

Associations of groundfishes and corals in the Southern California Bight



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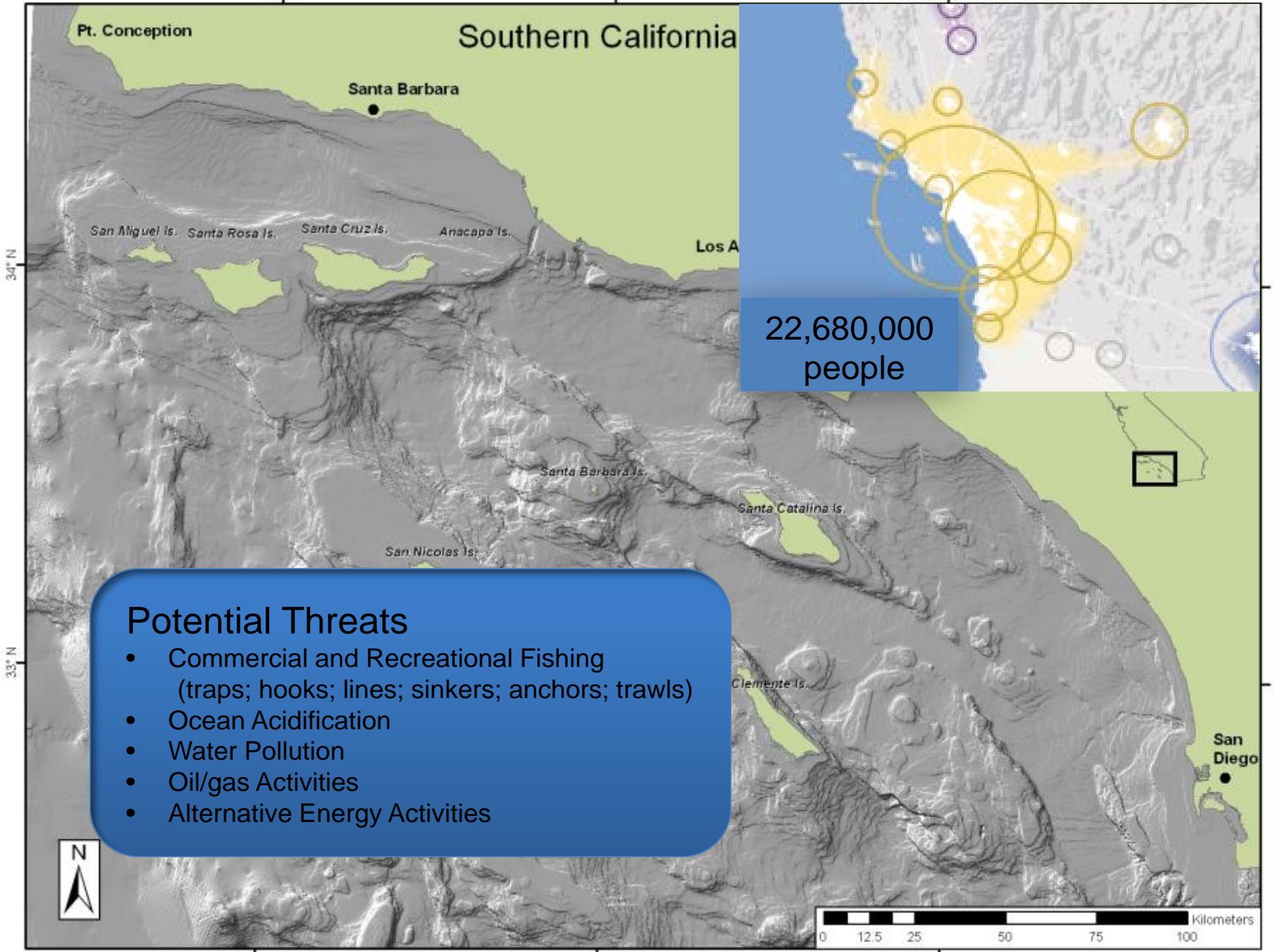
Mary Nishimoto

