

2. Urchin Grazing Assays

Grazing preferences of diadematid echinoids in Fiji

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4 spp. of urchin
15 spp. of algae
Not starved

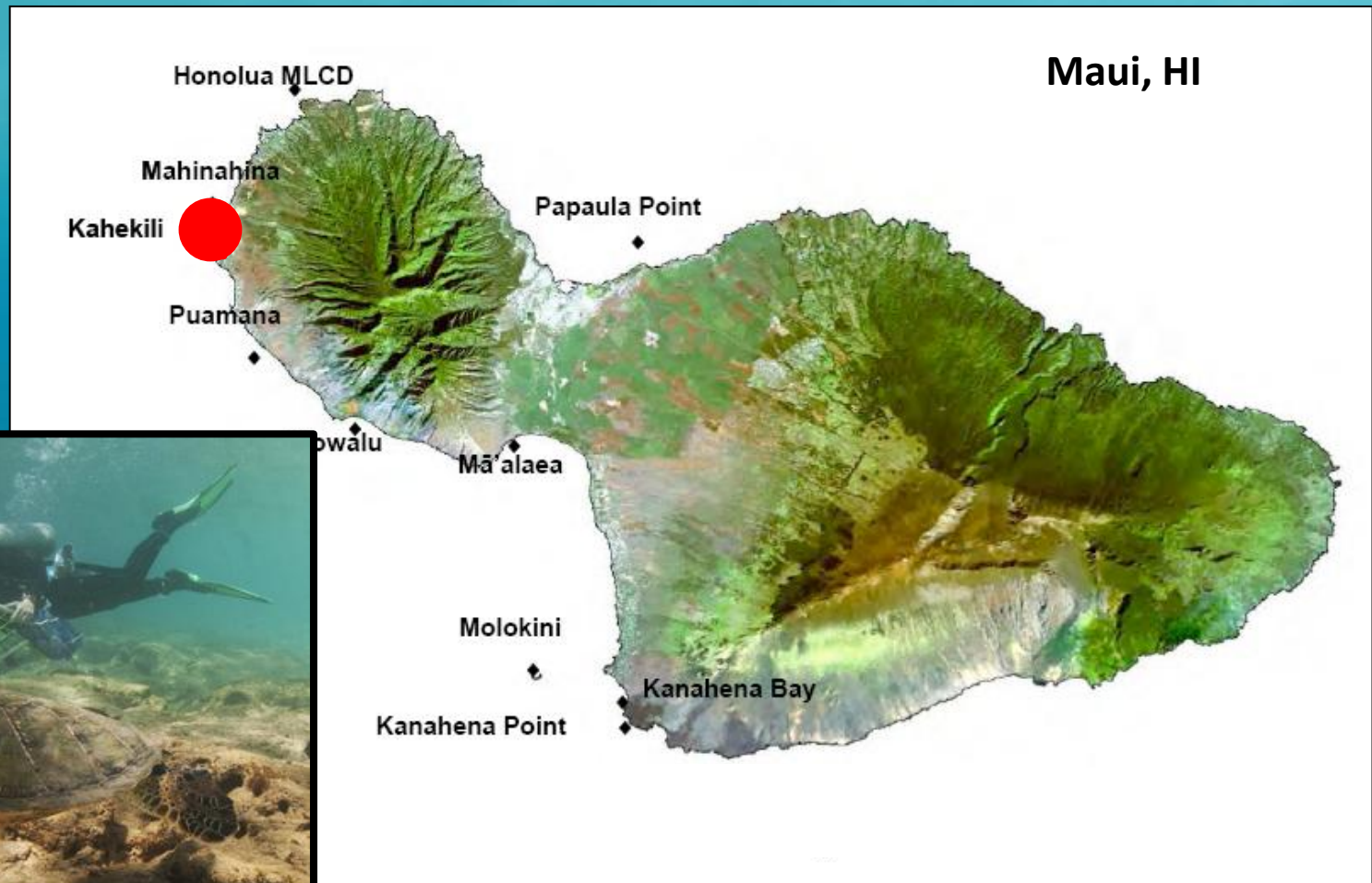


Echinothrix x 2 spp.
Hydroclathrus & *Padina*/grn fil.
36 g/d

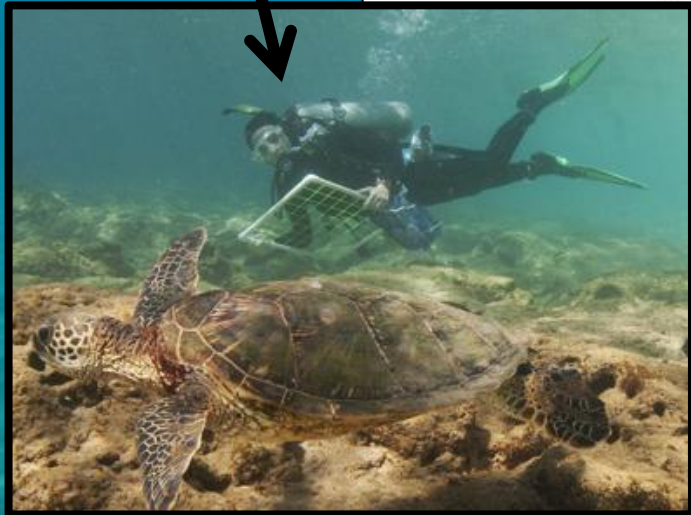


Diadema x 2 spp.
Codium & *Hydroclathrus*
20 g/d

