Rockfish larvae in Puget Sound: when, where, and (maybe) why

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Background

Basic knowledge of rockfish life histories in Puget Sound is lacking

Starting points: California Current, some historical work in Puget Sound

Most work is limited in time or space, often focused on older age classes

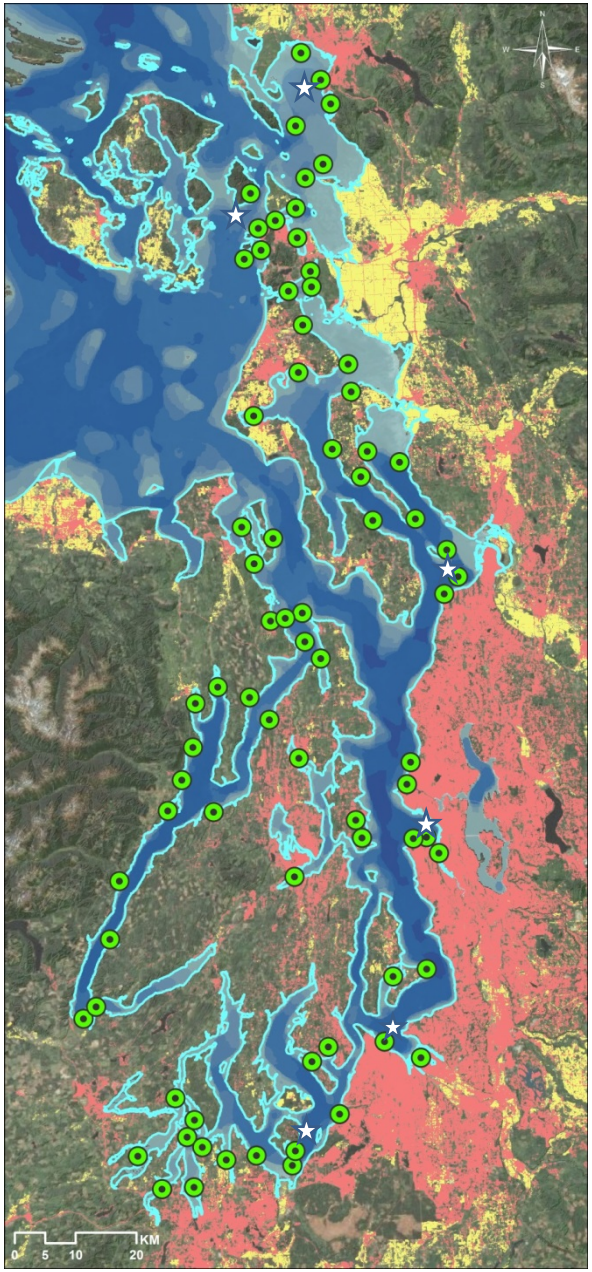
Questions

When are rockfish larvae present in Puget Sound?

Where are they most abundant?

Why do these spatial and temporal patterns occur?

The survey



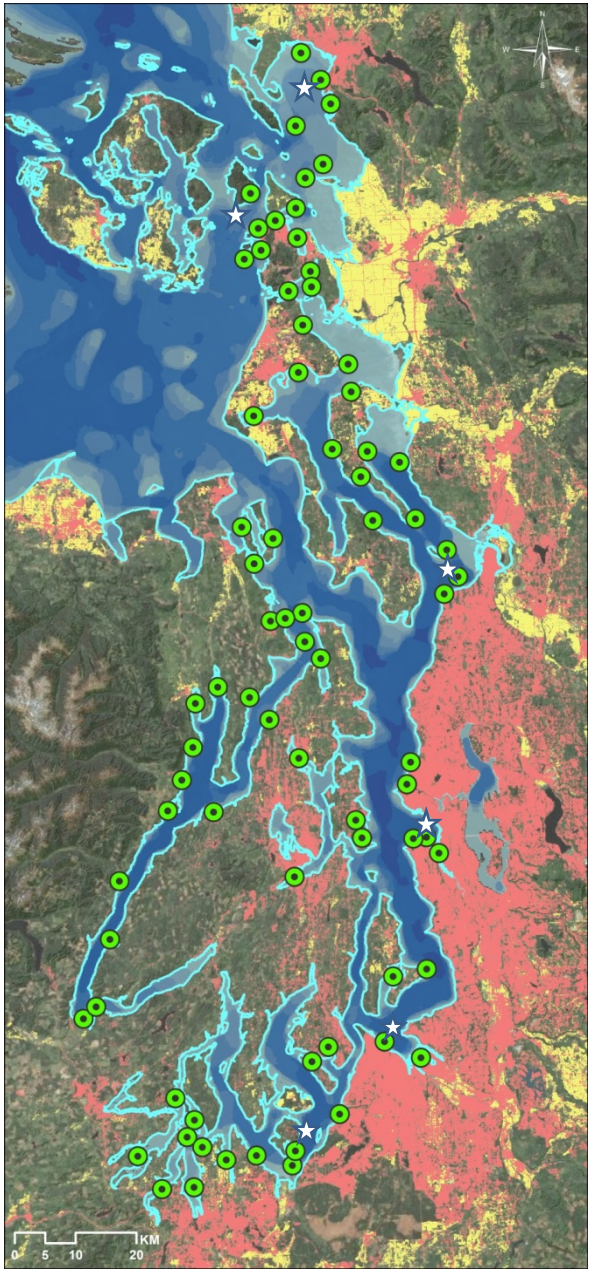
Examine major aspects of the nearshore pelagic foodweb

