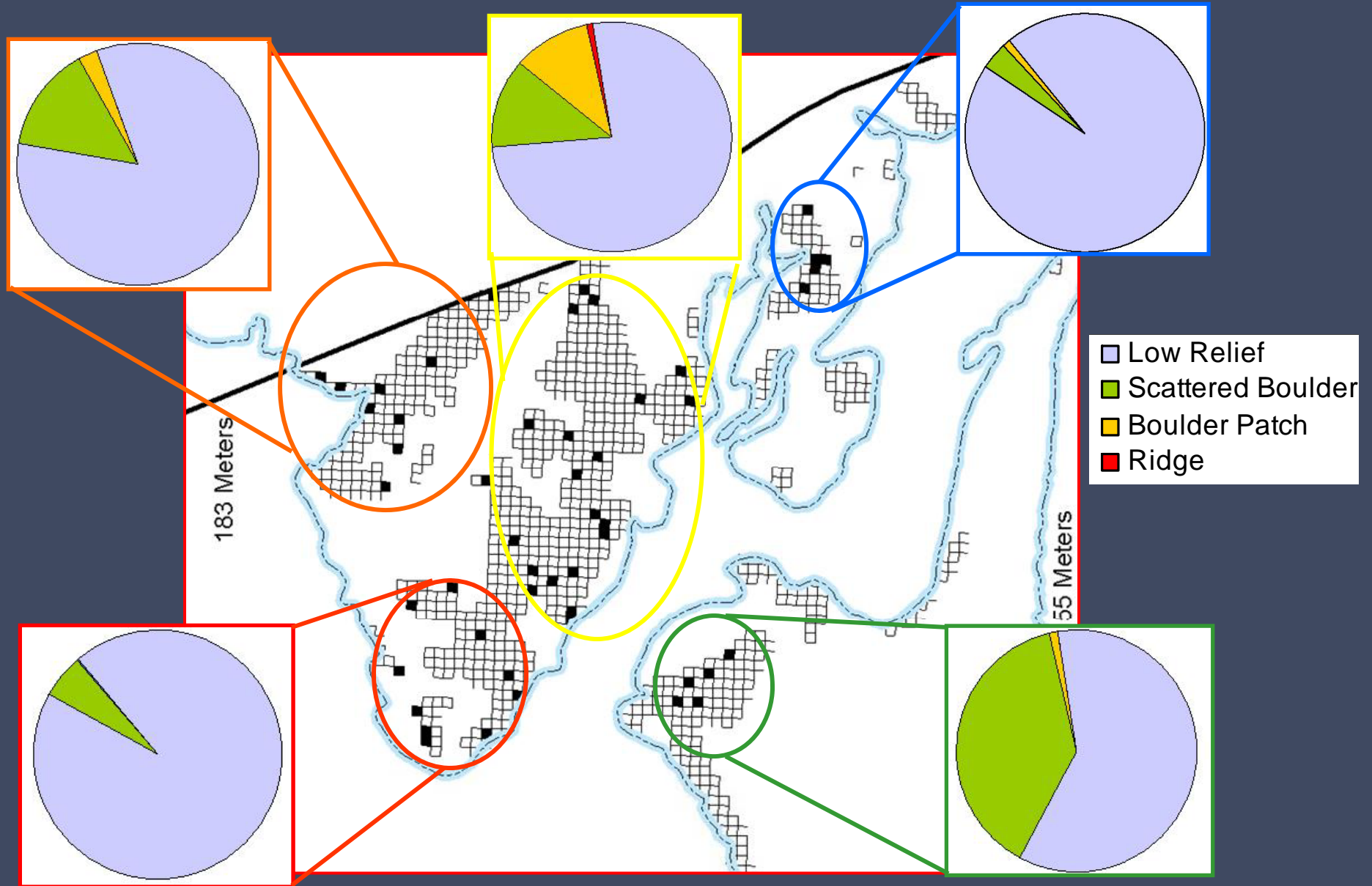
Sand/pebble/cobble: 81%  
Scattered boulder: 13%  
Boulder patches: 6%