World's First Herbivore Fishery Management Area



Emily Kelly



Diversity of Hawaii's Urchins (wana)



Diversity of Hawaii's Algae (limu)



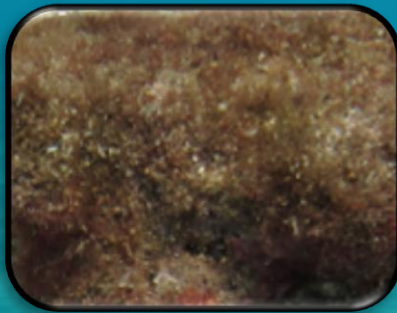
Ulva



Acanthophora



Turbinaria



Mixed Turf



Crustose Coralline Algae



Amansia

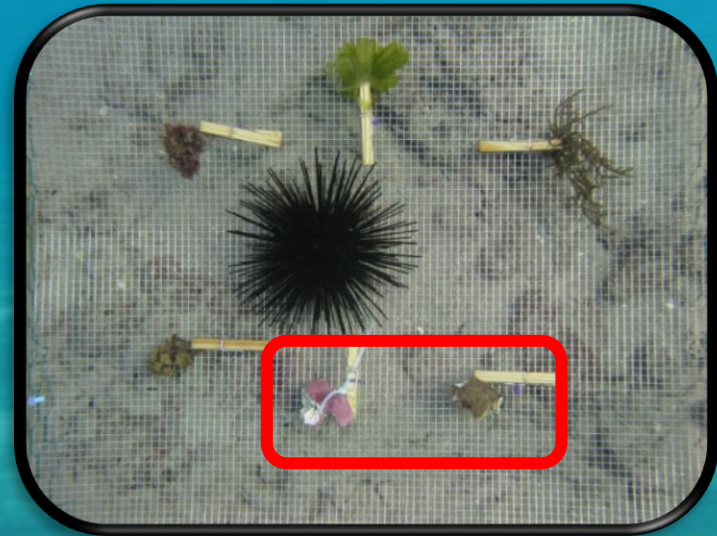
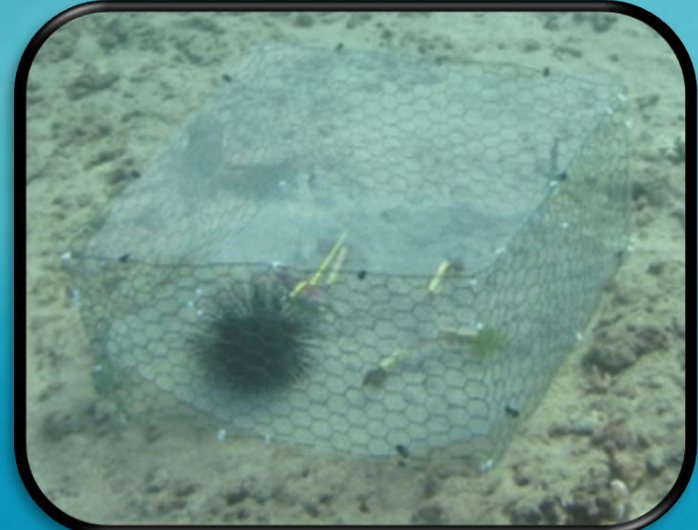
2. Urchin Grazing Assays - Questions



