The importance of corals and sponges as groundfish habitat off Central and Southern California

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Background and Need

Deep-sea corals and sponges (DSCS) provide important habitat for groundfishes; however, the strength and intricacies of these associations are poorly understood, and studies in the ENP have demonstrated mixed results.

Habitat associations of groundfishes typically are considered to be spatially consistent.

PFMC Groundfish EFH Priority and Data Needs - Evaluate the role of deep-sea coral and sponges and other habitat-forming invertebrates as habitat for managed groundfish species.

Offshore wind energy development has elevated the importance of determining benthic species assemblages and areas of high productivity and diversity.

A better understanding of SFMI-groundfish associations would advance the development of effective fisheries assessments and management considerations, including the development of holistic (i.e., ecosystem-based) management plans.

SWFSC-FED DSCS Research and Study Objectives

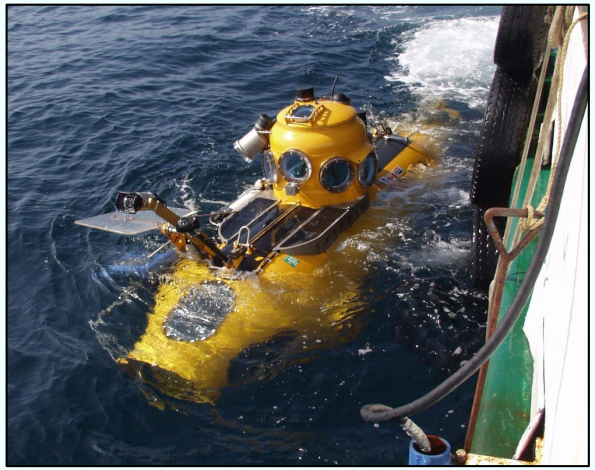
Began integrating DSCS into habitat studies in 2010 (Mary Yoklavich).

Provide data for and receive support from NOAA's Deep Sea Coral Research and Technology Program (2007) – dedicated to increasing scientific understanding of DSCS ecosystems.

The overall goal of this project is to investigate the use of DSCS as habitat for groundfishes by analyzing extensive, long-term video data sets collected in central and southern California.

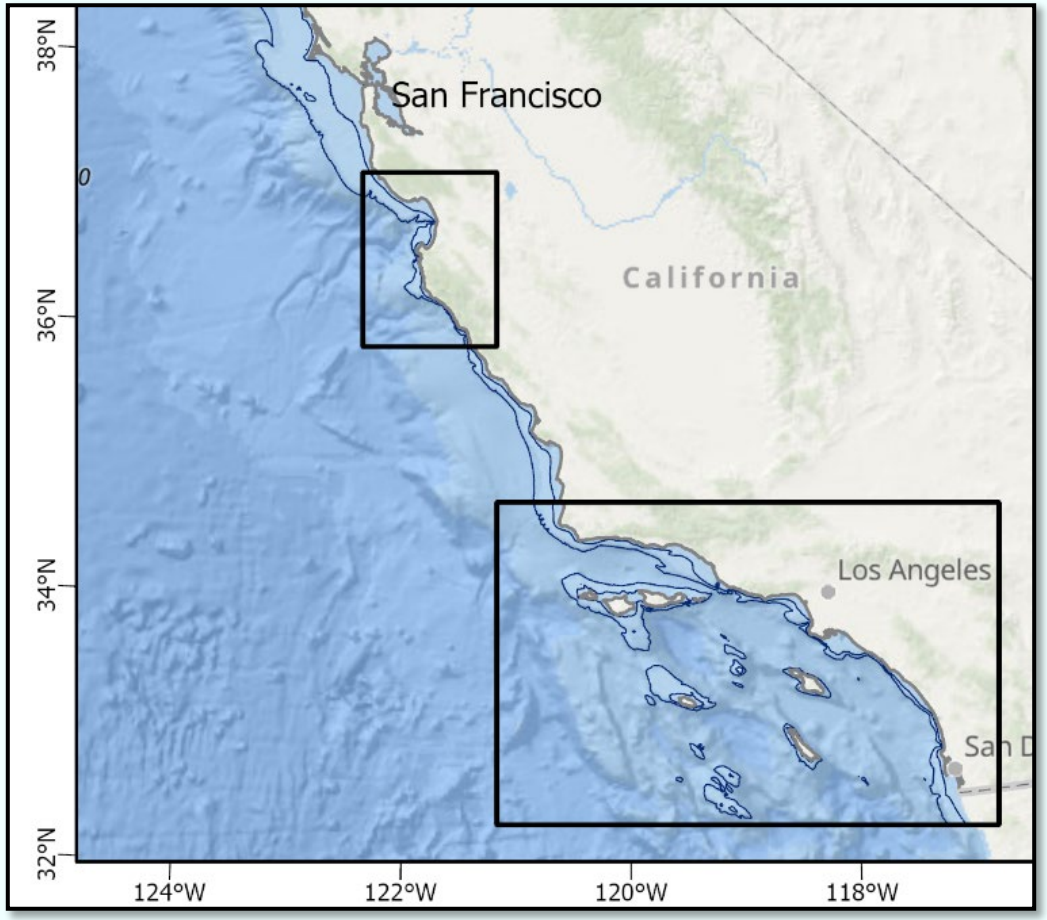
Objectives: 1) Do different groundfish species associate differently with corals or sponges?
2) Do these associations vary between study regions?

