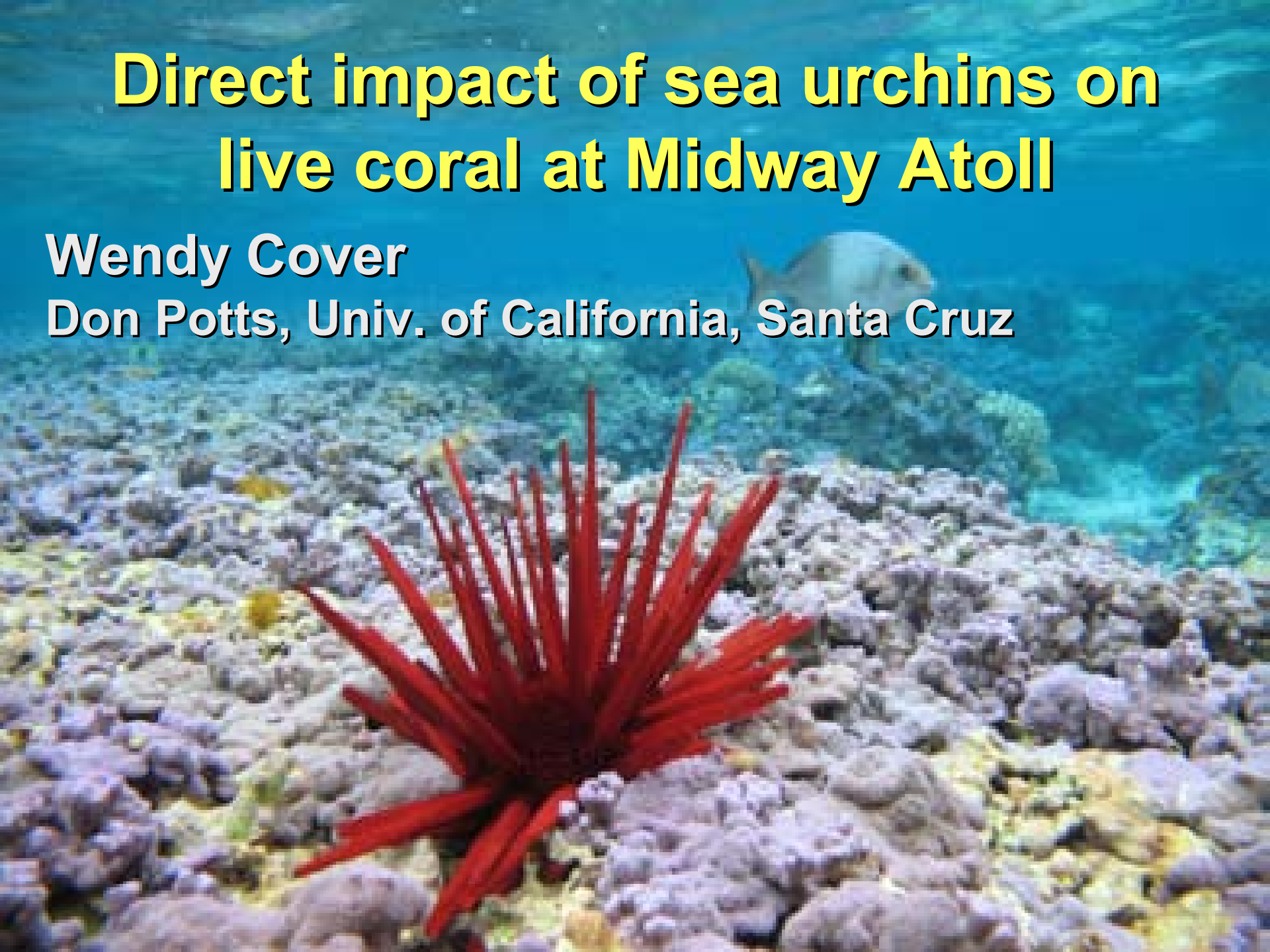
Direct impact of sea urchins on live coral at Midway Atoll

Wendy Cover
Don Potts, Univ. of California, Santa Cruz

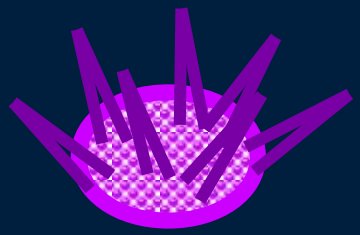


- Coral reef conservation depends on understanding key processes that influence the survival and spread of corals
- Other reef organisms can directly and indirectly impact corals
- Sea urchins are common grazers in coral reef ecosystems
- Urchins in the Caribbean can increase reef resilience

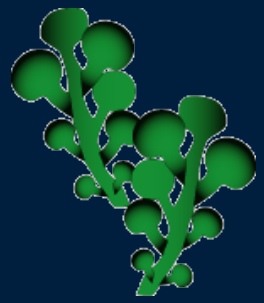
Role of urchins on reefs in Jamaica

(Hughes 1994)