1. Do urchin species prefer different algae?
2. At what rate does each species feed?

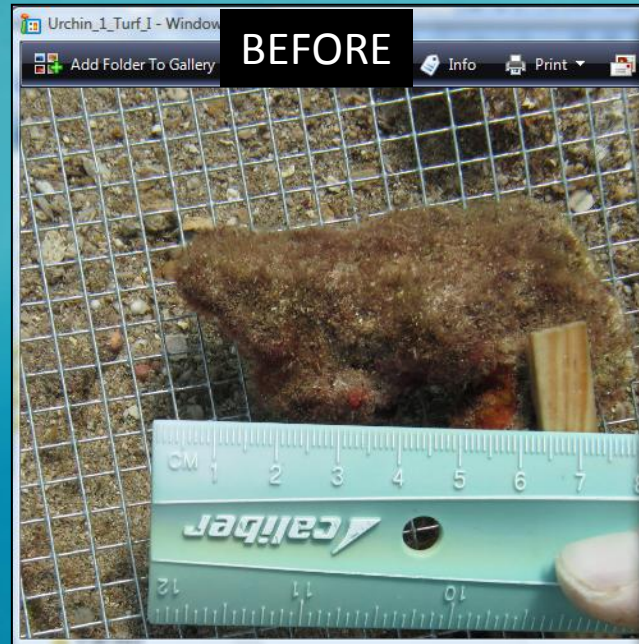
**Emphasis on functional redundancy/complimentarity
and grazing budgets**

