WHERE ARE THE CORAL GARDENS?

MAPPING DENSITY AND CONDITION OF GORGONIAN OCTOCORALS IN SOUTHERN CALIFORNIA.

A One NOAA presentation by NOAA's Deep-Sea Coral and Research Technology Program
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with inspiration from DSC-RTP

Tom Hourigan, Bob Stone, Kevin Stierhoff,
Mary Yoklavich, Elizabeth Clarke, and others

How do we compare deep-sea coral assemblages?

Which attributes are most important to measure?

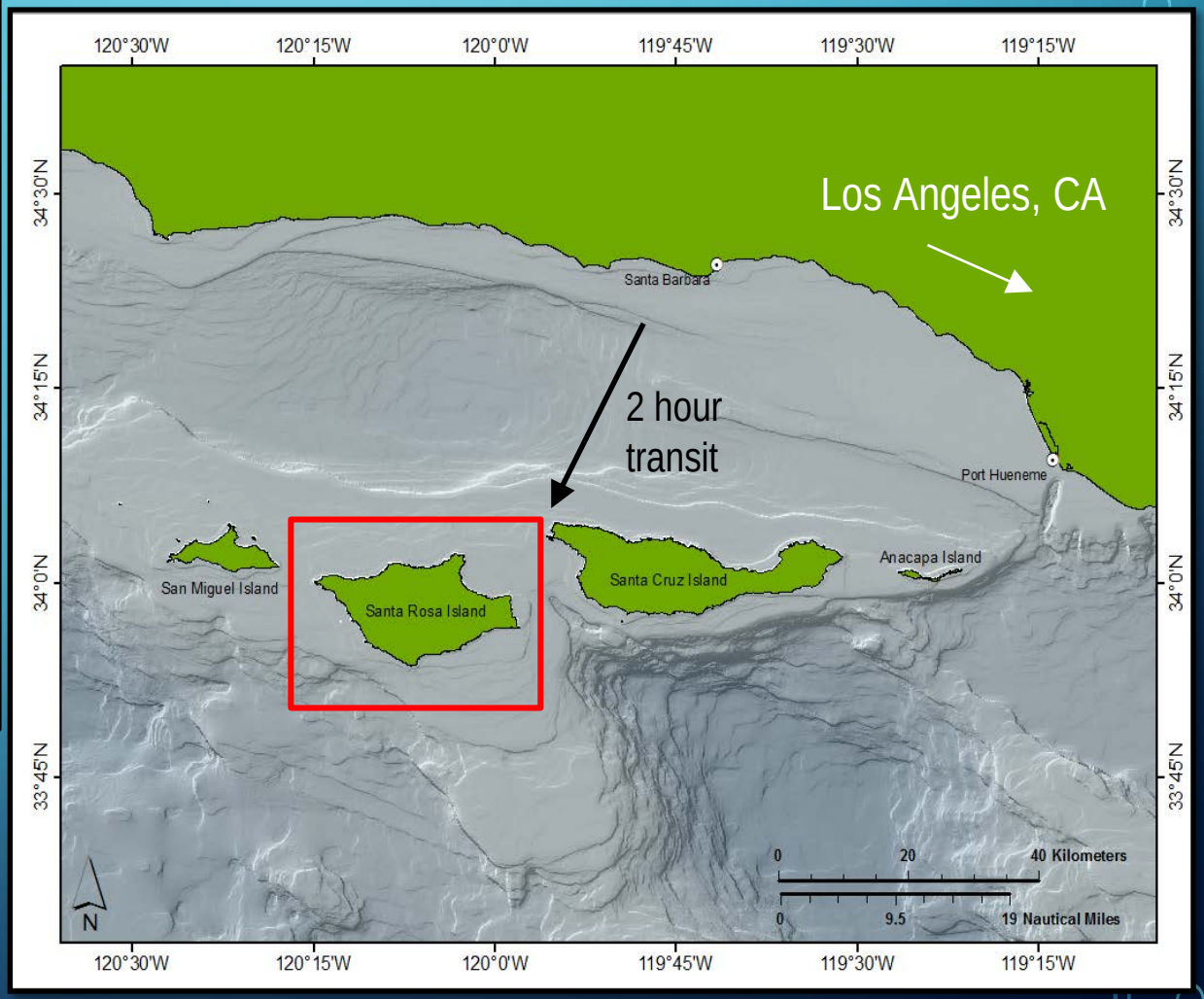
How can we tell healthy from unhealthy corals?

REVIEW OF THE TERM ‘CORAL GARDEN’

- *Helps to **measure habitat quality** and **prioritize conservation effort***
- *Refers to **density, colony size, extent** of gorgonian and black corals*
- *Stone 2005/2006 – density (3.85 colonies per m^2)*
- *Oslo/Paris Convention (OSPAR) 2008/2010 - invoked range of density, larger extent, diversity*
  - *Single species gardens, e.g. 50 – 200 colonies per·100 m^2*
  - ***Multispecies gardens, e.g. 100 - 700 colonies per·100 m^2***
- *See Bullimore et al 2013, Henry and Roberts 2014 (UK) !!*

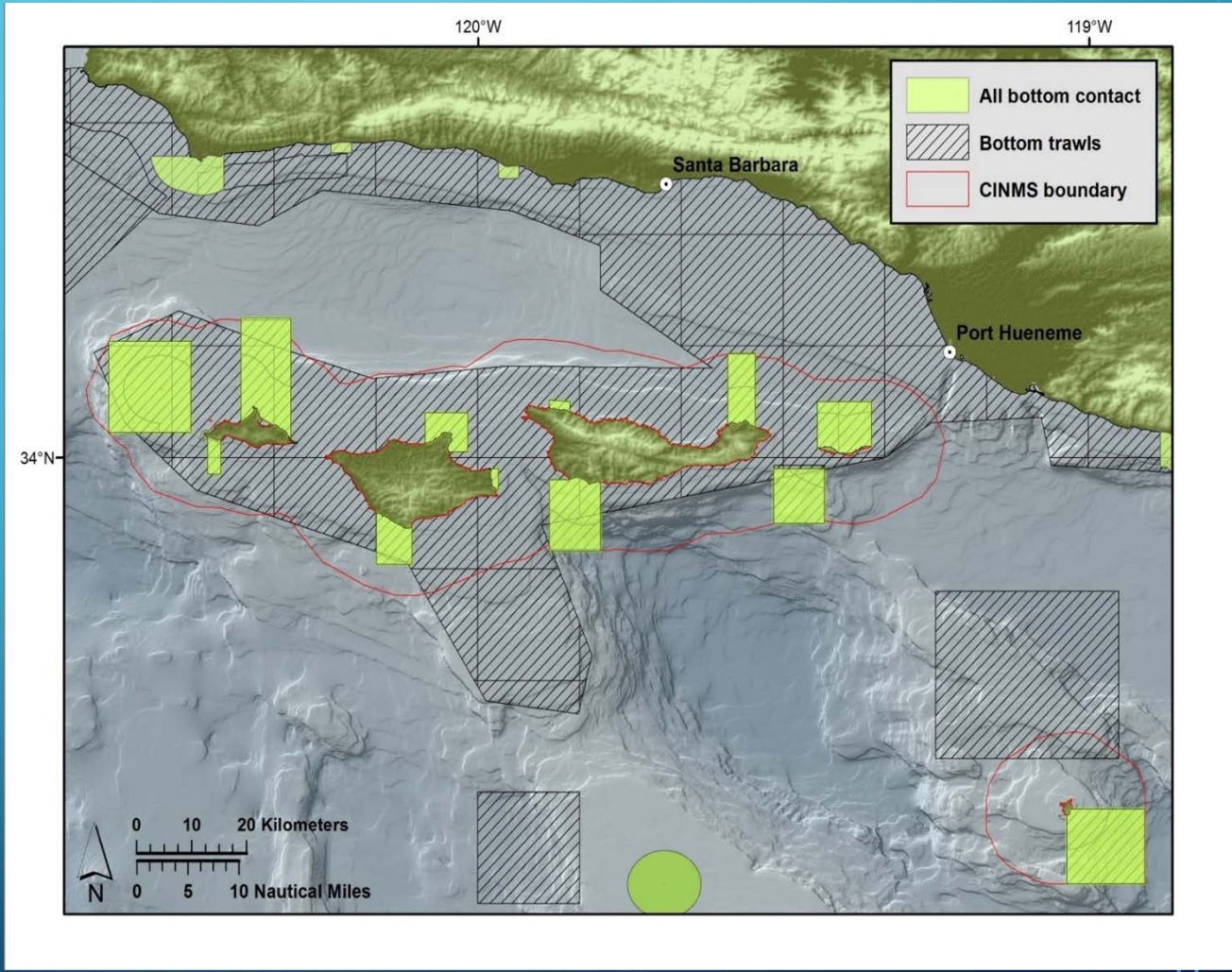
STUDY LOCATION: SOUTHERN CALIFORNIA

4 islands, W-E gradient, 2 hrs transit offshore



CHANNEL ISLANDS NATIONAL MARINE SANCTUARY (CINMS)

