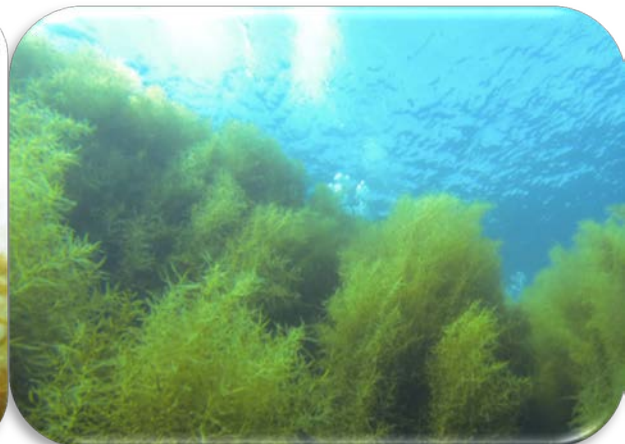


Multiple mechanisms affect resistance to an invasive algae in an MPA network

Jenn Caselle, Lindsay Marks and Katie Davis

**Marine Science Institute and Dept. of Ecology, Evolution and
Marine Biology, University of CA Santa Barbara**



The Invasion of the “DEVIL WEED”

Sargassum horneri

- Native of Korea, Japan, and China as far south as Hong Kong
- Annual furoid,
- Maximum height up to ~ 3 m,
- Most common on shallow reefs to ~ 15m but found to 30m+
- Recruitment occurs in the spring/summer
- Reproductive receptacles produced in winter