2. Urchin Grazing Assays - Methods



2. Urchin Grazing Assays – Turf & CCA

Turf



CCA



2. Urchin Grazing Assays – Turf & CCA

Turf



CCA



2. Urchin Grazing Assays – Turf & CCA

Turf



CCA

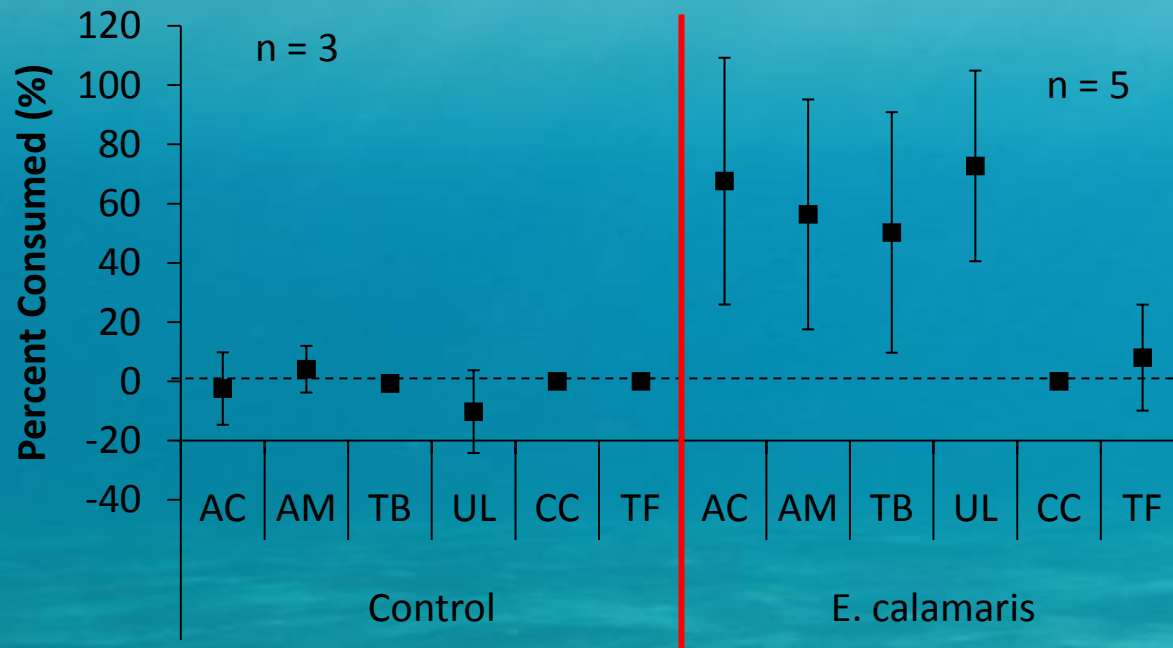


Grazing by Banded Urchins

Echinothrix calamaris



Percent Consumption



AC - Acanthophora



AM - Amansia



TB - Turbinaria



UL - Ulva



CC - CCA



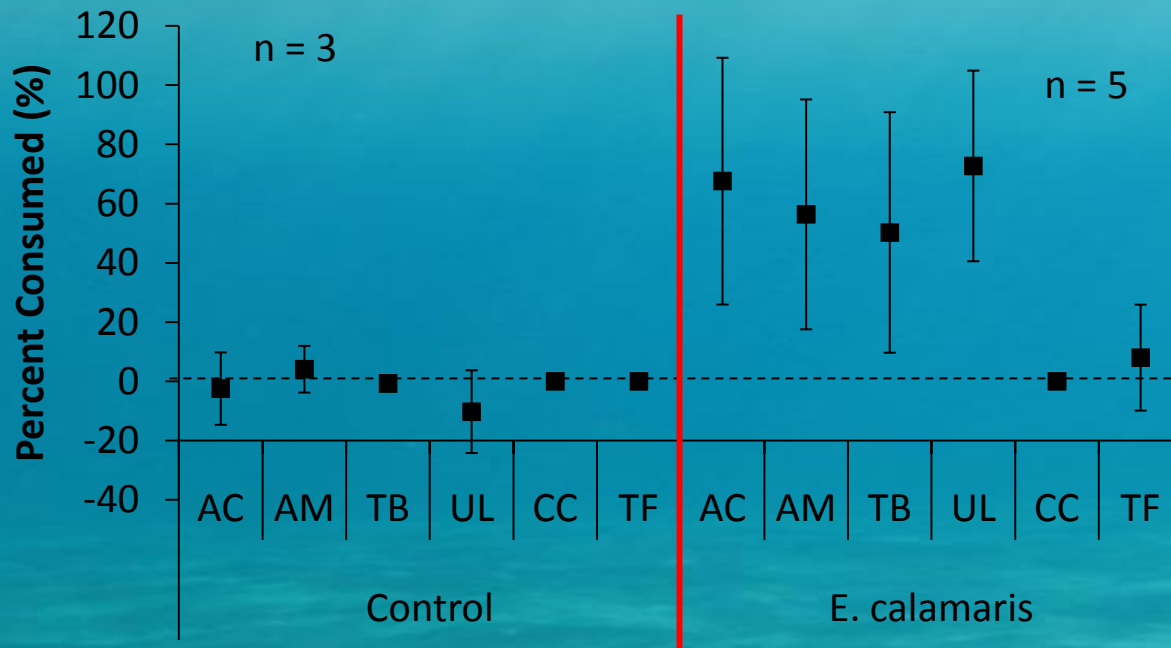
MT - Mixed Turf

Grazing by Banded Urchins

Echinothrix calamaris