Examine broad-scale spatial and temporal variation

- All major basins
- April-October

Regression design to detect possible effects of land use

The survey



Sampling at each site:

Water column metrics

Dissolved inorganic nutrients

Bacterial and phytoplankton abundance

Bacterial diversity

Heterotrophic microbial production

Small zooplankton

Large zooplankton and larval fish

Forage fish and juvenile salmon

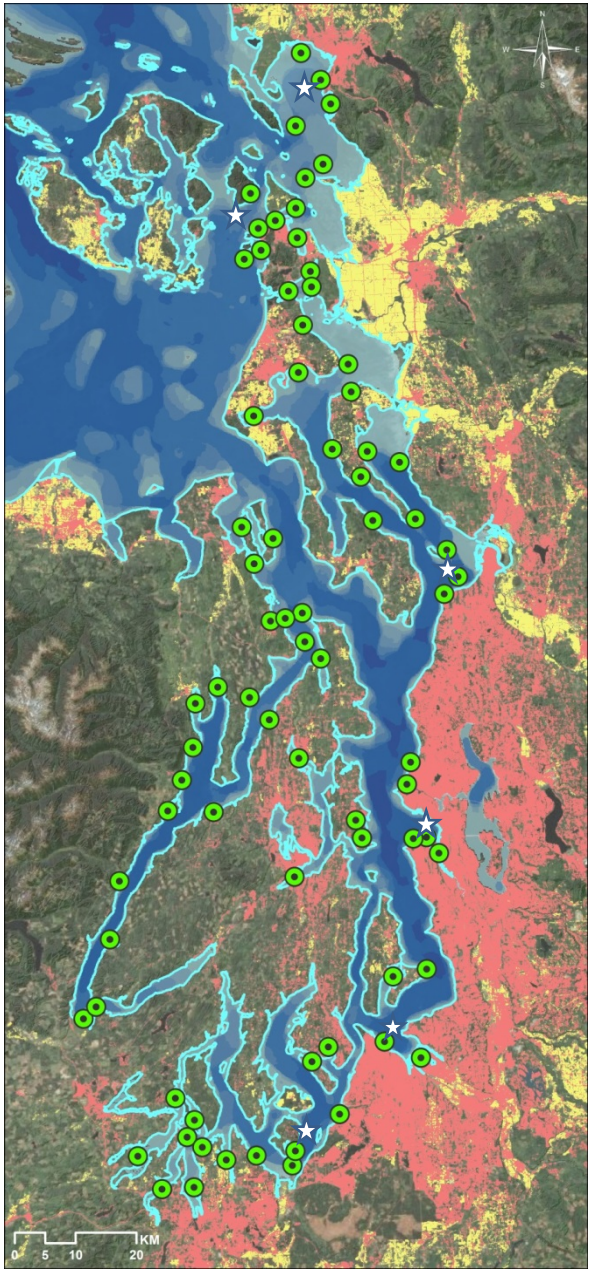
(size, abundance, biomass, and growth)

Jellyfish (size and biomass)

Stable isotopes (fish & invertebrates)