- CINMS shown in red. Most of the shelf is off limits to bottom trawling by RCA (hatched)
- Smaller parts are off limits to all bottom fishing gear, we refer to these as MPAs
- NOAA is mapping CINMS to characterize benthic habitat
- Presence of 'coral gardens' outside of MPAs may support expansion of MPAs



METHODS: SHIPS AND ROV'S

Beagle ROV from MARE

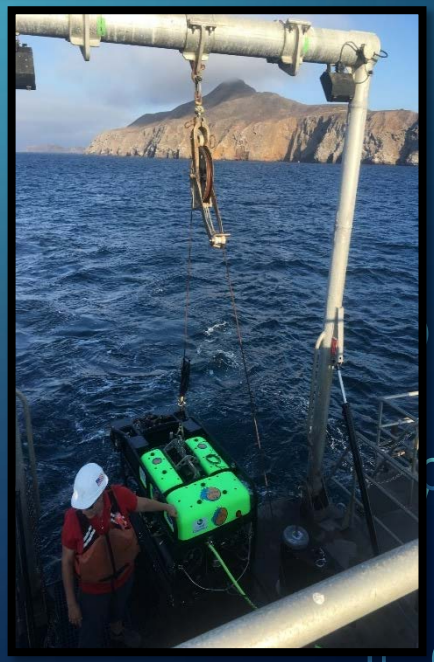
NOAA RV *Shearwater*

EV *Nautilus* & Hercules

NOAA ship *Bell Shimada*

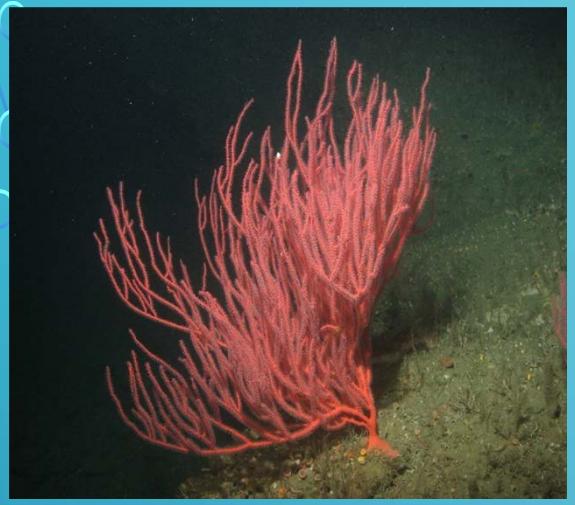
METHODS: VISUAL SURVEY TECHNIQUES

- We conduct 8-10 ROV dives (2 km) in these areas
  - North Santa Rosa (Carrington Point to San Miguel Pass)
  - South Santa Rosa (inc. Santa Rosa Flats)
- Parse the dive by 3 transect methods
  - 100 meters in GIS
  - 5 minutes in video
  - 15 minutes in video
- ROV flies at 0.8 m alt. and 0.5 knot speed, w/ lasers
- Still images every ~ 5 seconds (ID, size & health)
- Density (no. colonies/area) derived from
  - a) frame grabs over 5 min = 100 m and
  - b) HD video segments by time or distance



Example images of CINMS Deep Corals (30-300 m)

Image credits: NOAA, Marine Applied Research and Exploration

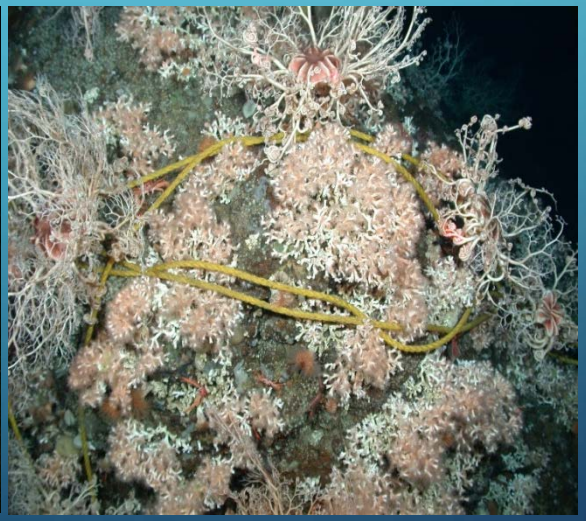


Leptogorgia chilensis

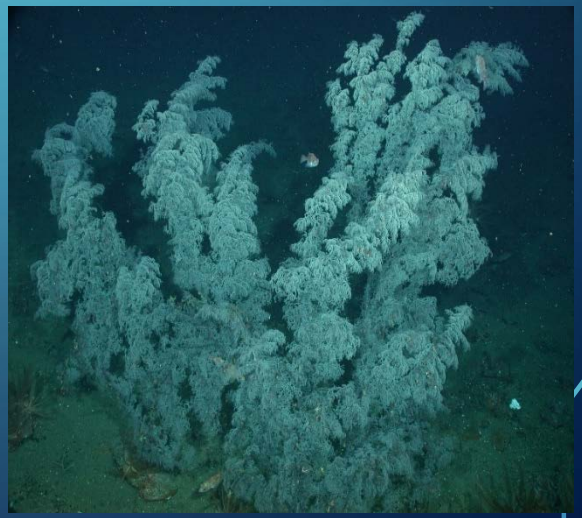
Eugorgia rubens

Adelogorgia phyllosclera

Acanthogorgia sp.
(gorgonian octocoral)

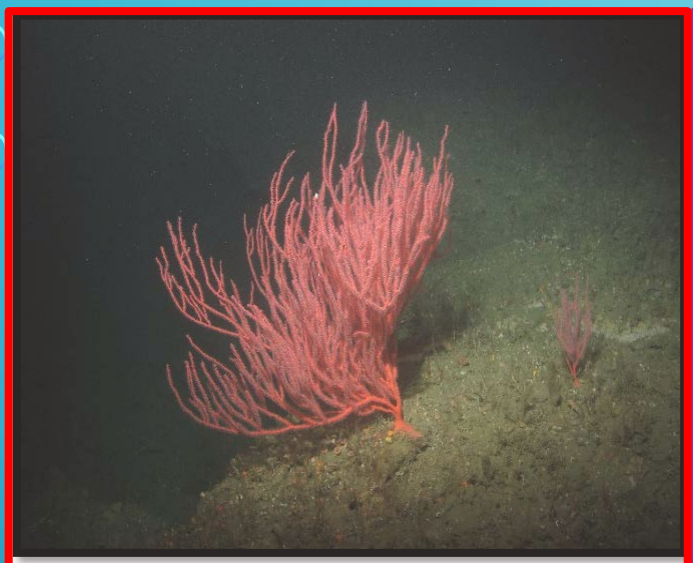


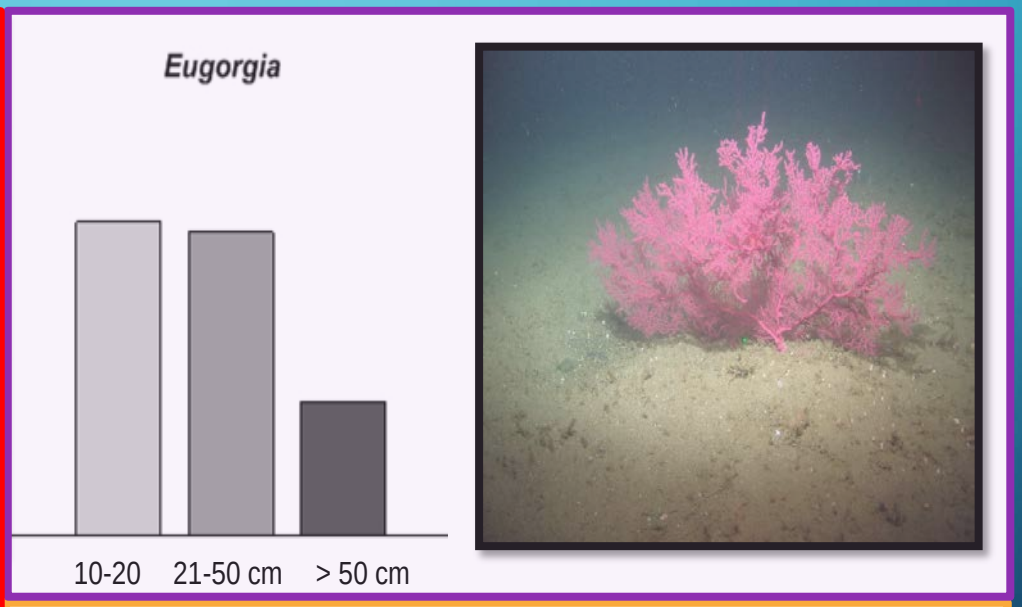
Lophelia pertusa
(branching stony coral)