Urchins on Reefs

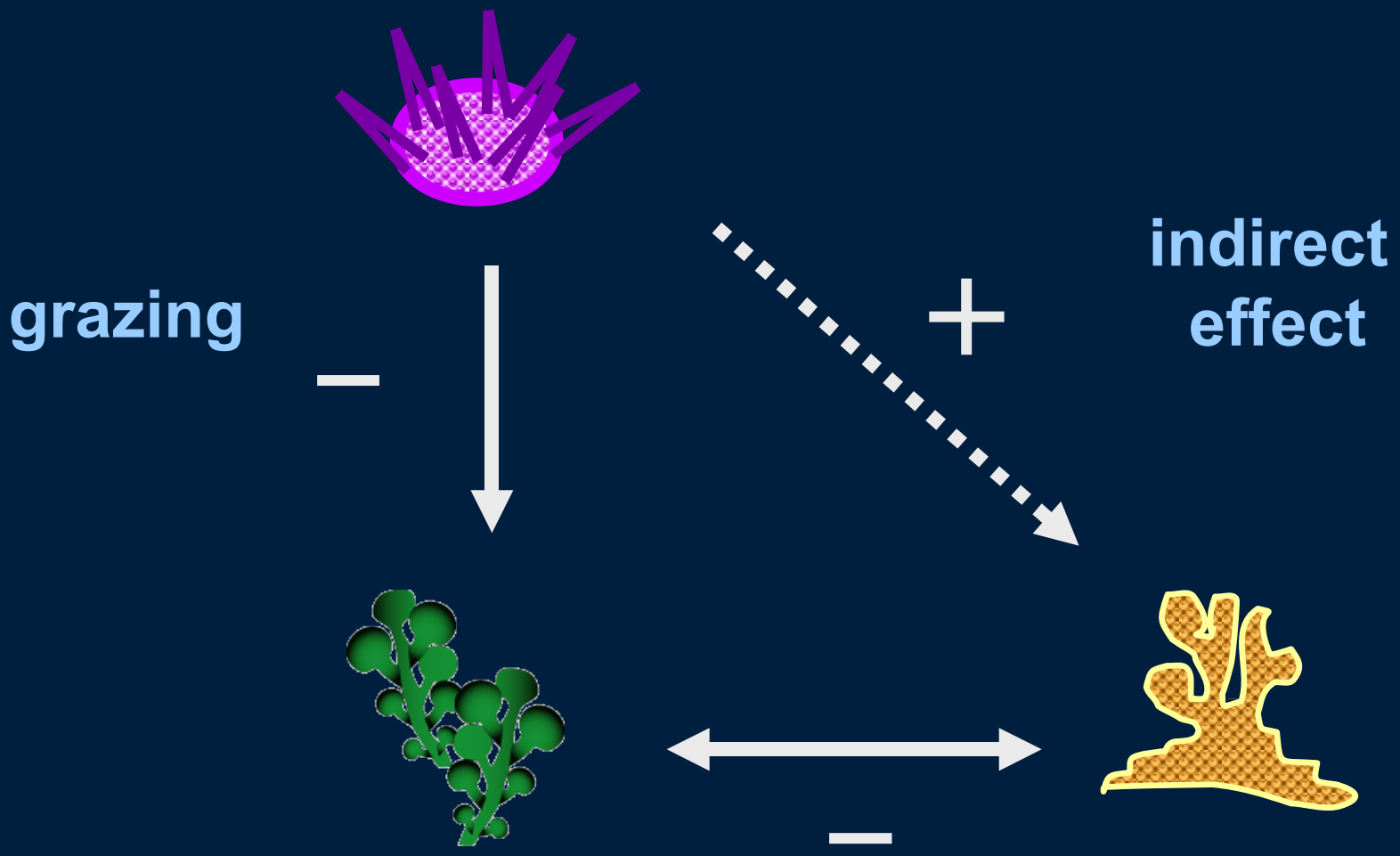


grazing

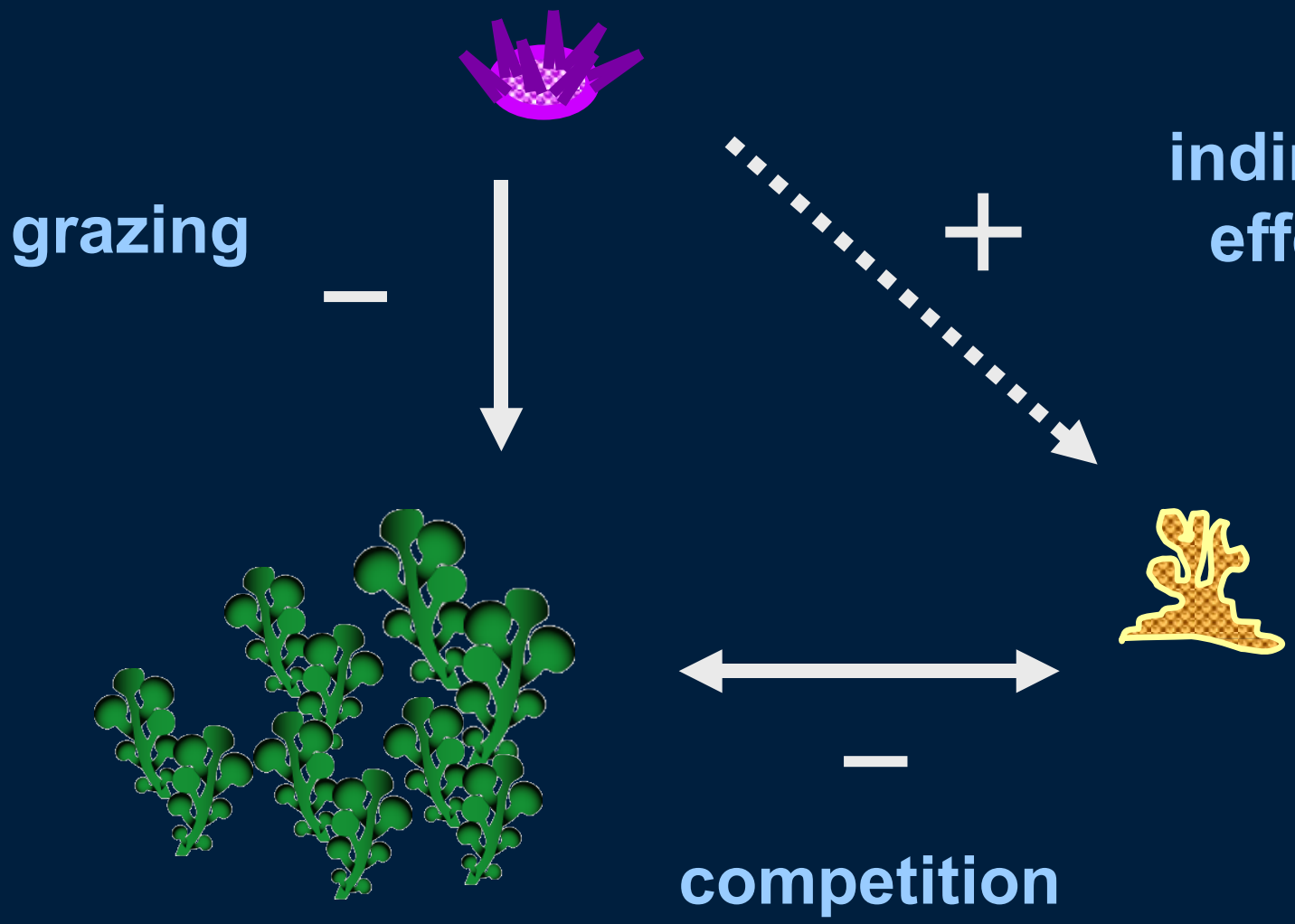


competition

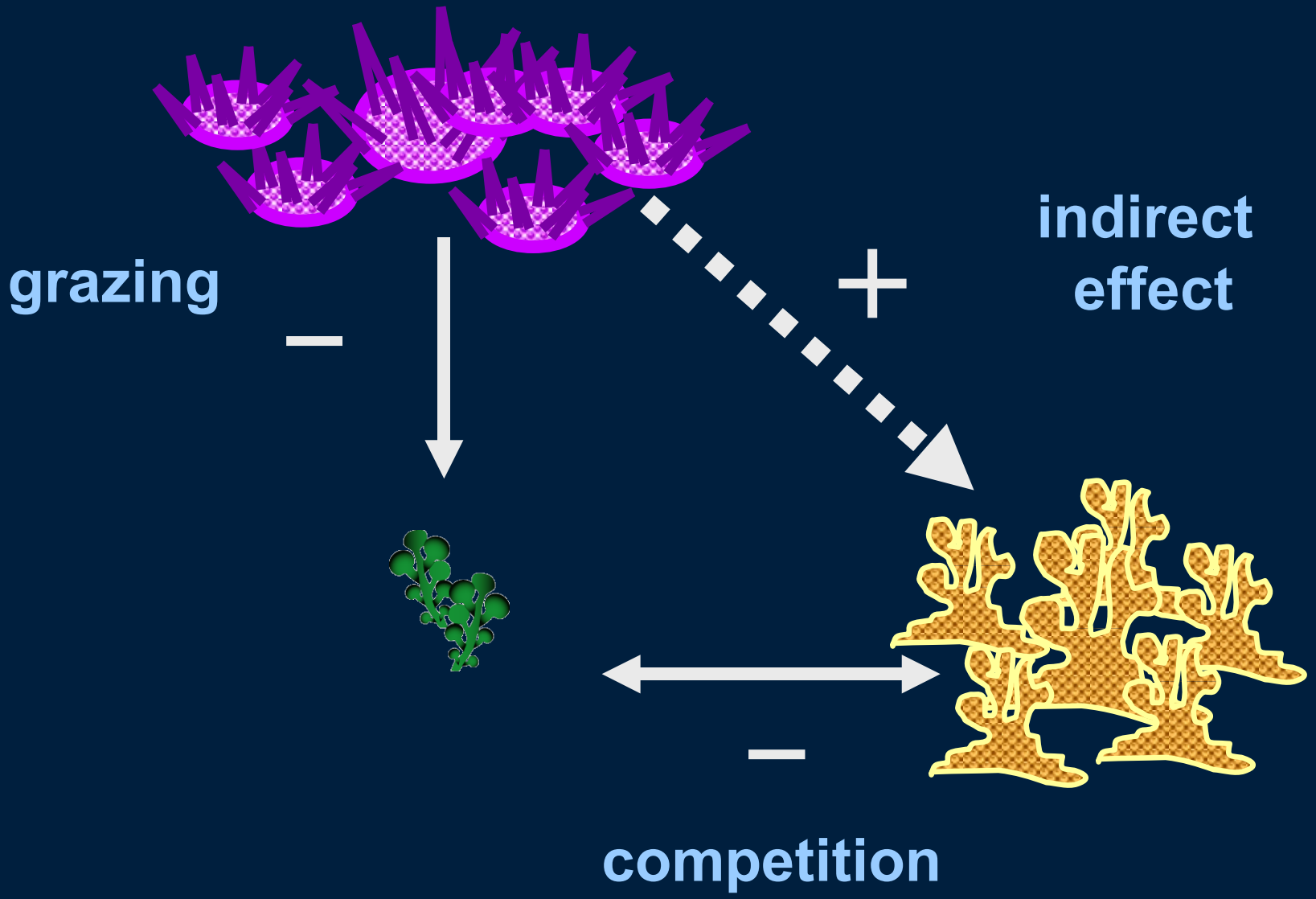
Urchins on Reefs

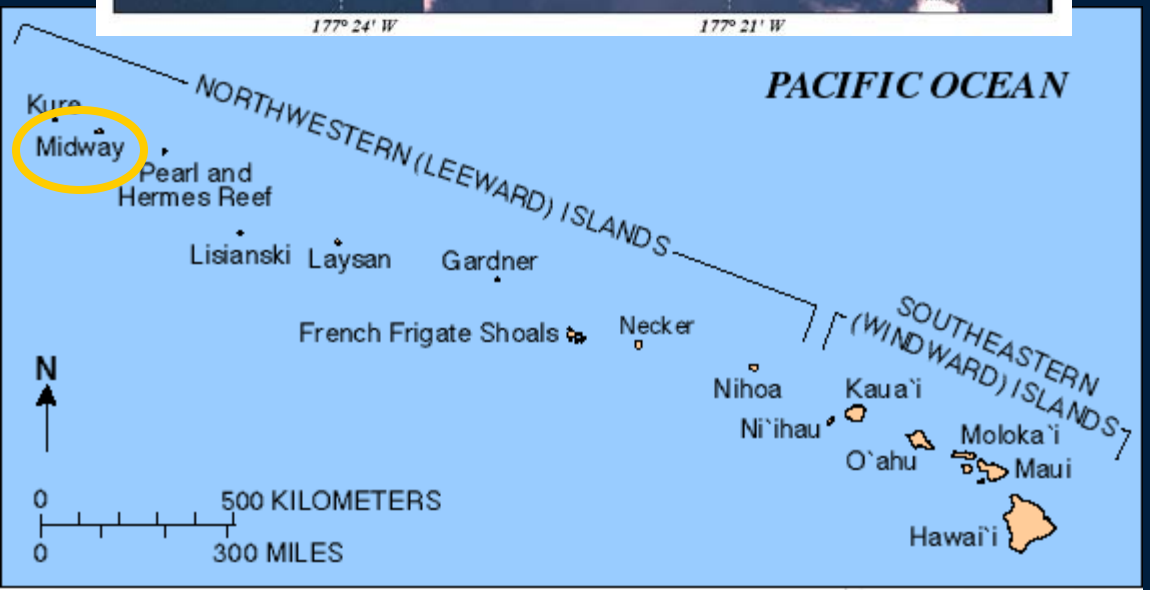


Urchins on Reefs – weak indirect effect

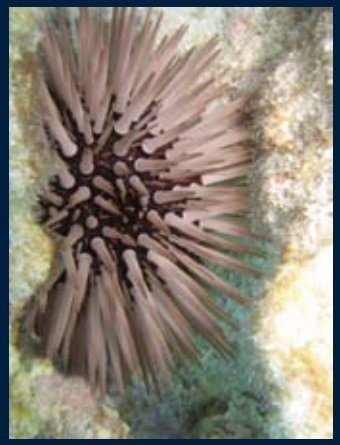