Preference: Macroalgae generalists



AC - Acanthophora



AM - Amansia



TB - Turbinaria



UL - Ulva



CC - CCA



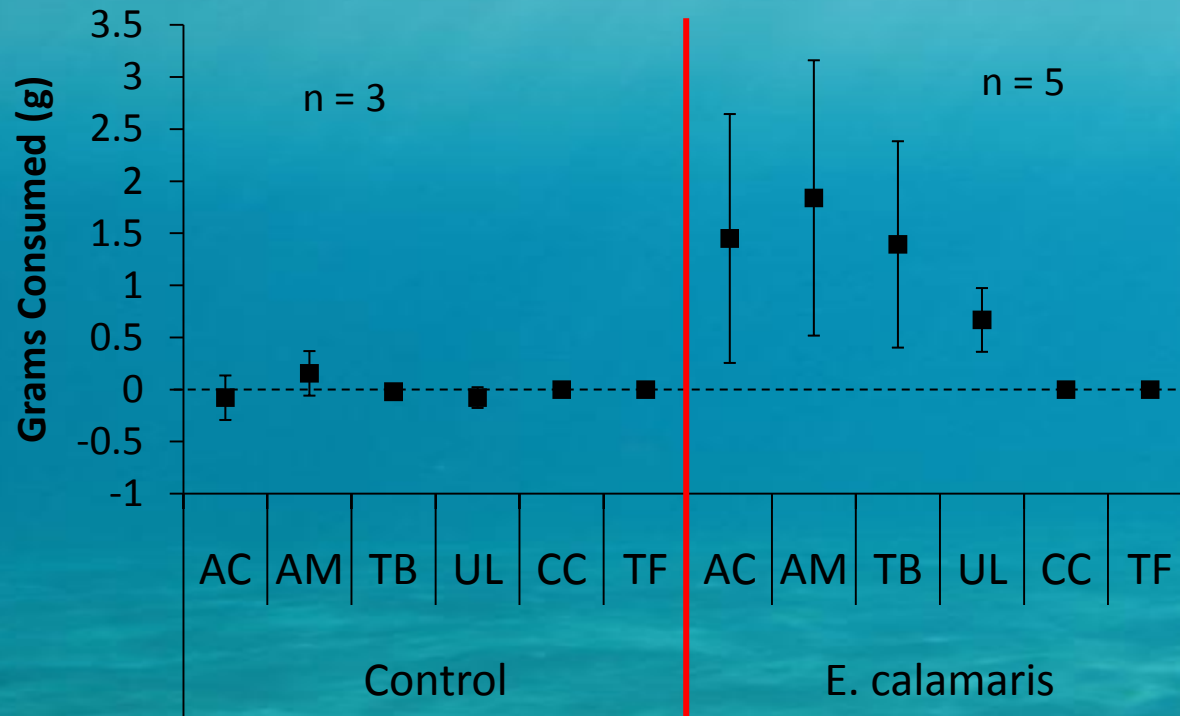
MT - Mixed Turf

Grazing by Banded Urchins

Echinothrix calamaris



Mass Consumption



AC - Acanthophora



AM - Amansia



TB - Turbinaria



UL - Ulva



CC - CCA



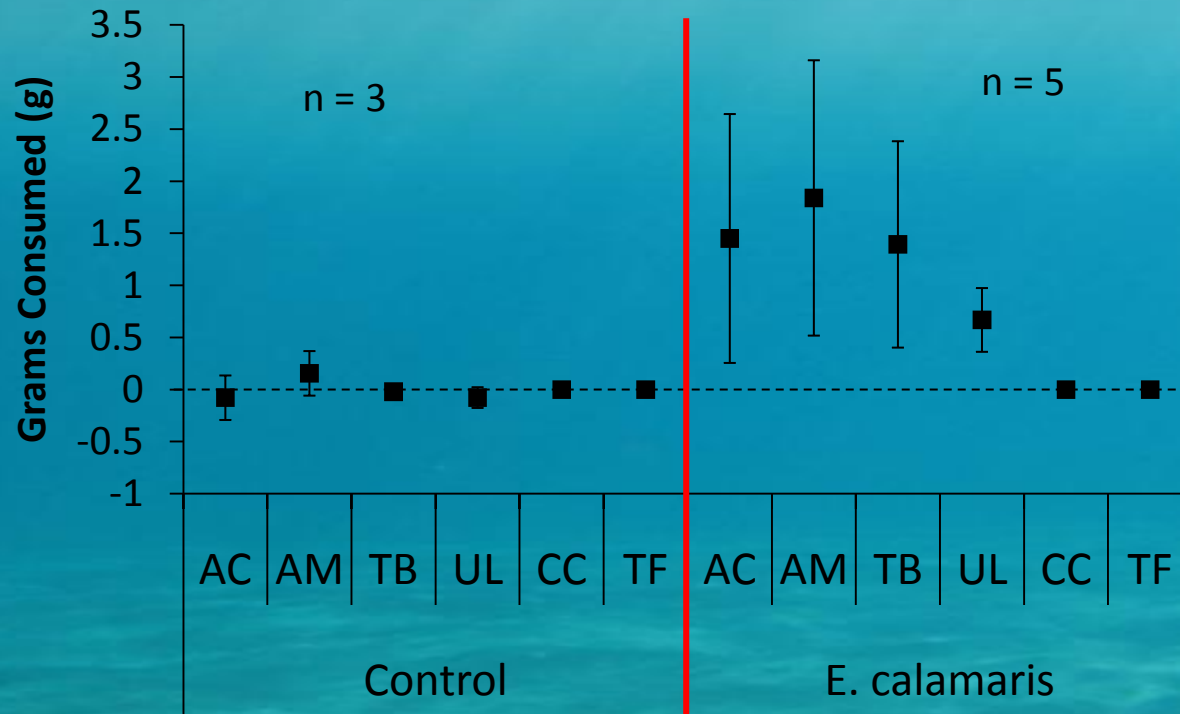
MT - Mixed Turf

Grazing by Banded Urchins

Echinothrix calamaris



Grazing Rate: 4-6 g urchin⁻¹ d⁻¹



AC - Acanthophora



AM - Amansia



TB - Turbinaria



UL - Ulva



CC - CCA



MT - Mixed Turf

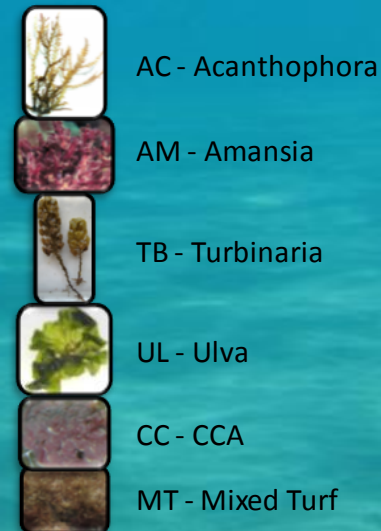
2. Urchin Grazing Assays – Turf & CCA

ISSUES:

- Urchin behavior - selective or opportunistic (proximity of samples?)
- Locating/removing/transporting certain species (Diadema, E. diadema, etc.)
- Differences in size
 - Urchins (per urchin or g^{-1} , think surveys)
 - Algae (biomass vs. surface area, (Ulva vs. Turb vs turf)
 - Measuring Turf & CCA (area?)
- Sample size vs. variance (N=20/Urchin sp?)
- Representative algal assortment?