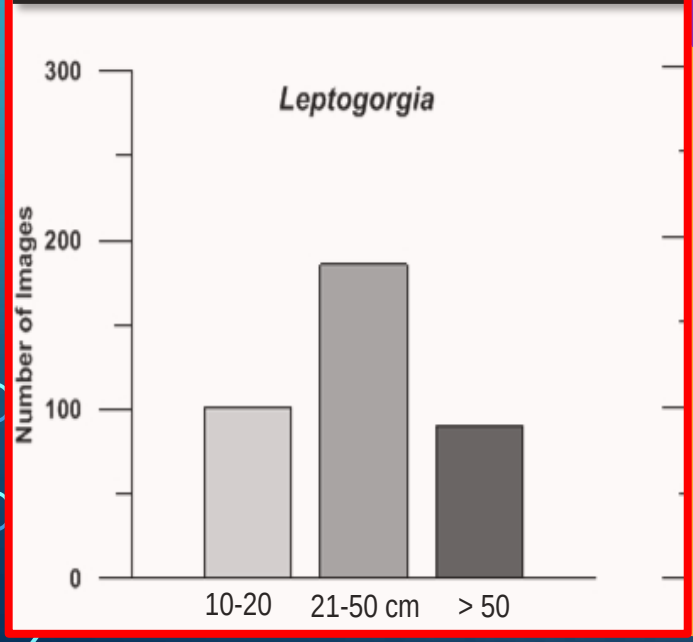


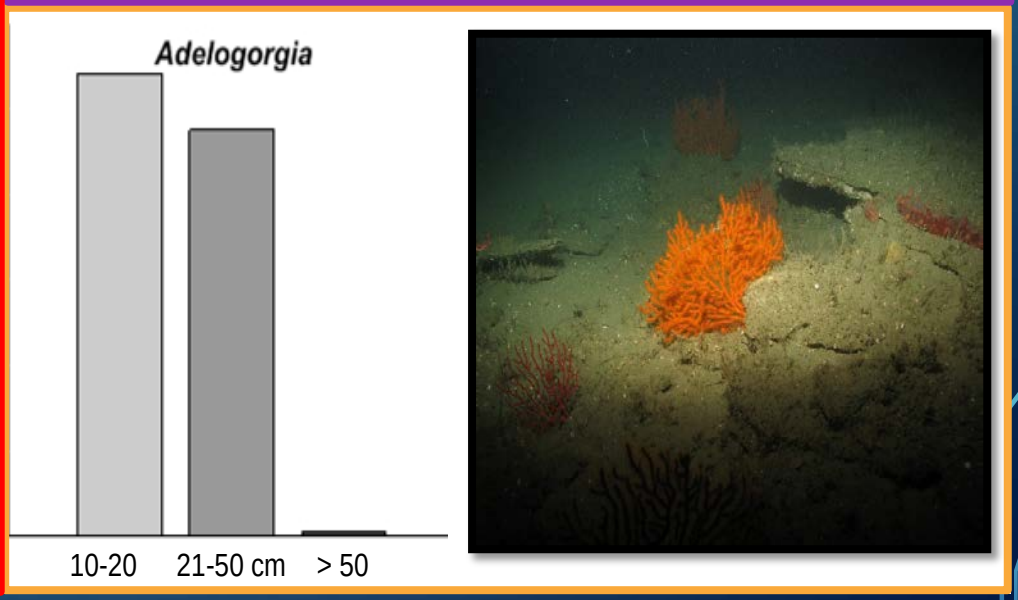
Antipathes dendrochristos
(black coral)