Humboldt State University

Brian Tissot

-120° W -119° W -118° W

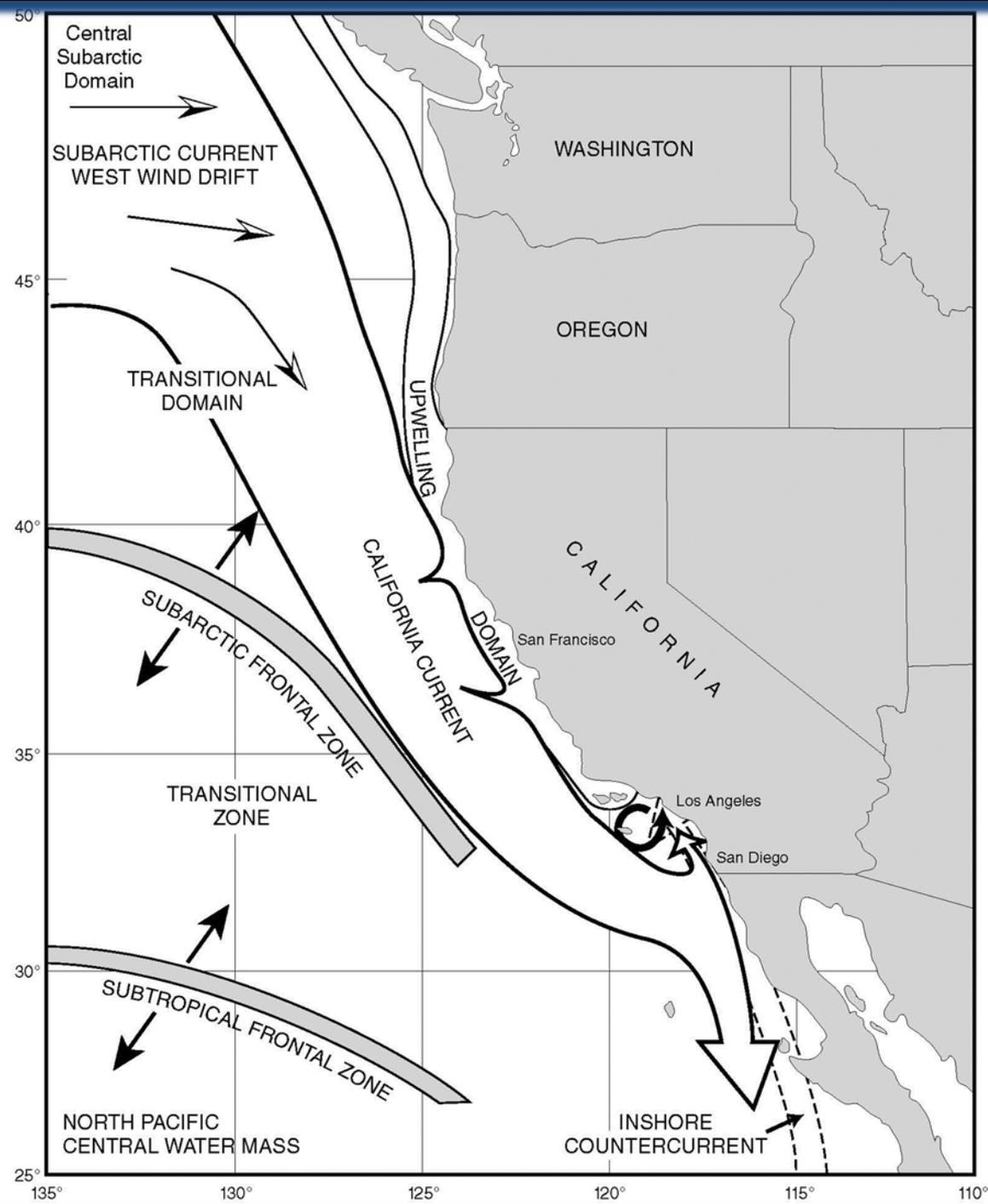
Southern California



Potential Threats

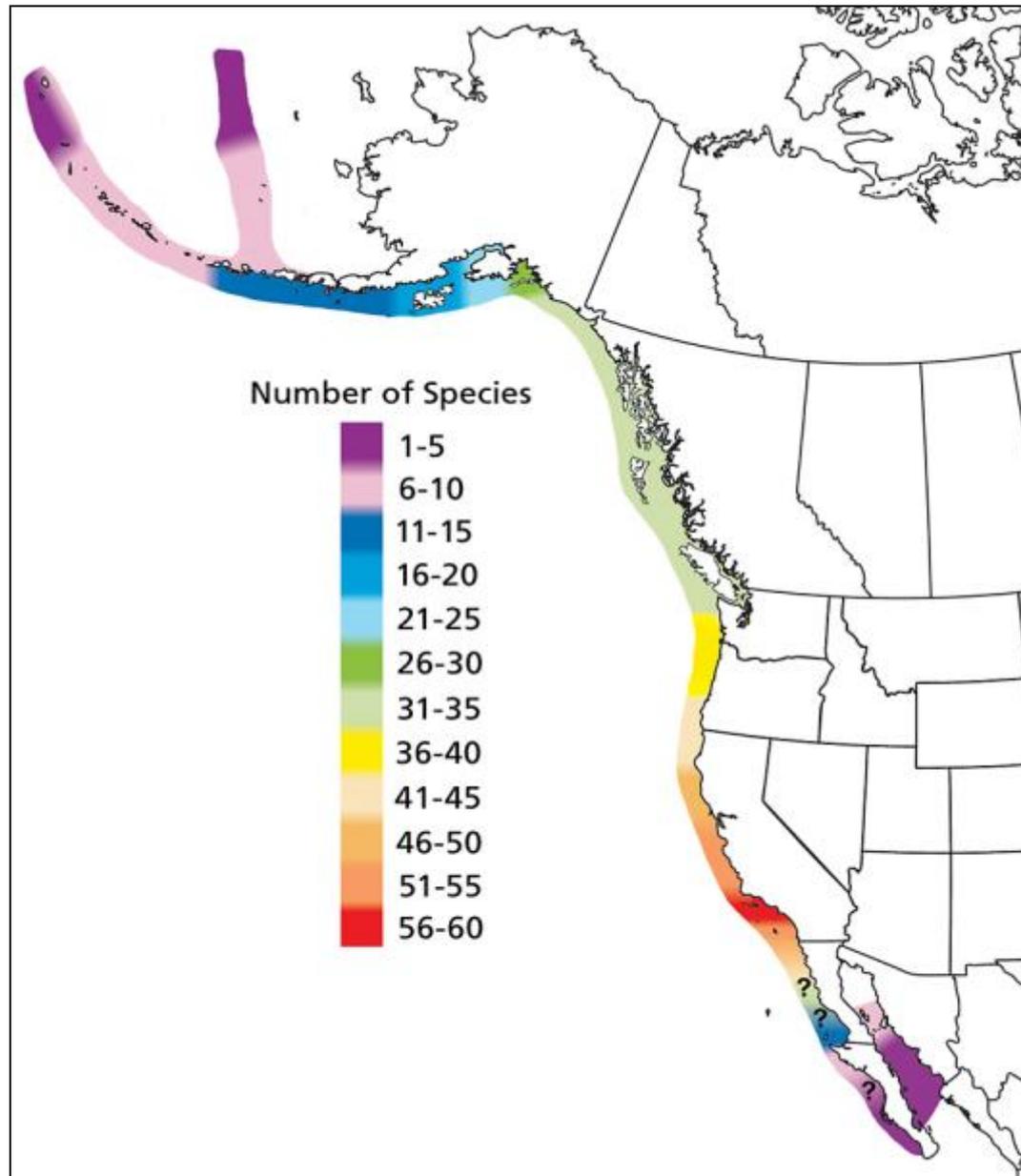
- Commercial and Recreational Fishing (traps; hooks; lines; sinkers; anchors; trawls)
- Ocean Acidification
- Water Pollution
- Oil/gas Activities
- Alternative Energy Activities



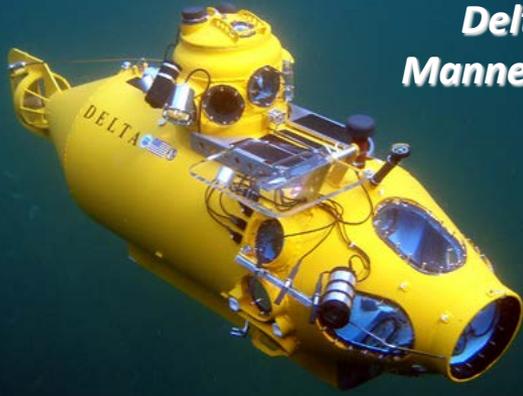


Love and Yoklavich 2003

Hot Spot of Rockfish Diversity In Southern California



Visual Survey Tools We Use to Characterize Deepsea Coral Communities



*Delta
Manned Sub*



*Dual DeepWorker
Manned Sub*



*UConn
Kraken 2*

-120° W

-119° W

-118° W

Southern California Bight

- NMFS FED - UCSB SUB
- CA State Waters
- CINMS boundaries
- CI State MPAs
- CI Federal MPAs
- Cowcod Conservation Areas
- EFH Conservation Areas
- State MLPA MPAs

34° N

33° N

Pt. Conception

Santa Barbara

Los Angeles

Palos Verdes

San Diego

San Miguel Is.

Santa Rosa Is.

Santa Cruz Is.

Anacapa Is.

Harrison's Reef

Dume Canyon

Hidden Reef

Kidney Bank

Santa Barbara Is.

Osbore Bank

Santa Catalina Is.

Lasuen Knoll

Potato Bank

San Nicolas Is.

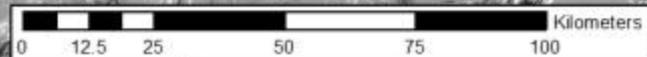
Farnsworth Bank

San Clemente Is.