Survey area characterized by:

- Heterogeneous mix of substrates
- Patches of habitat types and invertebrates



# Habitat Characterization



# Invertebrates

Providing structure and relief

- Crinoids encrusting on boulders
- Sponge gardens on flat sandy bottoms
- Other invertebrates: Other sponges, basket stars, anemones

Crinoids



Sponge garden



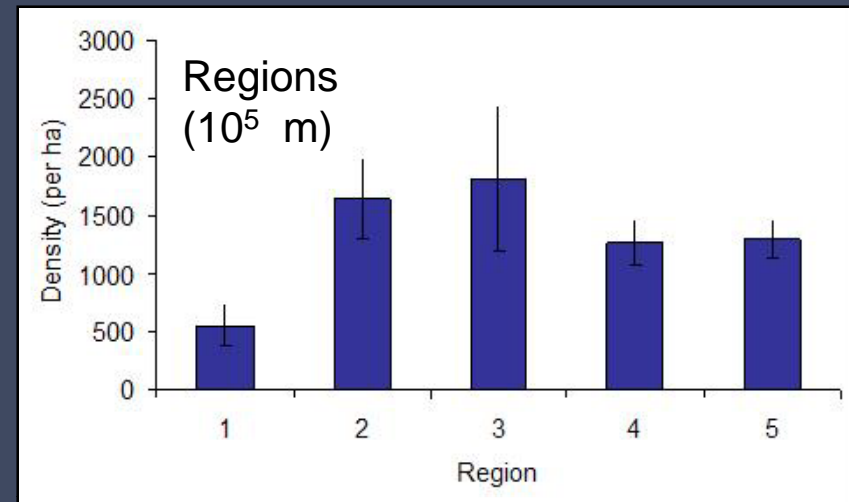
# Fish Distribution

Species	Number of transects
Unidentified	47
Greenstriped	47
Rosethorn	41
Canary	33
Redstriped	27
Yelloweye	24
Yellowtail	22
Sharpchin	20
Tiger	16
Silvergray	9
Widow	2
Quillback	2
Bocaccio	1
Greenspotted	1
Pacific ocean perch	1
Redbanded	1
Shortspine thornyhead	1

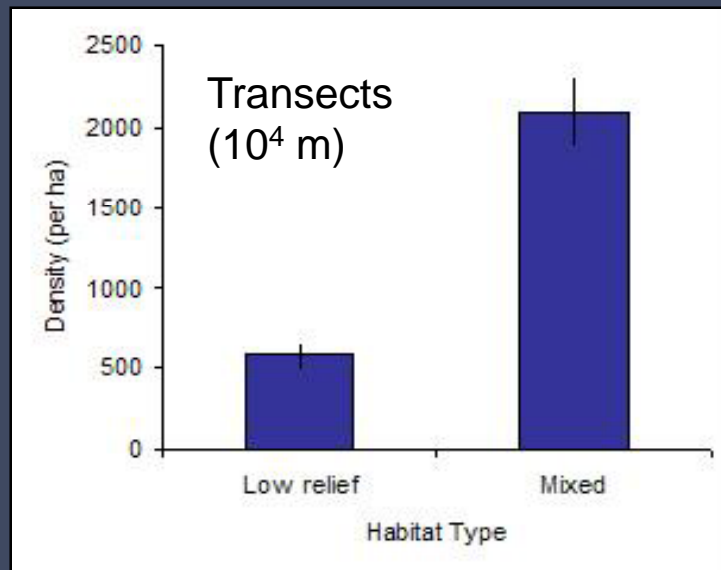
Species	Number of transects
Lingcod	34
Greenling	17
Unidentified Flatfish	49
Dover Sole	43
Halibut	35
Petrale Sole	31
Arrowtooth Flounder	8
Longnose Skate	32
Black Skate	21
Big Skate	14
Ratfish	33
Pacific Cod	30
Dogfish	4