OCTOCORAL SIZE CLASSES

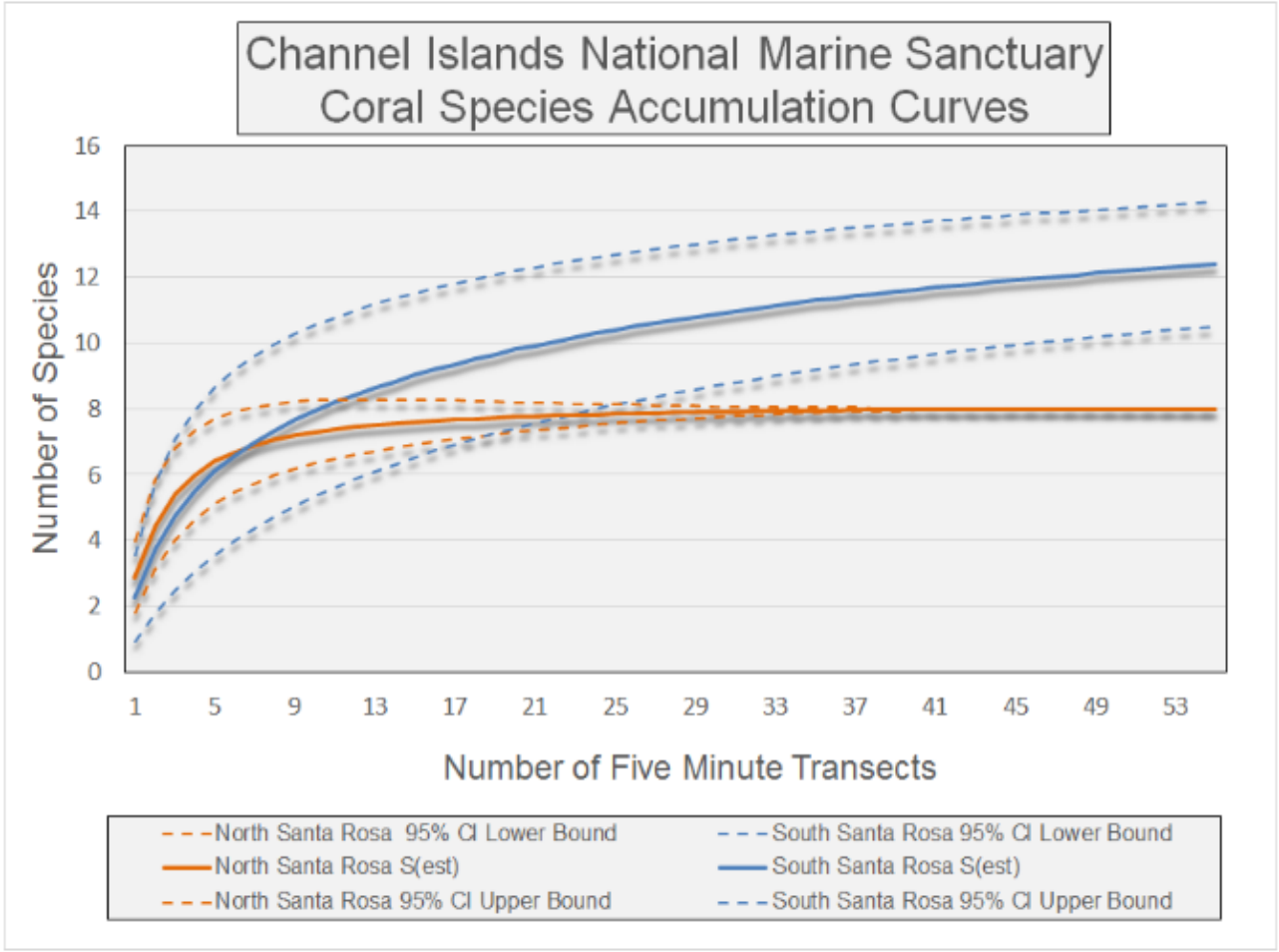


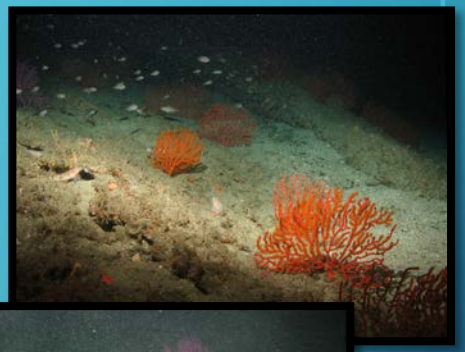


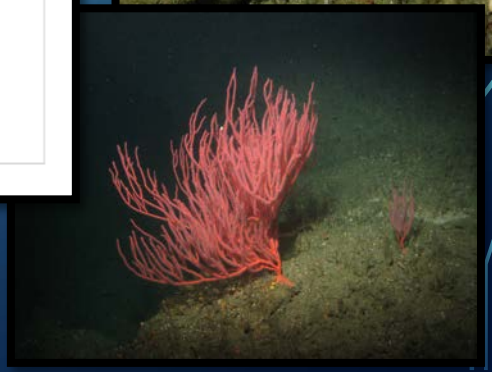




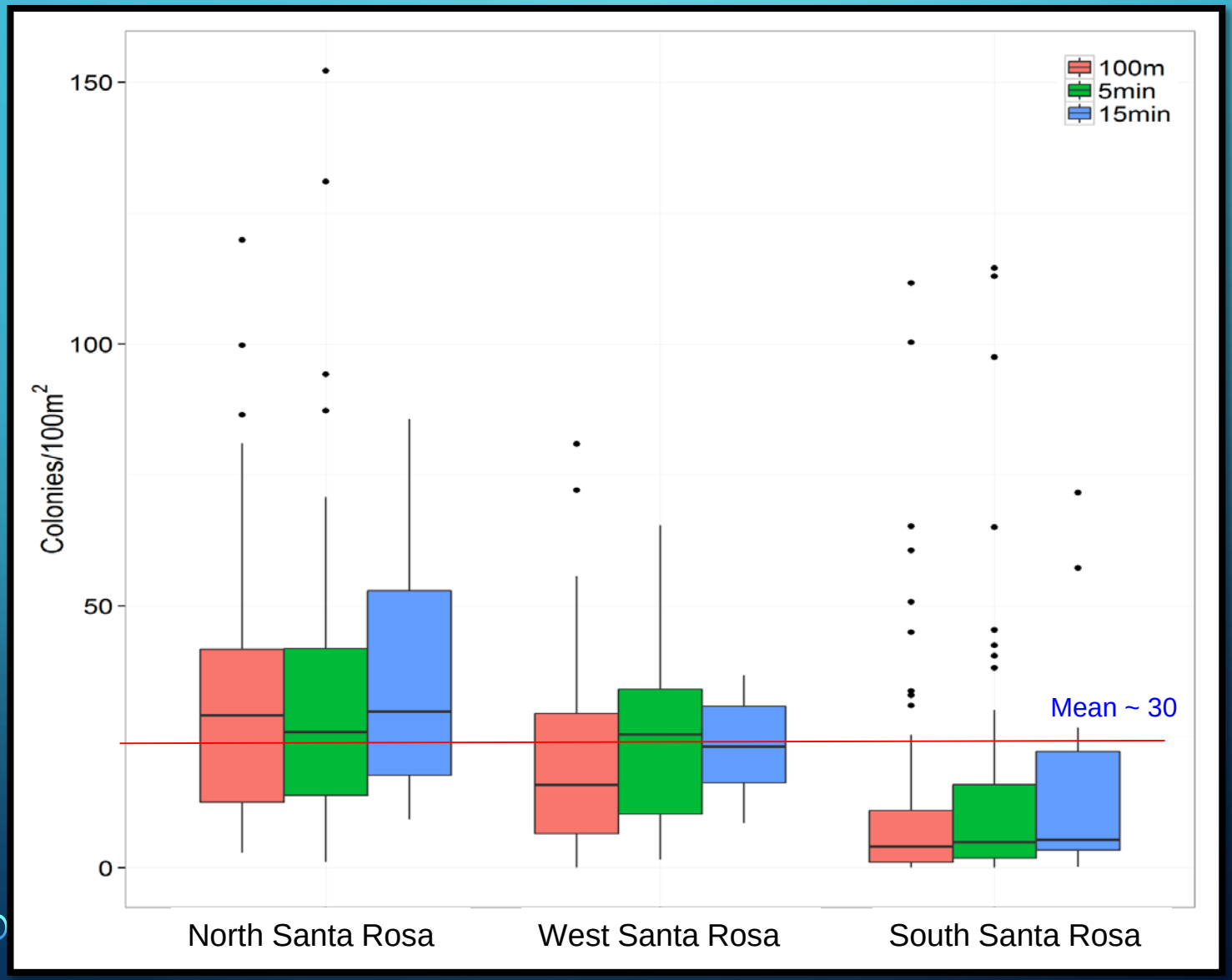
Diversity of corals on CINMS shelf