Successful completion of this project will result in quantitative estimates of the relative importance of corals and sponges as habitat for a variety of commercially and ecologically significant groundfishes and determine the spatial consistency of these associations.



Data Collection

Study Sites in Central and Southern CA



<u>*Delta* Dives (Transects)</u>
84 (105)– Central CA
71 (96) – Southern CA

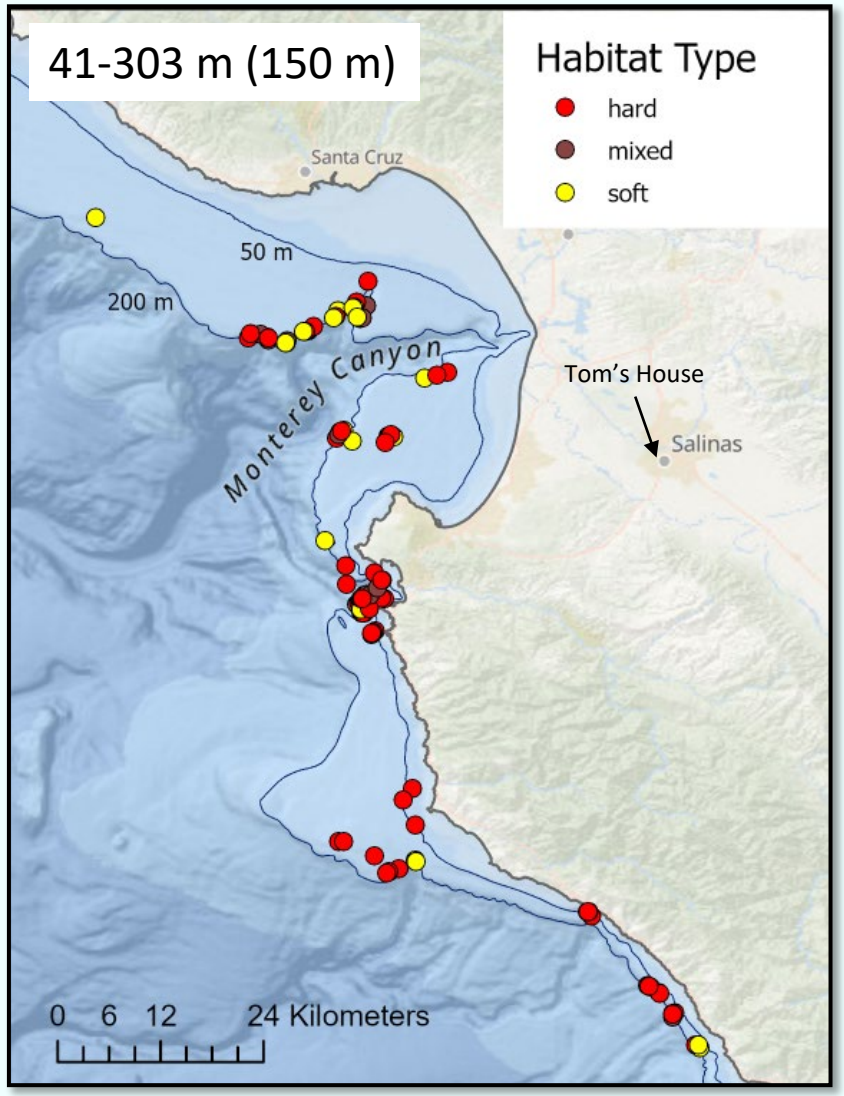
2000-2009

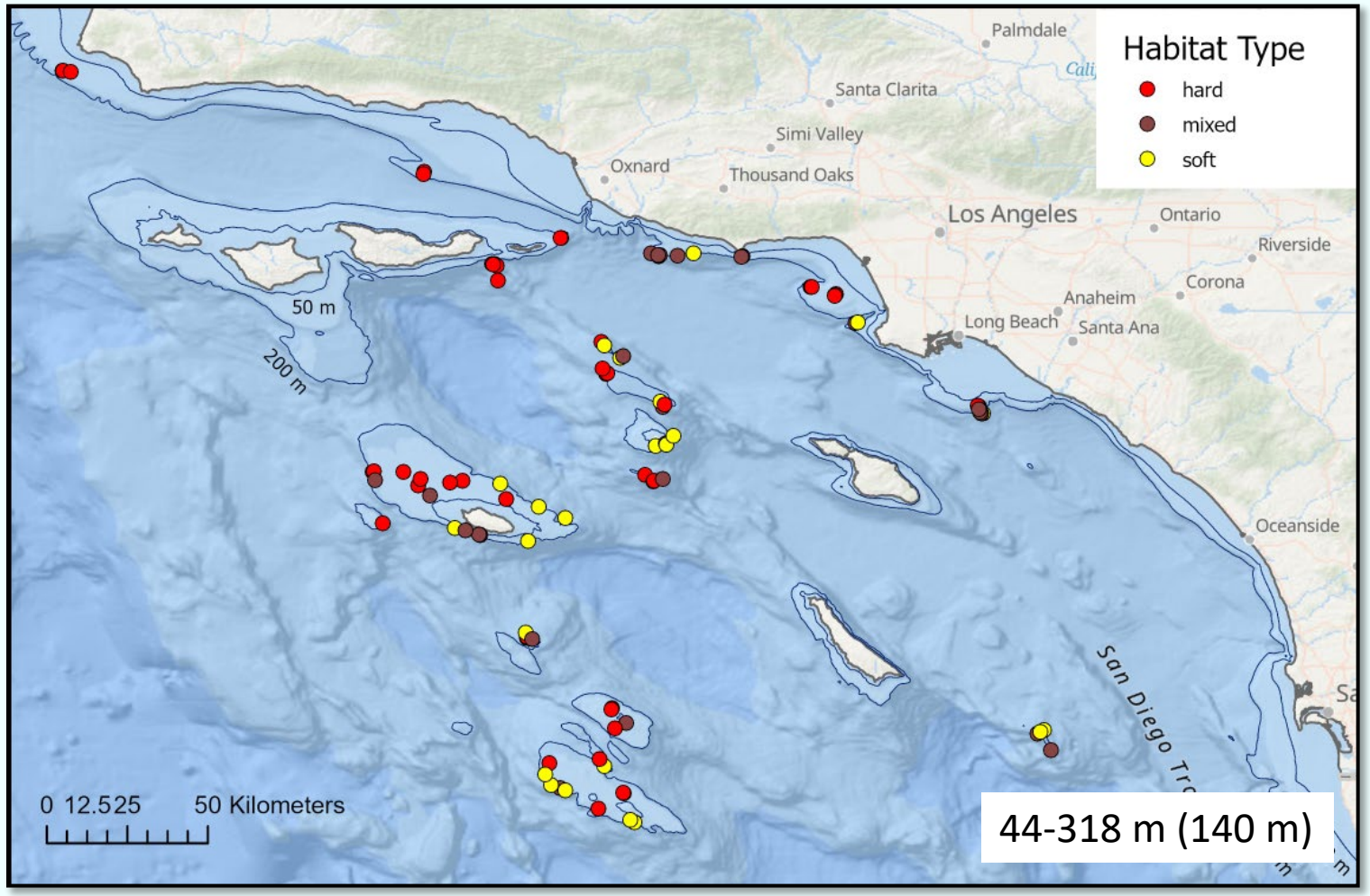
10 or 15 minute 2-m strip transects

<u>Video Analysis</u>
Fish and DSCS ≥ 10 cm identified, enumerated, and measured.

<u>3 Association Scales</u>
< 1 Body Length
< 3 m
Transect-level

Data Collection





Hard (rock, boulder, cobble)

Soft (pebble, gravels, sand, mud)

Region	Hard (m^2)	Hard (%)	Mixed (m^2)	Mixed (%)	Soft (m^2)	Soft (%)	Total (m^2)