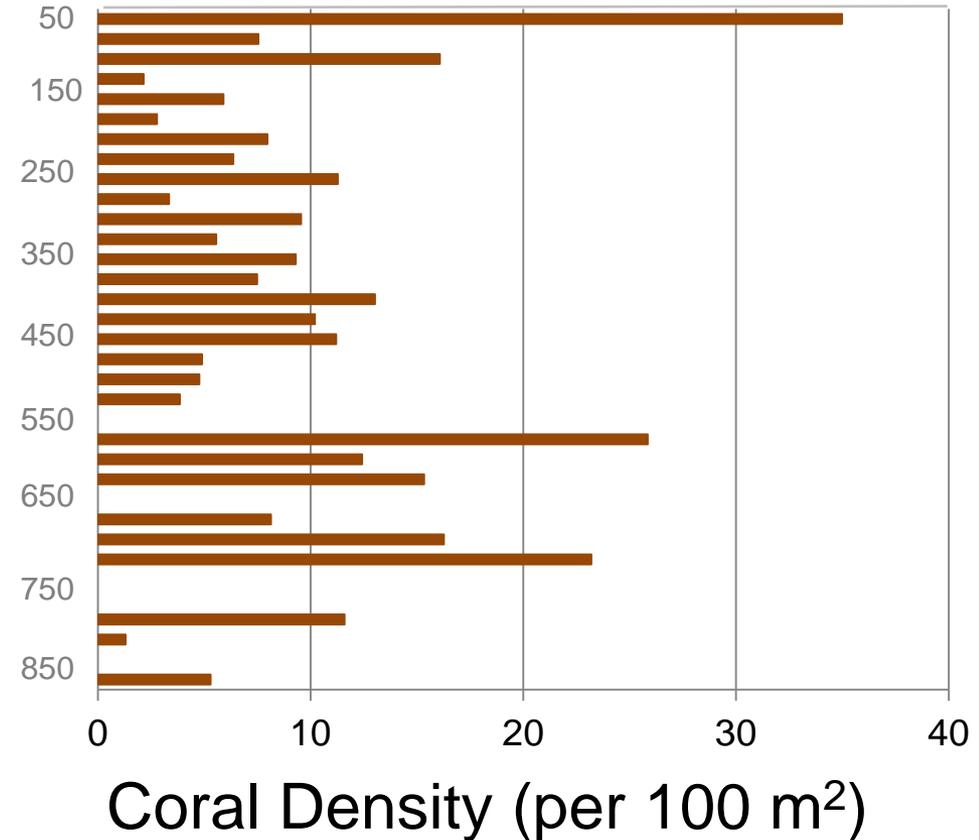
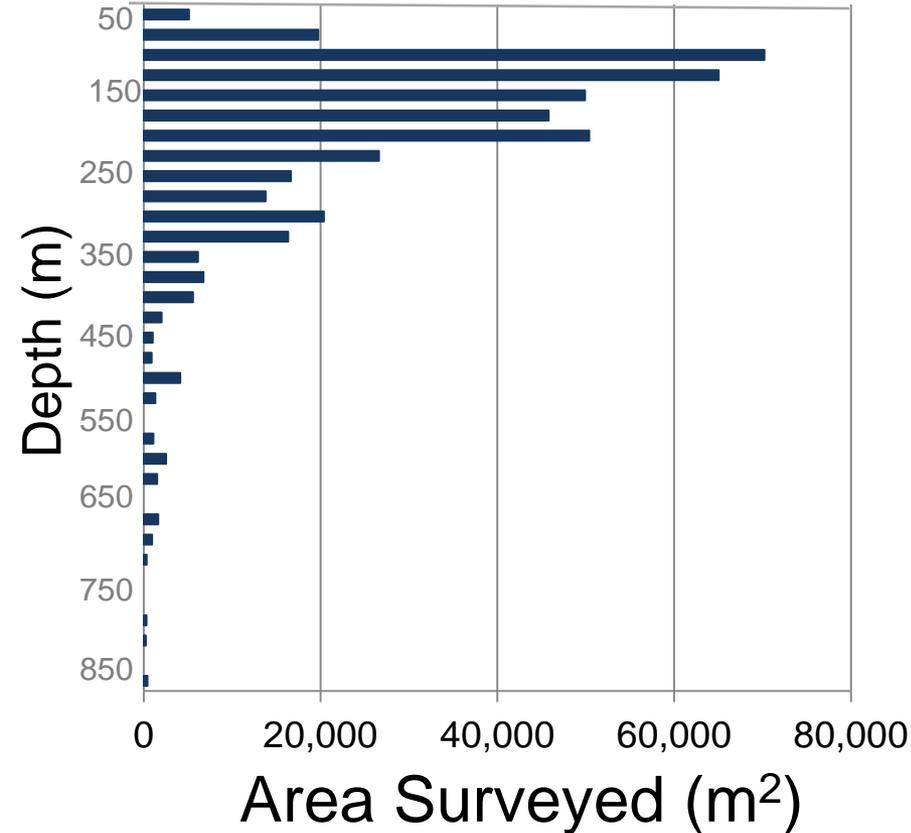
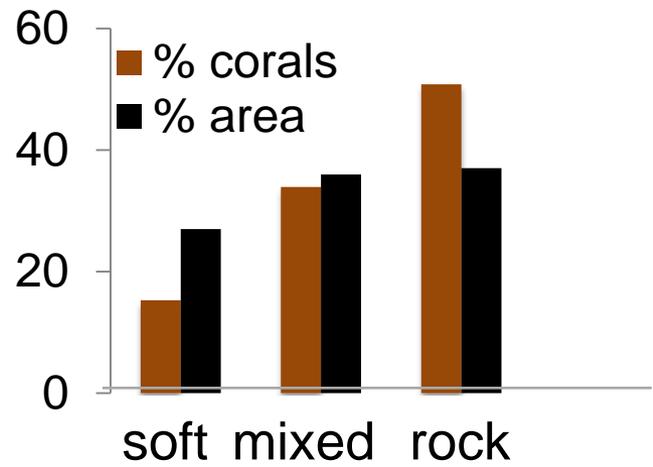
Cherry Bank

43 Fathom Bank

Tanner - Cortes Bank



- 585 transects
- 436,768 m² total area surveyed on rocky banks (22 – 868 m depth)
- Overall density: 0.07 coral / m²; 0.47 fish / m²



Most Abundant Taxa of Deep-sea Corals in Southern California

Total Number of Coral Colonies: 31,751

Number of Taxa: 32

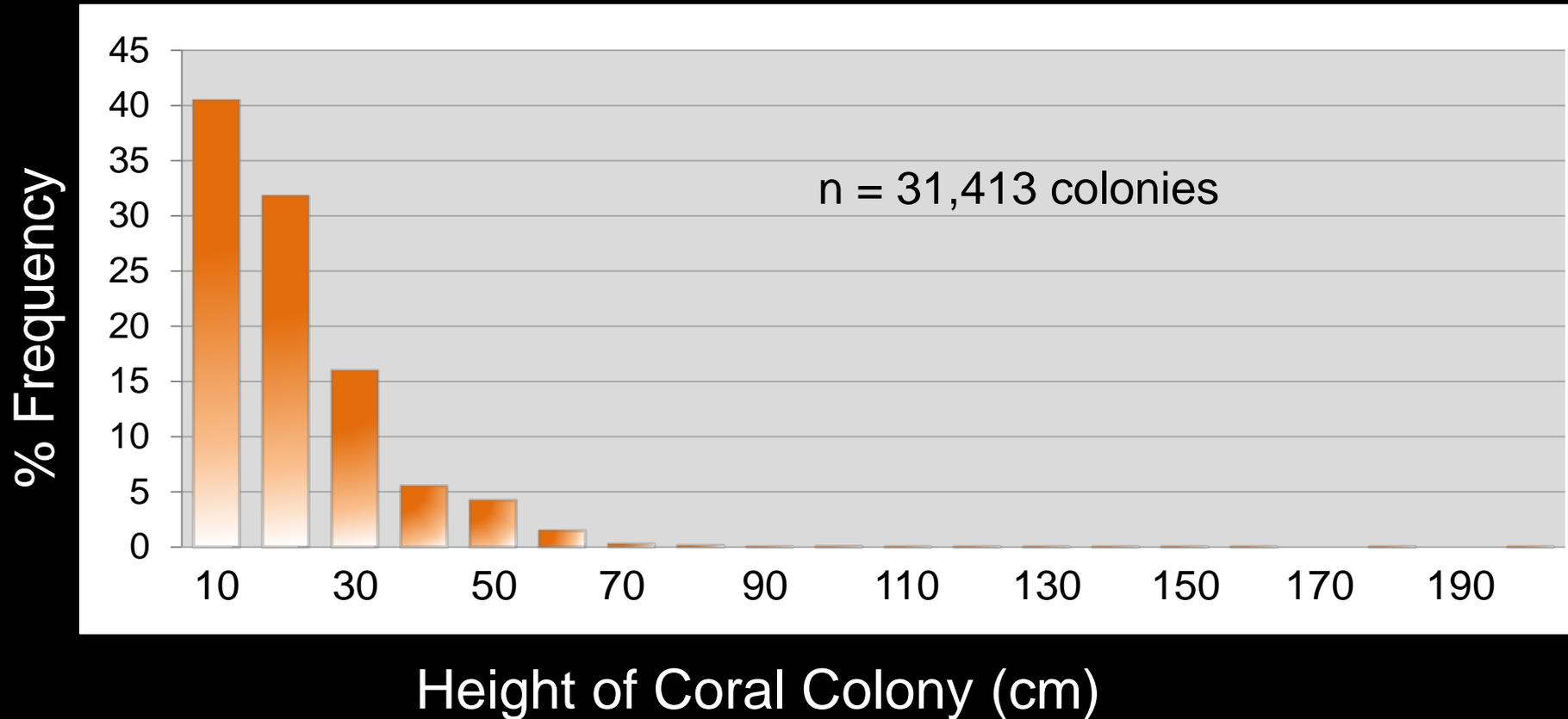
Taxa		Total		Cumulative
		No.	%	%
<i>Alcyonacea</i>	sea fan	5,894	19	19
<i>Pennatulacea #1</i>	thin sea pen	5,781	18	37
<i>Plumarella longispina</i>	primnoid	2,929	9	46
<i>Swiftia pacifica</i>	sea fan	2,895	9	55
<i>Antipathes dendrochristos</i>	Christmas tree	2,043	6	61
Hexacorallia/Octocorallia	unidentified	1,359	4	65
<i>Acanthogorgia spp.</i>	gold	1,343	4	69
Plexauridae #1	<i>Swiftia</i> type	1,350	4	73
Scleractinia	cup coral	1,043	3	76
Plexauridae #3	<i>Swiftia</i> type	1,004	3	79
<i>Lophelia pertusa</i>	white cup	927	3	82
<i>Lophogorgia chilensis</i>	red gorgonian	923	3	85