MULTISPECIES DENSITIES BY FRAME GRABS (2015)



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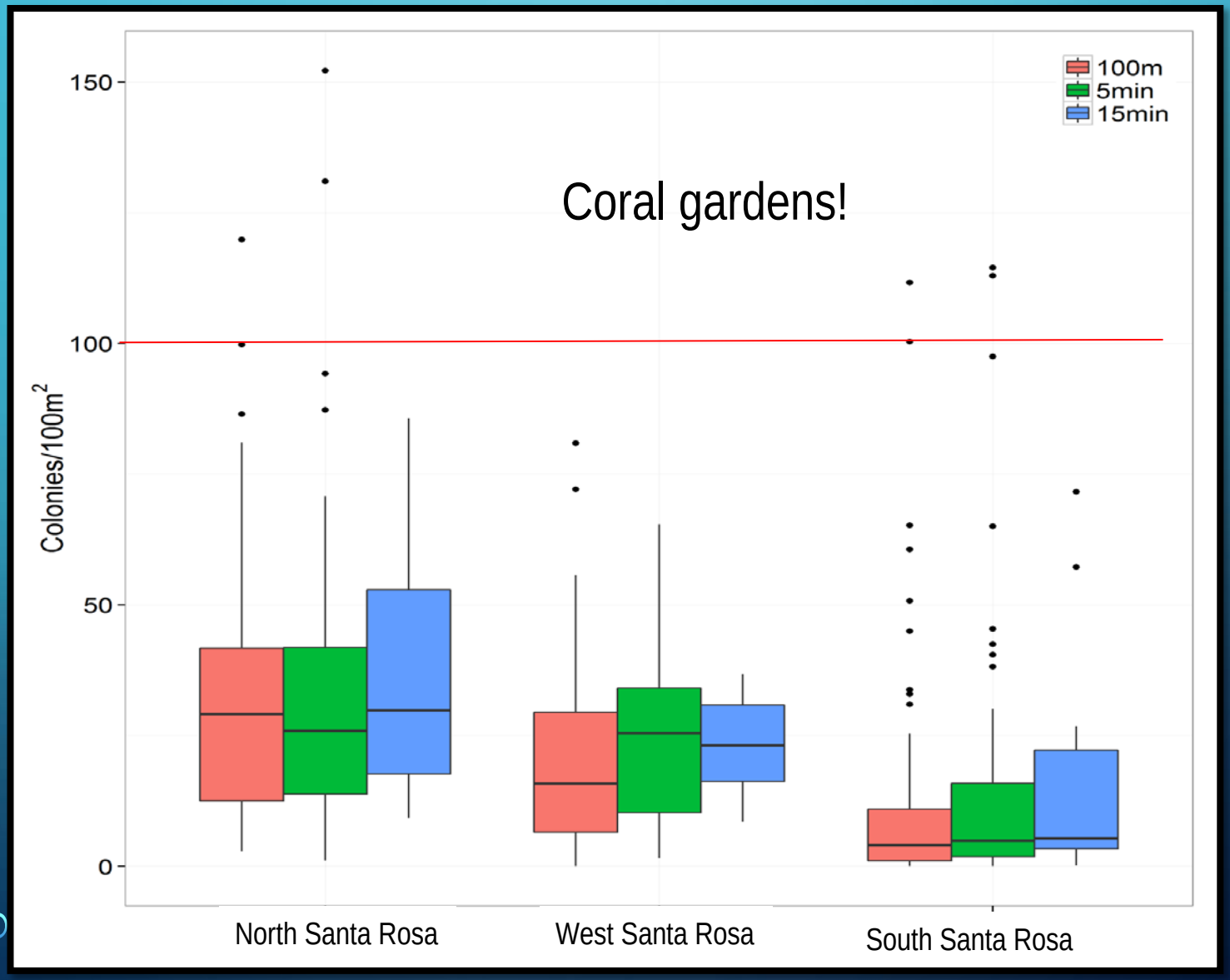
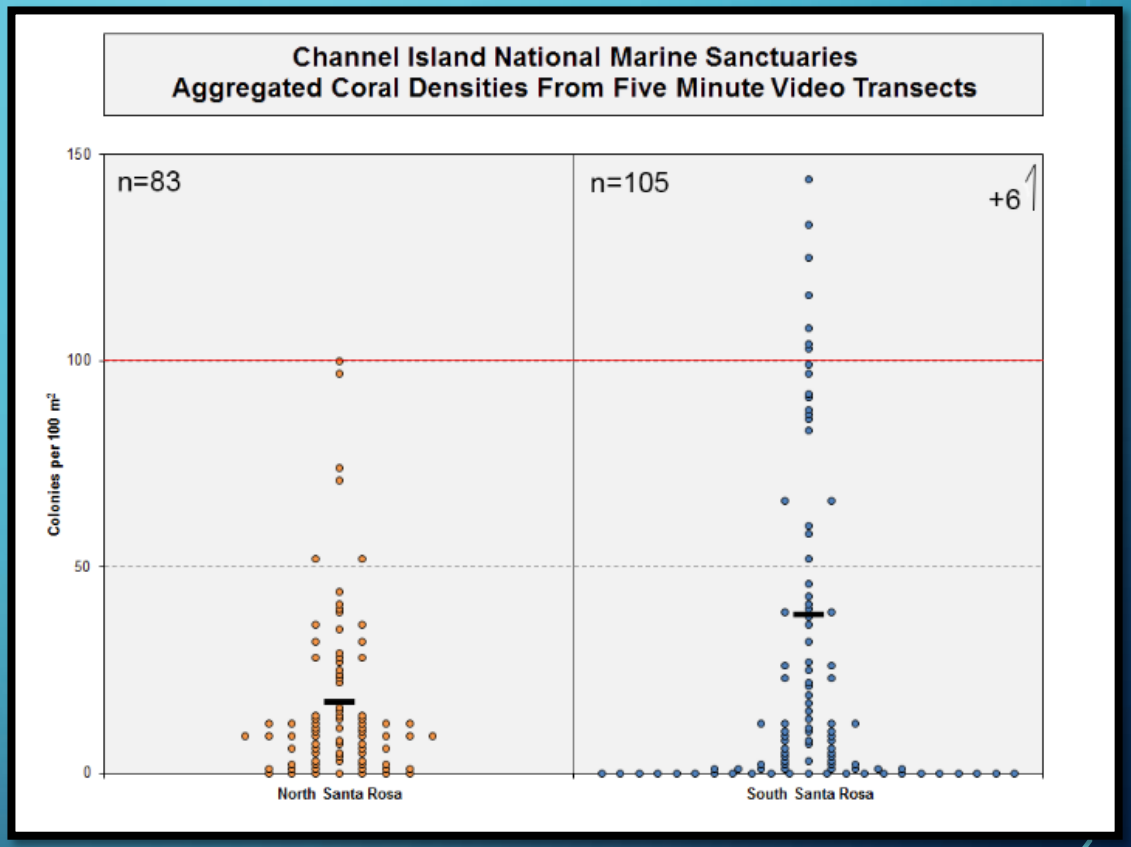
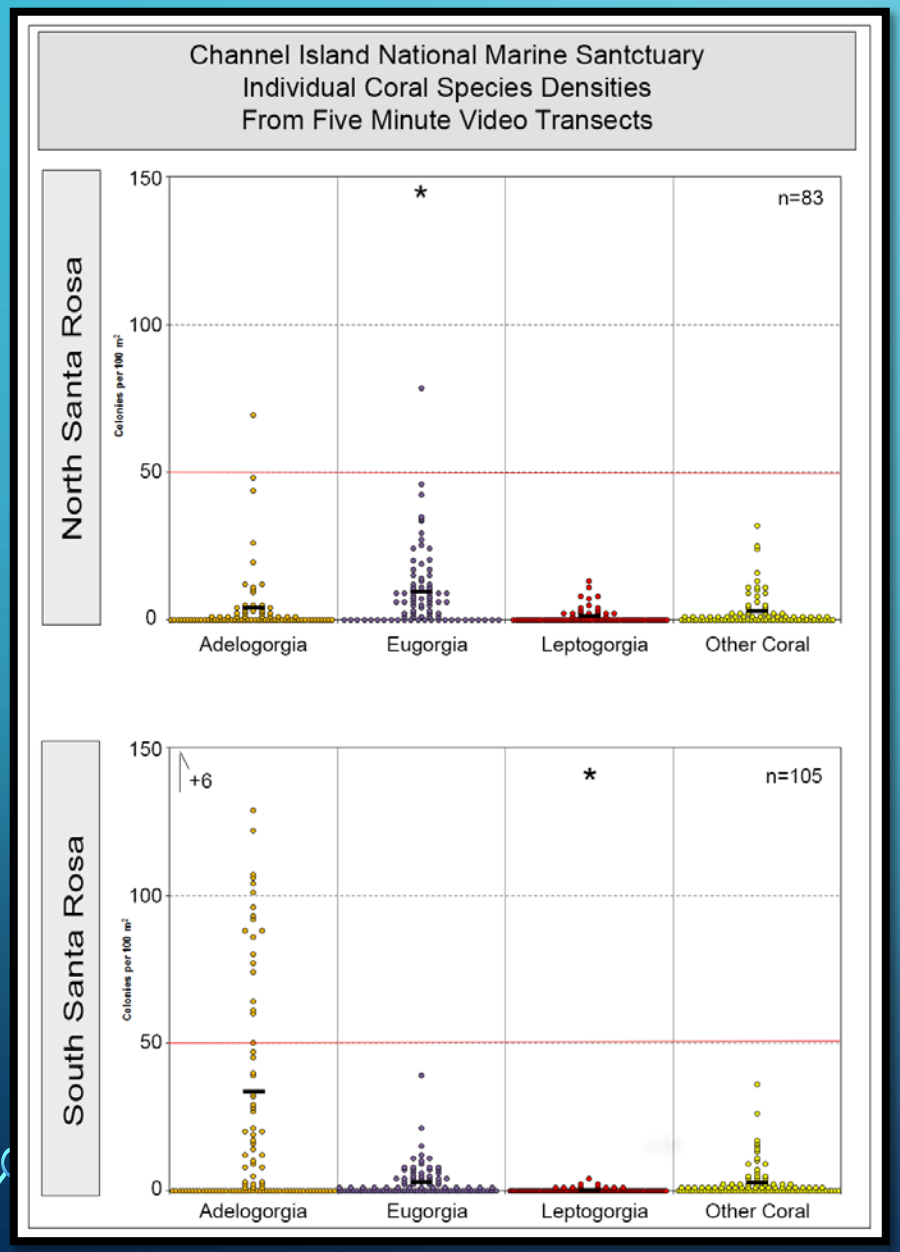