Central CA	29,483	58.5	10,754	21.3	10,195	20.2	50,432
Southern CA	30,018	41.1	21,593	29.5	21,503	29.4	73,114

Regional Faunal Characteristics

Fish Taxon	n	%
Pygmy Rockfish	6312	26.6
YOY Rockfish	3787	15.9
Squarespot Rockfish	3065	12.9
BlackeyeGoby	1214	5.1
Rosy Rockfish	891	3.8
Halfbanded Rockfish	781	3.3
Rosethorn Rockfish	603	2.5
Sebastomus	596	2.5
Unidentified Rockfishes	535	2.3
Bank Rockfish	515	2.2

DSCS Taxon	n	%
Unidentified Gorgonian	2618	33.4
Foliose Sponge	759	9.7
Shelf Sponge	734	9.4
Vase Sponge	728	9.3
Red Gorgonian	707	9.0
California Lace Coral	607	7.7
Branching Sponge	603	7.7
Sea Pen	573	7.3
Plexauridae	214	2.7
Other Coral	162	2.1

Central CA

23,749 fishes, 95 taxa (85.5% rockfishes)

7837 DSCS (62.3% corals)

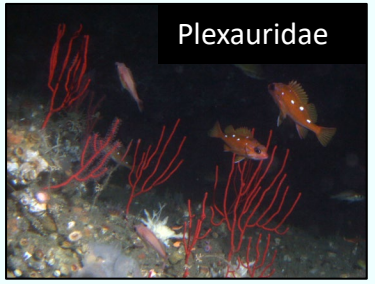
Southern CA

53,620 fishes, 117 taxa (89.7% rockfishes)

19,467 DSCS (52.8% corals)