Birds and marine mammals

The analysis

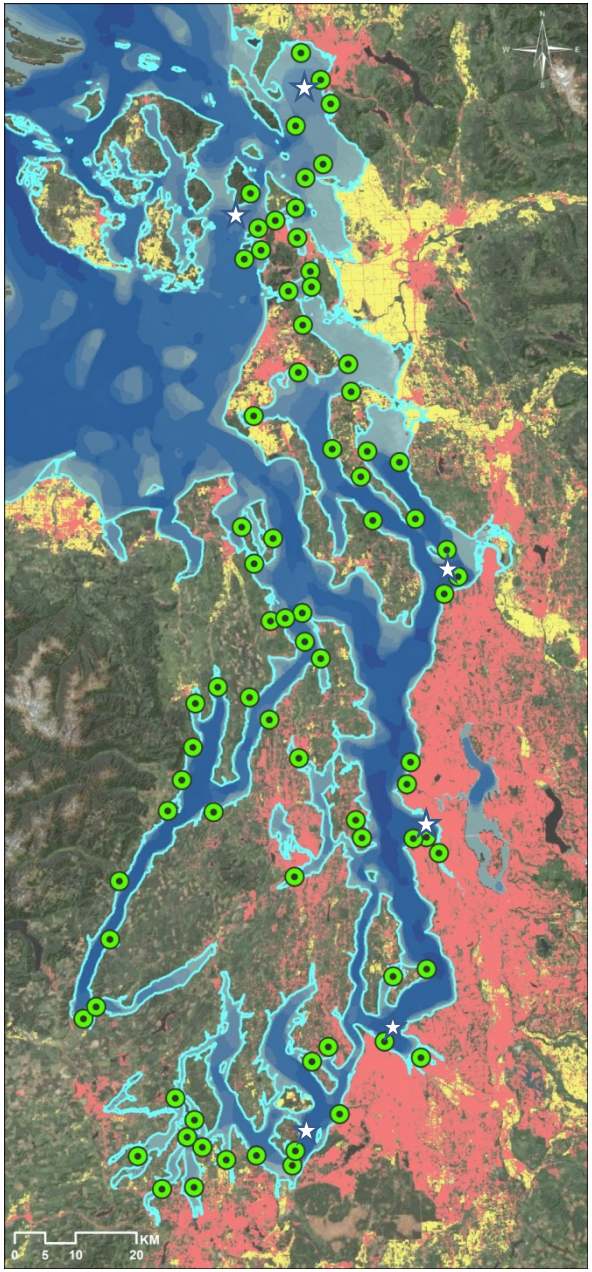


1) DMMP sediment disposal sites April-February

2) April-October across all basins

3) All sites in August

Analysis by the numbers



79 sites * 7 months + 6 sites * 11 months
= 619 samples collected