MULTI-SPECIES DENSITIES FROM VIDEO (2015 -16)

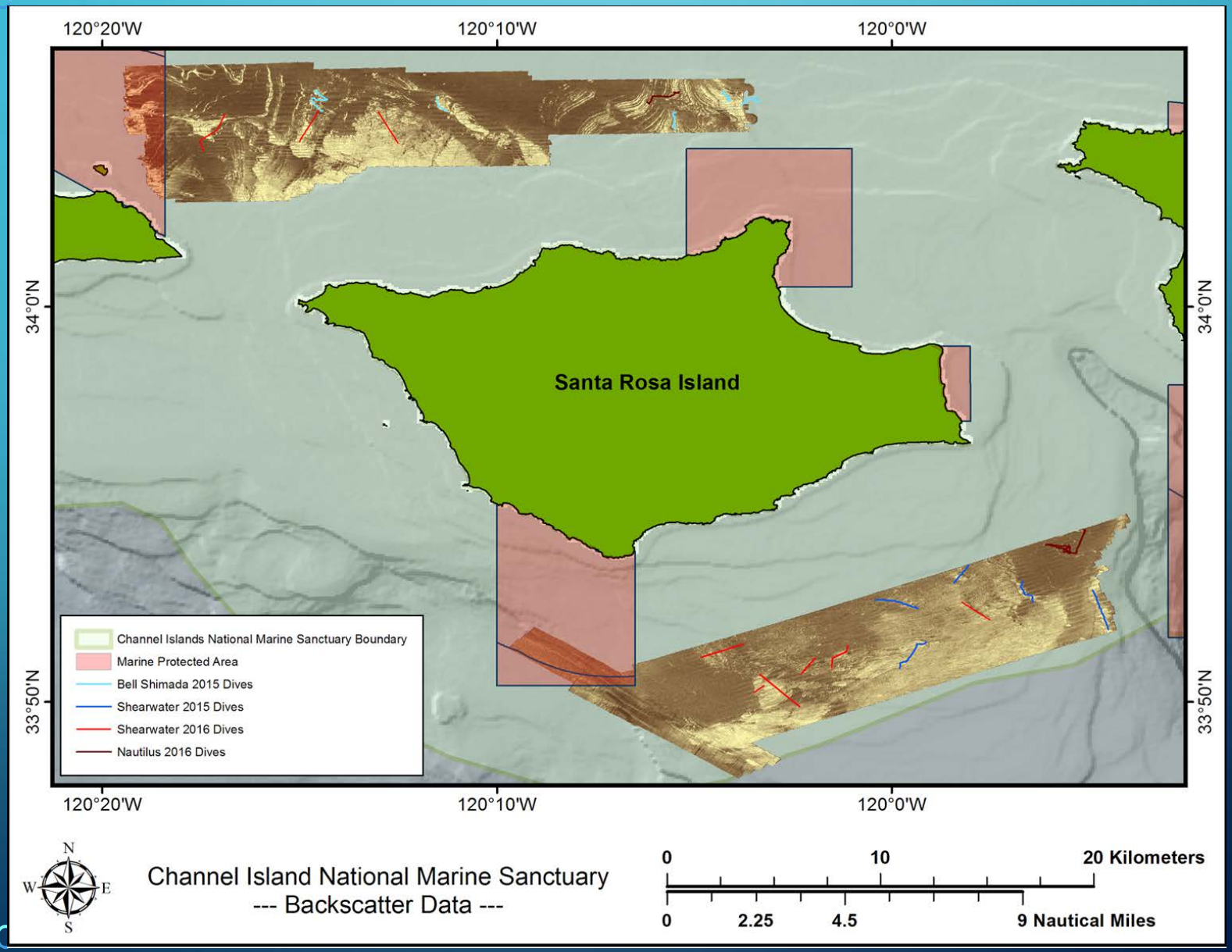


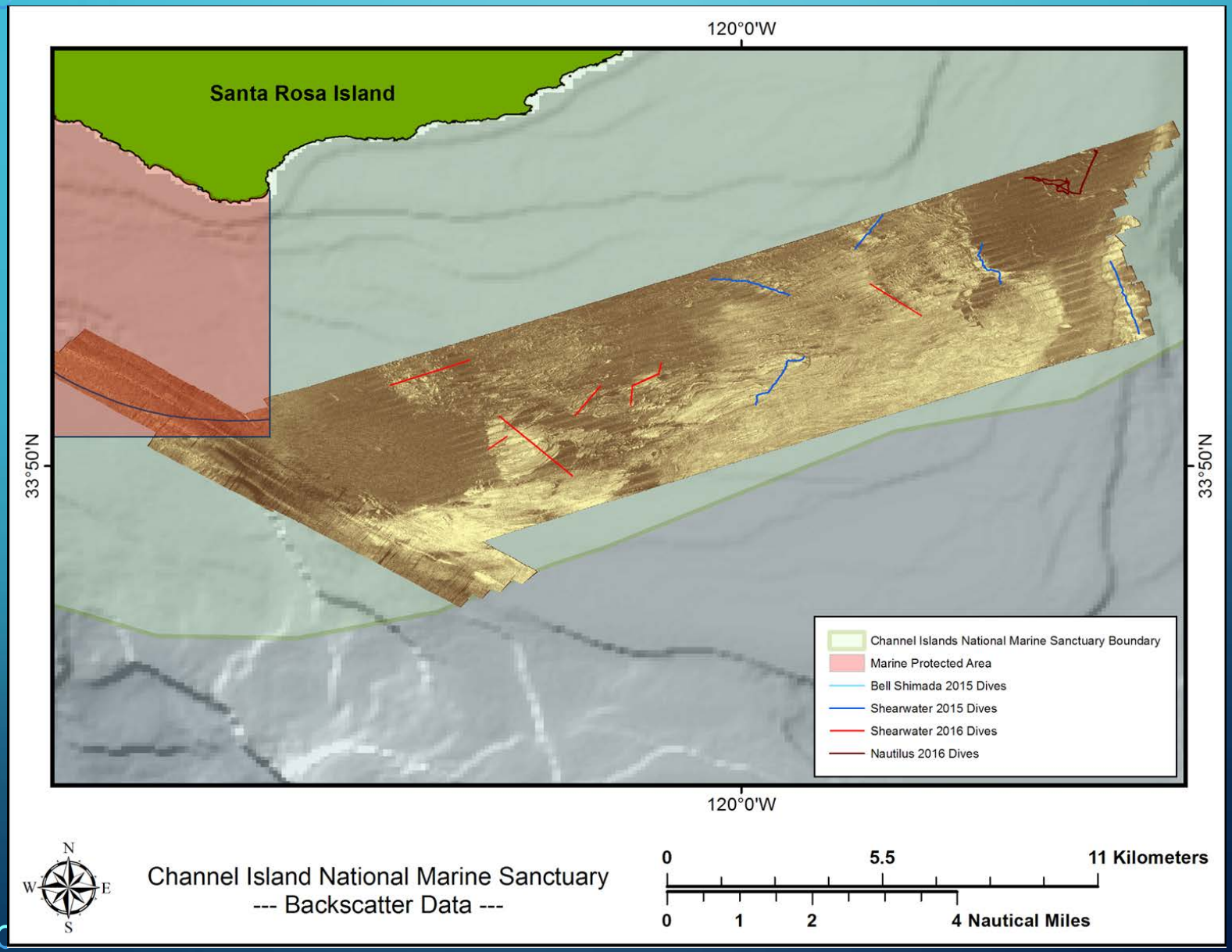
SINGLE SPECIES DENSITIES FROM VIDEO (2015-2016)



PART I : CONCLUSIONS

- Coral diversity is higher on South Santa Rosa (12 spp.)
- *Multispecies* densities of octocorals *do* meet OSPAR definitions of a ‘coral garden’ - 100 corals/100 sq m
- *Single species* densities *do* exceed 50 corals/100 sq m
- The extent of the ‘coral gardens’ in CINMS may be large, because the extent of hard bottom in backscatter is large on both sides of Santa Rosa Island in CINMS.

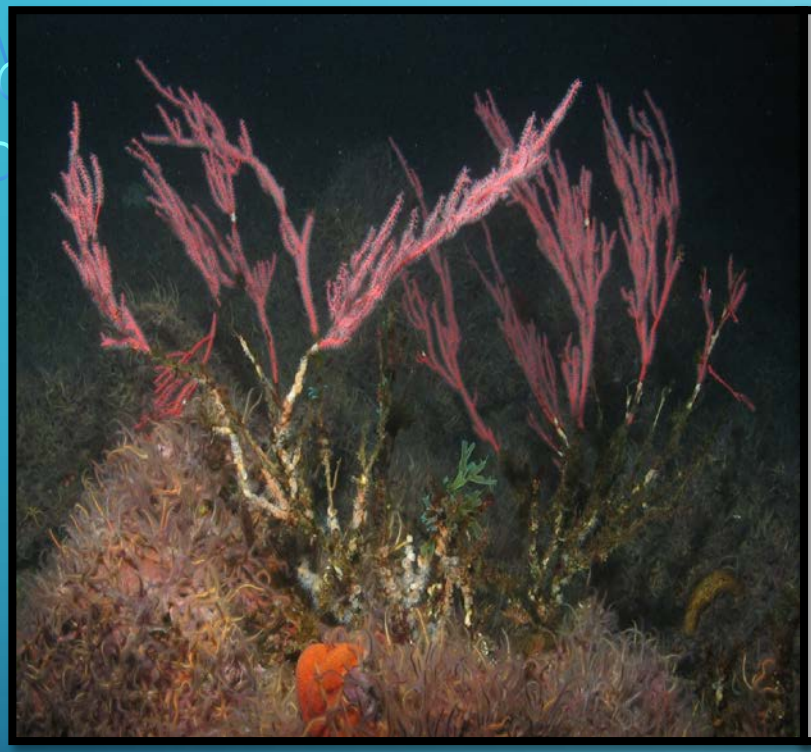

120°20'W
120°10'W
120°0'W
34°0'N
33°50'N
Santa Rosa Island
Channel Islands National Marine Sanctuary Boundary
Marine Protected Area
Bell Shimada 2015 Dives
Shearwater 2015 Dives
Shearwater 2016 Dives
Nautilus 2016 Dives
N
S
E
W
Channel Island National Marine Sanctuary
--- Backscatter Data ---
0
10
20 Kilometers
0
2.25
4.5
9 Nautical Miles

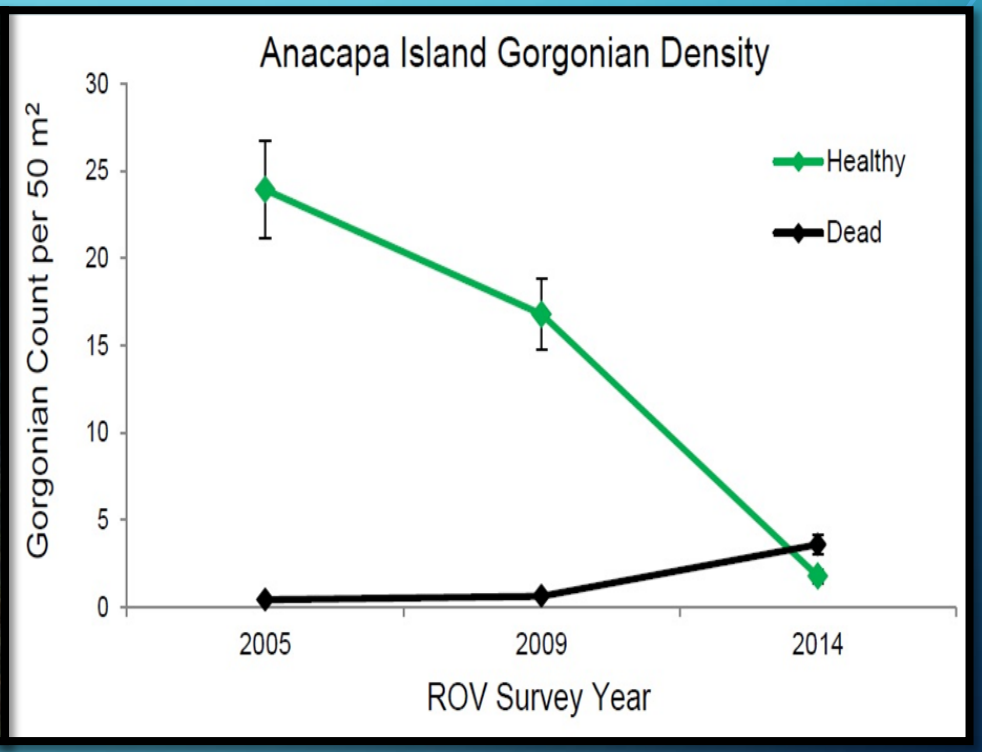

120°0'W
Santa Rosa Island
33°50'N
33°50'N
120°0'W
Channel Islands National Marine Sanctuary Boundary
Marine Protected Area
Bell Shimada 2015 Dives
Shearwater 2015 Dives
Shearwater 2016 Dives
Nautilus 2016 Dives
N
W
E
S
Channel Island National Marine Sanctuary
--- Backscatter Data ---
0
5.5
11 Kilometers
0
1
2
4 Nautical Miles