Urchins on Reefs – strong indirect effect





Dominant urchin species:



Echinometra mathaei

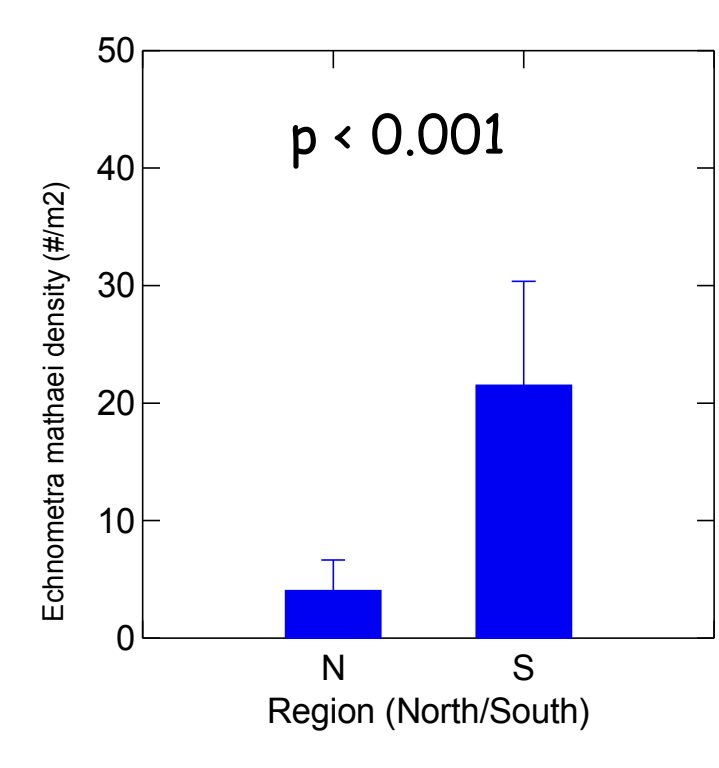
Heterocentrotus mammillatus

Bioerosion

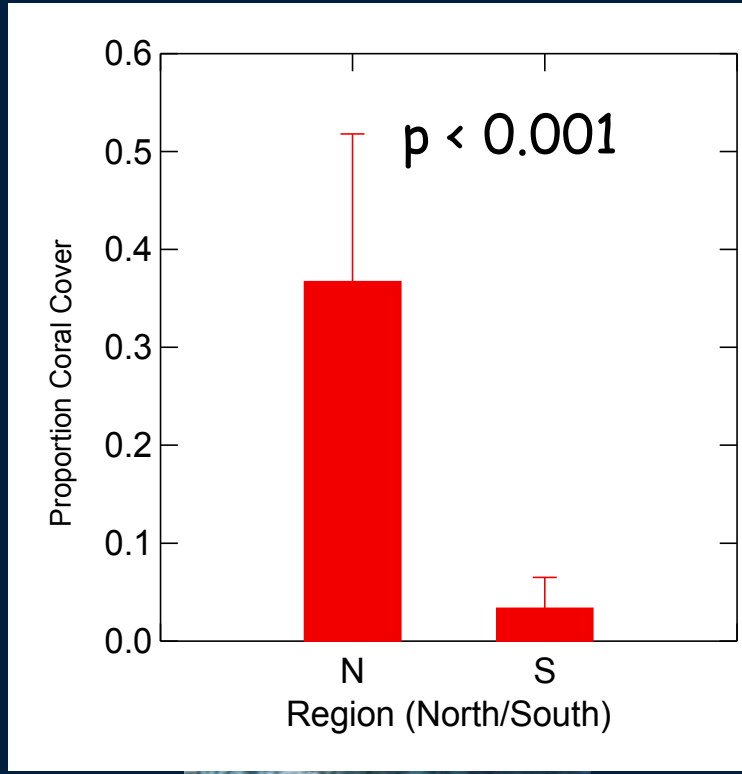
Removal of carbonate rock through mechanical scraping