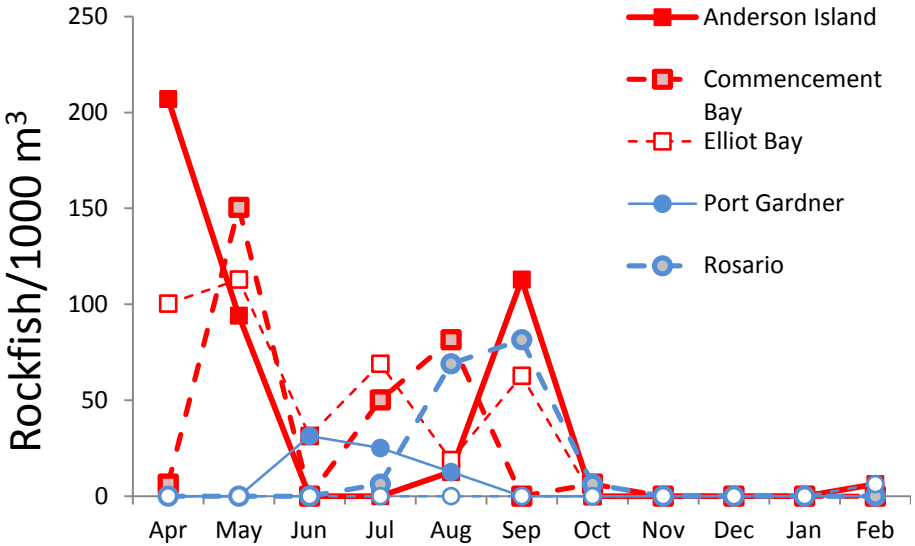
157 samples processed

997 rockfish identified

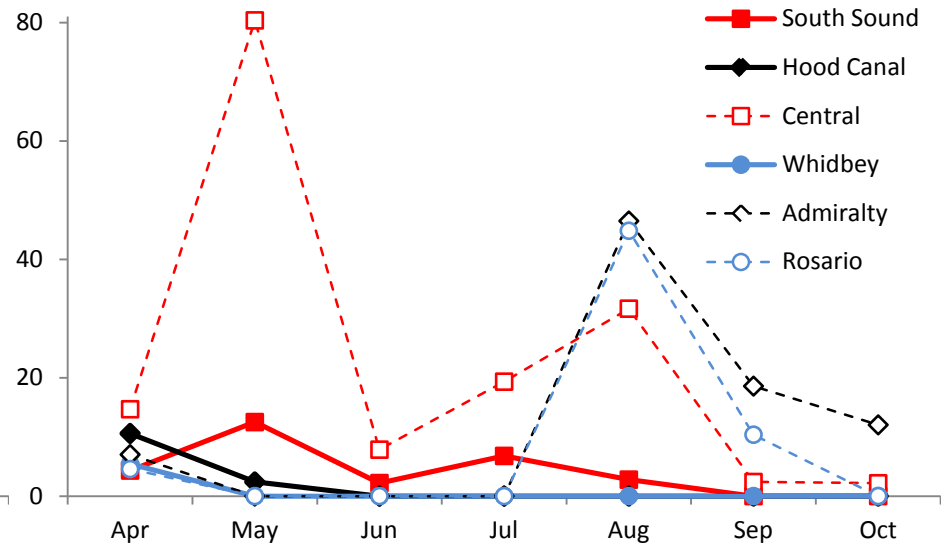
0 boccacio, canary, yellow-eye identified

When?

Army Corps Disposal sites
April – February



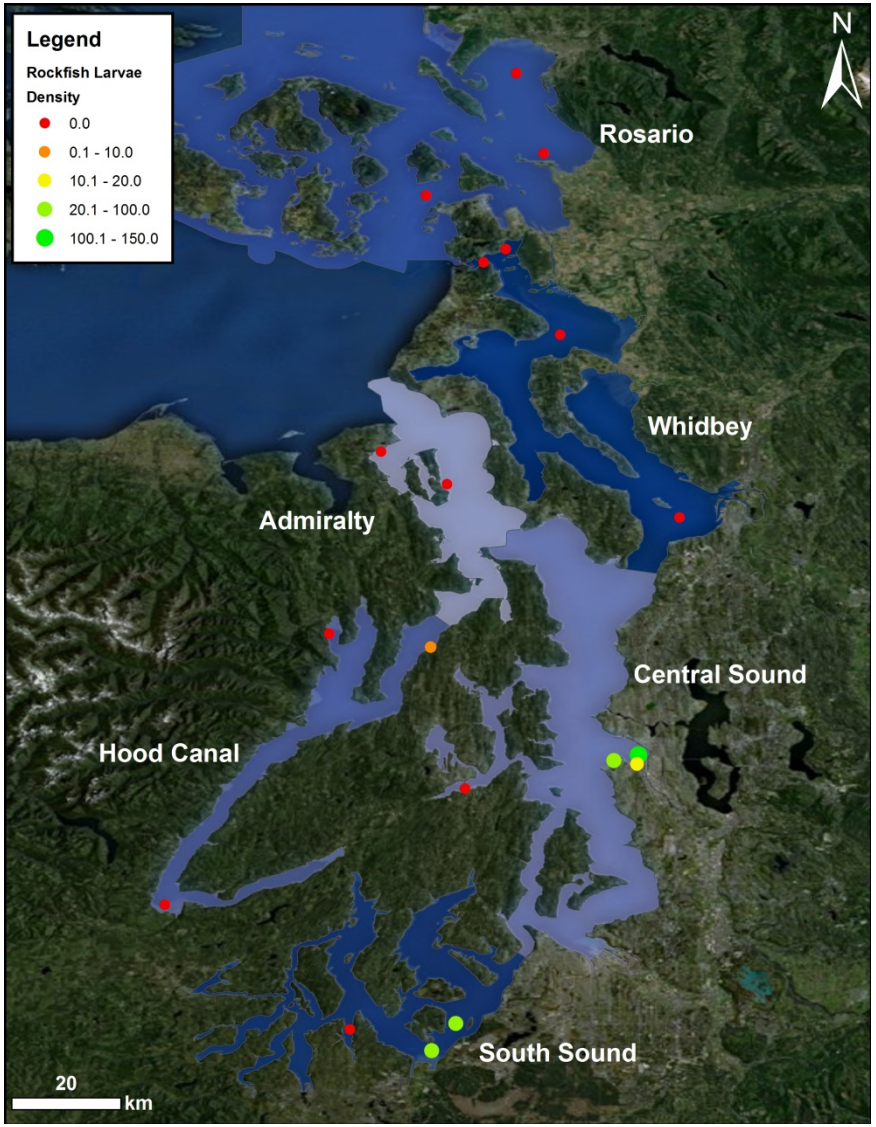
Subset of 16 sites across all basins
April-October