Spread of *Sargassum horneri* in Southern CA

2003

2006

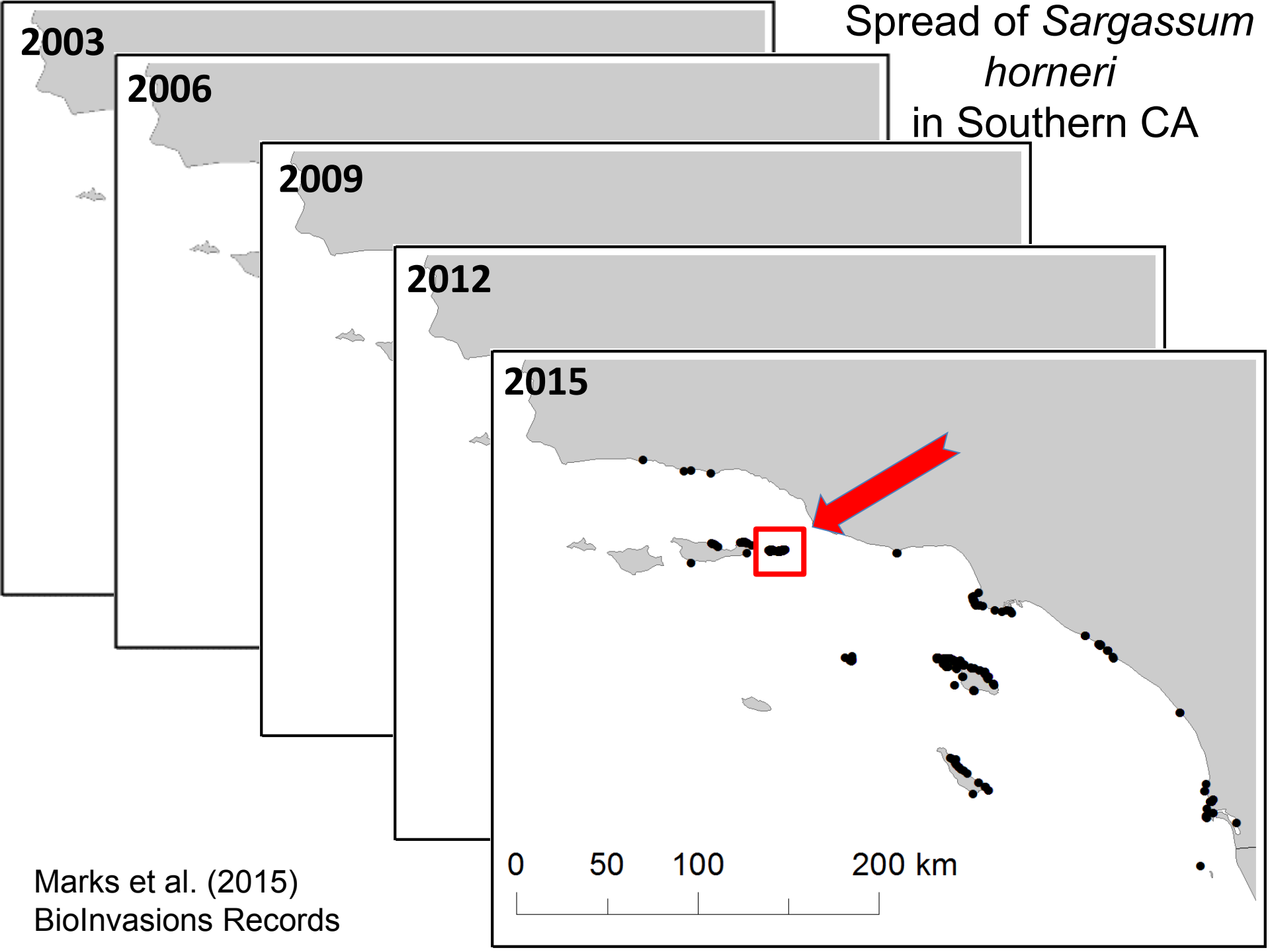
2009

2012

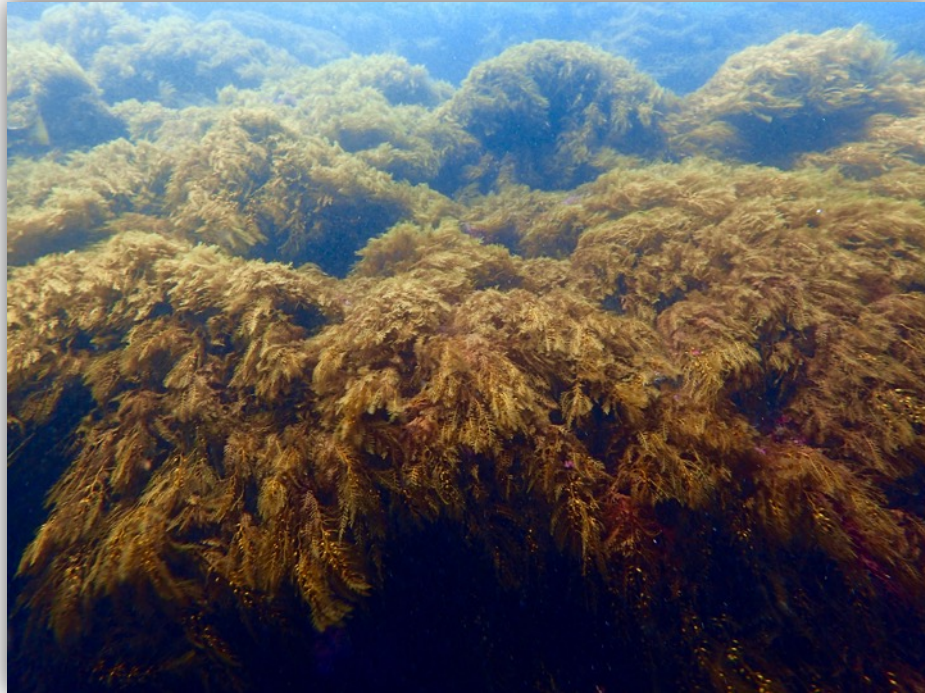
2015

0 50 100 200 km

Marks et al. (2015)
BioInvasionsRecords



Potential Biological Consequences



**Recruits create dense carpets
and may exclude other species**



**Interactions with native species
could have consequences on
higher trophic levels**

Anacapa Island



PISCO



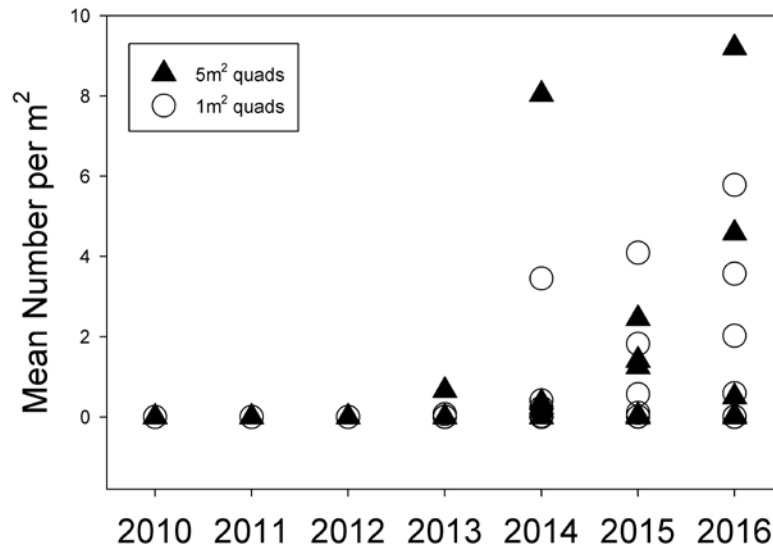
National Park Service



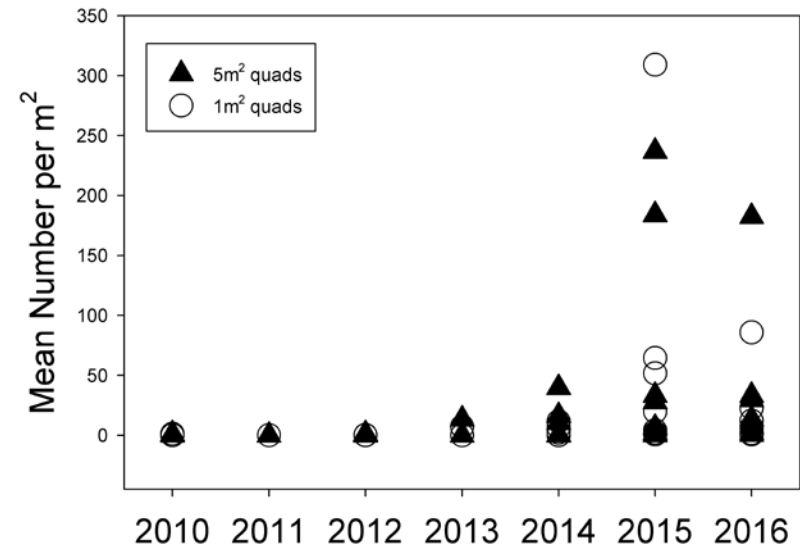
Time series of *Sargassum horneri* at Anacapa since 2010 (Kelp Forest Monitoring, NPS)



Adult density



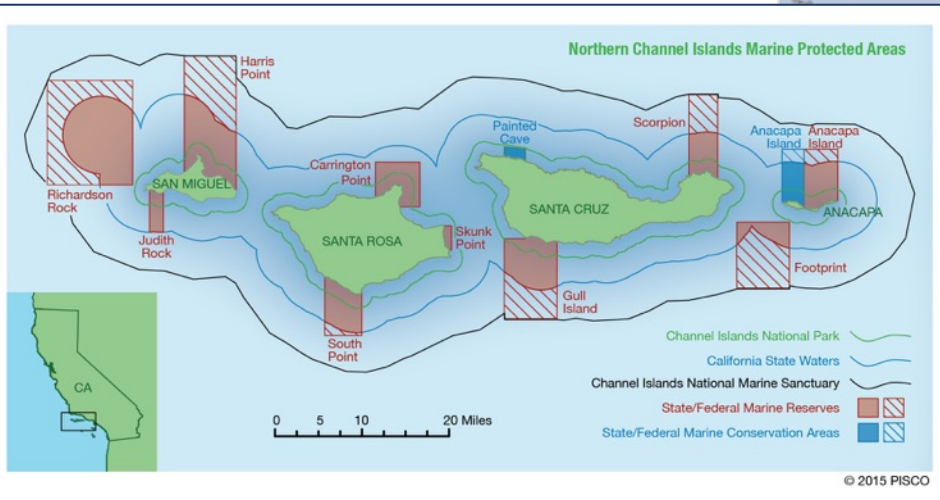
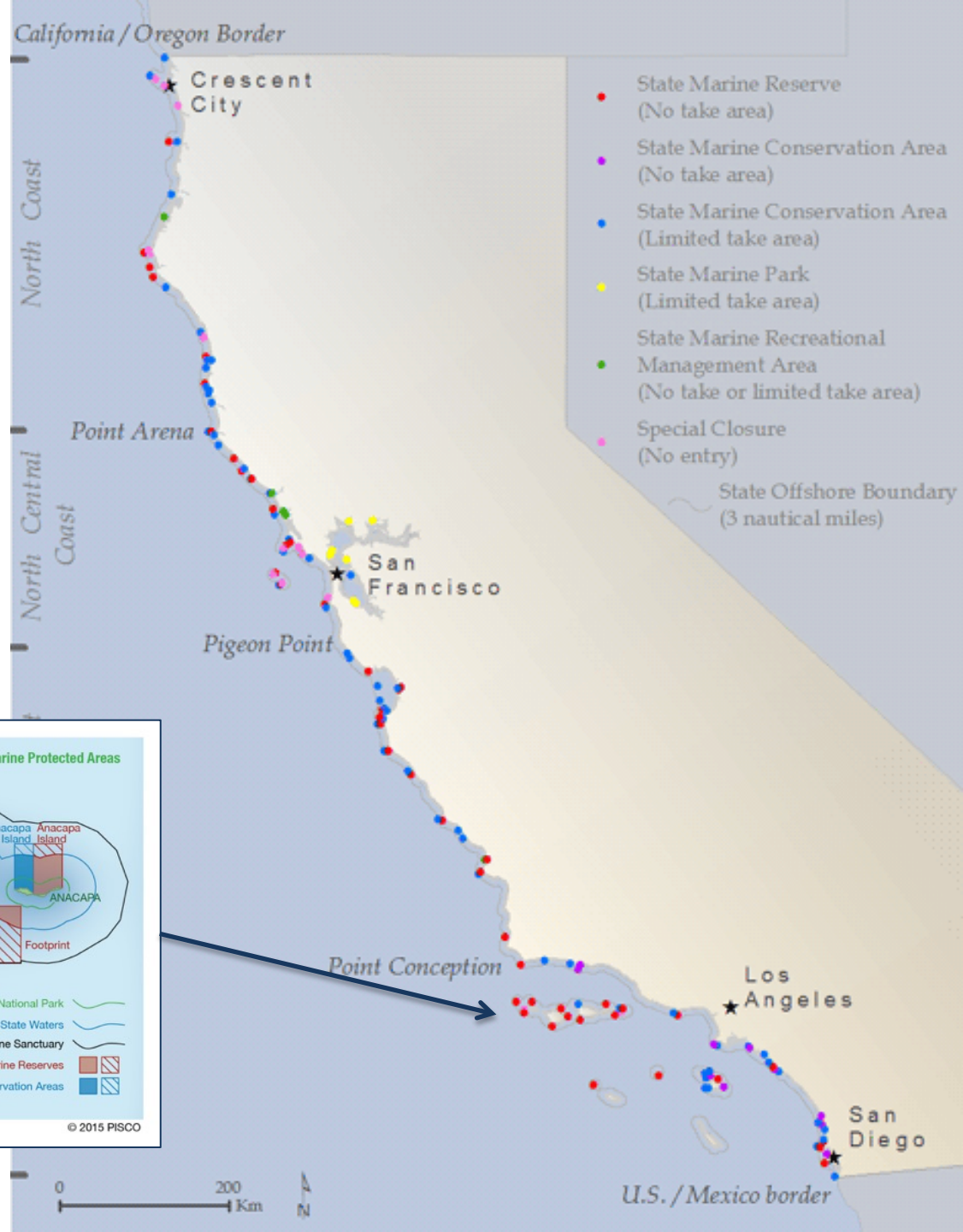
Juvenile density