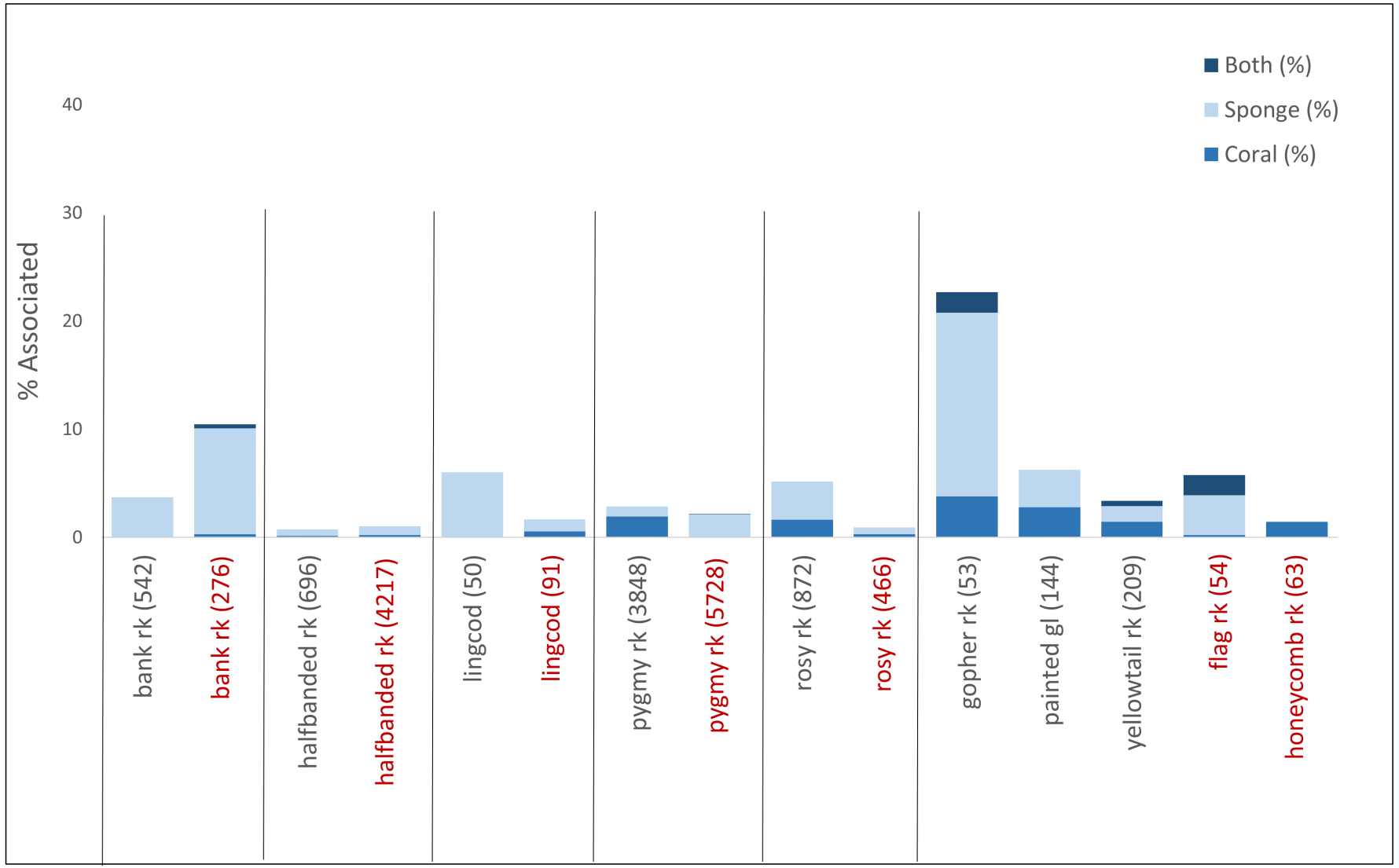
*anemones not included

Fish Taxon	n	%
Squarespot Rockfish	18062	33.7
YOY Rockfish	7996	14.9
Pygmy Rockfish	6822	12.7
Halfbanded Rockfish	4608	8.6
Swordspine Rockfish	2269	4.2
Sebastomus	1989	3.7
Blackeye Goby	1583	3.0
Dwarf-Red Rockfish	1562	2.9
Senorita	839	1.6
Shortspine Combfish	764	1.4



DSCS Taxon	n	%
Sea Fan	2693	13.8
Vase Sponge	2603	13.4
Foliose Sponge	2314	11.9
Shelf Sponge	1988	10.2
Red Gorgonian	1607	8.3
Other Coral	1574	8.1
Barrel Sponge	1277	6.6
Sea Pen	1163	6.0
Purple Gorgonian	946	4.9
Red Tree Coral	842	4.3