X



3. Urchin Diversity Experiment

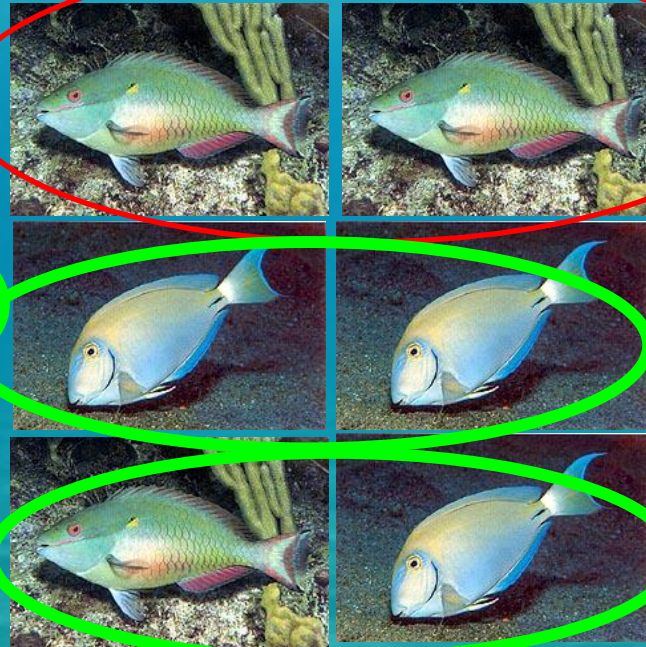
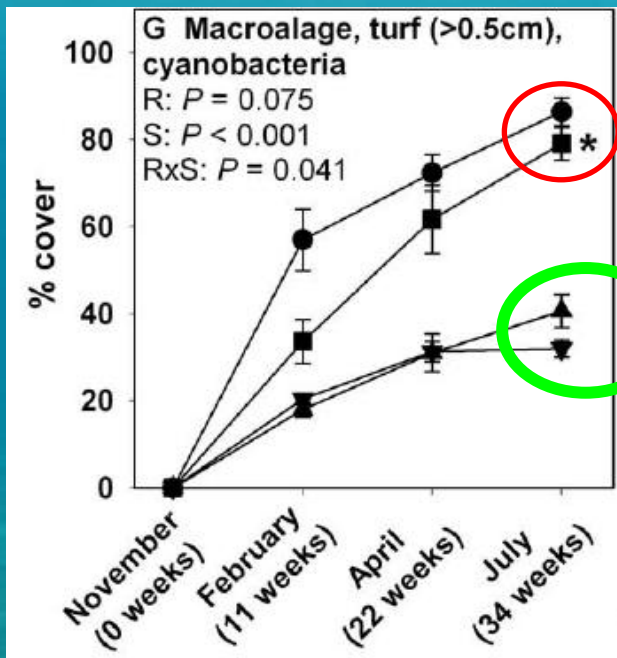
3. Urchin Diversity Experiment

Impact of Herbivore Identity on Algal Succession and Coral Growth on a Caribbean Reef

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* Stuart was right



Redband
Parrotfish

Ocean
Surgeonfish

Both

Only Ocean Surgeon had major effect

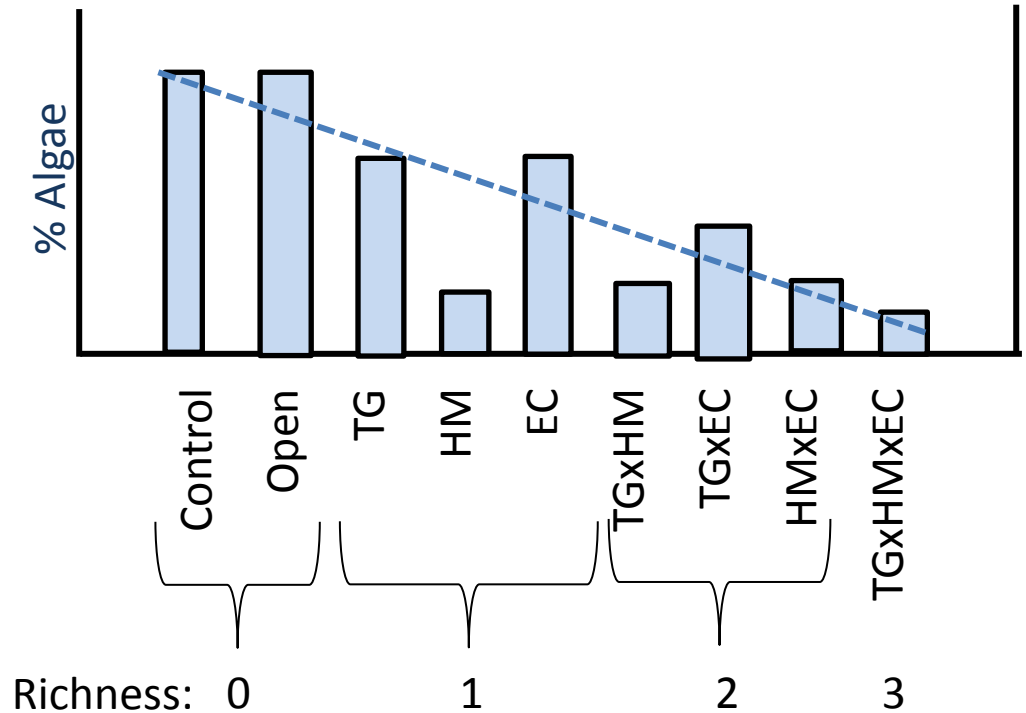
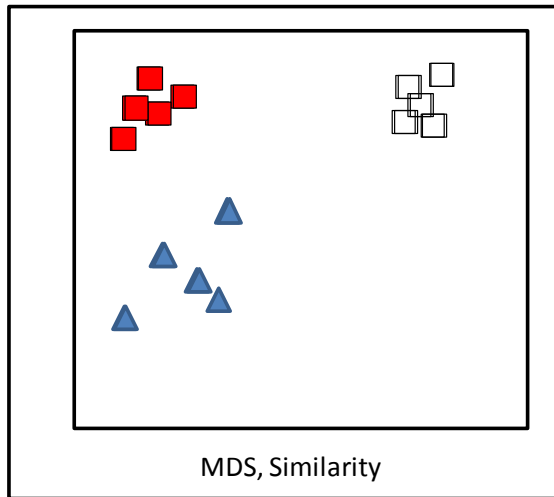
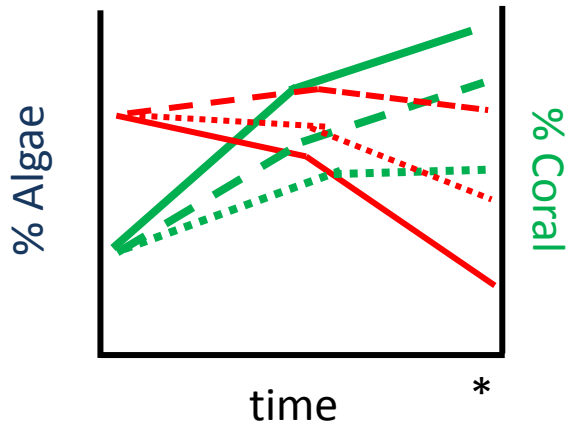
3. Urchin Diversity - Methods