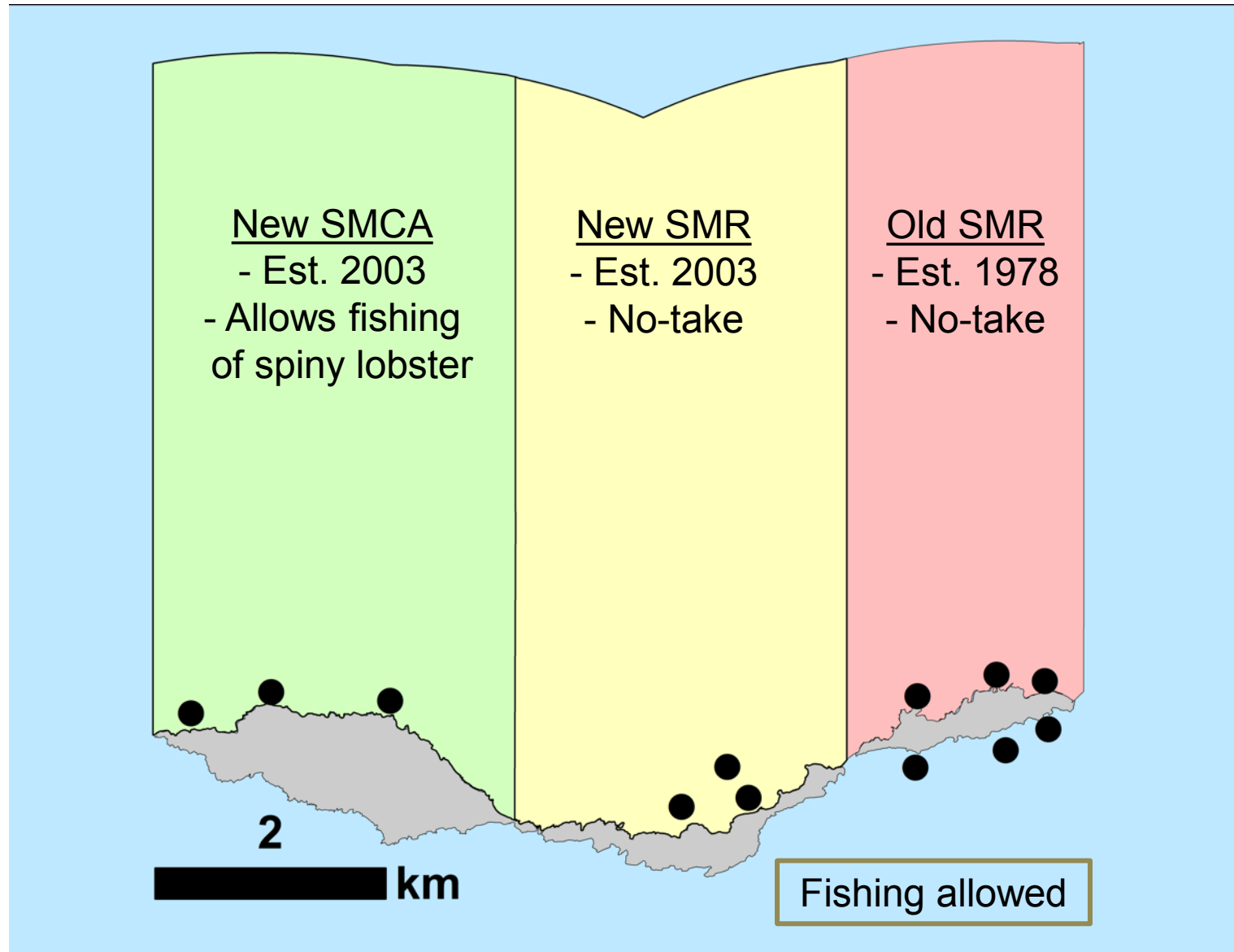
- Abundance increased in 2014 - 2016
- Strong spatial variation

Around same time
as *S. horneri*
invasion –

California
designated an
unprecedented
MPA network



Anacapa island protection zones



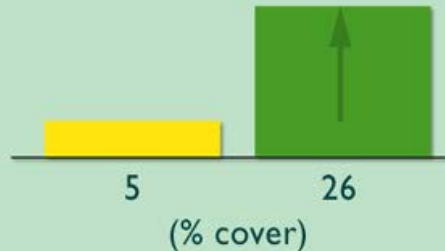
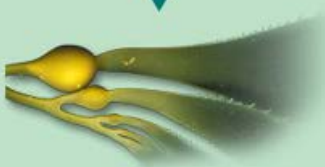
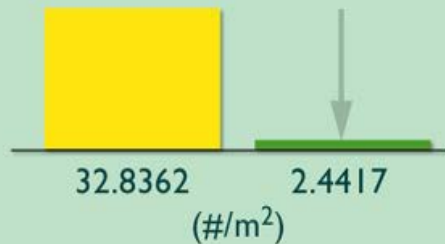
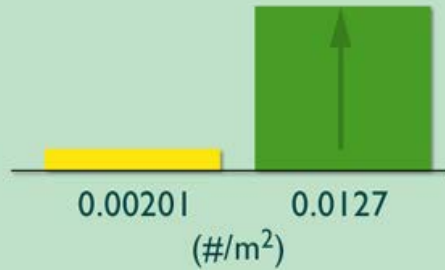
Reserves affect community structure

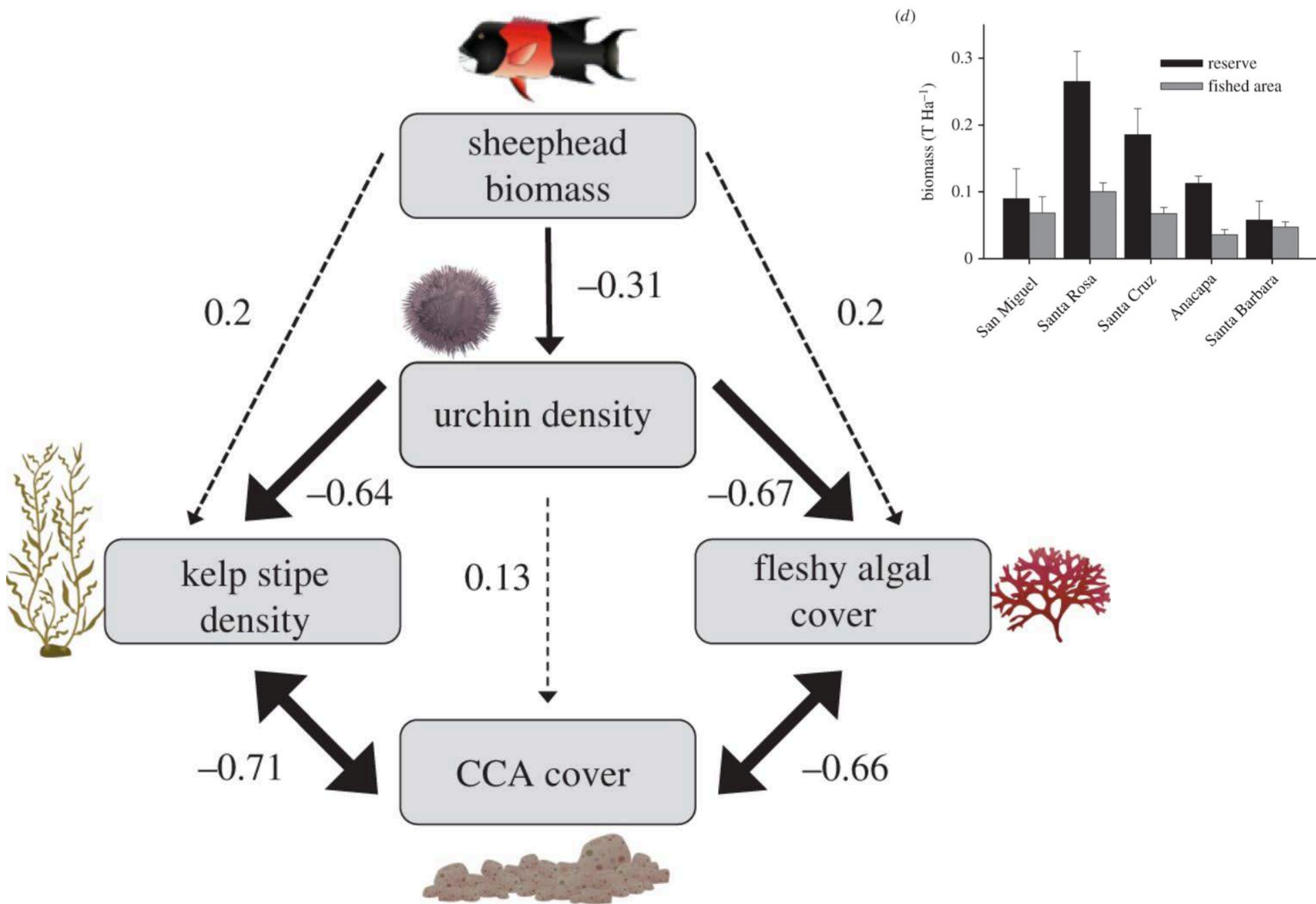
Shifts in food webs-trophic cascades

- In Old Reserve - 6x more lobster
- Fished Area - 13x more urchins
- Kelp only persists in Old Reserve



with Fishing with Reserve

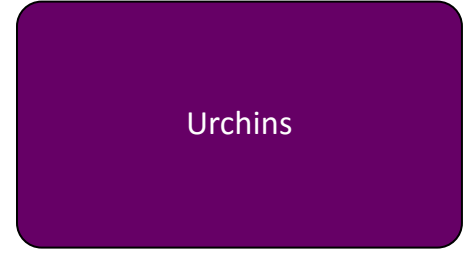
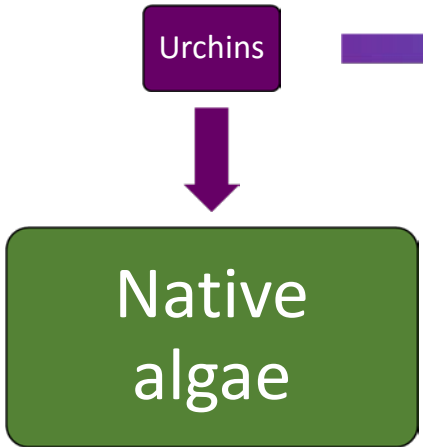
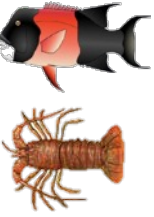