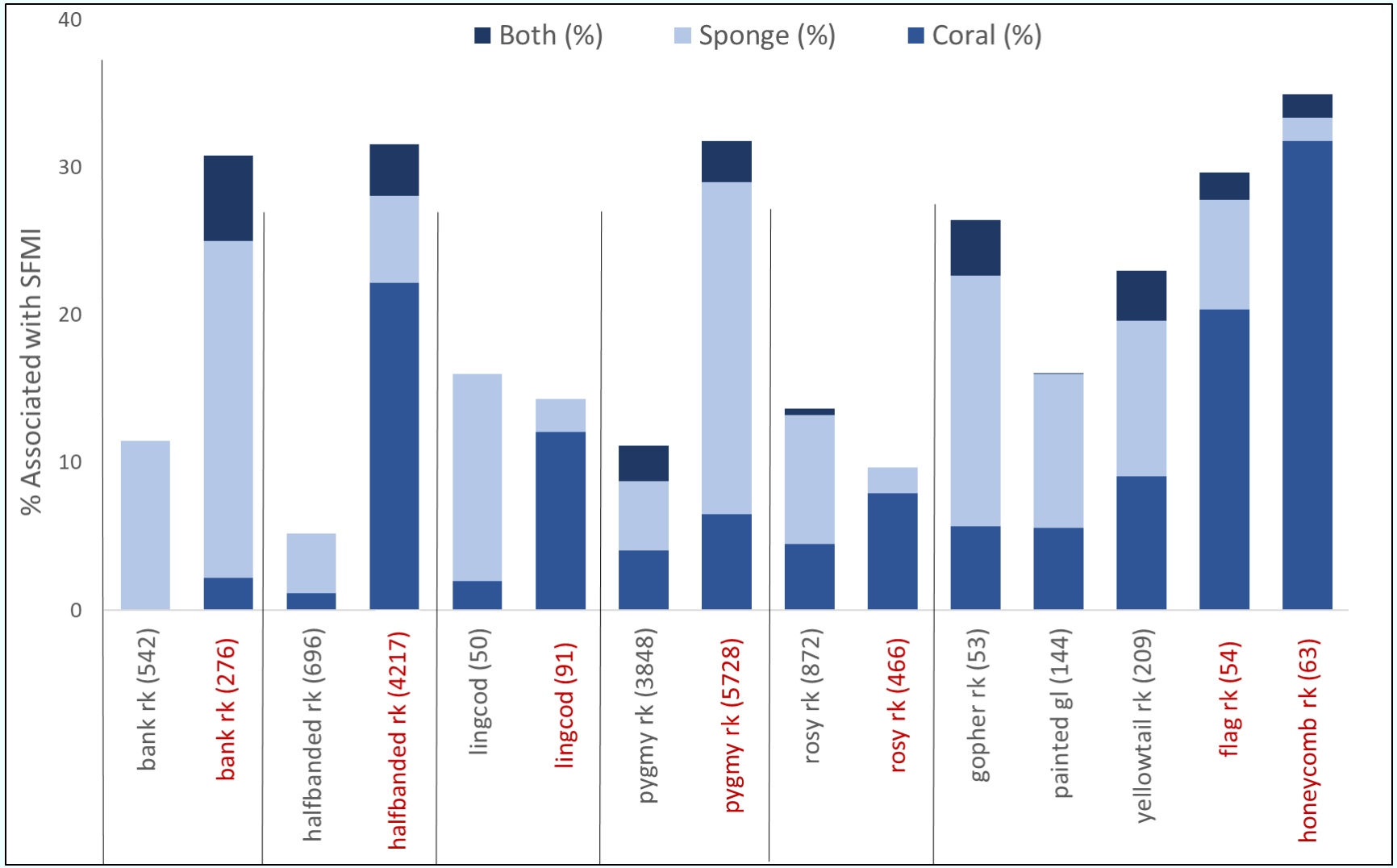
Fish-DSCS Associations: < 1 Body Length



Similar proportions of common groundfishes associated with DSCS between regions.

Sponges more commonly associated with groundfishes than corals at < 1 BL in both regions.

Fish-DSCS Associations: < 3 m



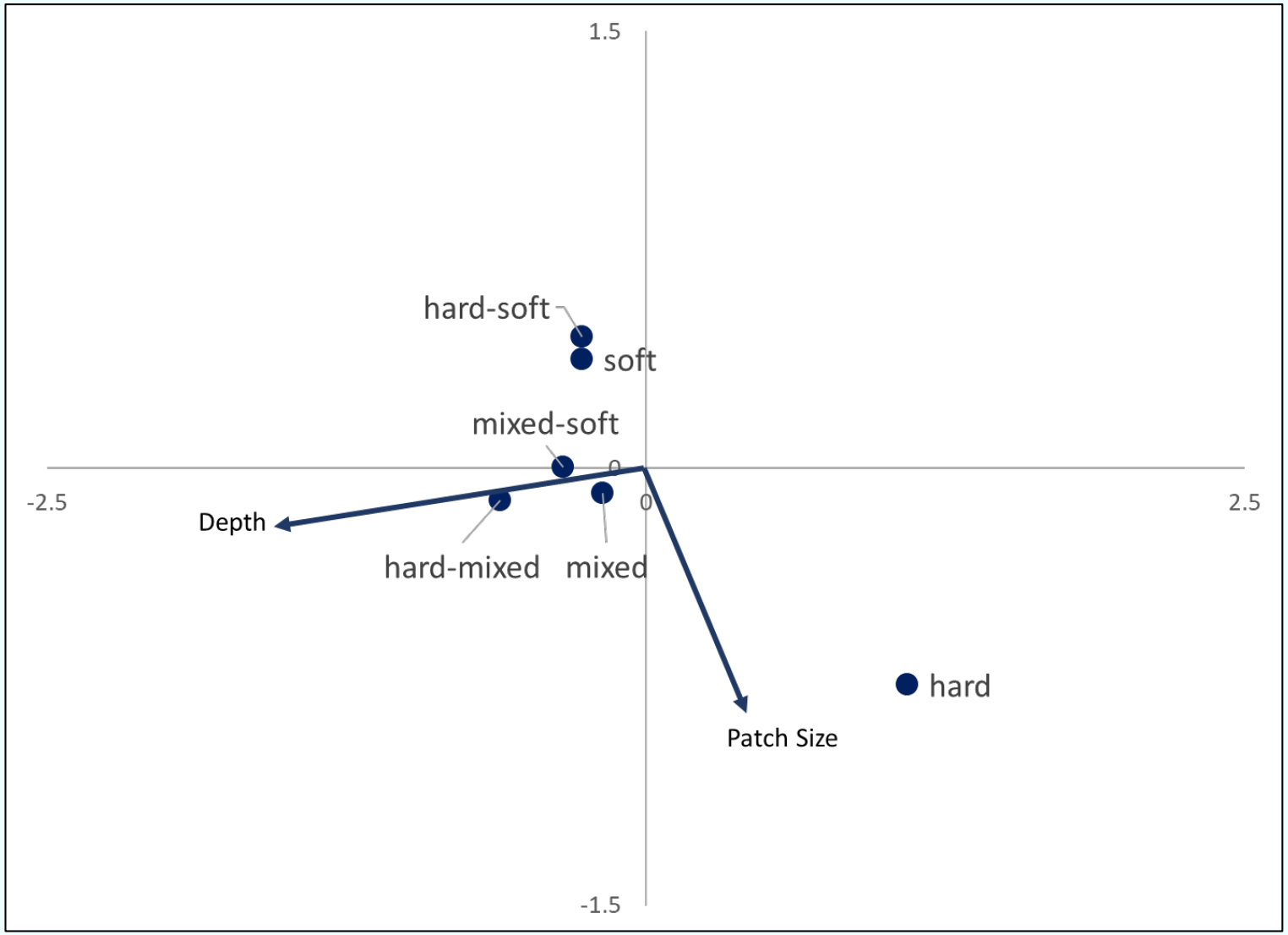
SoCal groundfishes had stronger DSCS associations.