Deep-sea Corals in Southern California Bight

Total Number of Coral Colonies: 31,751

Number of Taxa: 32



Most Abundant Taxa of Fishes in Southern California

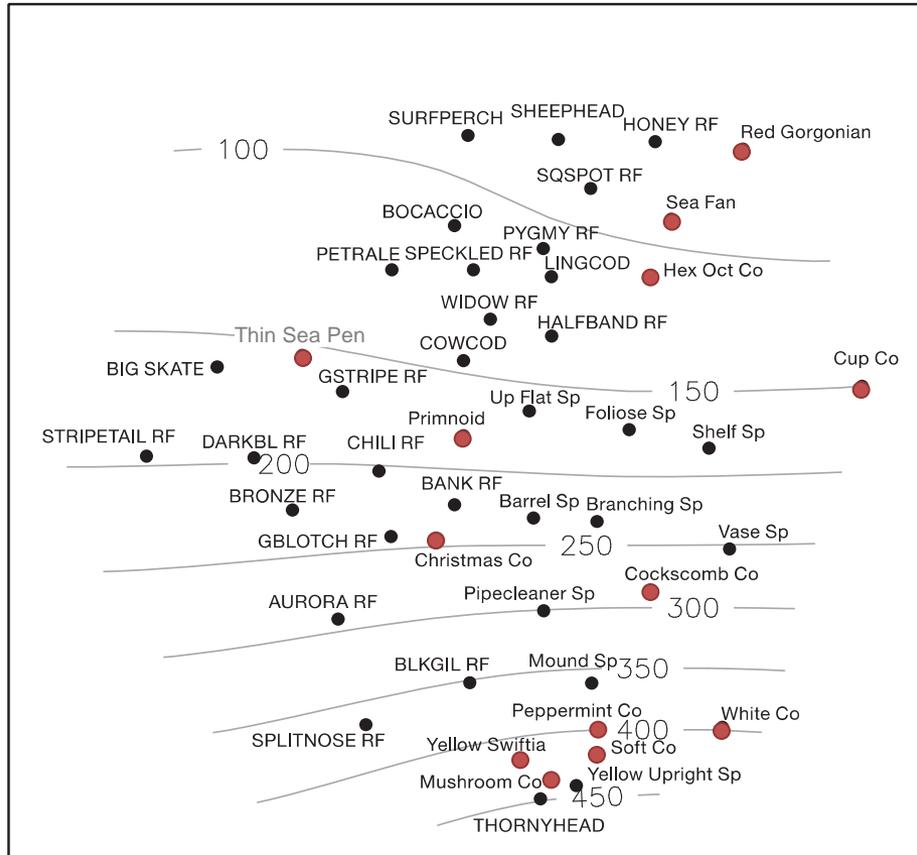
Total Number of Fishes: 203,317 Number of Taxa: 136

Taxa		Total No.	%	Cumulative %
<i>Sebastes hopkinsi</i>	squarespot rockfish	50,306	25	25
<i>Sebastes wilsoni</i>	pygmy rockfish	27,517	14	38
<i>Sebastes</i> spp. YOY	juvenile rockfish	22,899	11	50
Unidentified Sebastomus	Sebastomus rockfish	17,367	9	58
<i>Sebastes semicinctus</i>	halfbanded rockfish	13,063	6	65
<i>Sebastes ensifer</i>	swordspine rockfish	11,475	6	70
<i>Rhinogobiops nicholsii</i>	blackeye goby	5,479	3	73
<i>Zaniolepis frenata</i>	shortspine combfish	4,411	2	75
<i>Sebastes jordani</i>	shortbelly rockfish	4,366	2	77
<i>Sebastes rufus</i>	bank rockfish	3,764	2	79
<i>Sebastes</i> spp.	unidentified rockfishes	3,247	2	81
<i>Sebastes rufinanus</i>	dwarf-red rockfish	3,149	2	82