WHAT WE KNOW

ESTABLISHED MPA

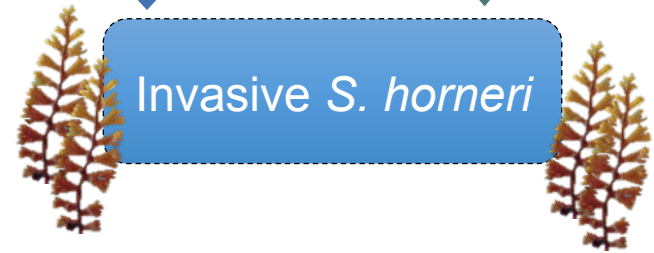
FISHED AREAS



WHAT WE DON'T KNOW

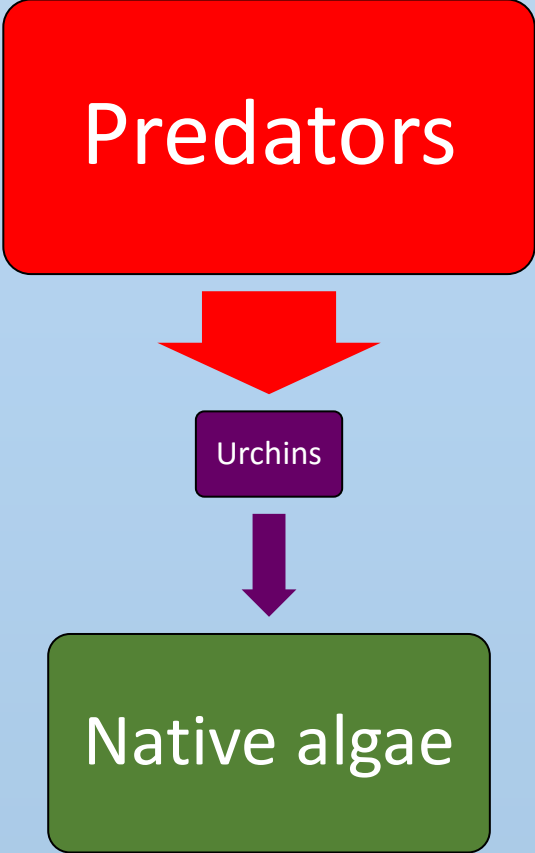
???

???

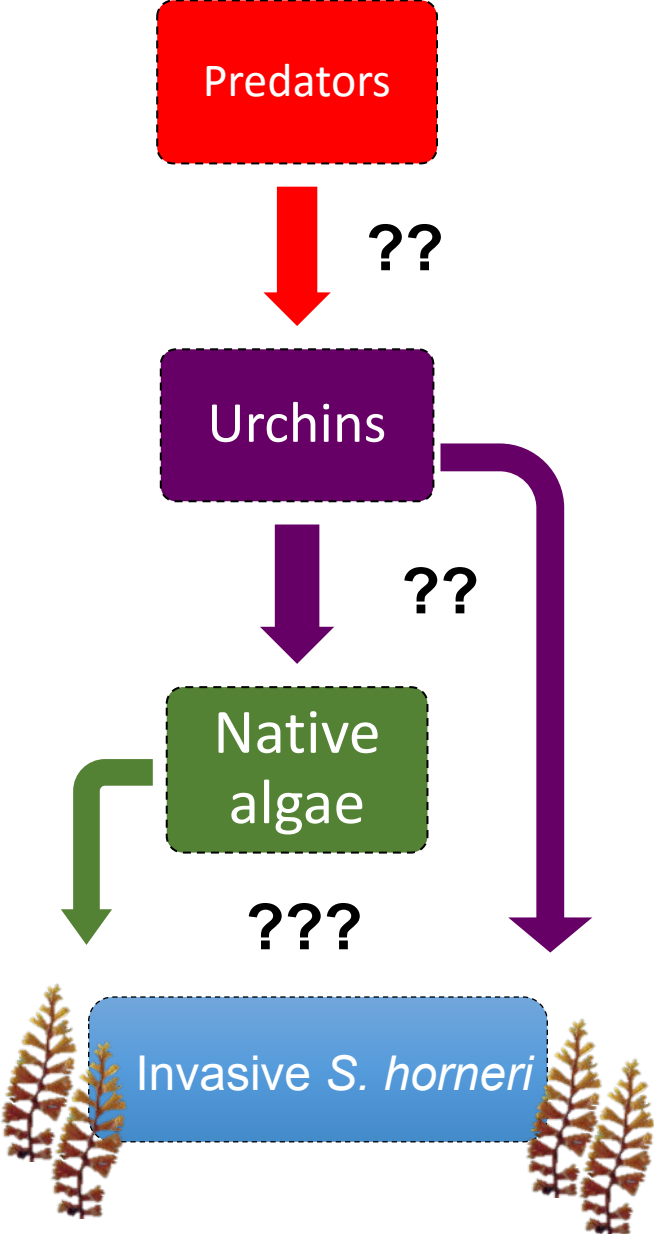
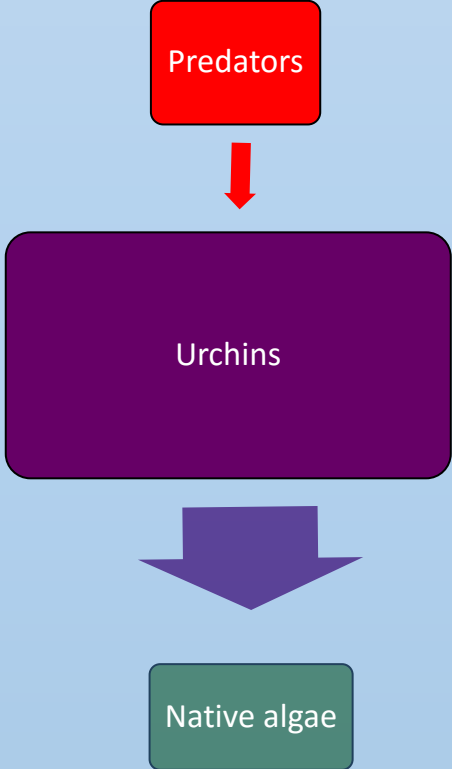


NEWER MPAs

ESTABLISHED MPA

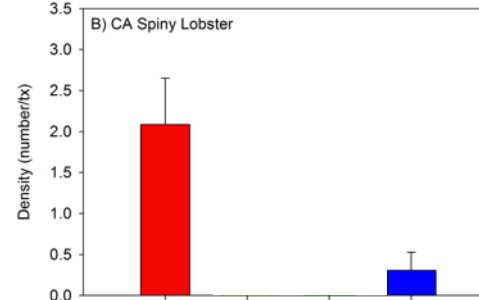
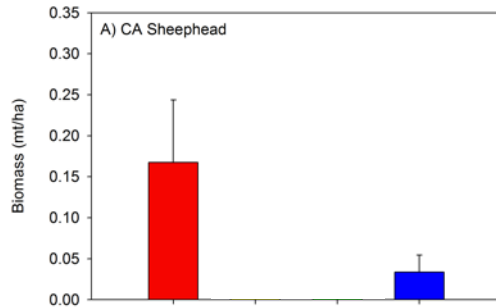


FISHED AREAS





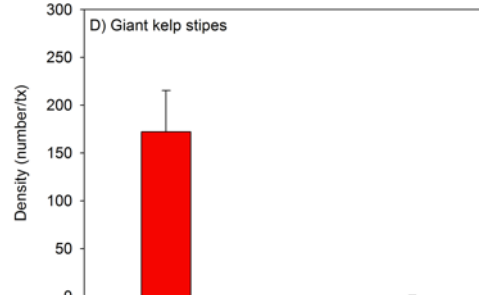
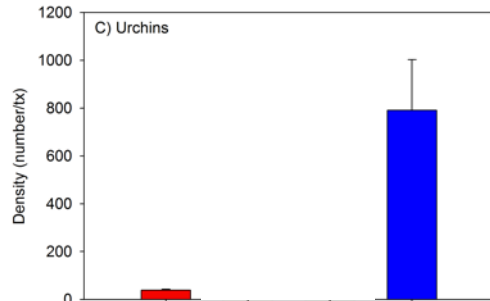
CA sheephead