# Total Fish

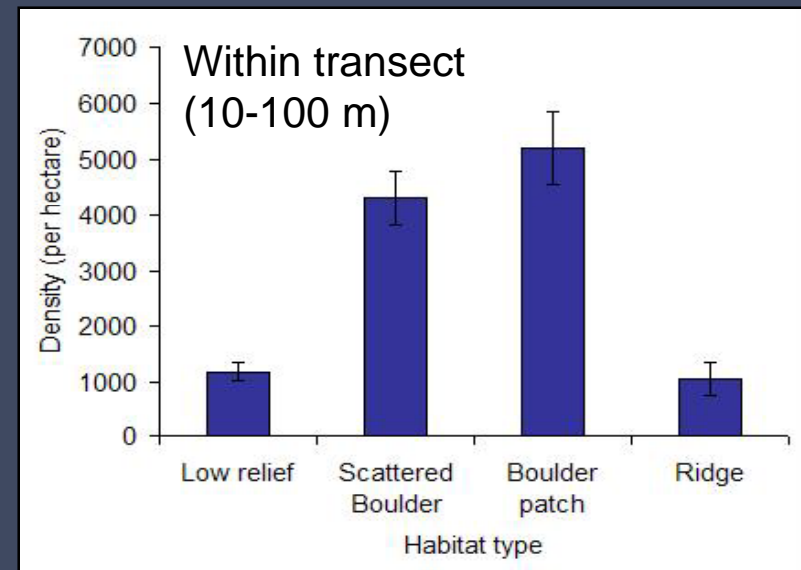
- Distributed across all regions, with lowest density in low relief region