PART I : CONCLUSIONS ON METHODS

- 5 min. transects yield higher densities than 15 min. transects because distribution of corals is patchy.
- *Shorter transects yield more ‘coral gardens’*
- 5 min transect method provides a useful standard w/100 m resolution, 15 min yields about 300 m
- NOAA should pursue a regional definition of ‘coral gardens’ because mean density is <<1 colony/sq m

PART II : DEMISE OF A CORAL GARDEN



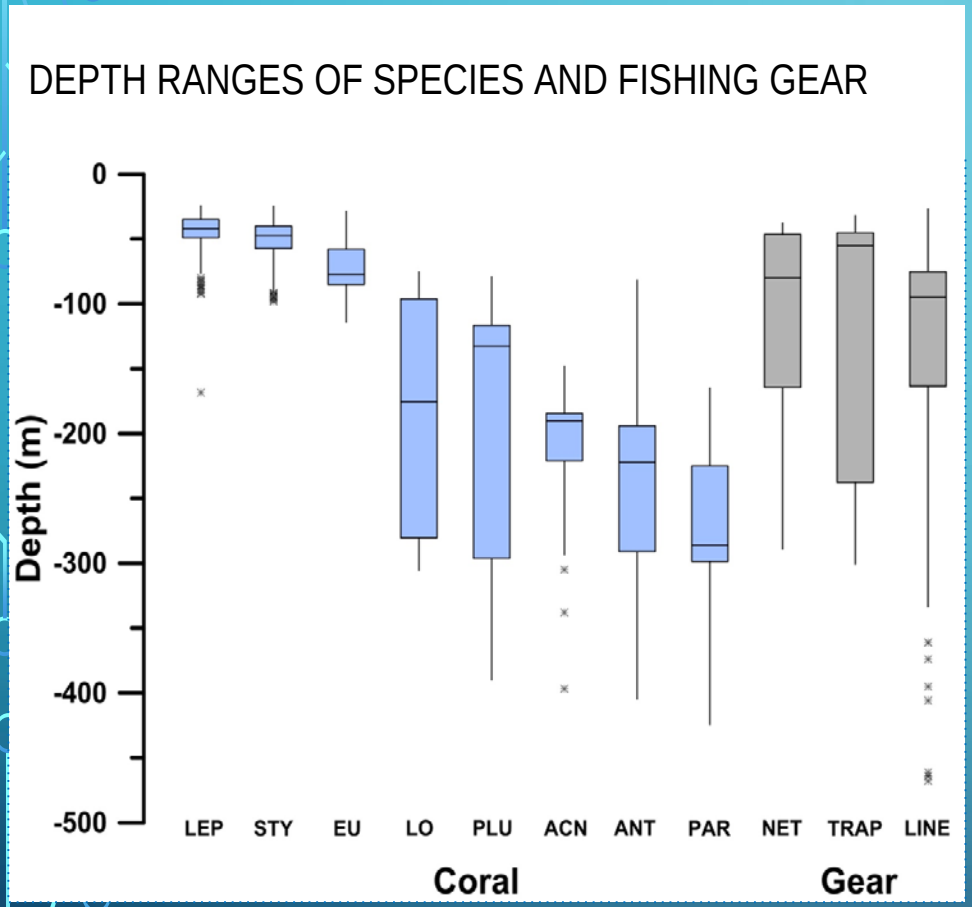


Most gardens off Santa Rosa island are pristine

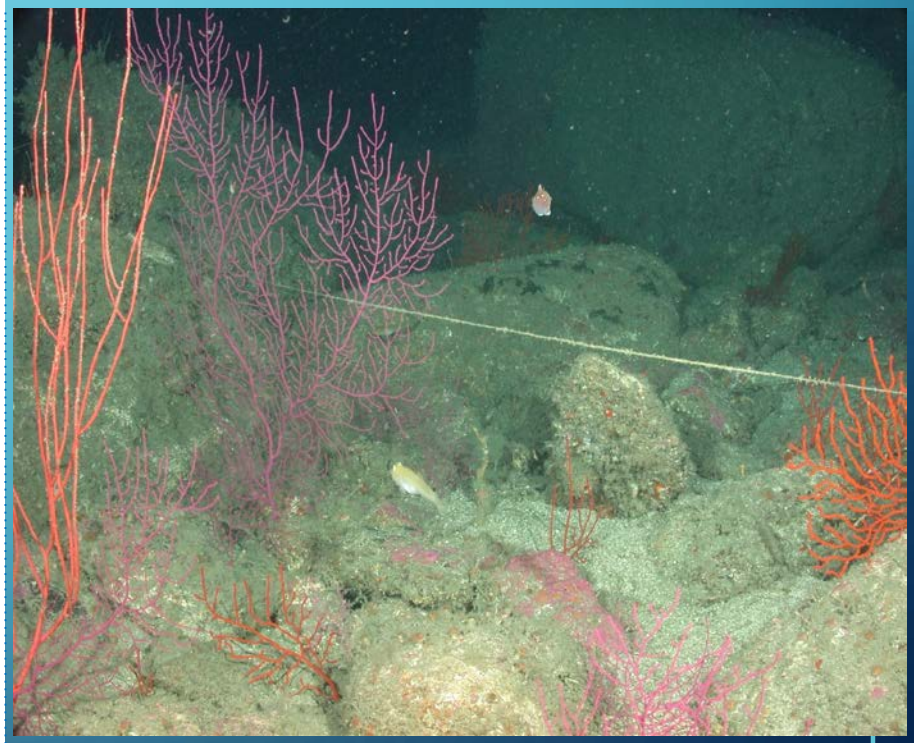
Some shallow (~30 m) declines from 2005 - 2014.

Possible culprits: fishing or temperature?

THREATS TO CORAL HEALTH: FISHING

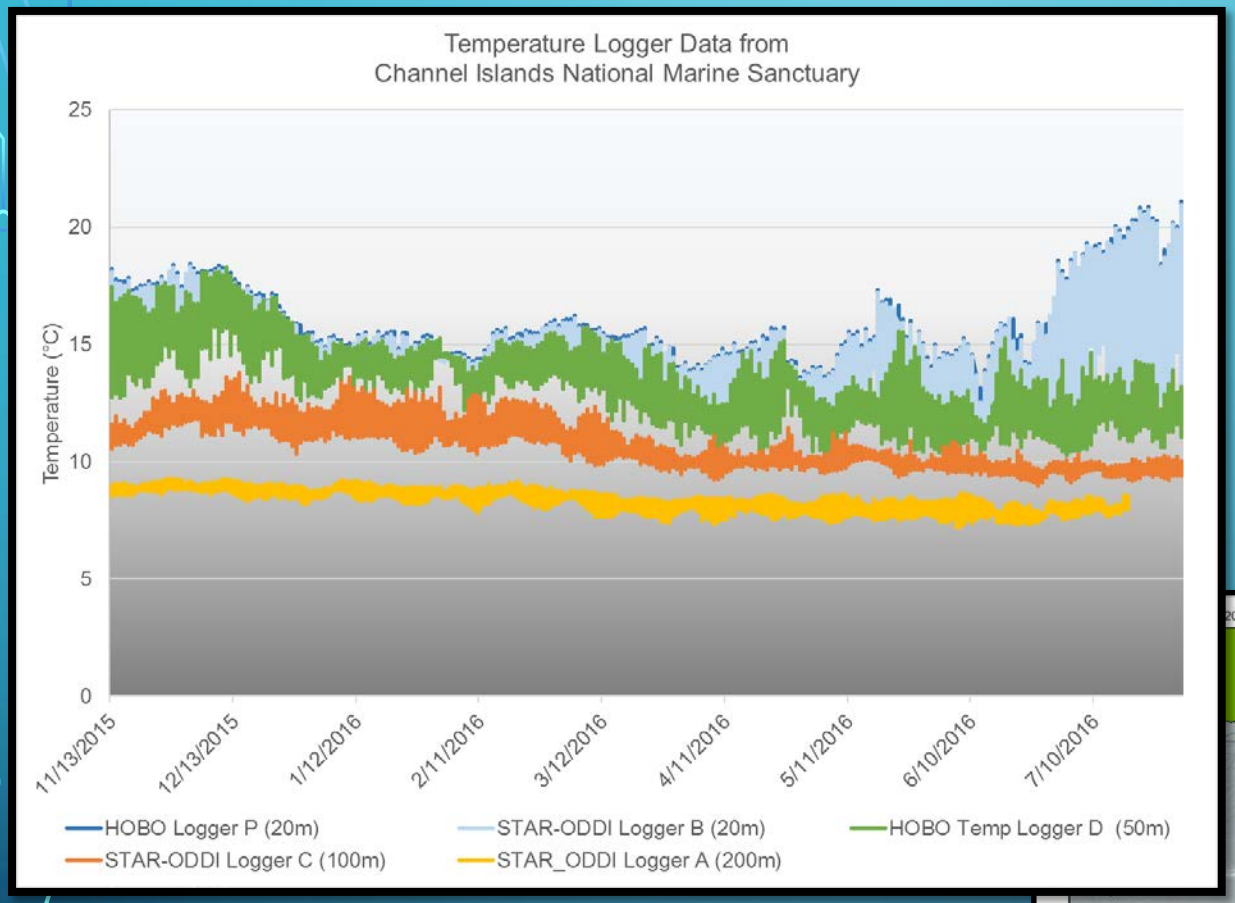


South Catalina Island at 82 m



Lines are the most commonly observed debris type
In NOAA database of 10,000 images from over 350 ROV dives since 2008