Lobster



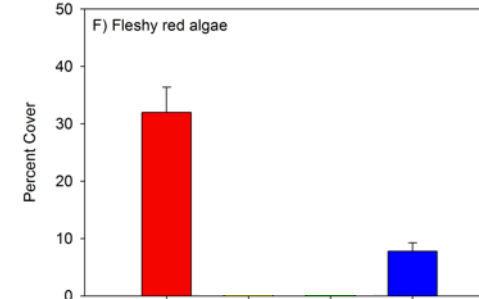
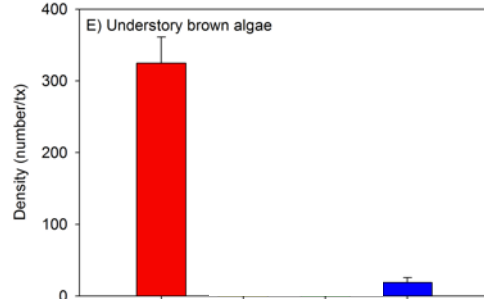
Sea urchins



Giant kelp



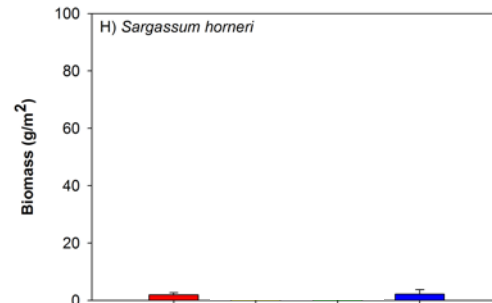
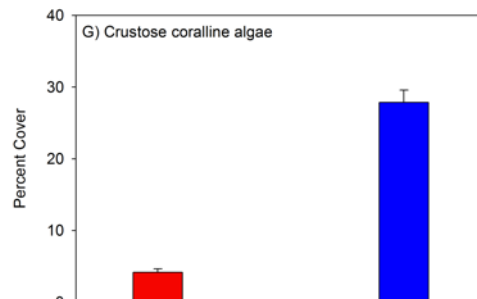
Understory kelps



Red algae



Crustose coralline algae



Sargassum horneri

OLD
SMR

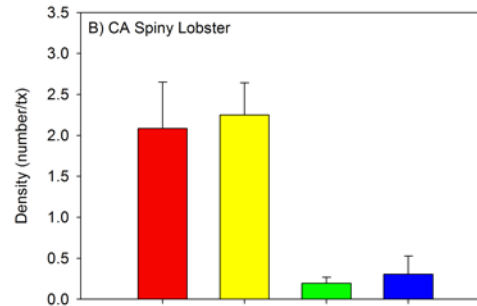
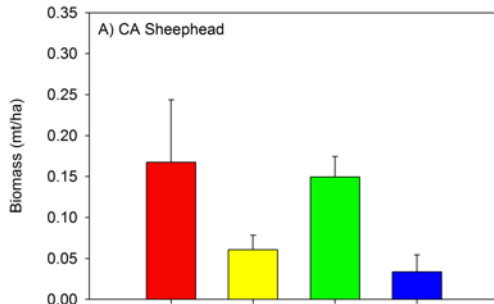
REF

OLD
SMR

REF



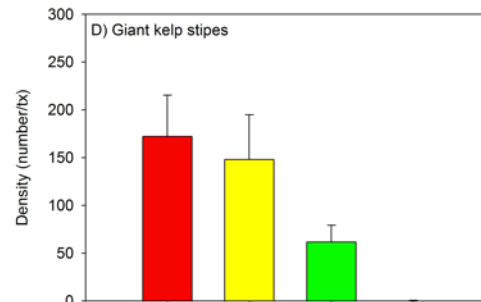
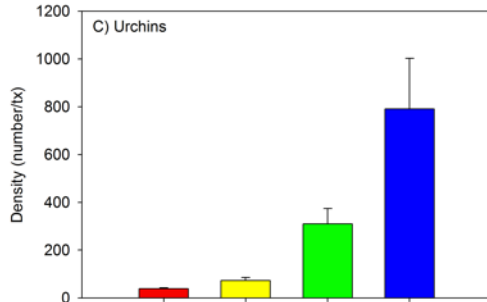
CA sheephead



Lobster



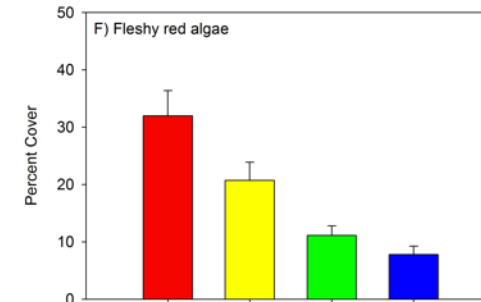
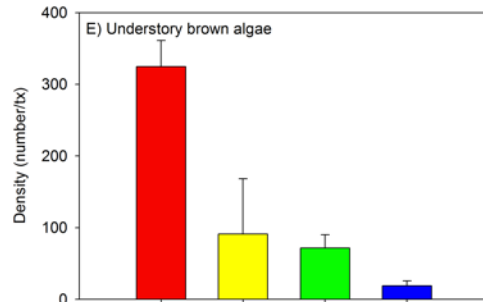
Sea urchins



Giant kelp



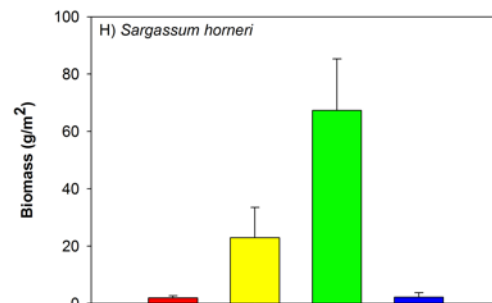
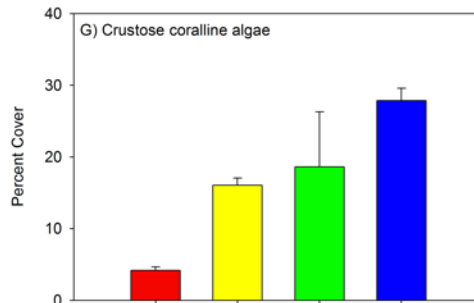
Understory kelps