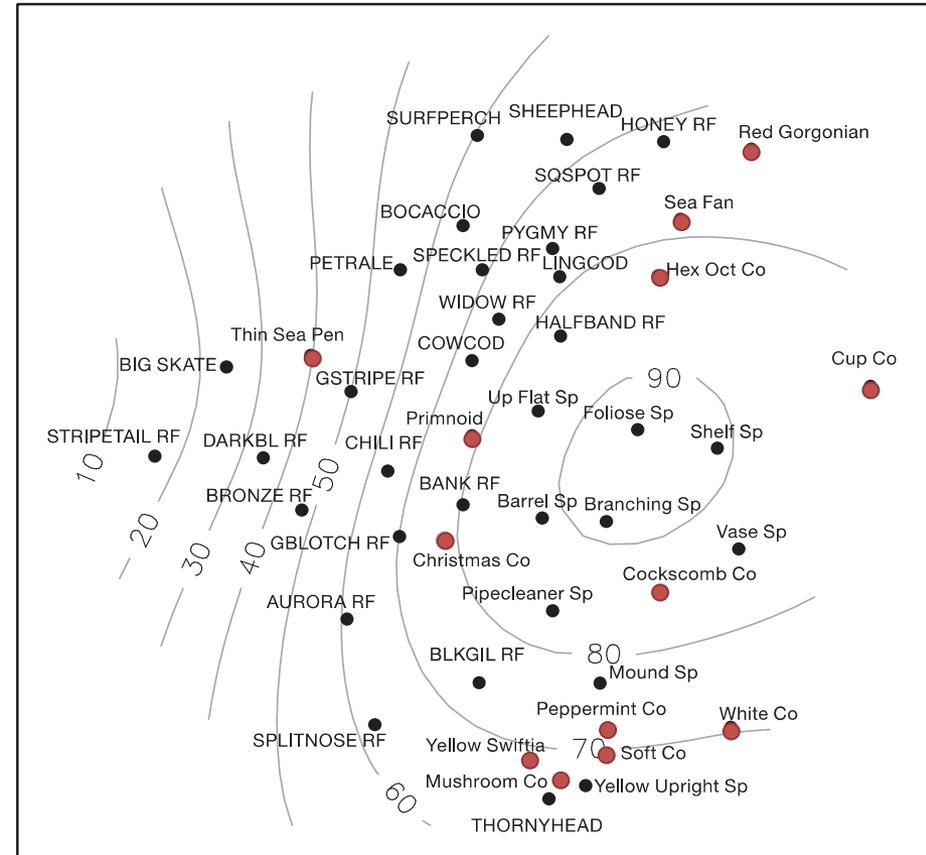


Fishes Co-occurring with Corals and Sponges

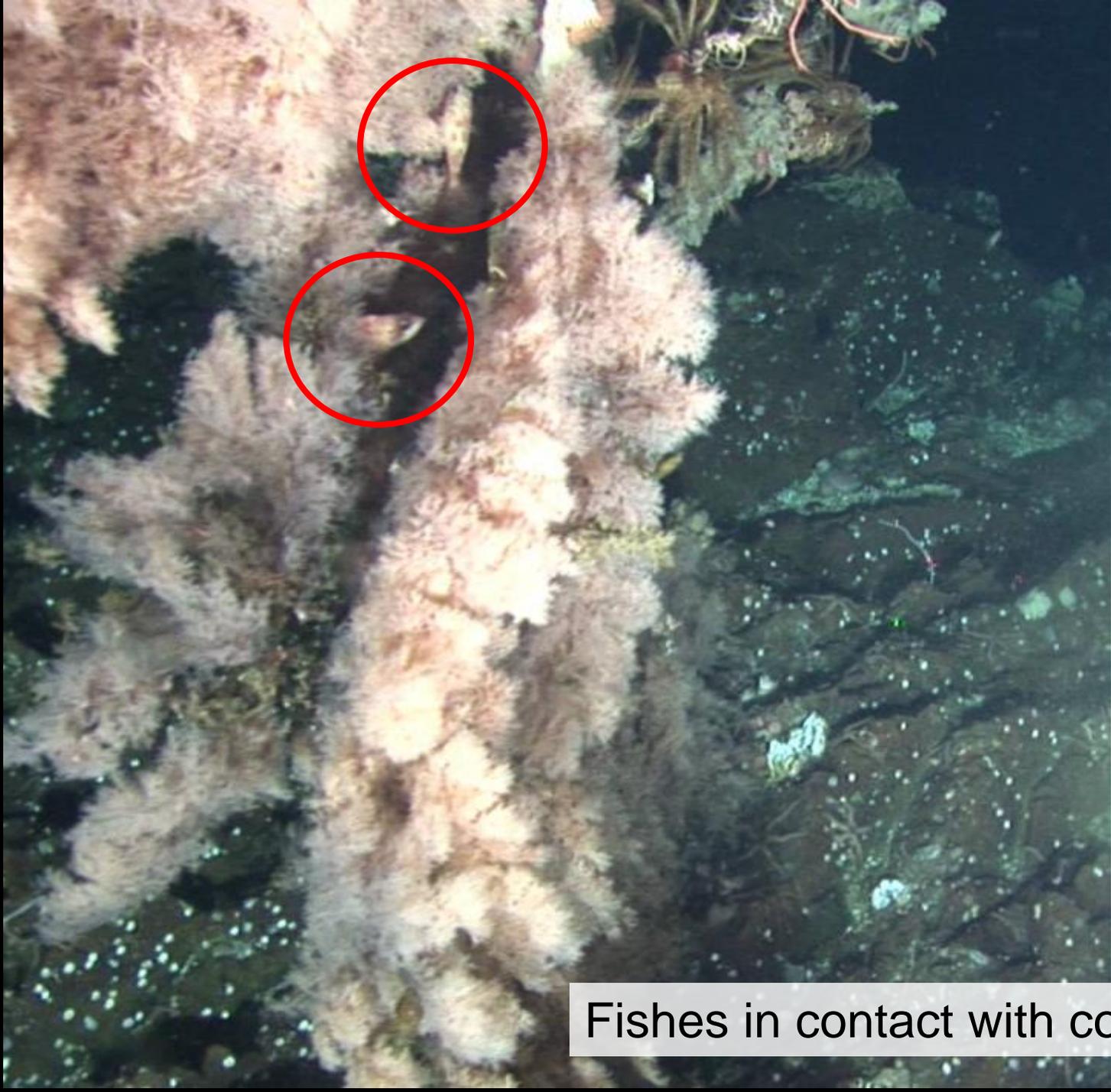
a) Depth (m)



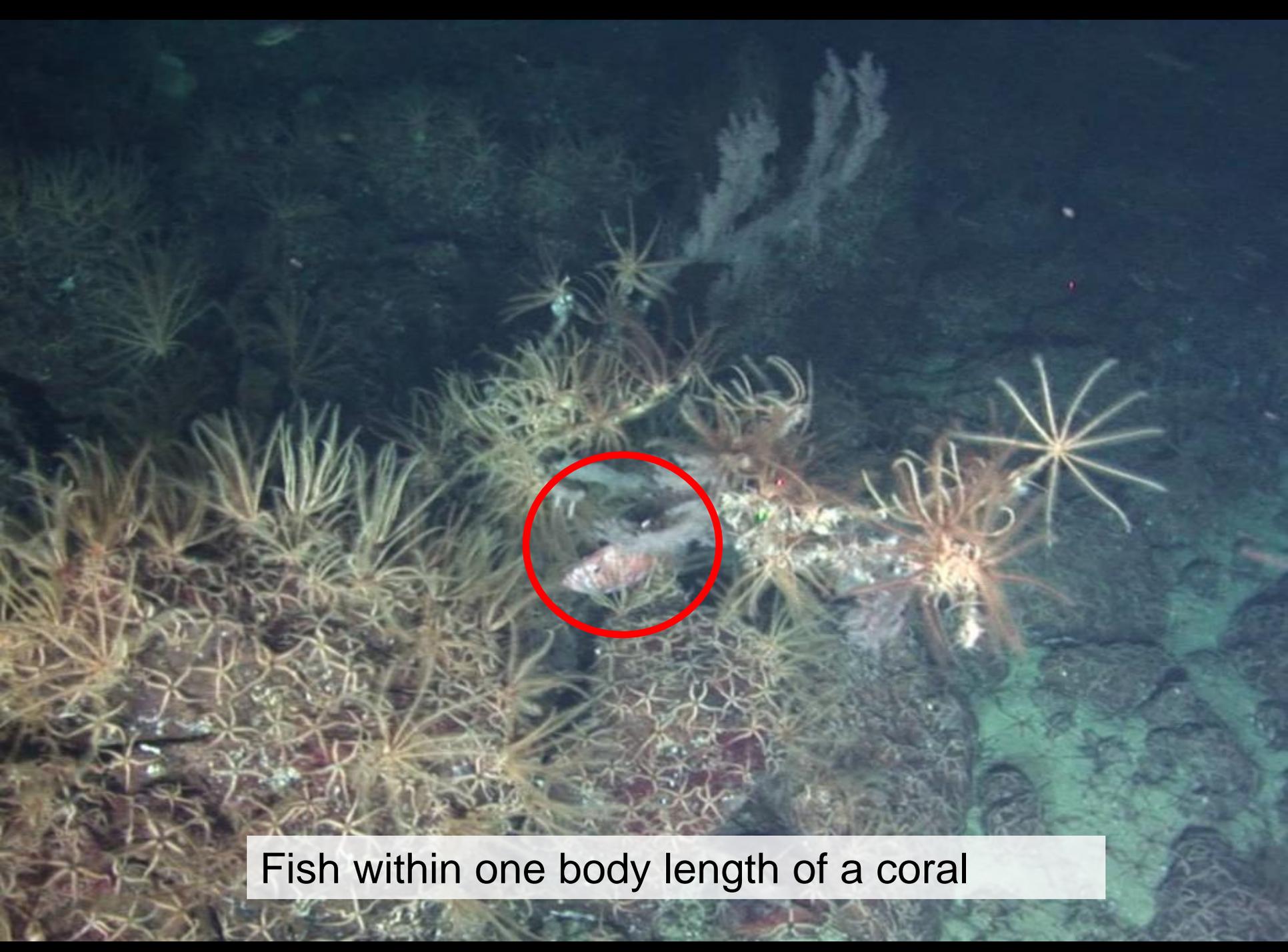
b) Percent hard substratum



Huff et al. 2013. Environmental factors influencing *Antipathes dendrochristos* in Southern California Bight. Mar Ecol Prog Ser 494:159-177.



Fishes in contact with coral



Fish within one body length of a coral



Small fish hovering over the top of a coral

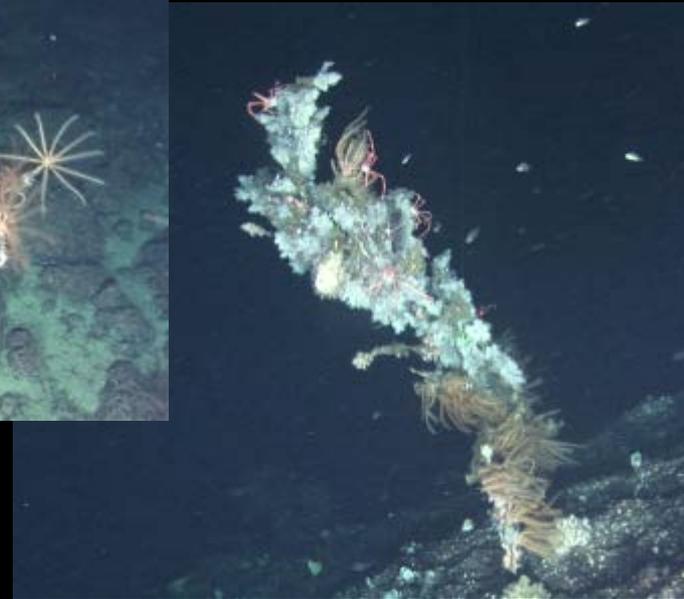
Fishes Associated with Coral



Fishes in contact with coral



Fishes within 1 body length of coral



Small fishes hovering over coral

Fishes Not Associated with Coral

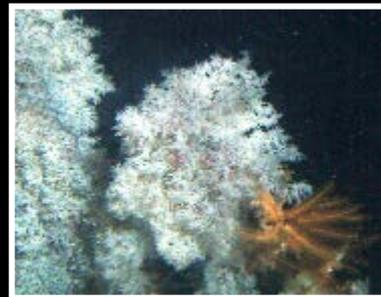
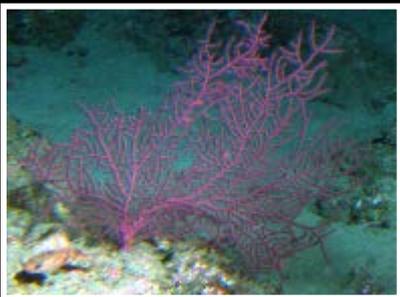


Tissot, B., M. Yoklavich, M. Love, K. York, and M. Amend. 2006. Benthic invertebrates that form habitat on deep banks off southern California, with special reference to deep sea coral. Fishery Bulletin 104:167-181.