- Transect level: significantly greater density in mixed transects



- Within transect: significantly greater density over boulder substrates

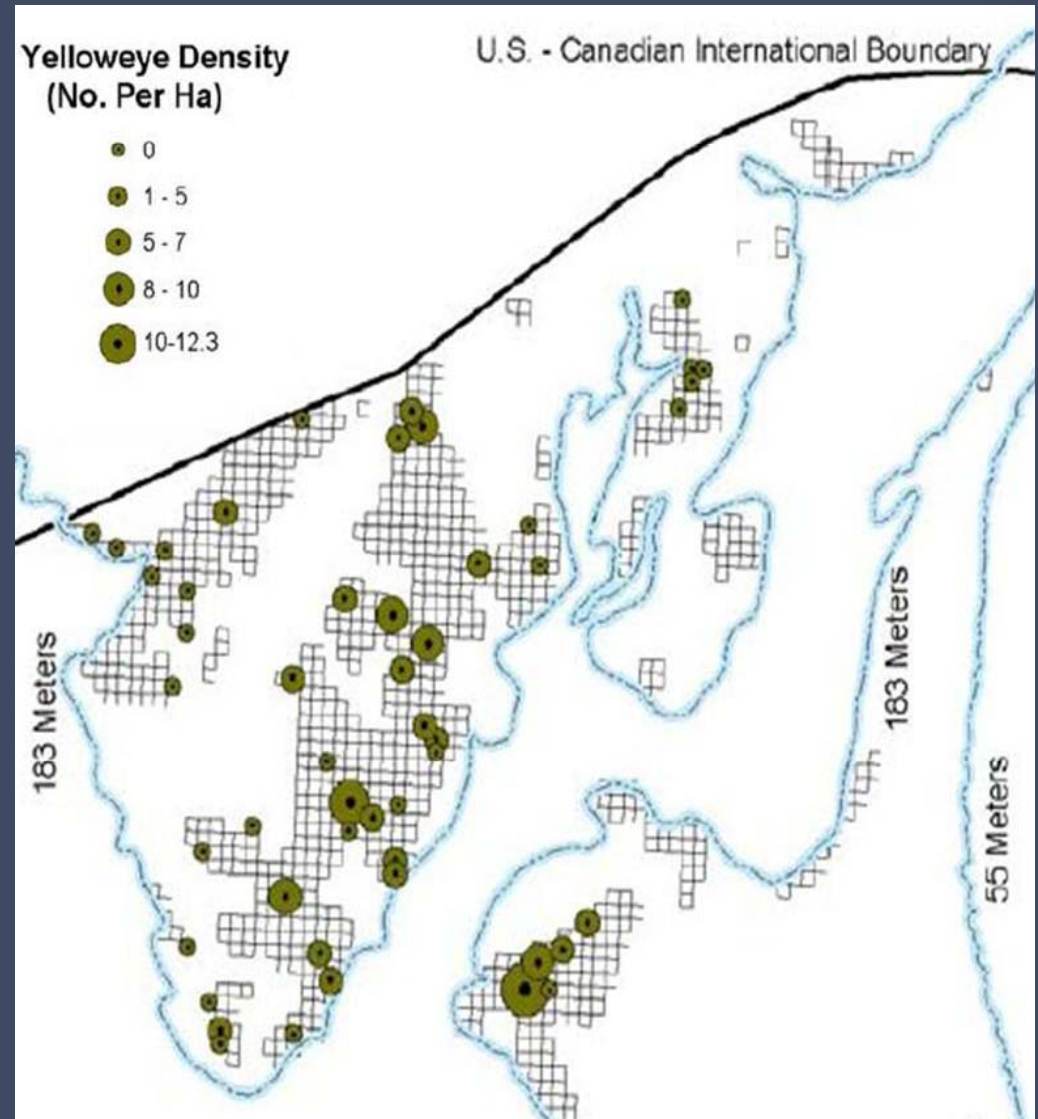


# Yelloweye rockfish

- Identified and counted 59 individuals
- Observed at depths of 102 to 164 meters
- Occupied all but the most nearshore region



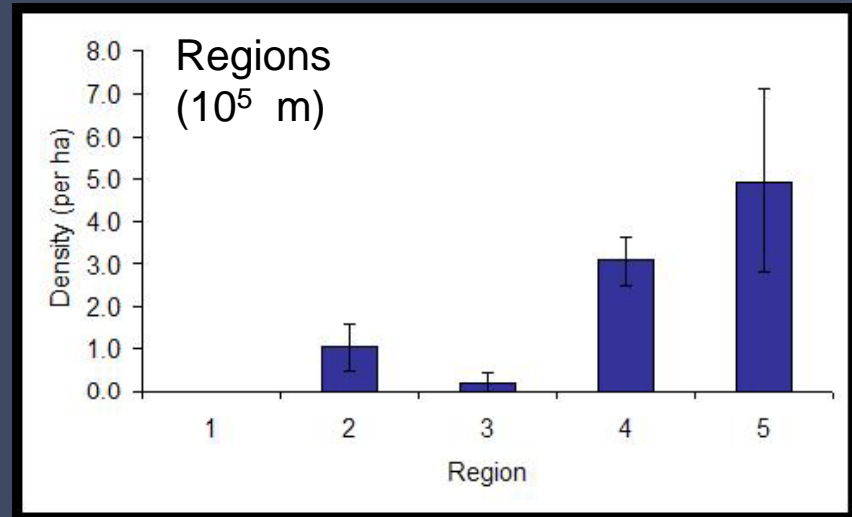
[www.pcouncil.org/groundfish/gfavoidyellow.html](http://www.pcouncil.org/groundfish/gfavoidyellow.html)