Red algae



Crustose coralline algae

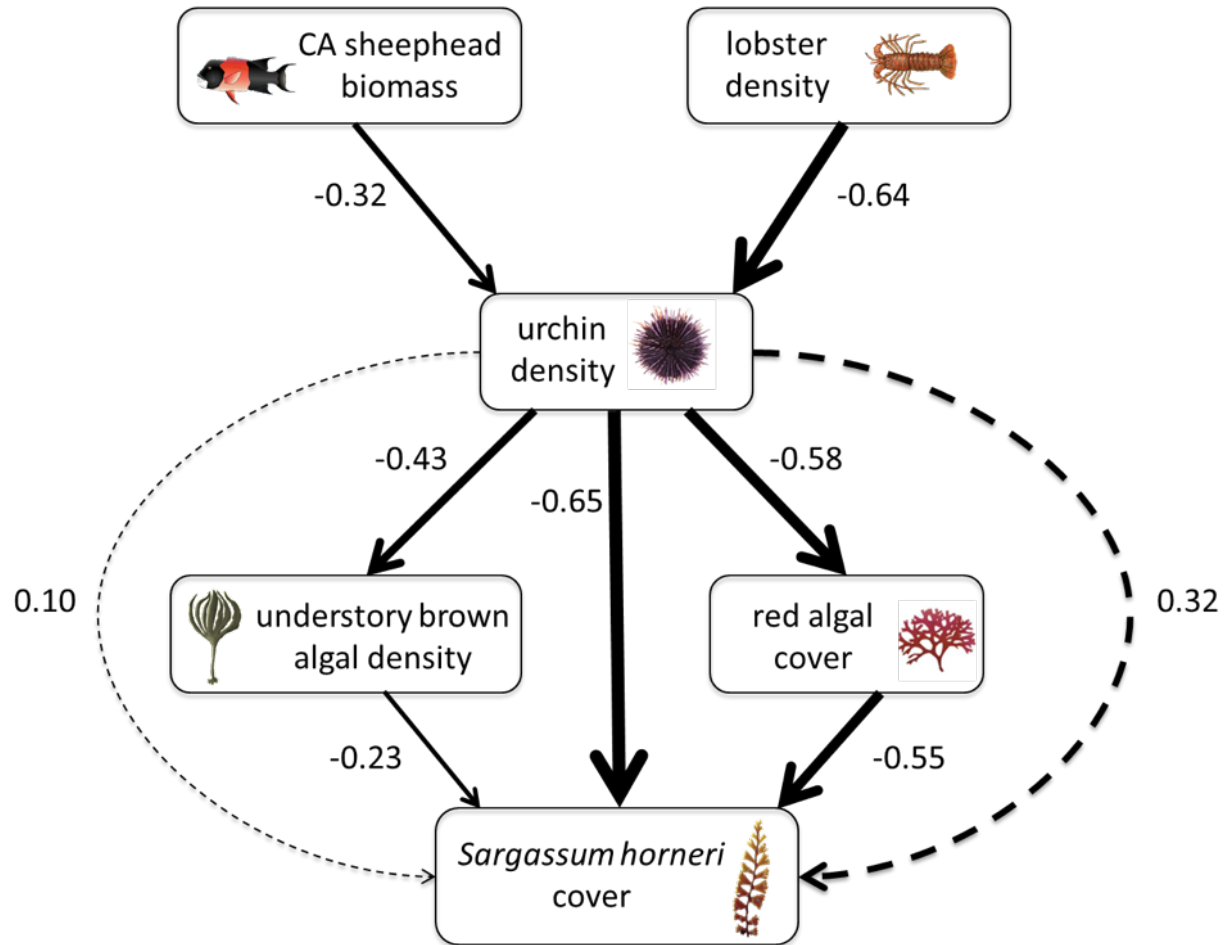


Sargassum horneri

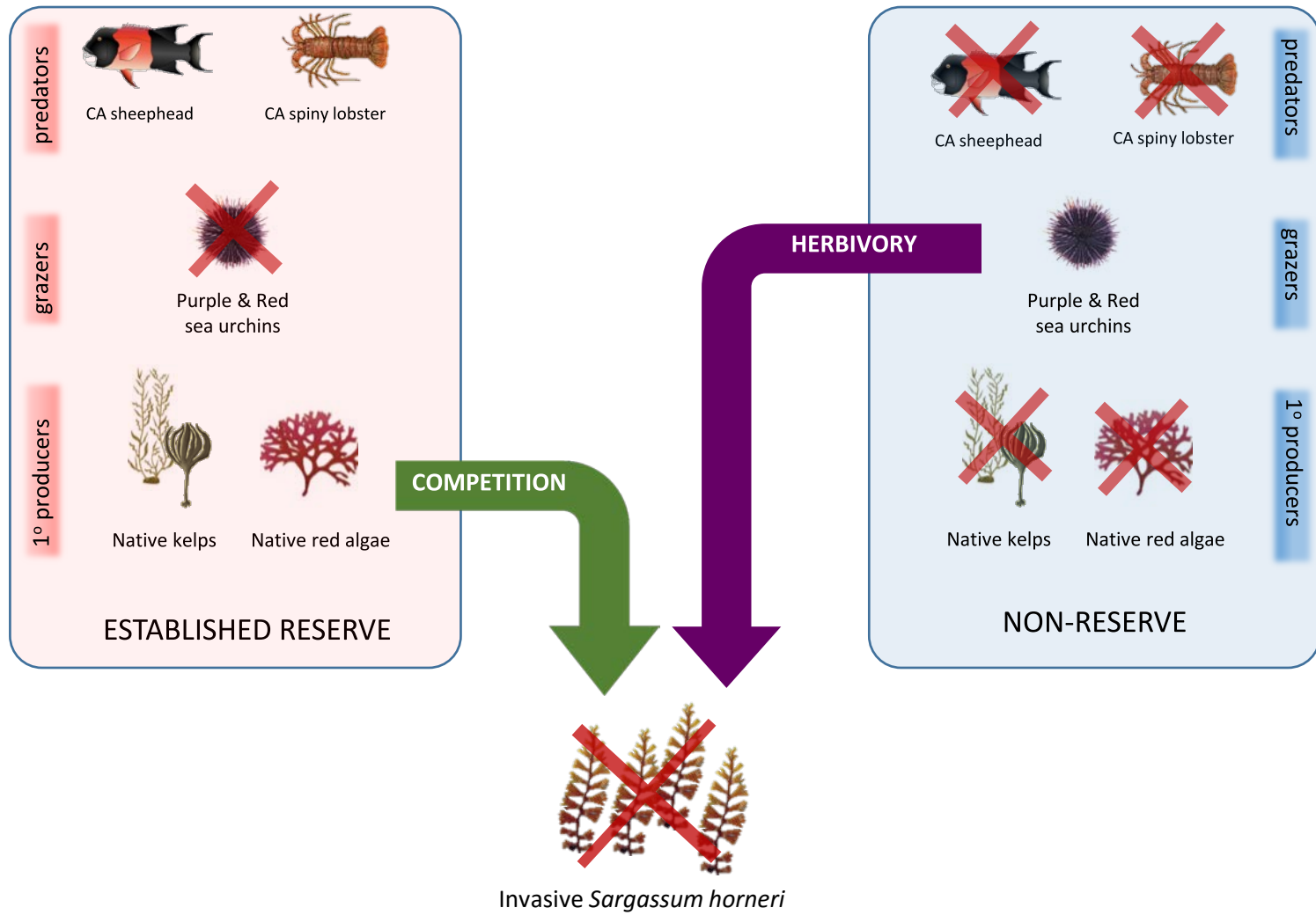
OLD NEW NEW REF
SMR SMR SMCA

OLD NEW NEW REF
SMR SMR SMCA

The food web with invasive algae

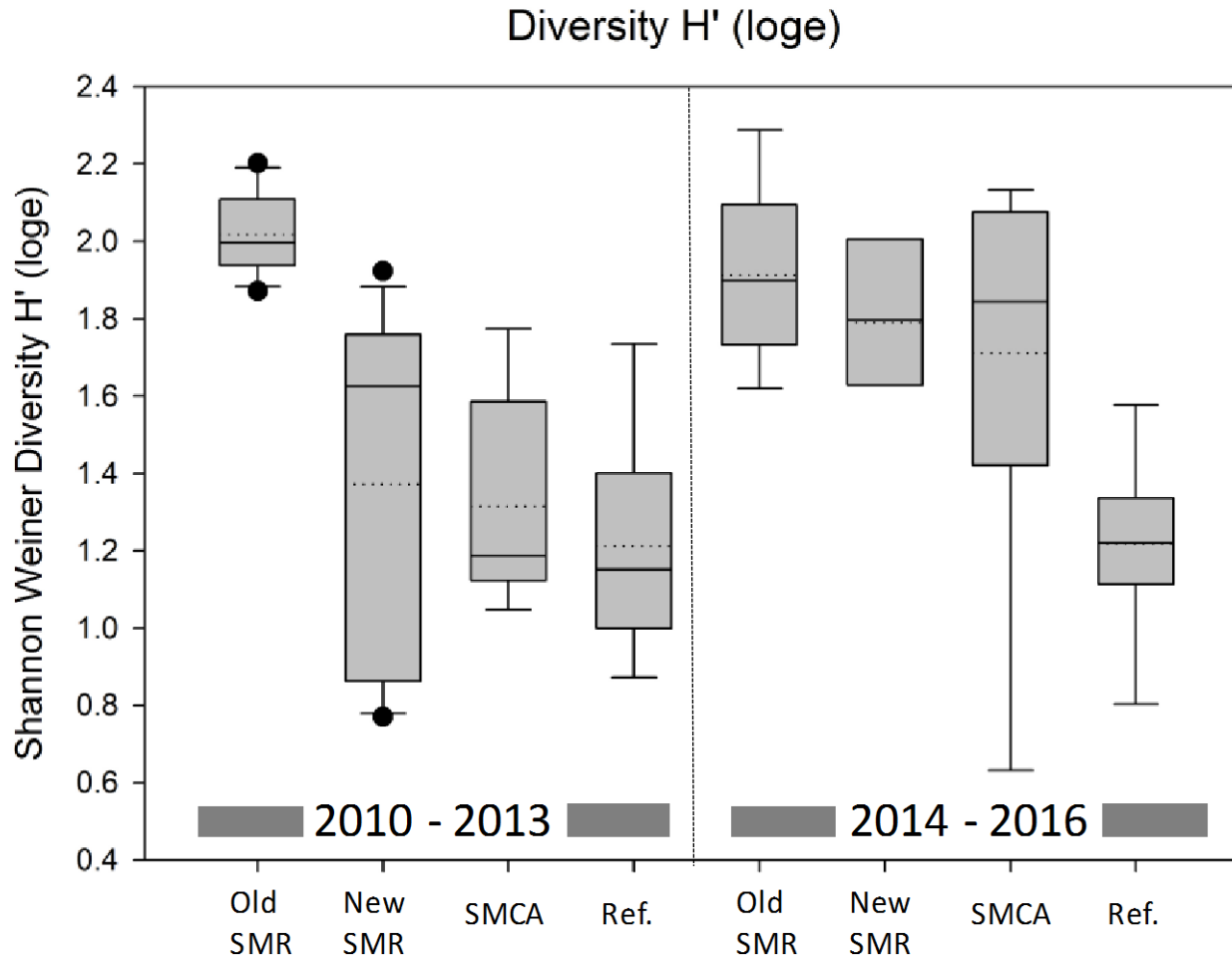


MULTIPLE PATHWAYS TO INVASION RESISTANCE