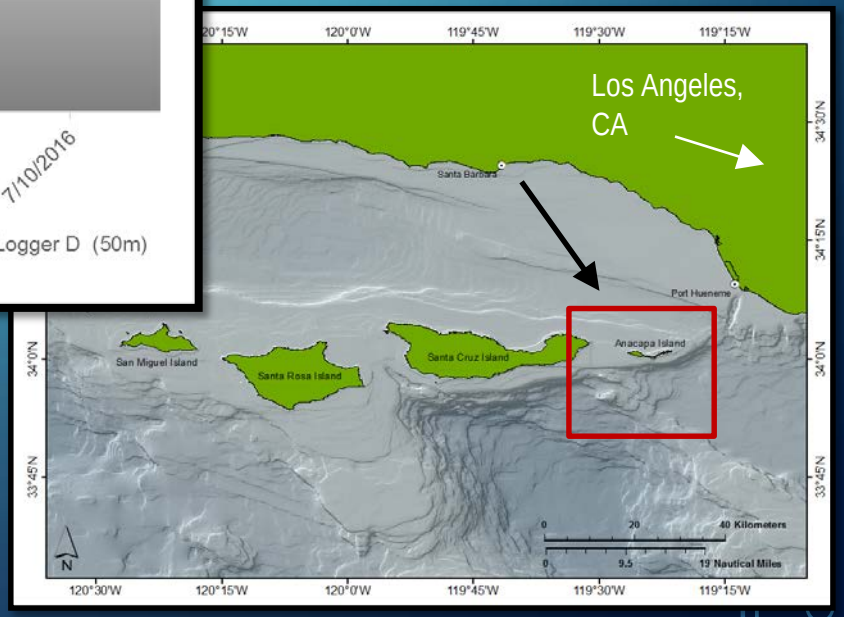
THREATS TO CORAL HEALTH: TEMPERATURE



Temp loggers deployed at 20, 50, 100, and 200 meters depth

Avg temp at 20 m was 14-15 C. Temps at 200 m were < 10 C.

Temps at 20 m reached 19 C for 4 weeks in July. Variable at 50 & 100 m.



TEMPERATURE LOGGERS WERE DEPLOYED AT ANACAPA ISLAND

LIVE CORALS FOR CHALLENGE EXPERIMENTS

What temperatures are fatal?

Can corals recover?

How deep does an anomoly go?

How long can it last?

Thank you!!

QUESTIONS?

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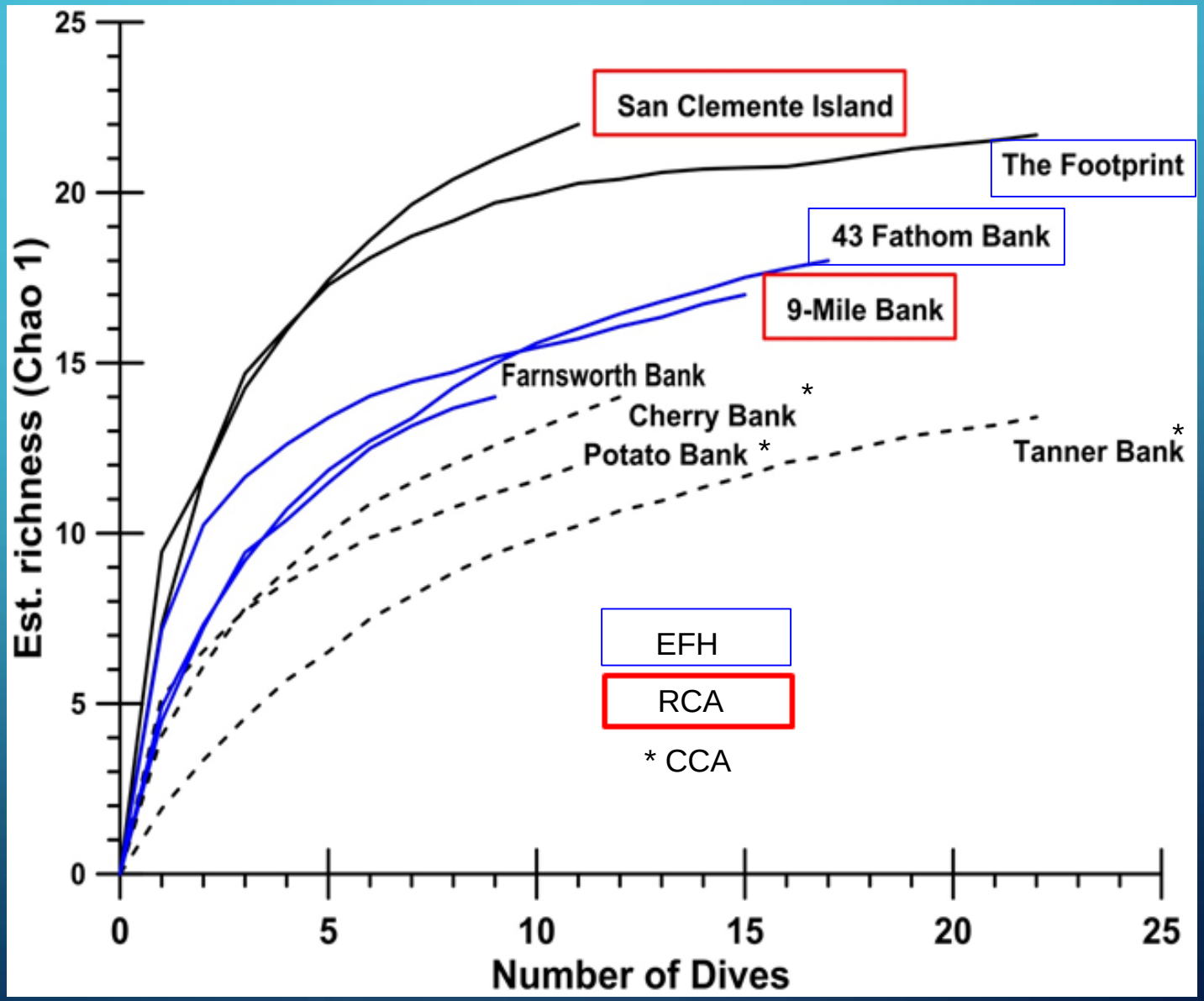
- Special thanks for support from:
  - NOAA National Centers for Coastal Ocean Science
  - NOAA Deep Sea Coral Research and Technology Program
  - NOAA Channel Islands National Marine Sanctuary staff

SoCal coral/sponge diversity and MPAs



SPECIES IDENTIFIED AT EACH SITE AND TOTAL COUNT

Locality	Taxa	Count
Carrington Point	*Eugorgia rubens*	1400
	Adelogorgia phyllosclera	224
	Leptogorgia sp.	217
	Halipteris sp.	122
	Ptilosarcus gurneyi	13

Locality	Taxa	Count
San Miguel Pass	*Adelogorgia phyllosclera*	498
	Eugorgia rubens	239
	Coenocyathus bowersi	123
	Ptilosarcus gurneyi	81
	Lophelia pertusa	78
	Halipteris sp.	73

Locality	Taxa	Count
South Santa Rosa	*Adelogorgia phyllosclera*	1568
	Eugorgia rubens	597
	Halipteris sp.	112
	Pennatulacea	95
	Coenocyathus bowersi	48
	Leptogorgia sp.	42
	Stylaster sp.	33
	Lophelia pertusa	8
	Alcyonacea	7
	Muricea sp.	4
	Plexauridae	2
	Ptilosarcus gurneyi	1
	Swiftia sp.	1

VIDEO COUNTS YIELD SIMILAR MEANS TO PHOTOS BUT HIGHER MAXIMUM ABUNDANCES

	Adelogorgia		Eugorgia		Leptogorgia	
	Video Counts	Framegrabs	Video Counts	Framegrabs	Video Counts	Framegrabs
Max	154	70	60	55	4	11
Mean	10	9	11	8	1	1
std. dev	27	15	15	14	1	2

- No significant difference in densities of 15 minute transects by photo and video methods
- 15 min transects are 270 m long on average