Survey Results – Coral and Urchins

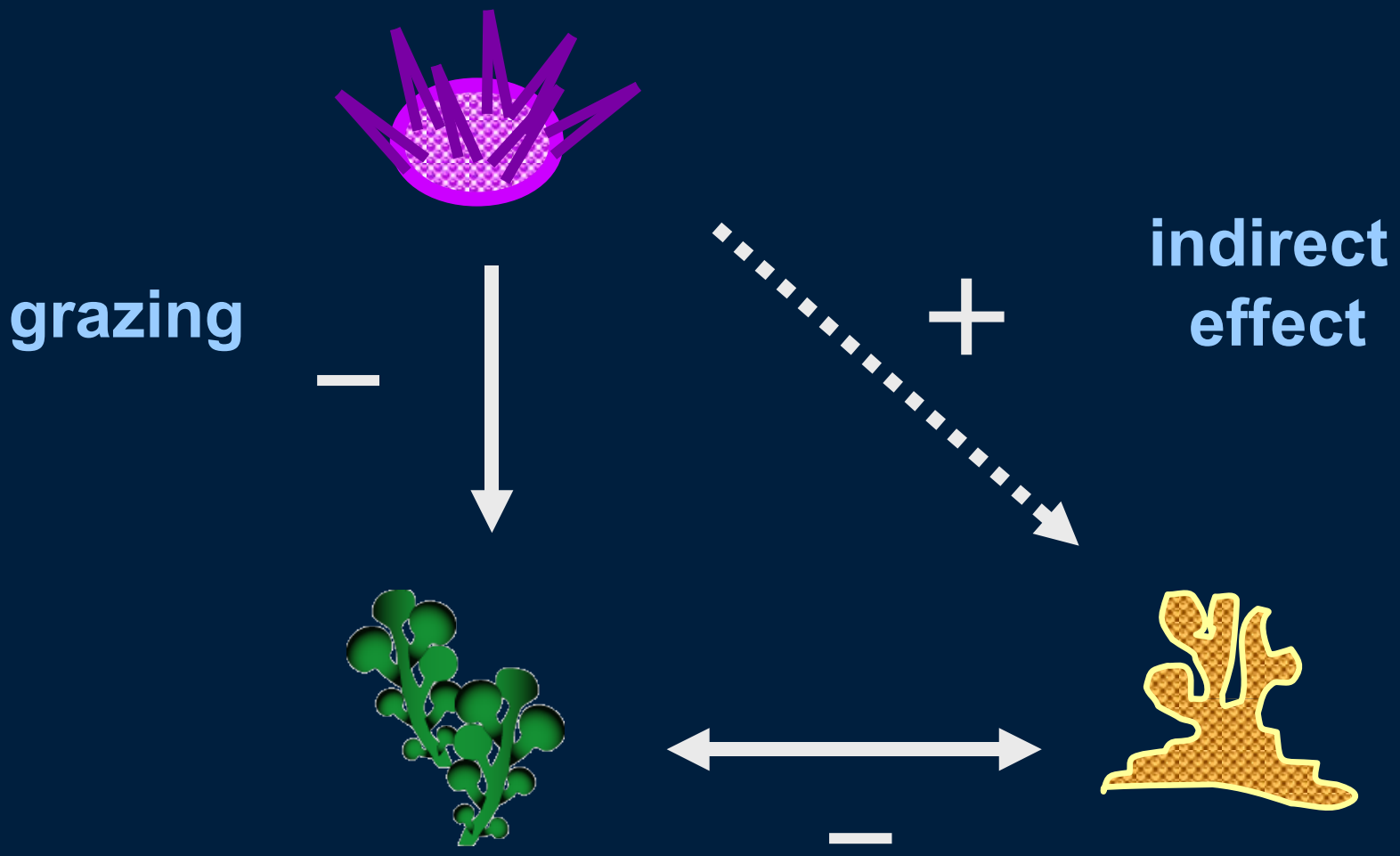
Urchins:



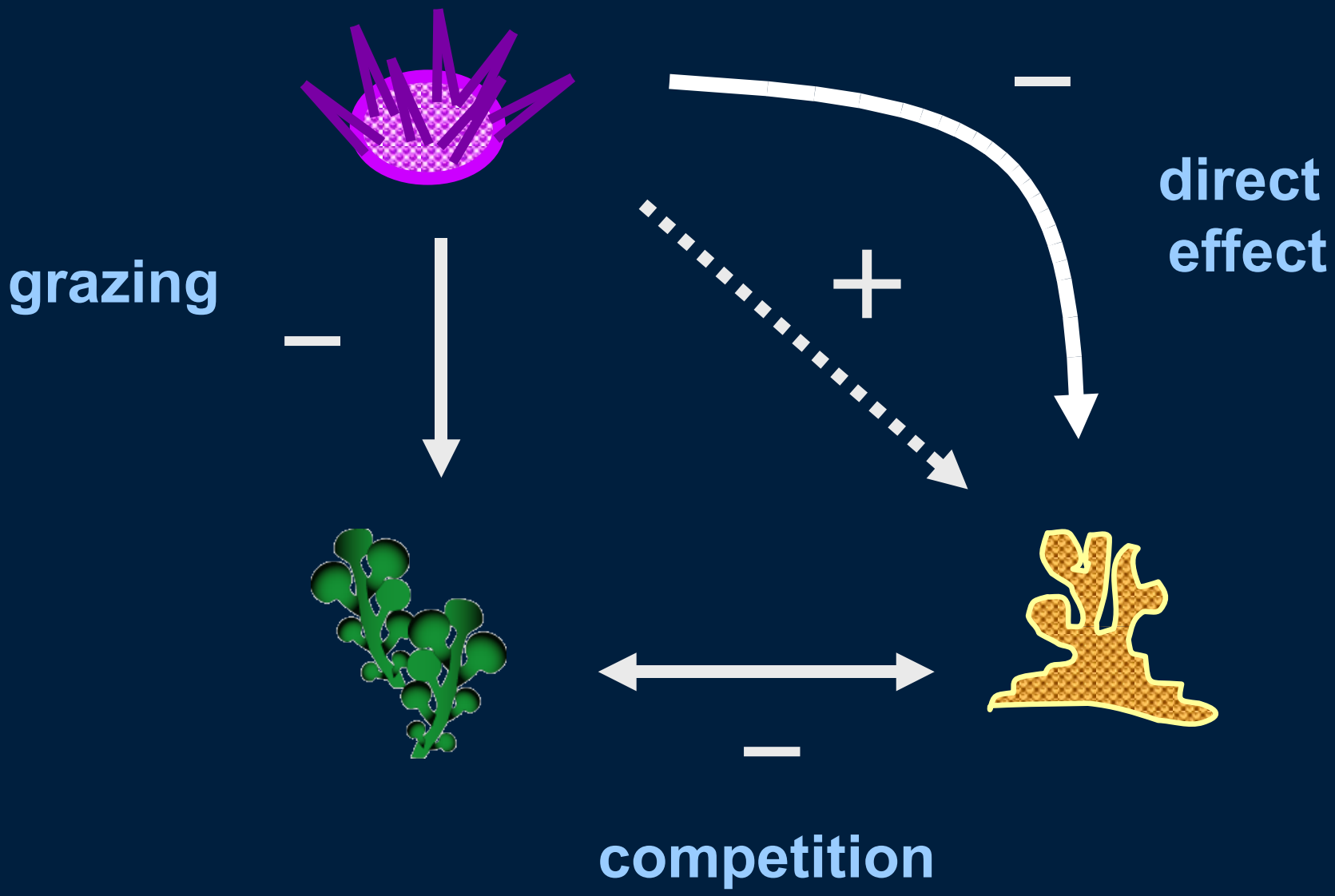
Corals:



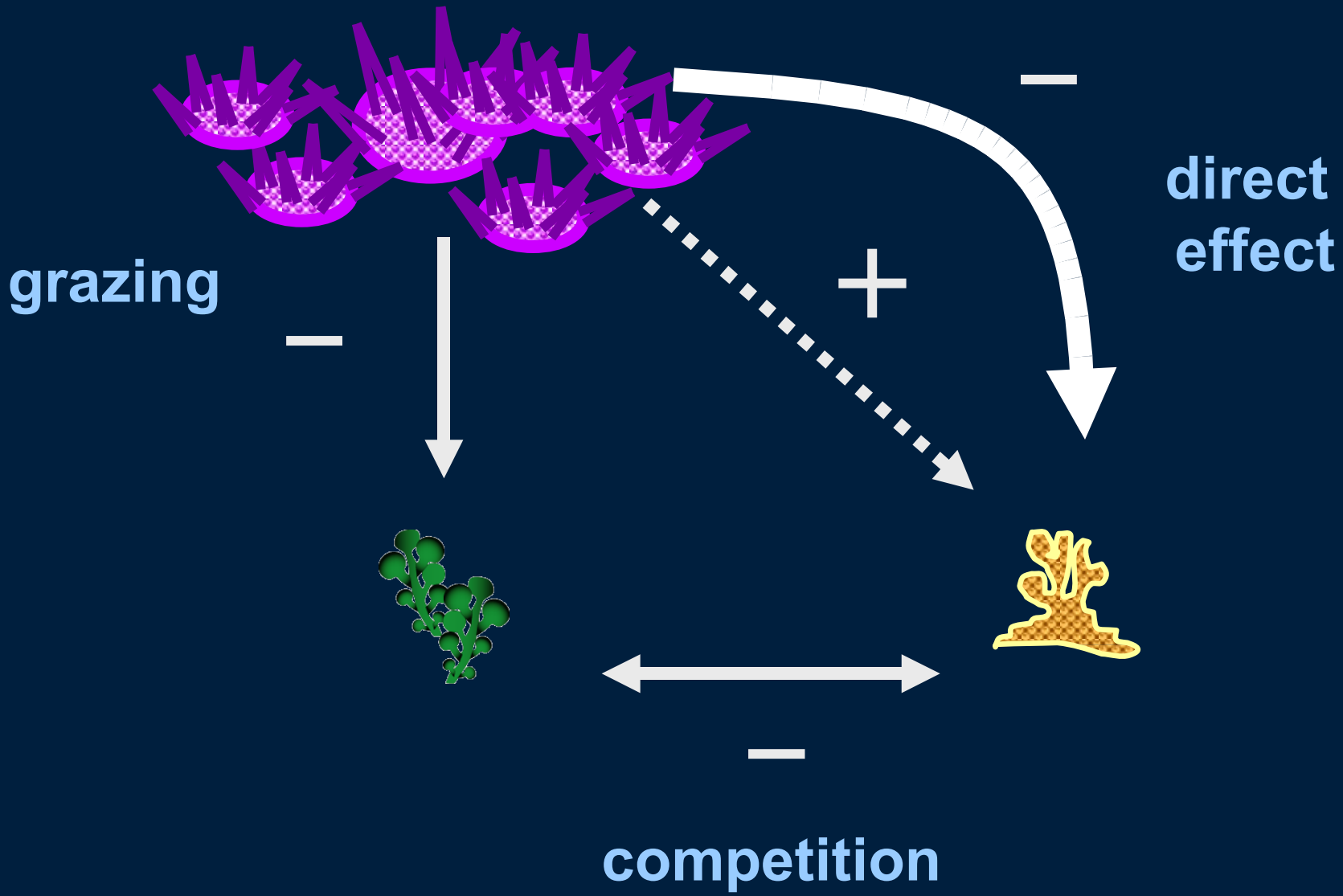
Urchins on Reefs



Urchins on Reefs – direct negative effect



Urchins on Reefs – direct negative effect



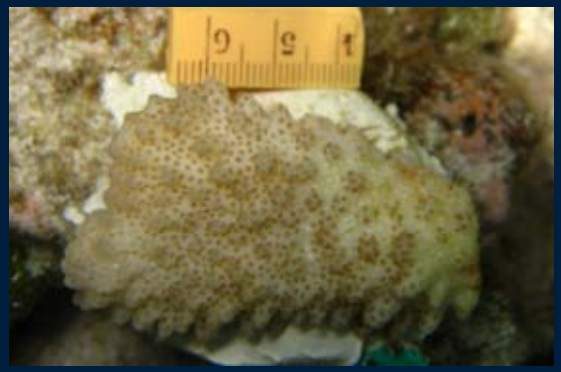
Questions

- Can urchins graze down live corals?
- Are urchin impacts species-specific?
  - Urchins
  - Corals
- Could coral-urchin interactions impact the larger community structure?

Experiment Overview

First experiment

- *Pocillopora ligulata* inside *Echinometra mathaei* urchin channels

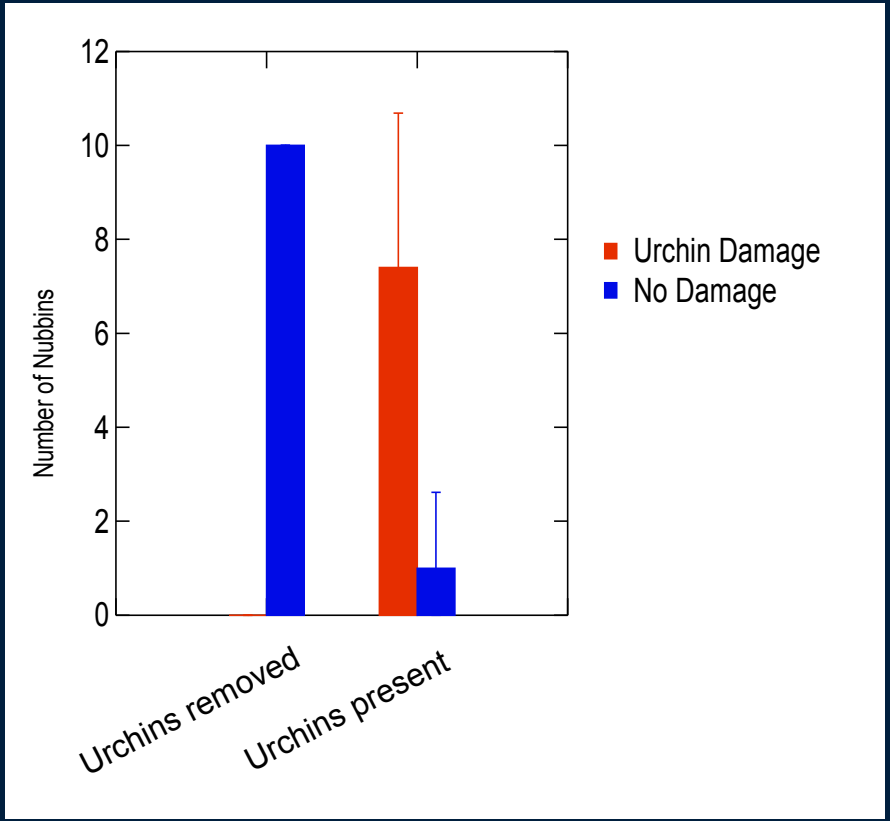


- Half of plots urchins removed

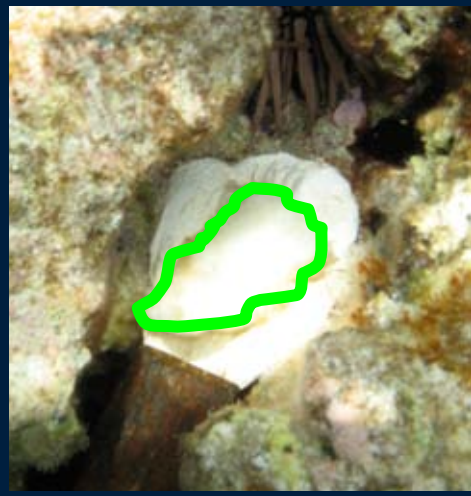
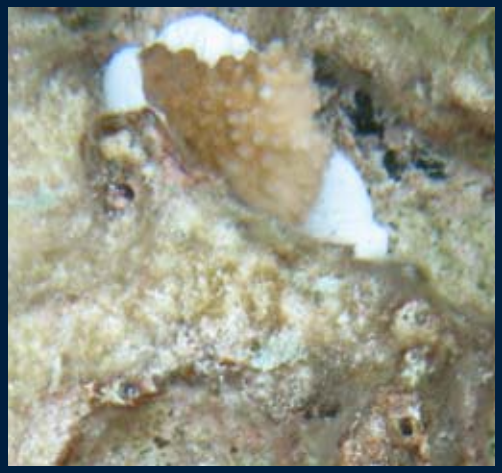
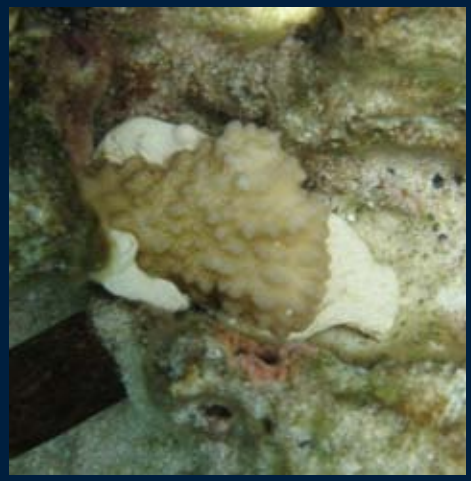
- South backreef site

Pocillopora experiment

Corals affected after one day:



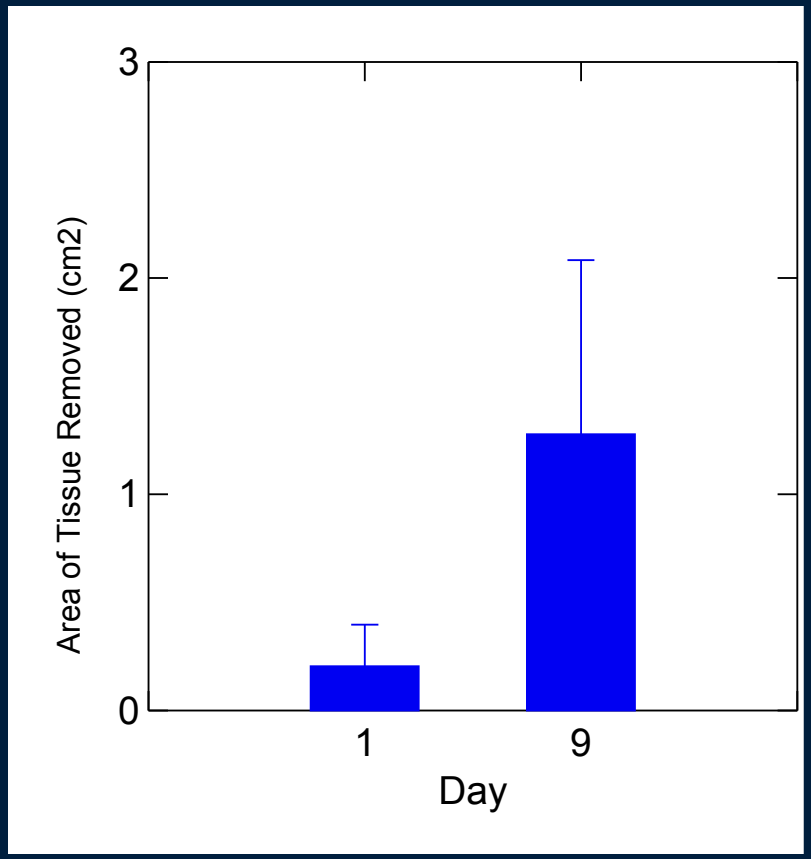
Pocillopora experiment

	Day 0	Day 1	Day 9
Urchins present:			
Urchins removed:			