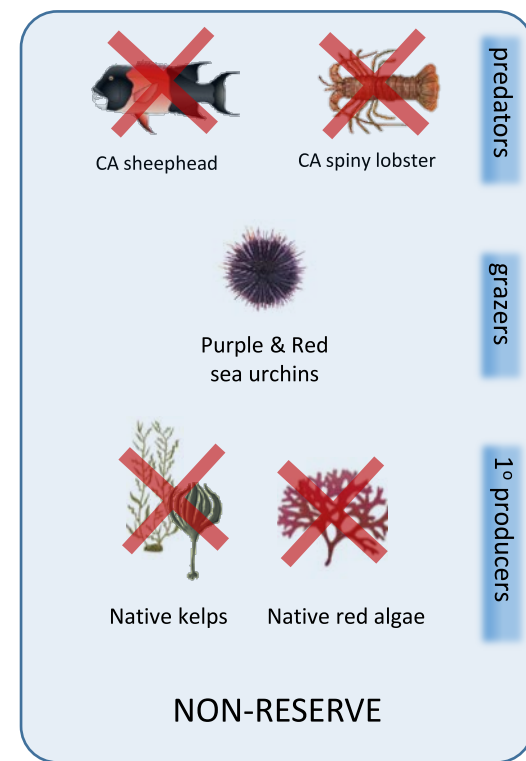
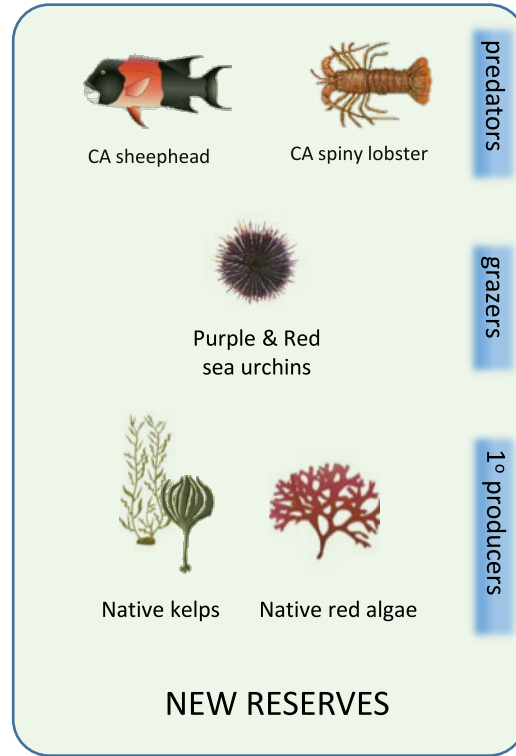
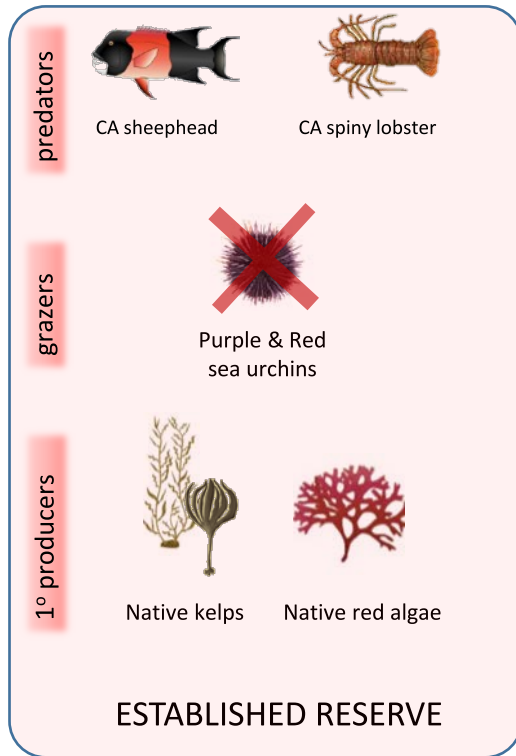


BUT ARE THE TWO ECOSYSTEM STATES EQUAL (OR DESIRABLE)?

Species diversity is greater in MPAs

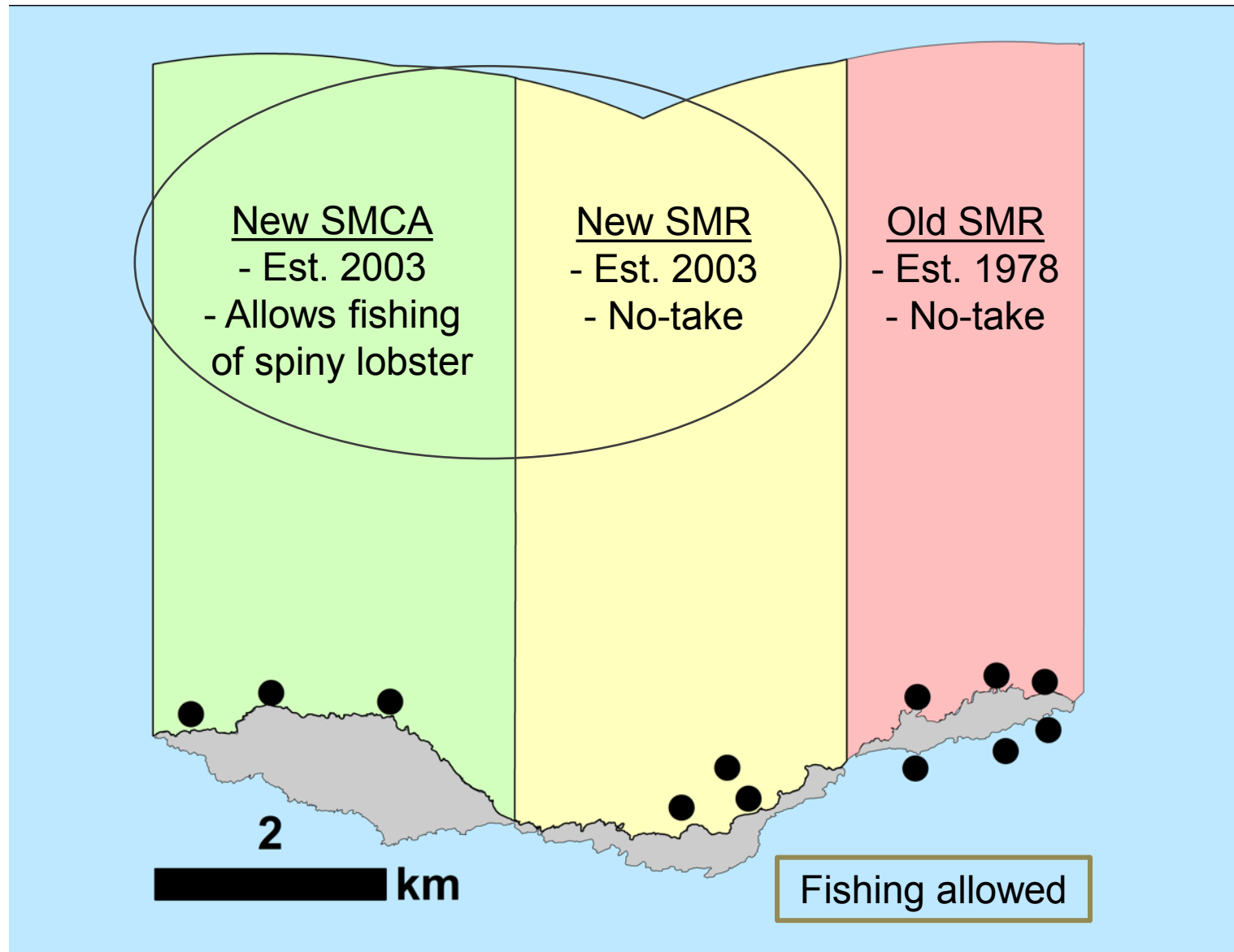


WHAT WILL HAPPEN IN THE NEWER MPAs?