# Yelloweye rockfish

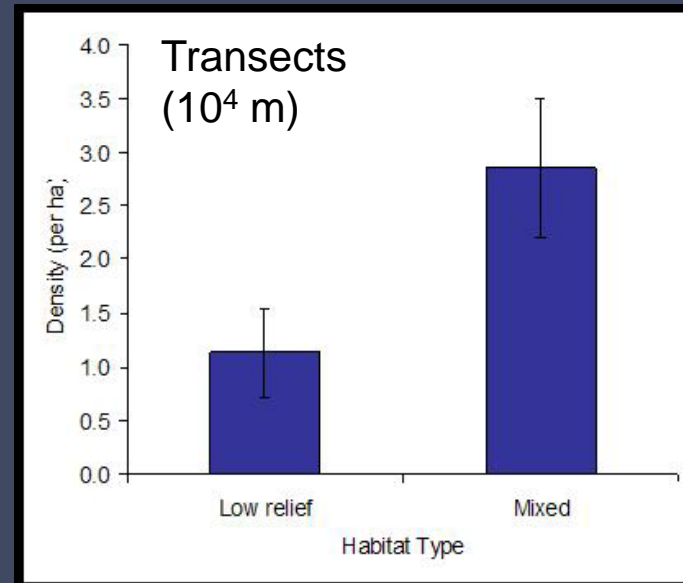
## Regional distribution

- General increase in density with increasing proportion of boulder habitat



## Transect level

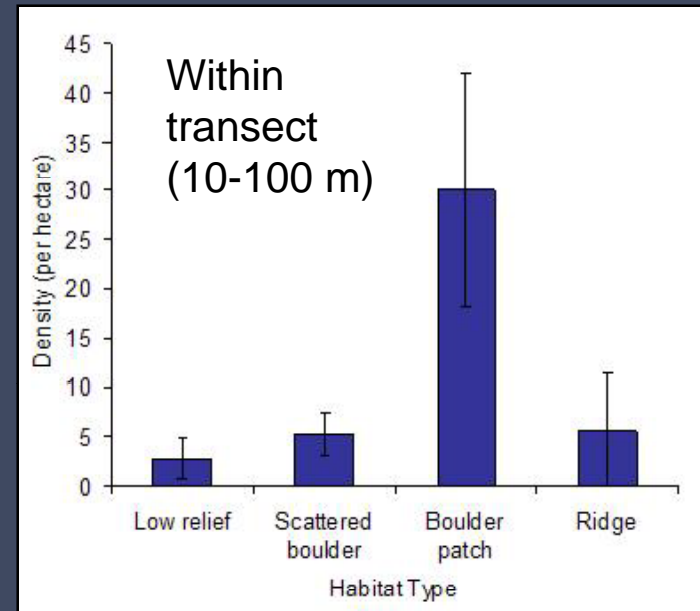
- Significantly greater density in mixed substrate transects compared to low relief transects



# Yelloweye rockfish

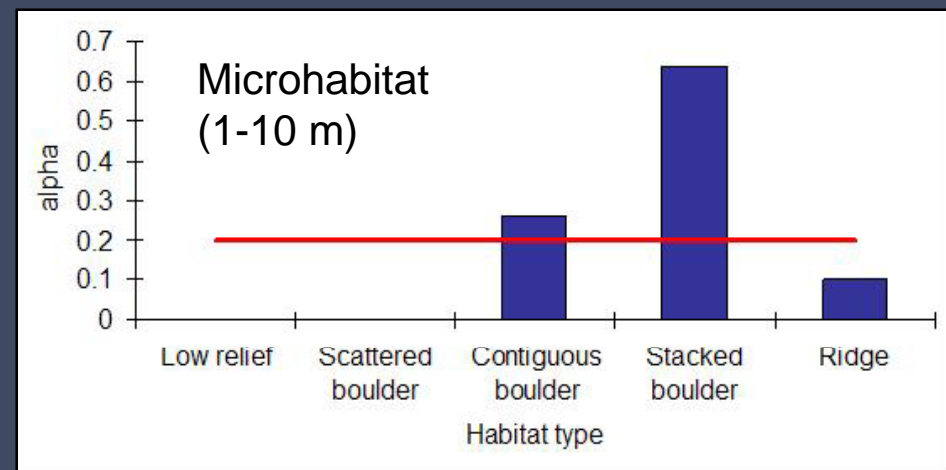
## Macroscale (10-100 m)

- Significantly greater density within boulder patches compared to other habitat types