Pocillopora experiment

Area Analysis

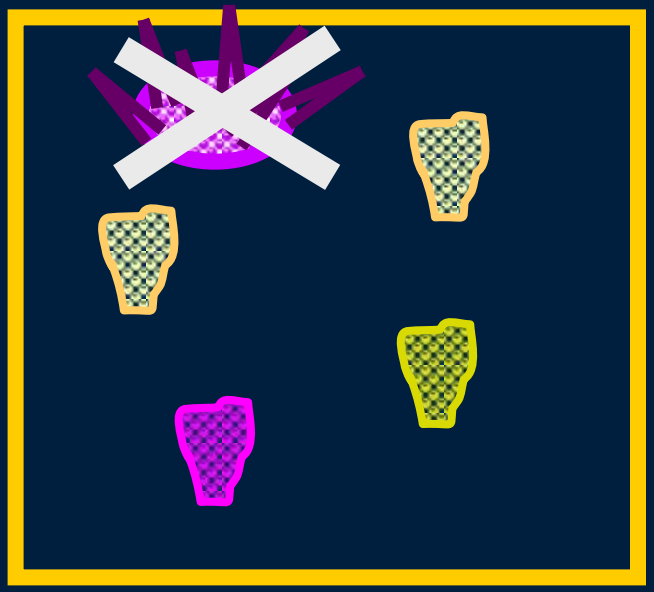
"Predation" increased over time:



Expanded experiment

Urchins Present:

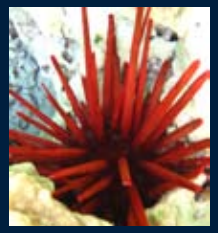
Urchins Removed:



1m2

X 20 / site -- *Echinometra mathaei*

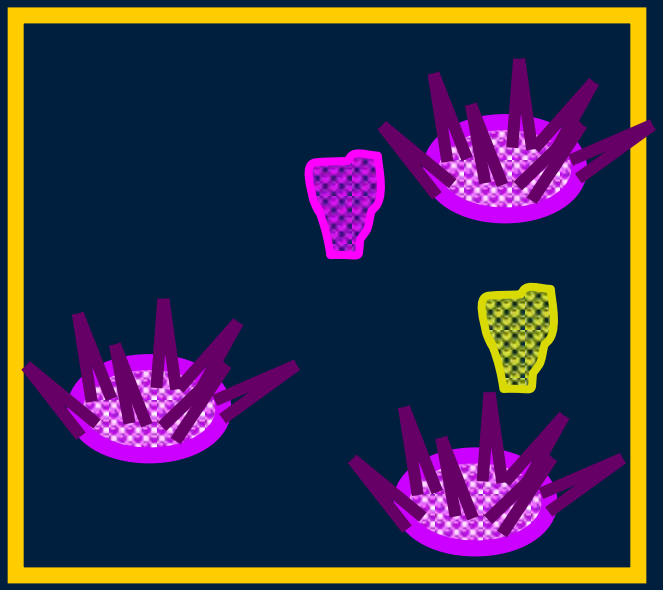
X 10 / site -- *Heterocentrotus mammillatus*



- Two sites: North and South backreef

Expanded experiment

Urchins Present:

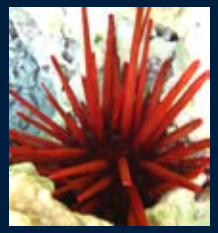


Urchins Removed:

1m2

X 20 / site -- *Echinometra mathaei*

X 10 / site -- *Heterocentrotus mammillatus*



- Two sites: North and South backreef

Expanded experiment

Echinometra plots

Montipora

Day 0:

2 weeks:

2 months:

with urchins:

urchins removed:

Expanded experiment

Echinometra plots

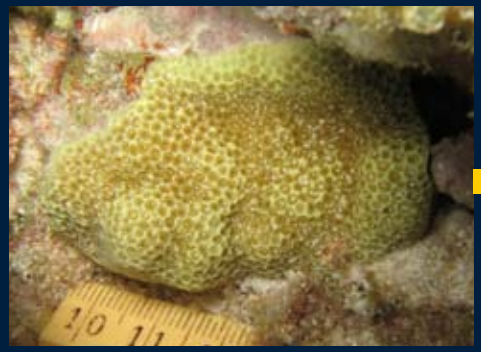
Porites

Day 0:

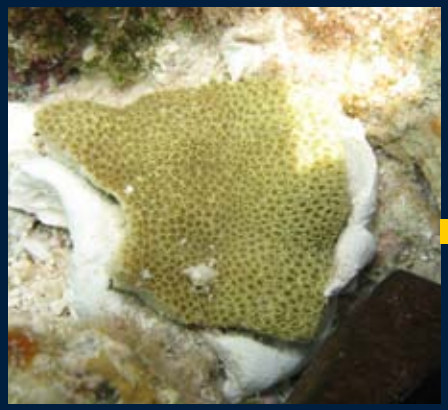
2 weeks:

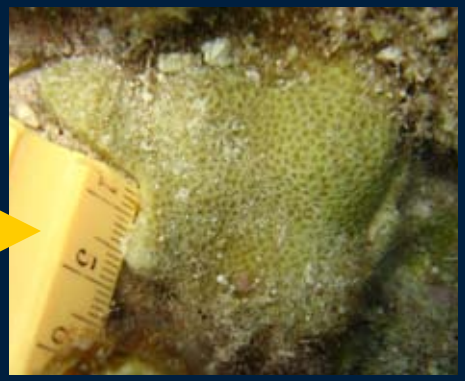
2 months:

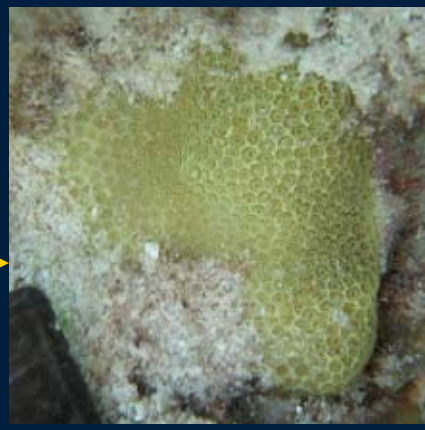
with urchins:



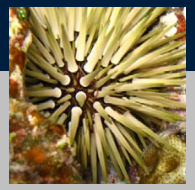
urchins removed:

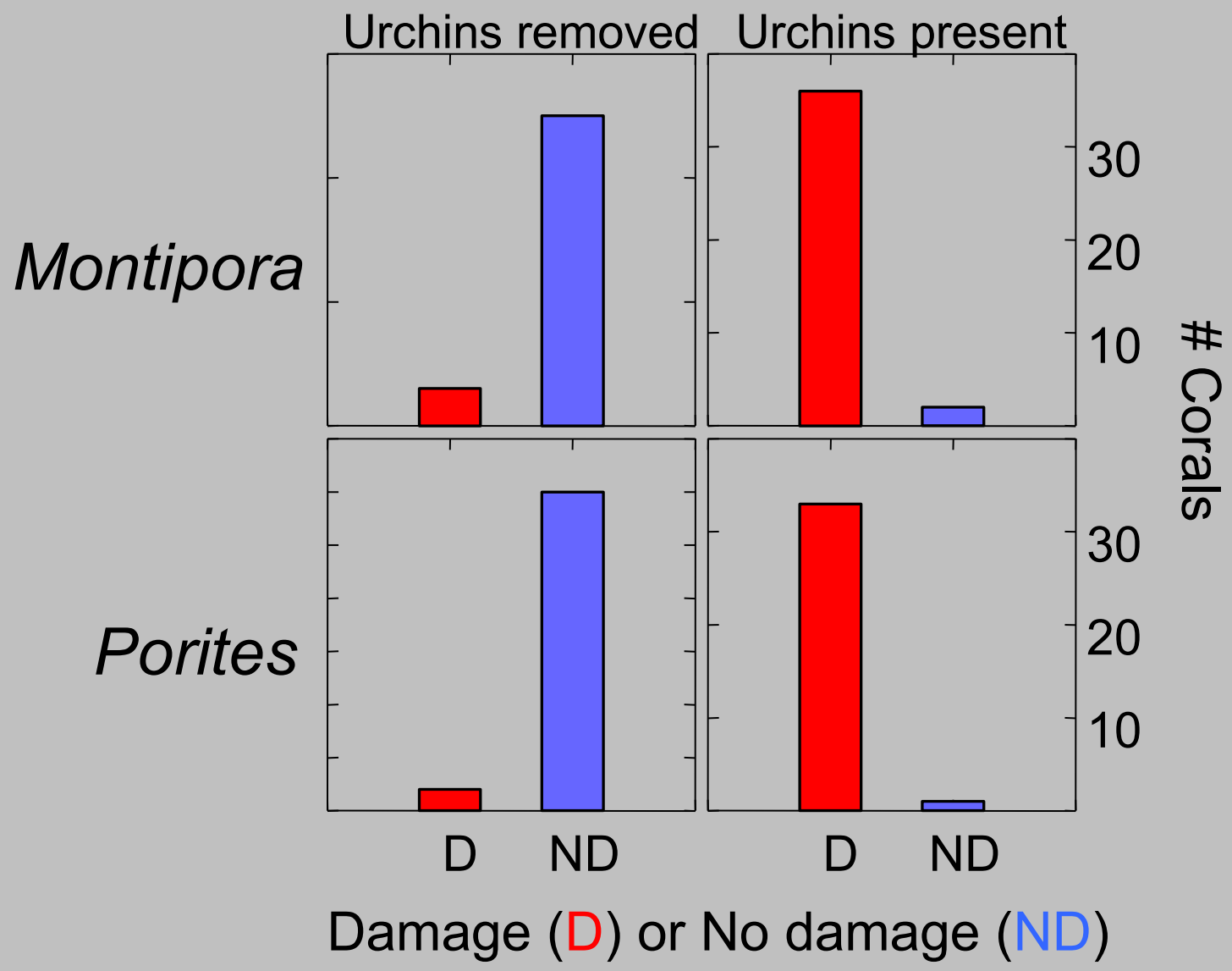






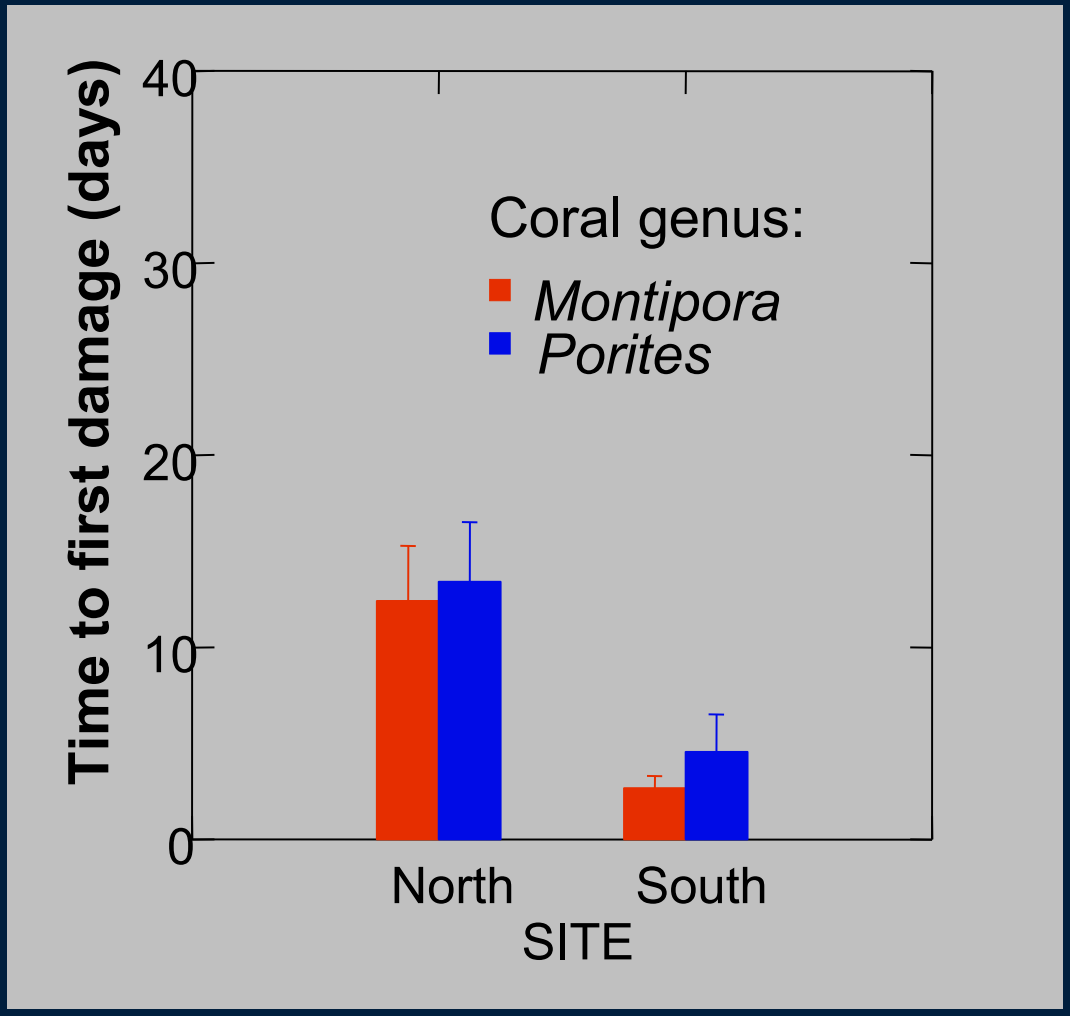
Echinometra Results

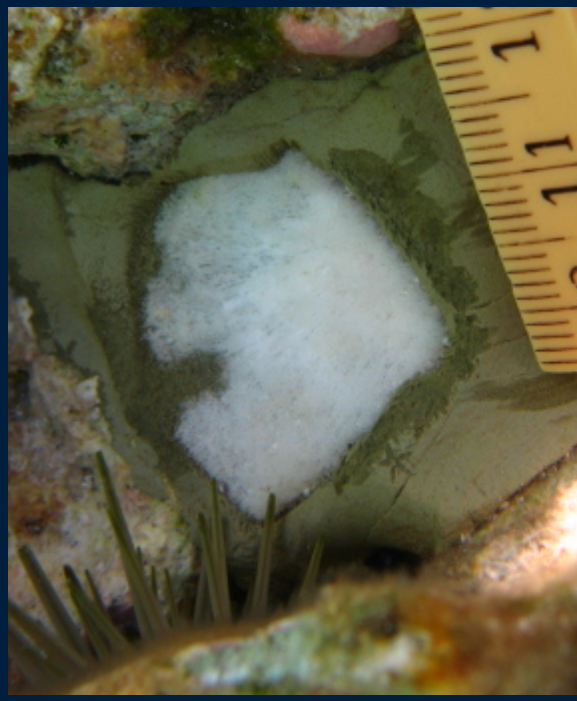


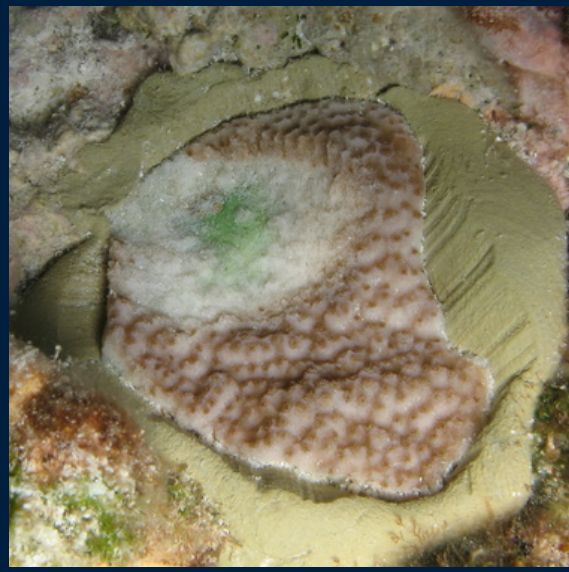


Echinometra Results

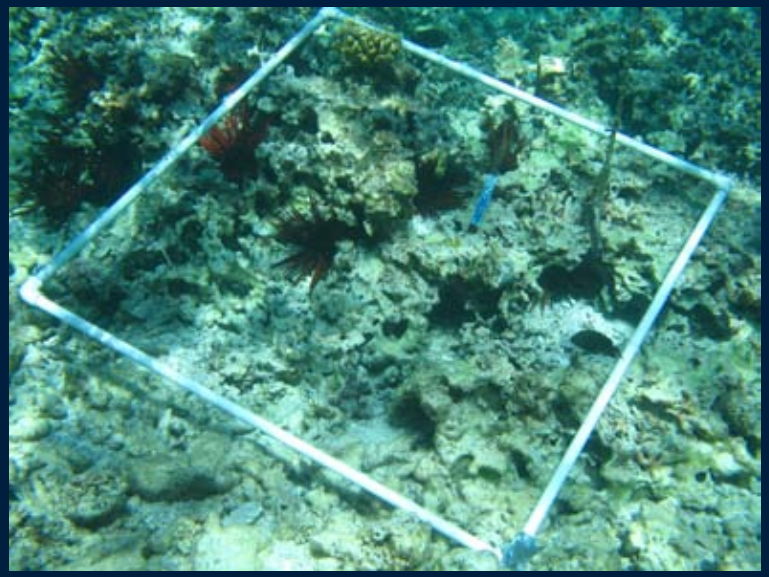
Time to first damage:

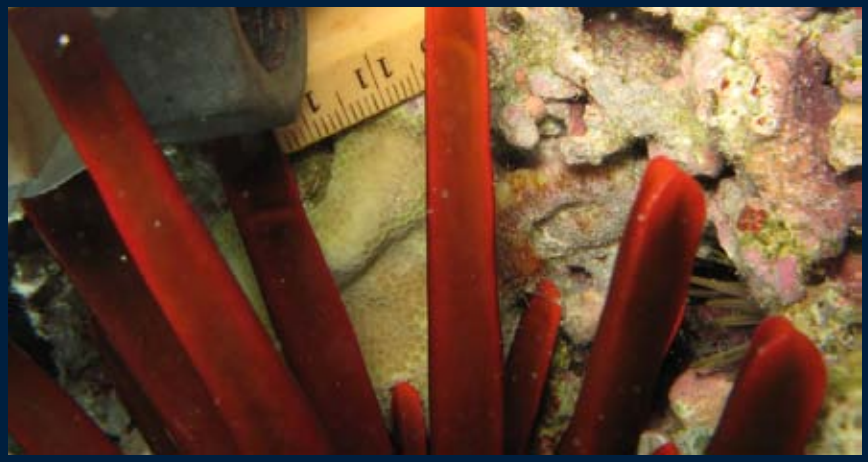






Heterocentrotus Results





- No damage for ~ 1 month
- Movement over corals

Heterocentrotus

Harvested in the main Hawai'ian Islands

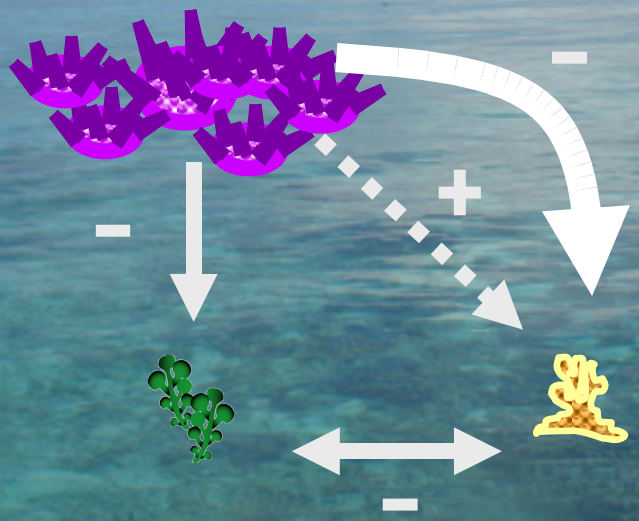
- Jewelry
- Souvenirs
- Likely overexploited

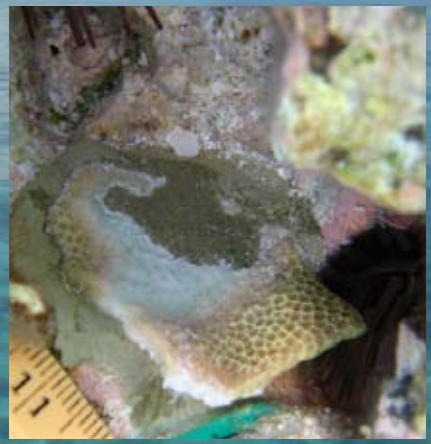
Their bioerosion may create hiding places for fish

Conclusions

Can urchins negatively impact live corals?

Yes

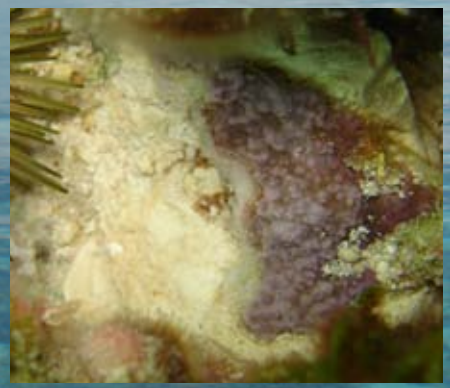
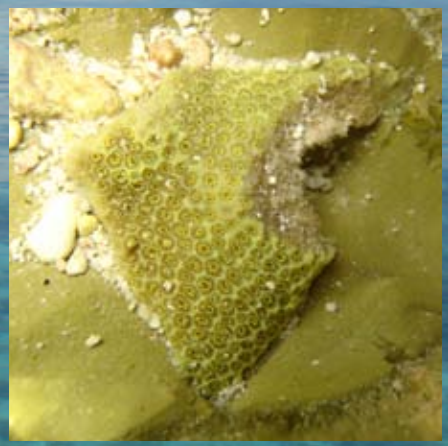




Conclusions

- Are urchin impacts species-specific?
  - Urchins Yes
  - Corals No



Implications