- 9,105 sponges & corals (8,943 sponges, 135 black coral, 27 gorgonians)
- 261,000 m² total area surveyed on rocky banks in SCB (32 – 320 m depth)
- 0.04 sponge & coral / m²; fish density not reported

Findings:

- No organisms (fish or inverts) associated with 98% of all sponges & corals
- Fishes were associated with 1.3% of the black corals and 0% of the gorgonians
- Spatial Analysis: 6 fish taxa (out of 108) were found more often near large invertebrates than the number of times predicted from fish-density on the transect (median distance = 1 - 6 m away)
- Concluded: fishes not strongly associated with corals/sponges; no functional relationship was evident



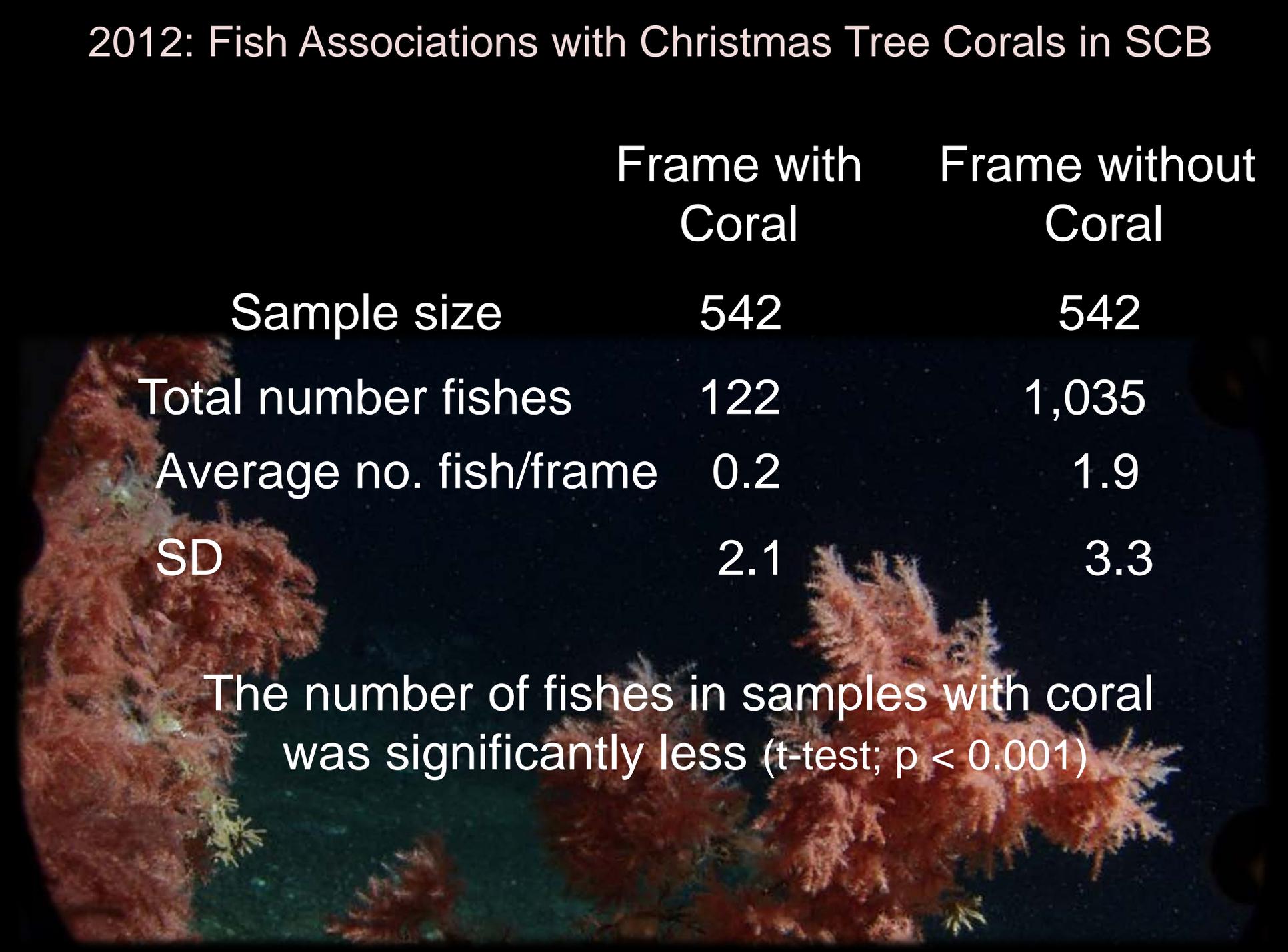
2012: Fish Associations with Christmas Tree Corals in SCB

- 30 transects; 27,200 m² area surveyed on 3 banks in SCB
- 542 Christmas tree corals (5-200 cm high; 5-200 cm wide)

Fish Taxa	Total number fishes associated w/corals (n= 122)	Total number fishes on survey (n= 18,458)
Young rockfish (10 cm)	59	1,397
Catshark eggcase	16	17
Squarespot rockfish	15	5,275
Bank rockfish	8	759
Unidentified Sebastomus	8	5,774
Young bocaccio (15 cm)	3	3
Cowcod	2	43
Halfbanded rockfish	2	677
Pygmy rockfish	2	1,951
Splitnose rockfish	2	135
Widow rockfish	2	10
Aurora rockfish	1	6
Sharpchin rockfish	1	2
Shortbelly rockfish	1	1,298
Others	0	1,111



2012: Fish Associations with Christmas Tree Corals in SCB



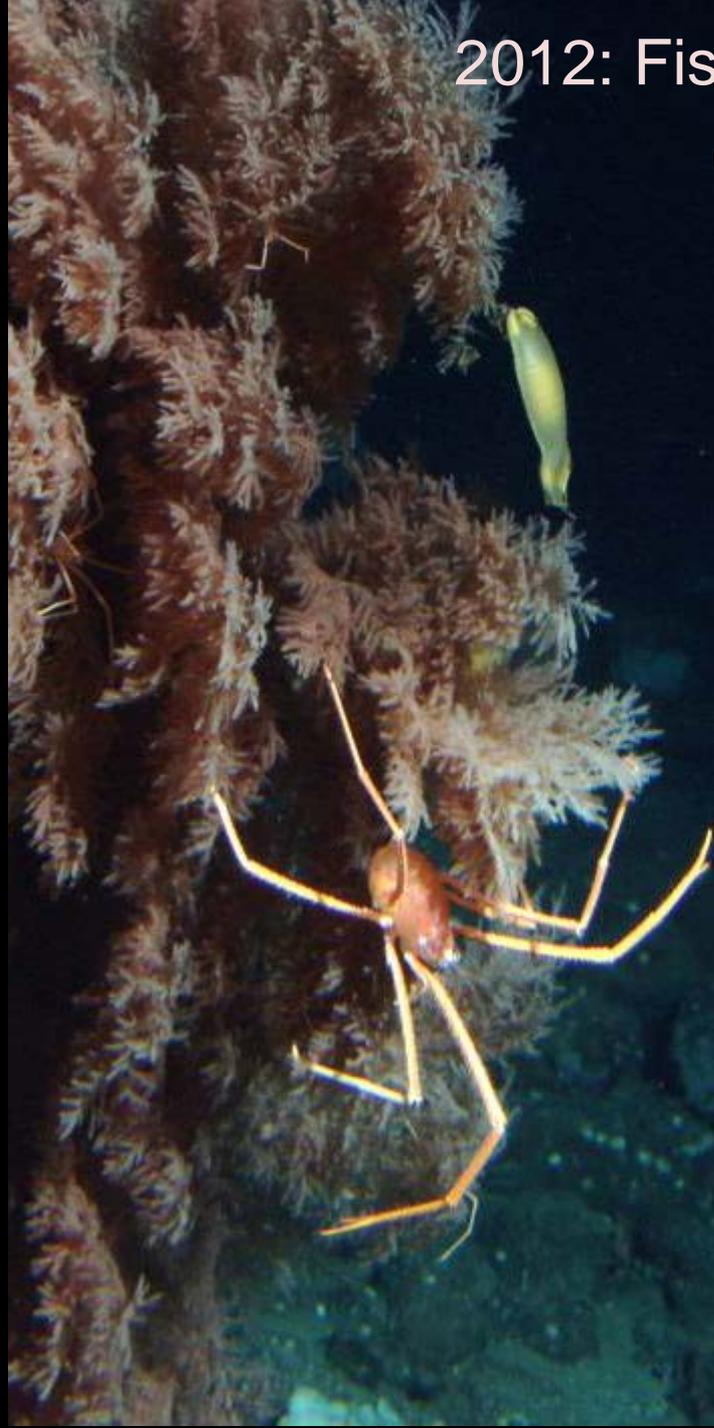
	Frame with Coral	Frame without Coral
Sample size	542	542
Total number fishes	122	1,035
Average no. fish/frame	0.2	1.9
SD	2.1	3.3