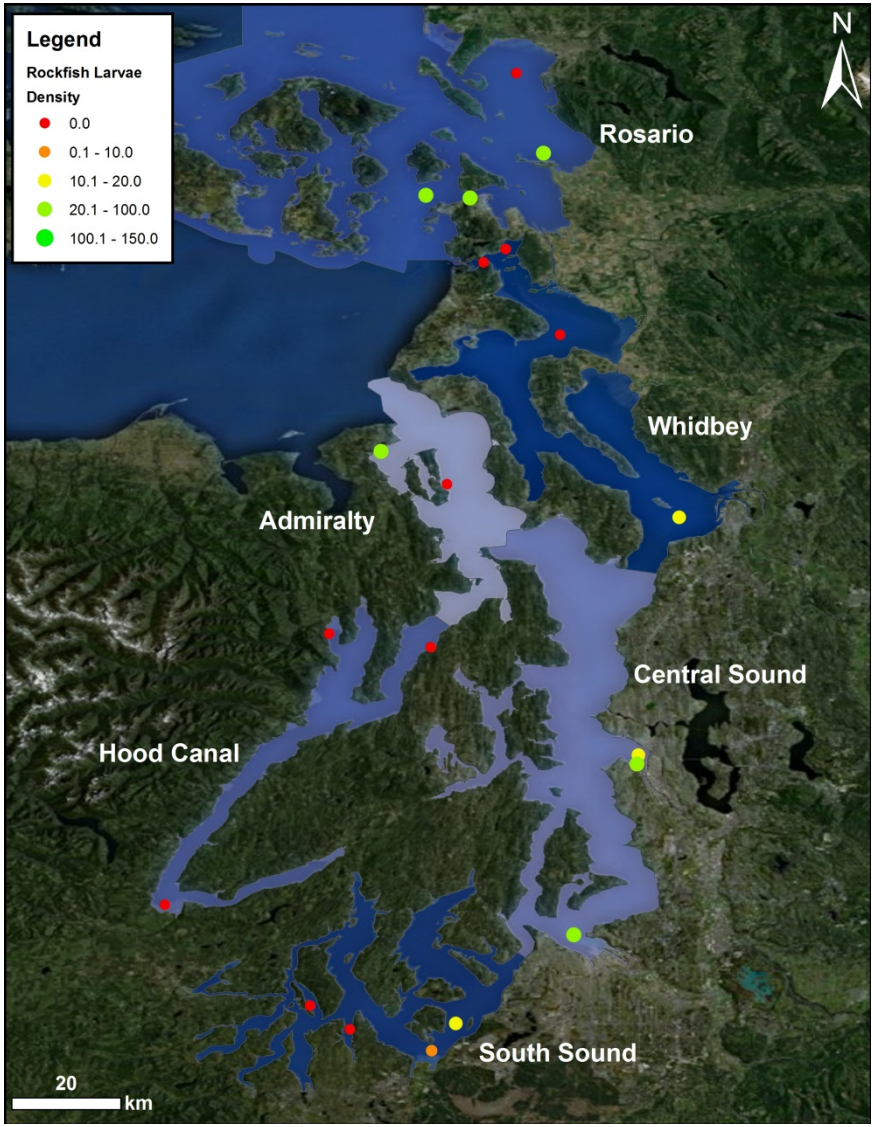
Month

Where?