Could coral-urchin interactions impact the larger community structure?

- **Strong effect of *Echinometra* in channels**
- **Percent of reef covered by urchin channels**
- **Potential negative impact on coral recruits**

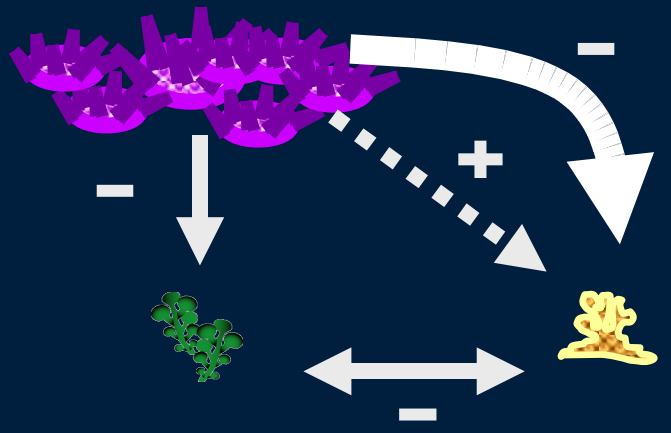
Management

Sea urchin removals (SUR)?

(McClanahan et al 1996 Cons. Bio.)

- Unlikely to impact fish populations
- Urchins are naturally at high densities
- May indirectly reduce coral cover by increasing macroalgae
- Prohibitively time-consuming at a large scale
- Small-scale urchin removals may help coral transplants or to save a threatened coral bommie from erosion
- Long-term effects?

Summary



- Documented urchins removing coral tissue over time
- Urchins as “predators”
- Some urchins have both positive and negative effects on corals and reef resilience

Acknowledgements

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