Relative use of DSCS was similar overall, but more sponge use in CenCal and more coral use in SoCal.

Coral use elevated at < 3 m scale.

Species-specific relative proportion of DSCS generally inconsistent.

Central California Fish-DCSC: CCA Analysis (Transect Scale)



1% n, 25% FO
Sqrt transformed densities.

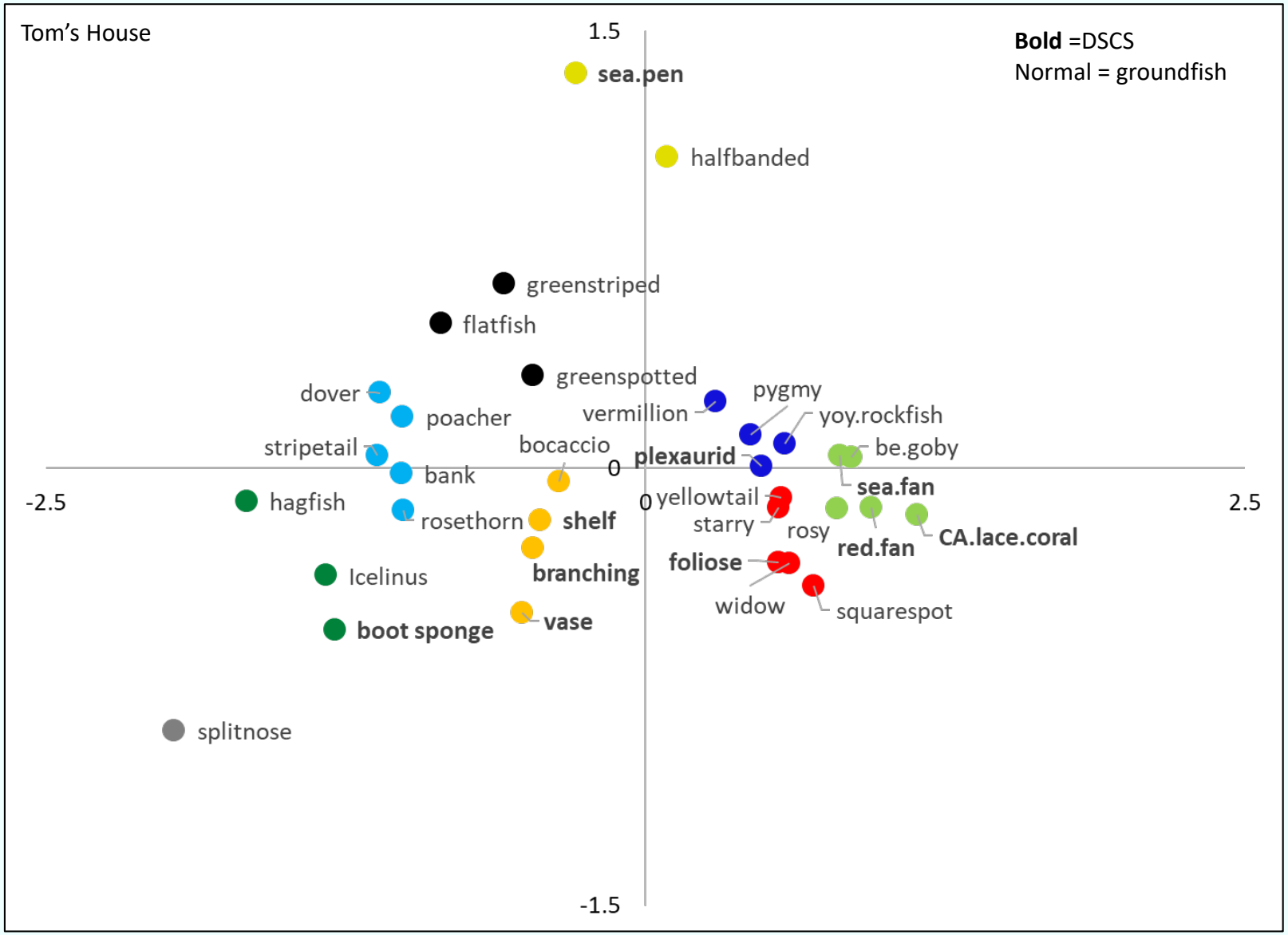
DCA indicates that CCA (unimodal data) is appropriate model.