			<u>AREA</u>	<u>DENS</u>	<u>DIV</u>	<u>N</u>
			1m ²	2/m ²	1	5
			1m ²	2/m ²	2	5
			1.5m ²	2/m ²	3	5
No Urchins			1m ²	0/m ²	0	5
Cage Control			1m ²	0/m ²	0	5

9 Treatments
x 5 reps/treat
 45 Plots

Measurement
 % Cover (images)
 Algal Index (quad)
 Similarity

3. Urchin Diversity - Analyses



3. Urchin Diversity - Analyses

Issues:

- Should we start with high algae (Maalea?) Can algae go down here?
- How to measure bioerosion?
- Response times for corals, CCA?
- What change to we predict to see?

Reef @ Kahekili Beach Park



Urchin Diversity Experiment x 45 plots

Urchin Grazing Assays x 13 plots

Cryptic Invertebrate Imaging

200 m

Park Entrance

Significance

- **Algal Grazing Budget** (reef status)

$$[\text{production}] - [\text{consumption}] \left\{ \begin{array}{l} > 0 \text{ degrading} \\ = 0 \text{ balanced} \\ < 0 \text{ recovering} \end{array} \right.$$



Significance

- **Algal Grazing Budget** (reef status)

[production] – [consumption]



> 0 *degrading*

= 0 *balanced*

< 0 *recovering*



- **Management Implications**

Sea urchins bred to clean up reef

About 1,000 wana are placed on the coral in Kaneohe Bay to halt harm from algal

By Rob Shikina

POSTED: 01:30 a.m. HST, Jan 30, 2011

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Tiny sea urchins are now devouring blankets of algae smothering some of the best coral reef in the state.

State scientists, environmentalists and a local canoe club released about 1,000 collector sea urchins yesterday at Kaneohe Bay with the goal of restoring the bay.

It was first time anyone successfully bred sea urchins to counter an alien seaweed in Hawaii.

David Cohen, urchin hatchery manager at the Anuenue Fisheries Research Center, said he used about a million larvae to produce 25,000 sea urchins that reached at least 15 millimeters in