May

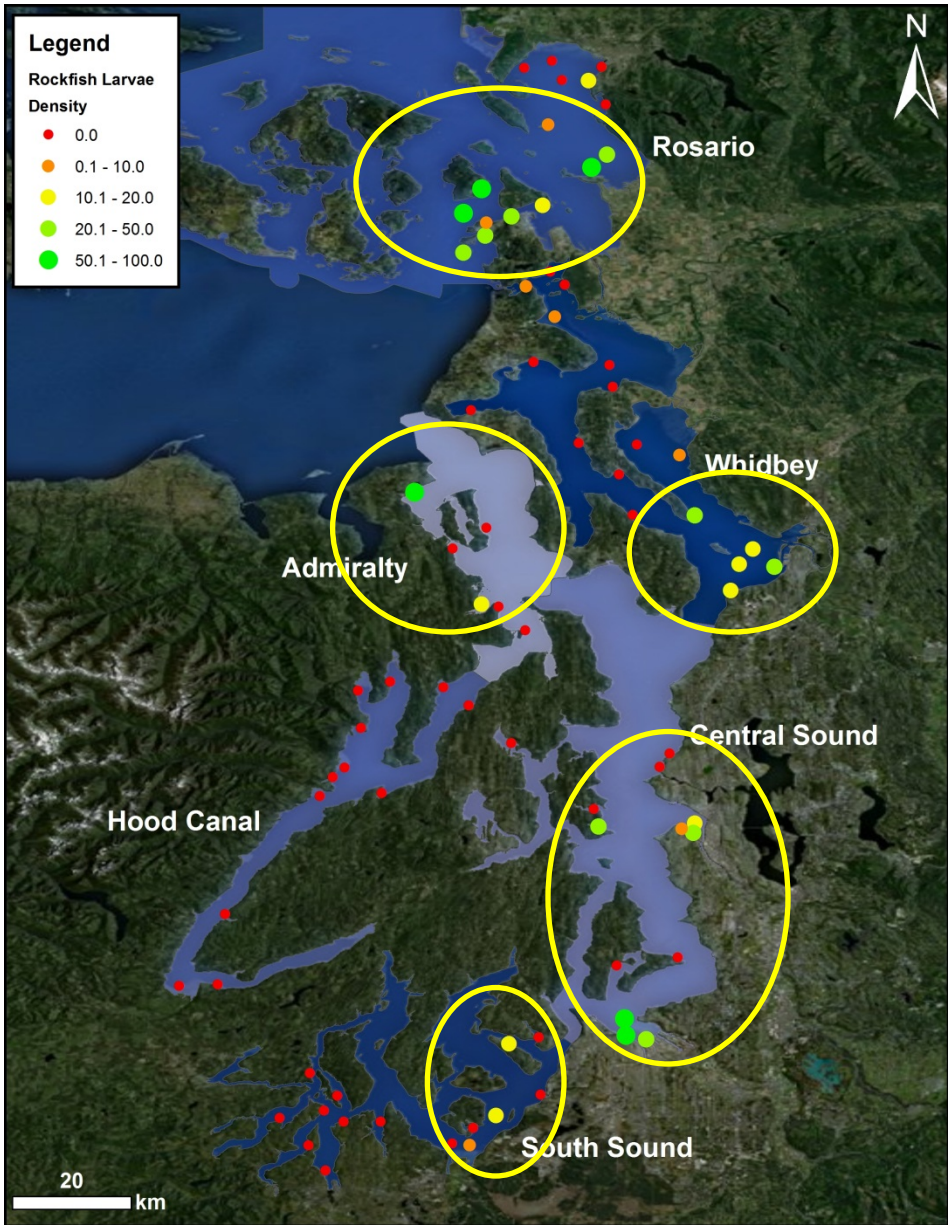


August

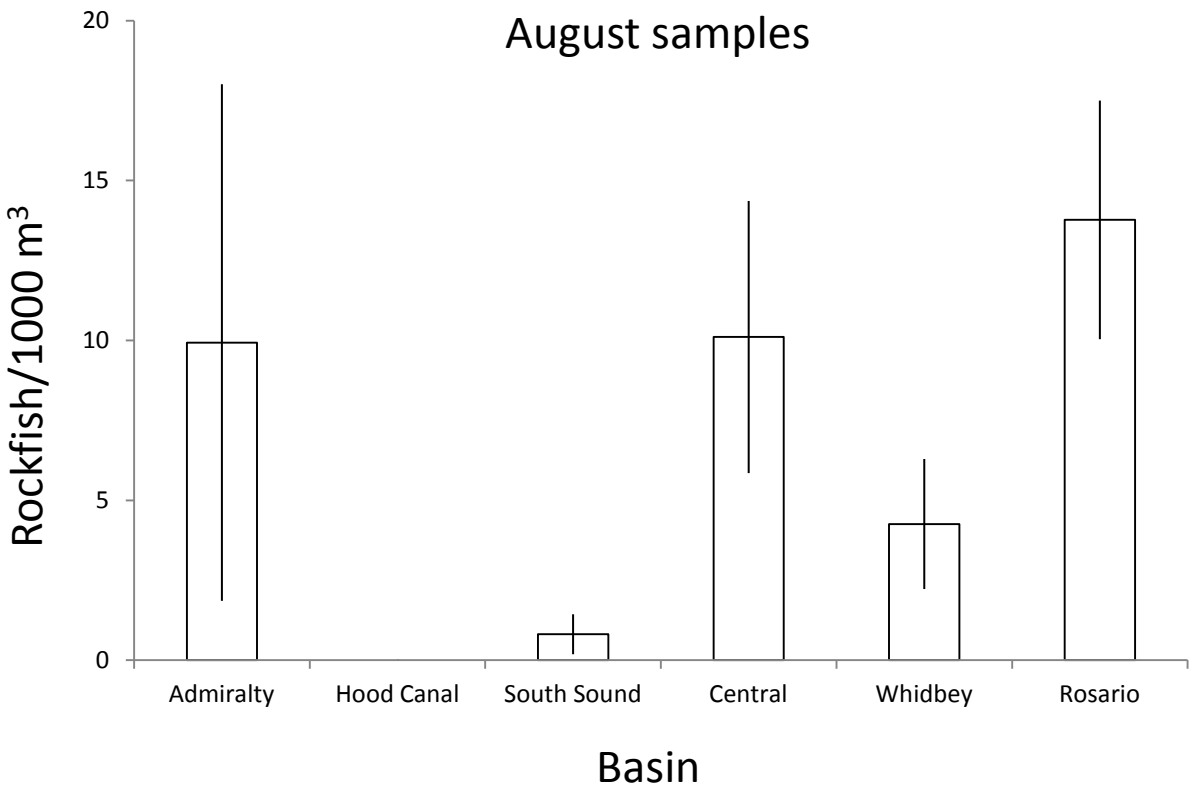


Where?

August, all sites



Where?


August samples
Rockfish/1000 m3
20
15
10
5
0
Admiralty
Hood Canal
South Sound
Central
Whidbey
Rosario
Basin

Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

Pelagic habitat conditions
Rocky habitat
Productivity gradients
Predator distributions
Circulation patterns
Adult abundance

Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

Pelagic habitat conditions
Rocky habitat
Productivity gradients
Predator distributions
Circulation patterns
Adult abundance

Temperature	**-0.279***
DO	0.162
PAR	-0.081
pH	**-0.371**
Salinity	**0.300**
Turbidity	-0.177

*$p < 0.05$

Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

Pelagic habitat conditions
Rocky habitat
Productivity gradients
Predator distributions
Circulation patterns
Adult abundance

Shoreline development	**0.193**

Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

Pelagic habitat conditions
Rocky habitat
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Circulation patterns
Adult abundance

N:P	**0.259**
Chl A	0.156
Phytoplankton	**0.184**
Bacterial Productivity	-0.170
Synechococcus	**0.208**

Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

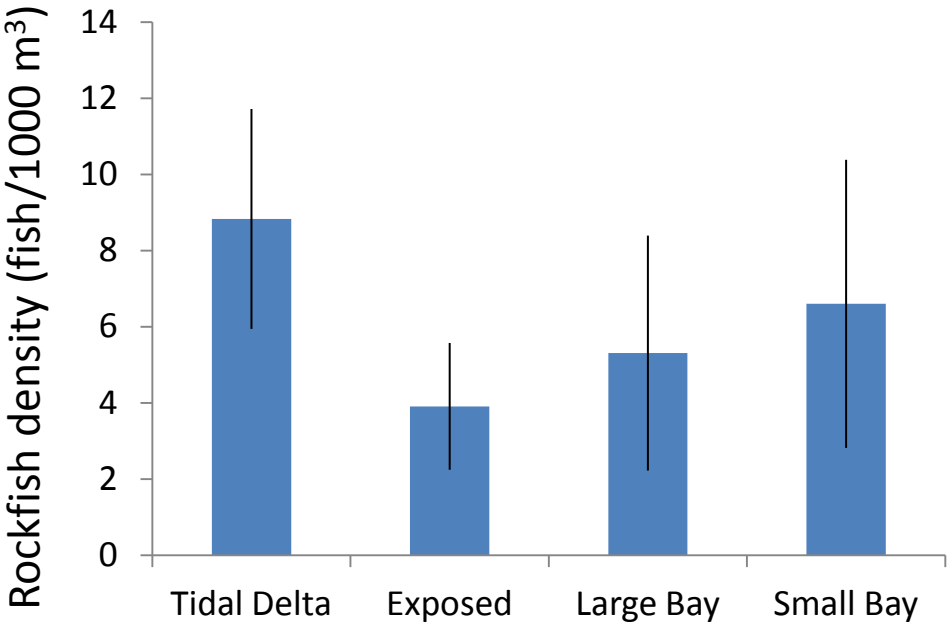
Pelagic habitat conditions
Rocky habitat
Productivity gradients
Predator distributions
Circulation patterns
Adult abundance