The number of fishes in samples with coral was significantly less (t-test; $p < 0.001$)

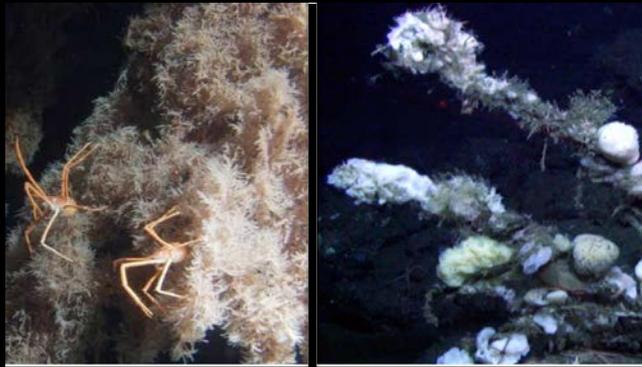
2012: Fish Associations with Christmas Tree Corals

Concluded:

- Only 36 of 542 corals were associated with fishes
 - Large corals (n=20)
 - Dying or dead corals
- Only 122 of 18,458 fishes were associated with corals
 - Small rockfishes
 - Catshark egg cases
- Less fish in samples with coral than without coral



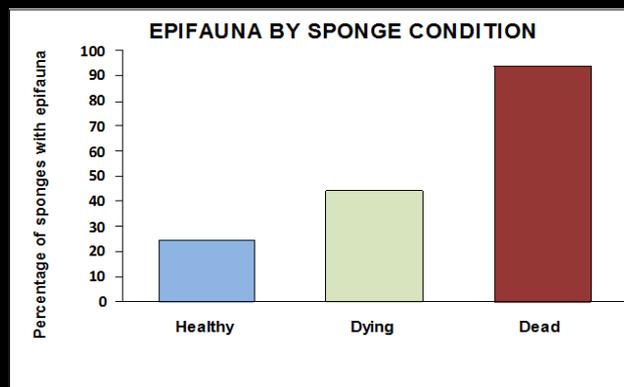
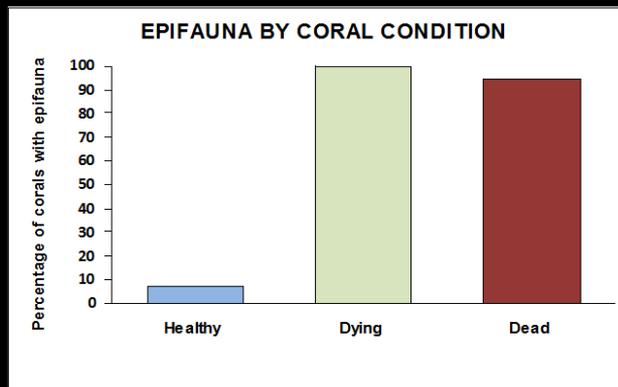
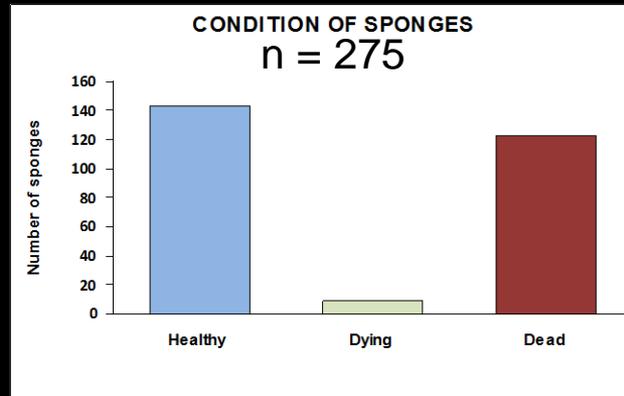
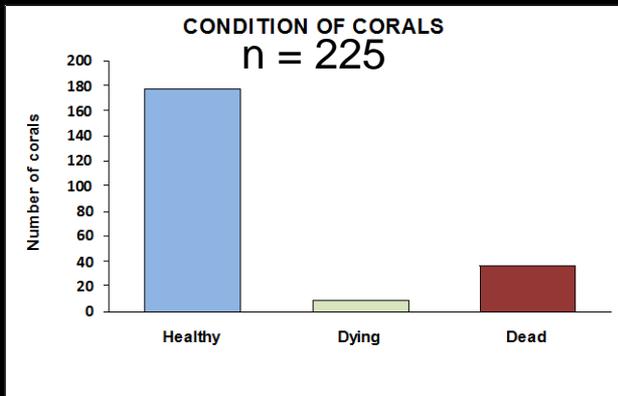
2012: Christmas Tree Corals and Goblet Sponges as Habitat for Other Invertebrates