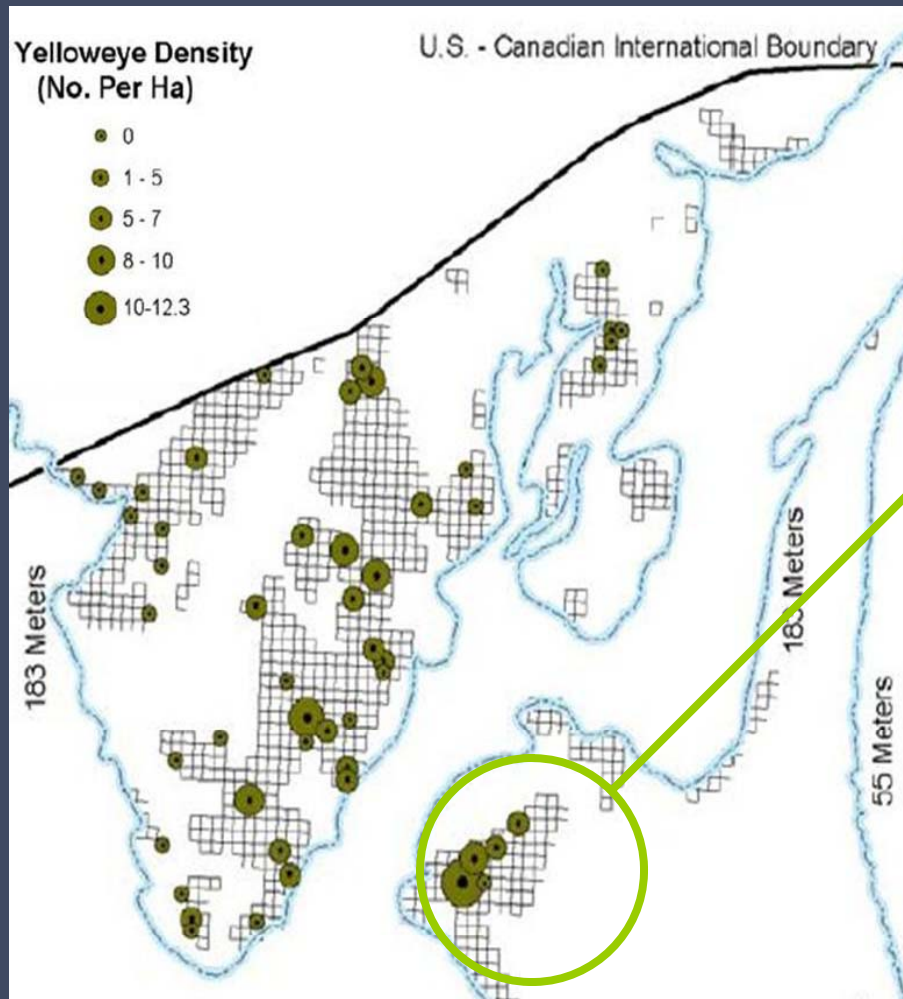


## Microscale (1-10 m)

- Preference for contiguous to stacked boulder substrates (Chesson's alpha electivity index)



# Yelloweye Habitat Associations



- Trend in association with boulder substrates consistent across spatial scales



# Summary – Habitat associations

## Habitat

- Majority of survey area characterized by low relief substrates
- Patchiness within regions and transects – boulder patches

## Fish-Habitat Associations

- Diversity of species observed and counted
- Greatest fish density observed in boulder habitat
- Yelloweye rockfish associated with complex boulder habitat, similar to observations in other areas off the US West coast.

## Further Work and Applications

- Community level associations
- Quantitative models to compare relationships across habitat types
- Application to survey design, EFH, management concerns



# Acknowledgements

Funding & Support:

National Marine Fisheries Service

Washington Department of Fish and Wildlife

Washington Cooperative Fish & Wildlife Research Unit

Beauchamp Lab

VanBlaricom Lab

UW School of Aquatic and Fishery Sciences Egtved Scholarship

ARCS Fellowship: Candice Rosenberg Endowment

UW Department of Biology and Department of Oceanography

Equipment & Field support:

Delta Oceanographics

Velero IV Research Vessel