Three constraining variables: Depth, Patch Size (m), Habitat Type

Model explains 32.8% of variability, CCA1 (22.0 %) + CCA2 (5.0%) = 74.9%

Depth and Patch Size uncorrelated.

Central California Fish-DCSC: Habitat Guilds



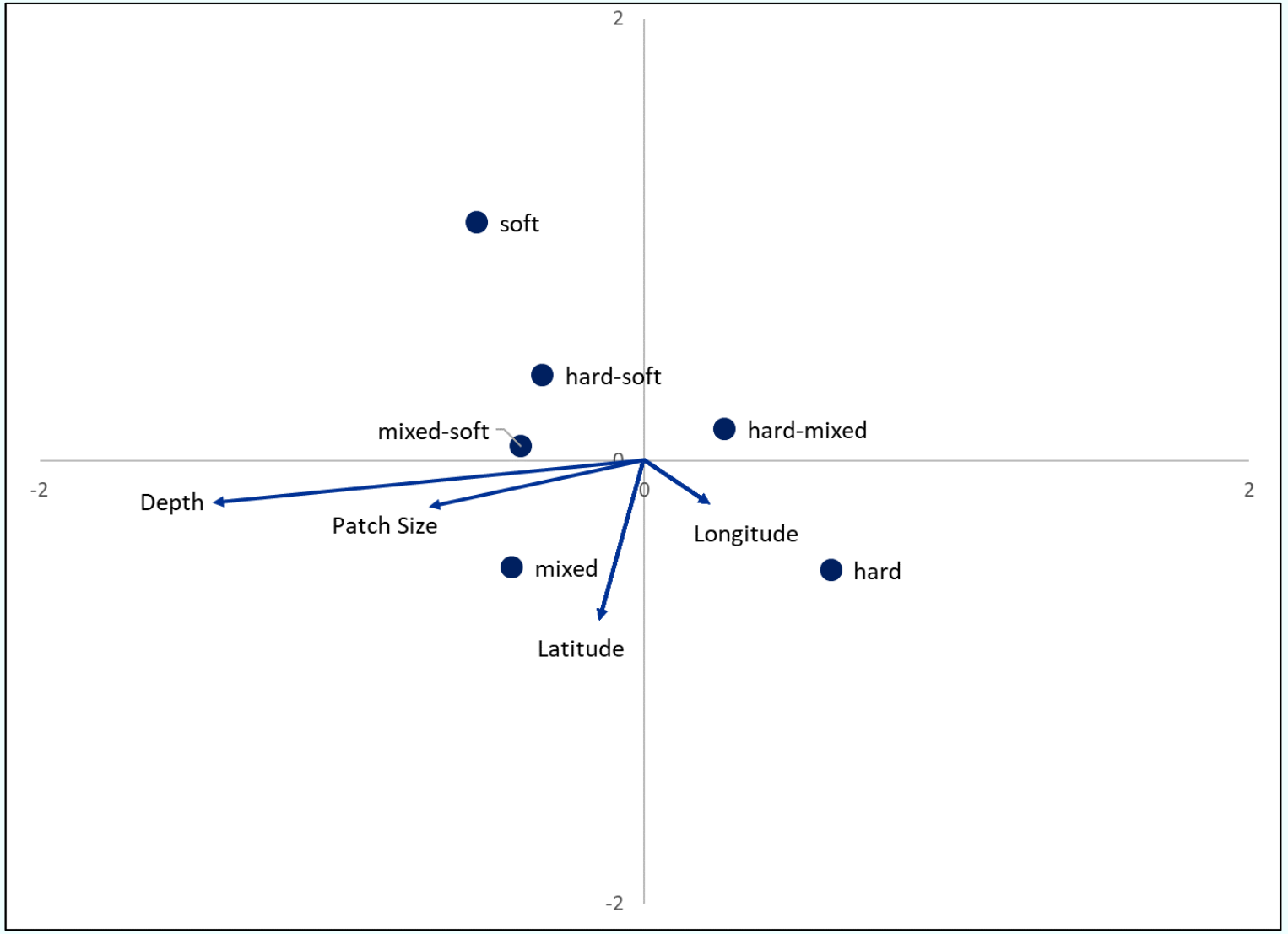
K-means Clustering indicates 9 clusters at transect scale.

3 groundfish clusters.

3 groundfish clusters contain sponges and groundfishes.

3 groundfish clusters contain corals and groundfishes.