Salmon	**-0.310**
Jellies	-0.018
Forage fish	0.006
Pelagics	-0.088

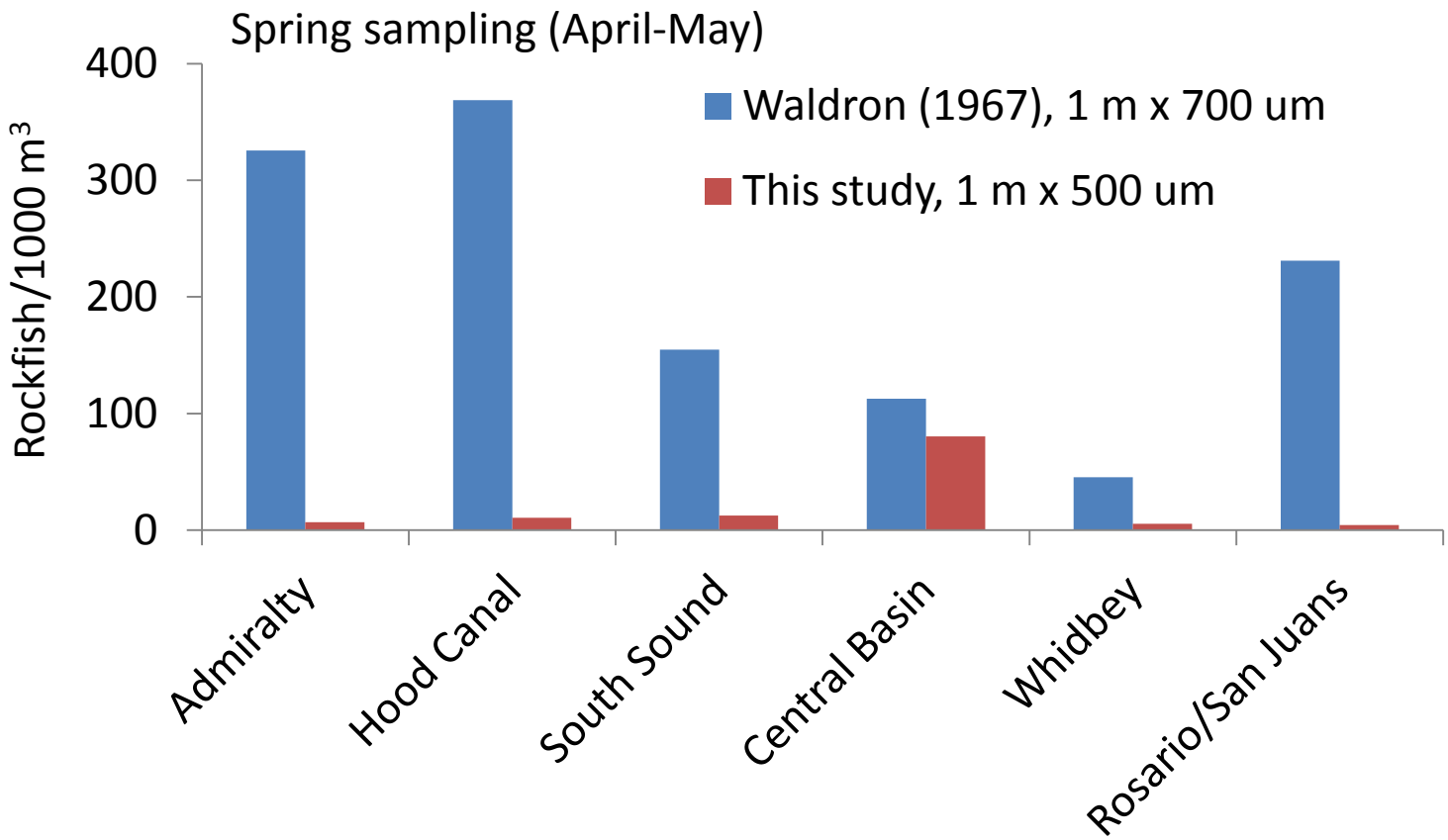
Why?

Mechanisms that may influence distribution and abundance of rockfish larvae

Pelagic habitat conditions
Rocky habitat
Productivity gradients
Predator distributions
Circulation patterns
Adult abundance



Adult abundance?



A 28-98% "decline"

Summary

When Spring and Summer peaks, absent in fall & winter

Where Central Basin, Admiralty Inlet, San Juan Islands

Why Correlations of density with pelagic environment, land use, productivity, and salmon

Interpretations colored by huge changes in abundance?

Future efforts

1) More sample processing – eggs and larvae for all samples in spring. All April samples have now been processed.

2) More species – Other key groups including forage fish and flatfish have been keyed out and analyzed.

3) More sophisticated analyses.

4) Examinations of rockfish and other larvae in salmon diets.