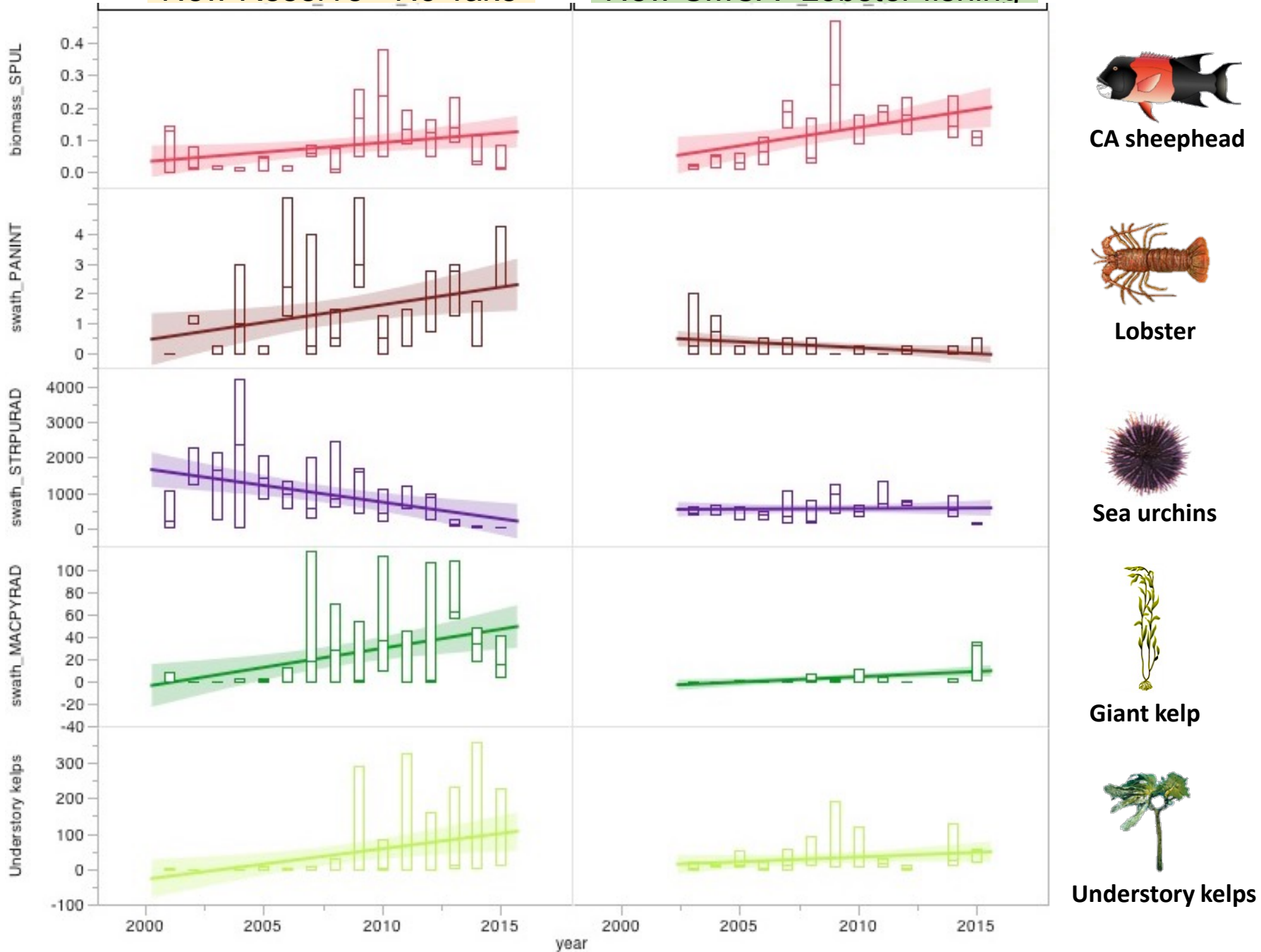
Invasive Sargassum horneri

Anacapa island protection zones



New Reserve - No Take

New SMCA- Lobster fishing



CA sheephead



Lobster



Sea urchins

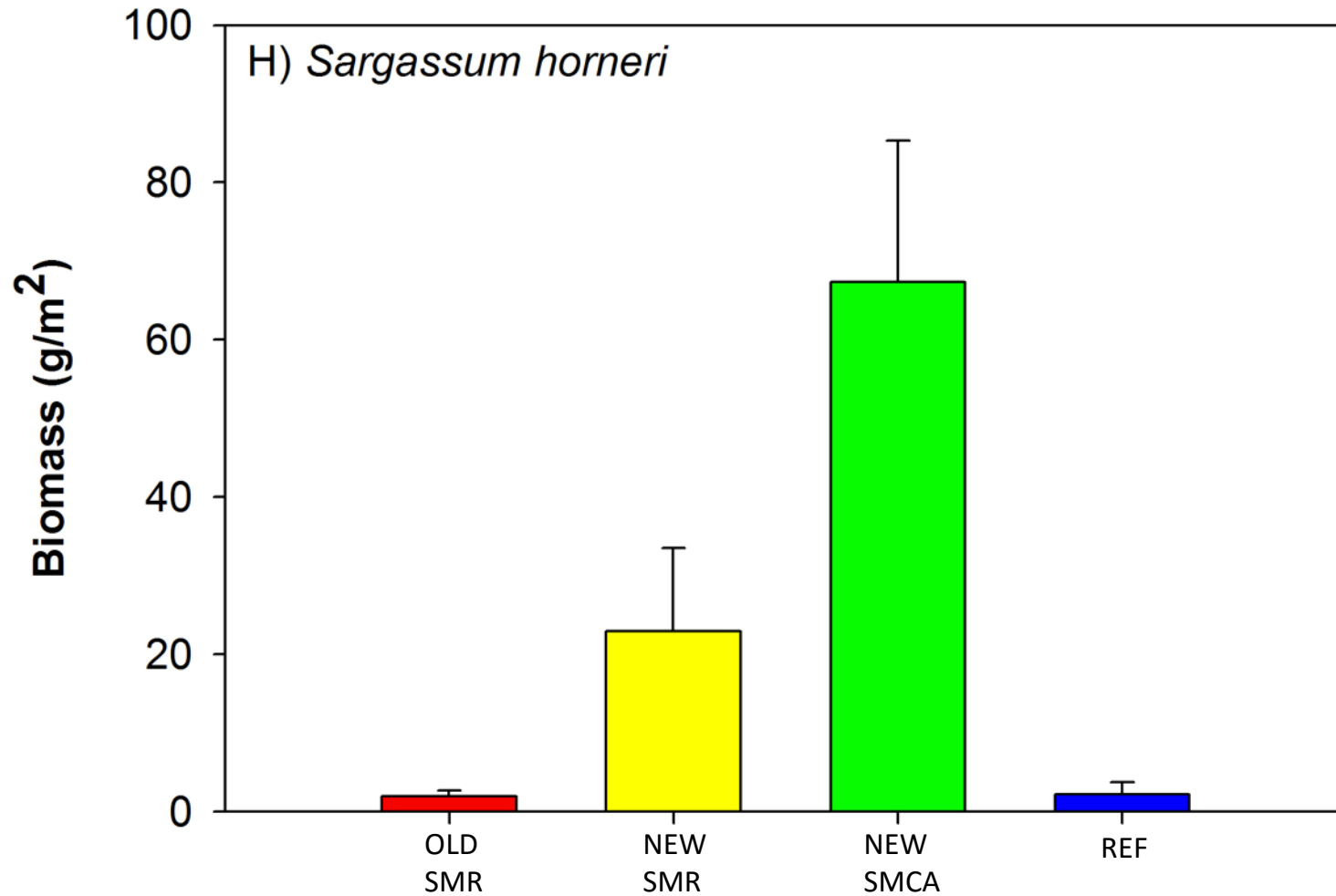


Giant kelp



Understory kelps

S. horneri is most abundant at the SMCA that allows lobster fishing



Conclusions

- *Sargassum horneri* is invading southern California with potentially dramatic effects on kelp forest ecosystems
- Marine protected areas with healthy native algal communities may resist the invasion – likely mechanism competition for space and shading
- Overfished, urchin barrens also “resist” invasion – likely mechanism predation by urchins
- This study is correlative but suggestive of a number of interesting next steps including experimental manipulations and broader spatial monitoring



Implications

Kelp forest restoration



Disease dynamics and urchin populations

As Sea Stars Die, New Worries About Urchins

Some urchins waste away, others come out of hiding as the fallout from sea star disease ripples along the California coast.

By **Leslie Willoughby**, National Geographic

PUBLISHED APRIL 1, 2015

Urchins Could Be the Next Victim of Sea Star Wasting Disease

The virus that has struck out Pacific sea star populations could now be affecting their Echinoderm cousins



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More than 1 million urchins removed in Palos Verdes kelp restoration project

POSTED BY JOHN SCHREIBER ON NOVEMBER 19, 2014 IN LIFE | 1,112 VIEWS | [LEAVE A RESPONSE](#)

Volunteers In Palos Verdes Peninsula: Rebuild Kelp Forests And Marine Life Will Come

November 19, 2014 5:41 PM

Filed Under: Conservation, Ecosystem, Kelp, Marine Biology, Marine Life, Nature, Ocean, Palos Verdes Peninsula, The Bay Foundation



LISTEN LIVE



Acknowledgements