Healthy (left) and dead (right) Christmas tree coral



Healthy (right) and dead (left) goblet sponges



2014: Fish Associations with Corals in SCB

585 transects; 436,768 m² area surveyed throughout SCB

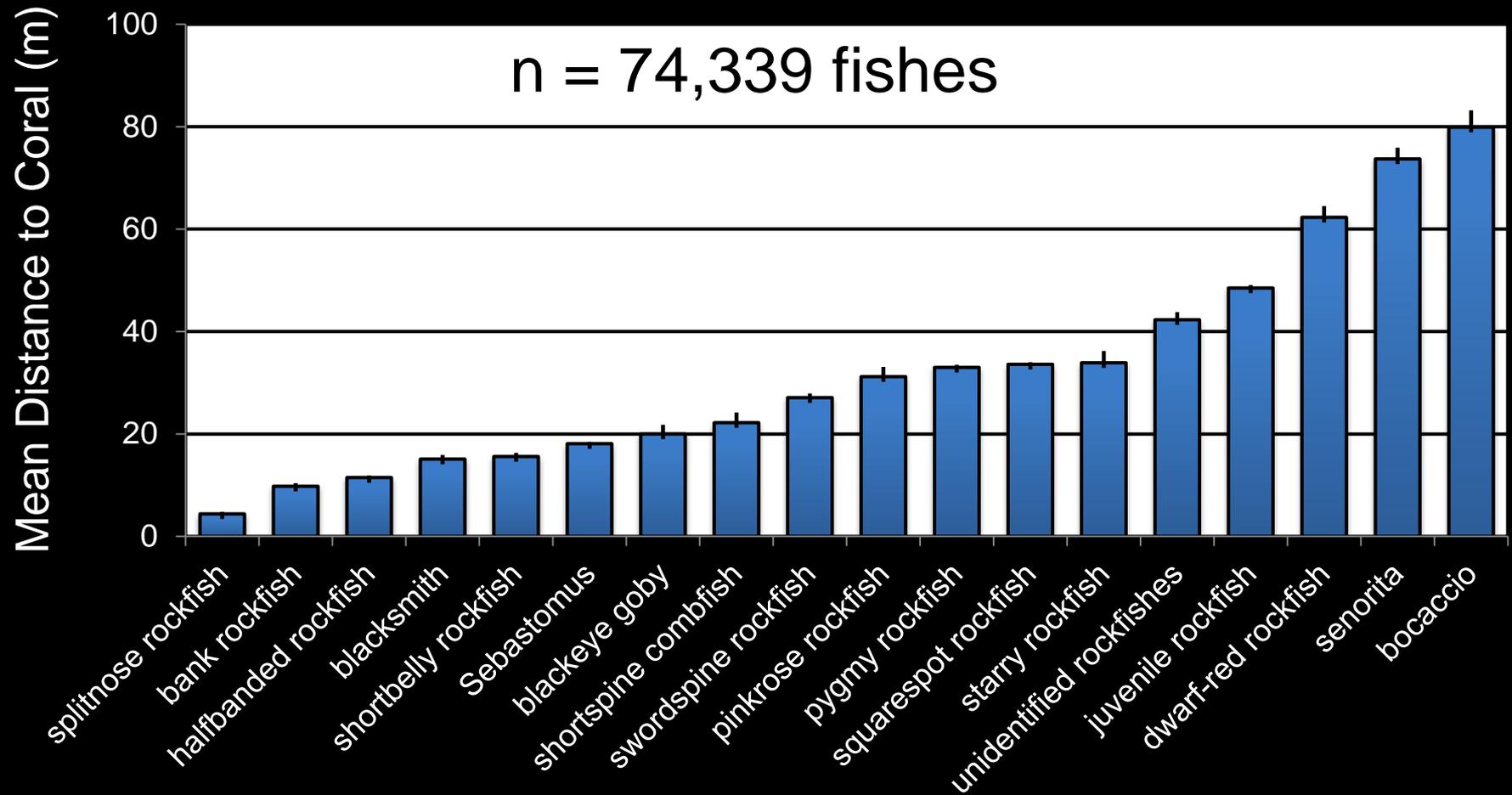
Fish Taxa	Total number fishes associated w/ corals (n= 500)	Total number fishes on survey (n= 203,317)
Halfbanded rockfish	93	13,063
Squarespot rockfish	93	50,306
Young rockfish (10 cm)	87	22,899
Blackeye goby	50	5,479
Pygmy rockfish	35	27,517
Unidentified Sebastomus	32	17,367
Catshark eggcase	15	-
Unidentified rockfish	14	3,247
Swordspine rockfish	12	11,475
Rosy rockfish	11	1,117
Bank rockfish	7	3,764
Splitnose rockfish	7	1,751
Thornyhead	6	1,389
Combfish	4	1,405
Cowcod	4	300
Honeycomb rockfish	4	87
Others (18 taxa)	26	42,151

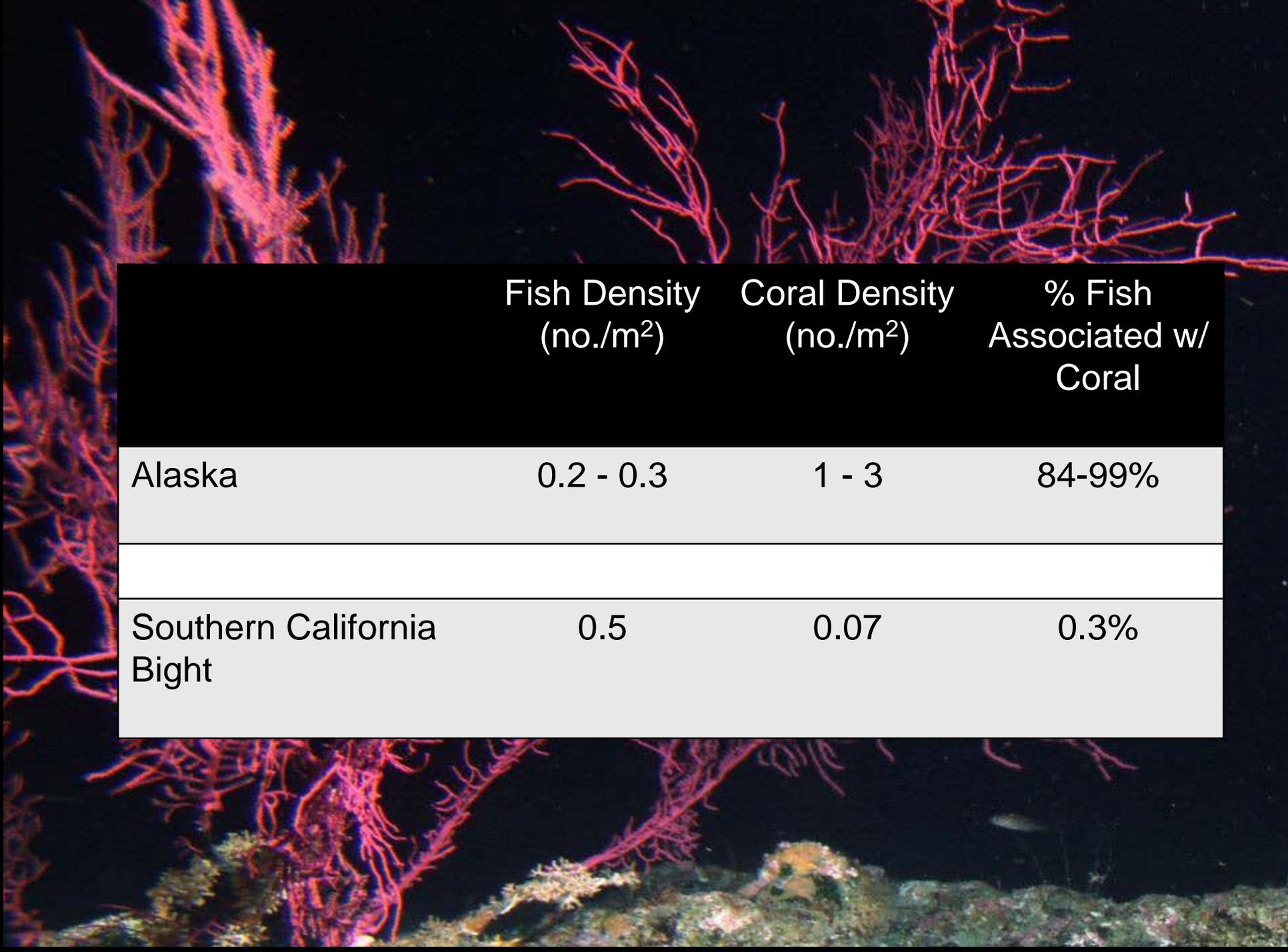
2014: Fish Associations with Corals in SCB

585 transects; 436,768 m² area surveyed throughout SCB

Coral Taxa	Total number colonies associated w/ fishes (n= 555)	Total number colonies on survey (n= 31,751)
Alcyonacea (sea fan)	256	5,894
Scleractinia (cup coral)	118	1,043
<i>Antipathes dendrochristos</i>	61	2,043
<i>Desmophyllum dianthus</i> (cup)	35	508
<i>Lophogorgia chilensis</i> (red gorgonian)	19	923
<i>Acanthogorgia</i> spp. (gold gorgonian)	18	1,343
Unknown coral	15	1,359
<i>Eugorgia rubens</i> (purple gorgonian)	14	797
<i>Plumarella longispina</i> (primnoid)	9	2,929
Plexauridae #1 (<i>Swiftia</i> type)	3	1,350
<i>Parastenella ramosa</i> (primnoid)	2	331
<i>Clavularia</i> spp. (soft coral)	1	131
<i>Lophelia pertusa</i> (white cup)	1	927
Pennatulacea #1 (thin sea pen)	1	5,781
Plexauridae #3 (<i>Swiftia</i> type)	1	1,004
Zoantharia (zoanthid coral)	1	488

Distance from Fish to Coral on Rock Substrata





	Fish Density (no./m ²)	Coral Density (no./m ²)	% Fish Associated w/ Coral
Alaska	0.2 - 0.3	1 - 3	84-99%
Southern California Bight	0.5	0.07	0.3%

Association of FMP Species with Emergent Epifauna: Case Studies from Alaska



Robert Stone
Alaska Fisheries Science Center





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Things to Consider

- Density of corals relative to the density of fishes
- Extent and type of rocky structure available to the fishes
- Night-time use of corals by fishes as shelter
- Other structure-forming invertebrates (crinoids; sponges; anemones)
- Other parts of the coast or other U.S. ecosystems
 - Productivity of the system



Questions?