Southern California Fish-DCSC: CCA Analysis (Transect Scale)



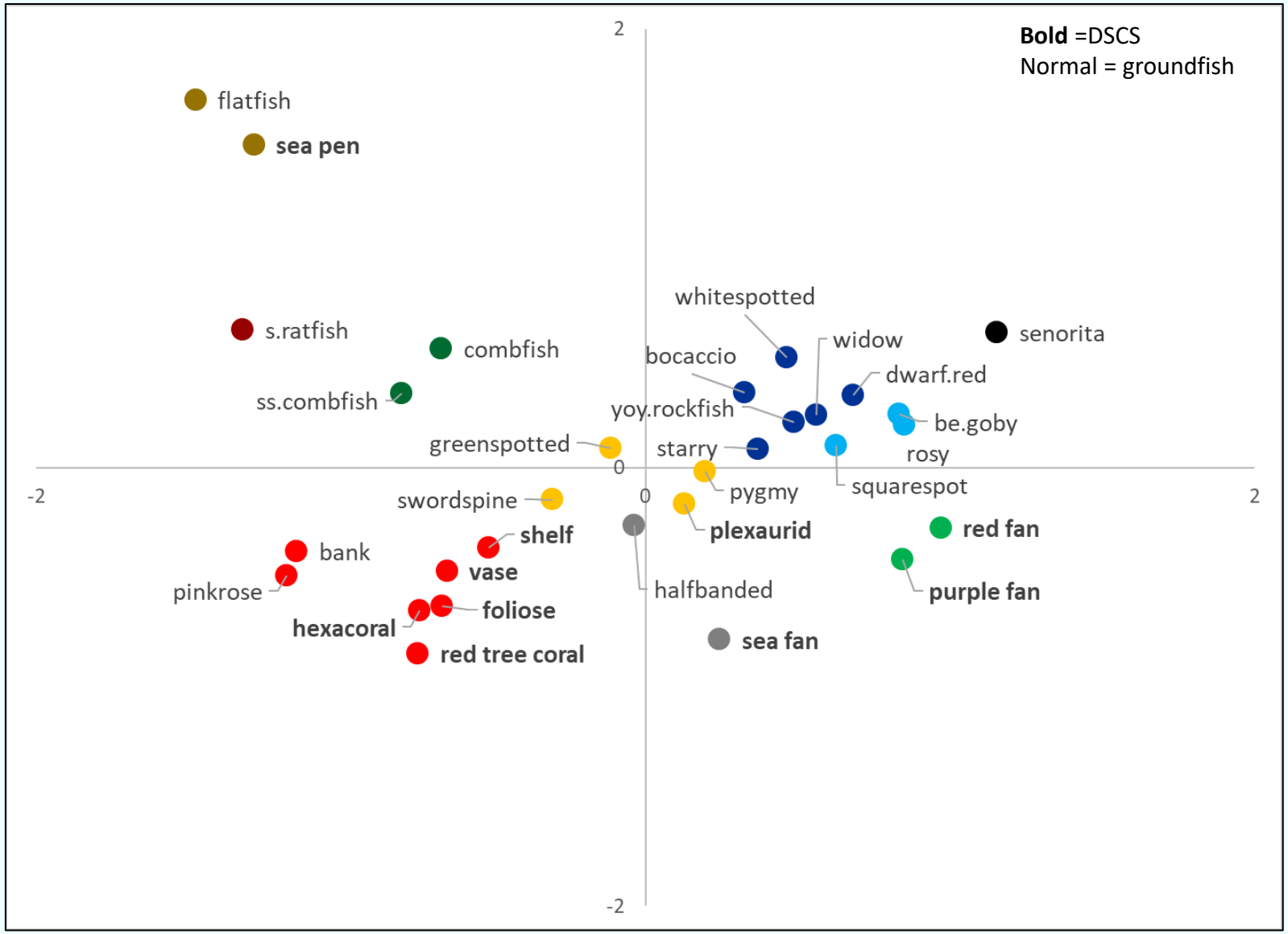
DCA indicates that CCA (unimodal data) is appropriate model.

Five constraining variables: Depth, Patch Size (m), Habitat Type, Latitude, Longitude

Model explains 37.4% of variability, CCA1 (14.4 %) + CCA2 (7.3%) + CCA3 (5.9%) = 73.9%

Depth and Patch Size highly correlated, uncorrelated with Latitude, negatively correlated with Longitude.

Southern California Fish-DCSC: Habitat Guilds



K-means Clustering indicates 10 clusters at transect scale.

5 groundfish clusters.

3 groundfish clusters contain corals and groundfishes.

1 groundfish clusters contains corals, sponges, and groundfishes.

1 coral cluster.

Discussion

Greater densities of groundfishes and DSCS (also larger) in Southern California.

Small-scale (< 1 BL) associations greater with sponges than corals in both regions.

Relative use of DSCS was similar at < 3 m scale, but more sponge use in Central CA and more coral use in Southern CA.

Species-specific relative proportion of DSCS generally inconsistent between regions.

Habitat guilds of co-occurring species indicate regional variability in fish-DSCS associations (e.g., bocaccio DSCS differed, pygmy-plexaurid use consistent).

Greater degree of small-scale associations for DSCS (especially sponges, gorgonians) found in this study (3.8%) than by Tissot et al. (1.4%, 2006).

Future Work

This Study:
1) Incorporate rock types (rock, boulder, cobble) into CCA
2) Length-based analyses
2) Regression models (species-specific, diversity)

Creation of a Relational Database of Deep-Sea Coral-Fish Associations for the U.S. West Coast (Curt Whitmire).

A global review of the strength of evidence for associations between fishes and cold-water corals and sponges (Lewis Barnett).

Ryan Gasbarro (Post-Doc, Tunnicliffe-Cordes Labs) – influence of habitat structure and oceanography of DSC communities, and using predictive methods to model potential effects of climate change.

Acknowledgements

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