The Feasibility of Using Hatchery-Raised *Diadema antillarum* in Coral Reef Restoration: The Prickly Prologue

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The Rationale:

Diadema antillarum, a keystone herbivore, experienced a mass mortality event in the early 1980's from which the population has yet to recover.

Coral reefs in the Florida Keys are in decline due, in part, to an increase in algal cover.

Recent advances in rearing captive-spawned *D. antillarum* to the benthic stage raises the possibility that *D. antillarum* can be produced *ex situ* and released onto Florida Keys reefs as part of a comprehensive coral reef restoration effort.

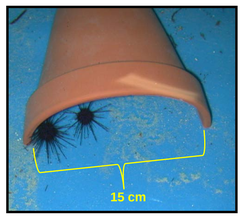
We are thus assessing the behavioral and ecological characteristics of hatchery-reared *D. antillarum* to ensure that they can be used to augment the wild population. The following summarizes several preliminary experiments comparing the behavior of hatchery-raised and wild individuals.

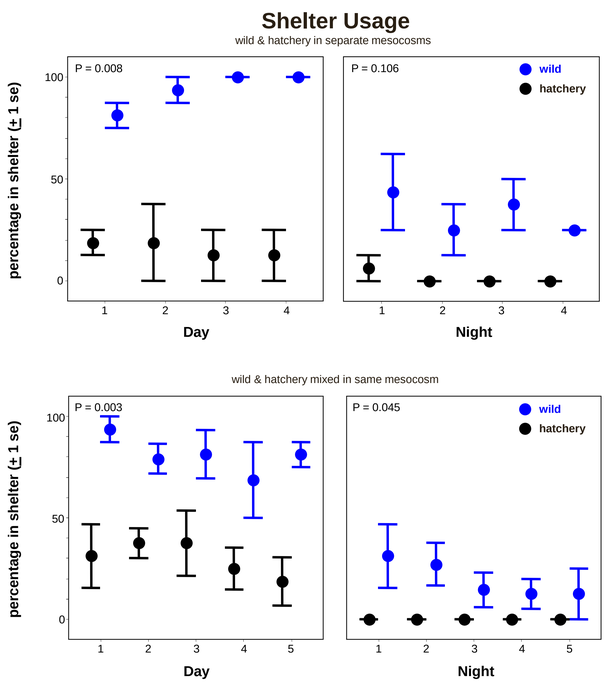
Experiment I:

Do hatchery-raised juvenile *D. antillarum* exhibit the same diurnal sheltering behavior as wild individuals?

- circular mesocosms with standardized shelters (flower pots cut in ½ and arranged as shown at right)
- eight urchins per mesocosm (not shelter limited)
- one trial with wild and hatchery urchins in separate mesocosms
- one trial with wild and hatchery urchins mixed in the same mesocosm

Results: Significant differences in sheltering behavior; wild juveniles sought shelter during the day, whereas hatchery individuals remained in the open day and night.



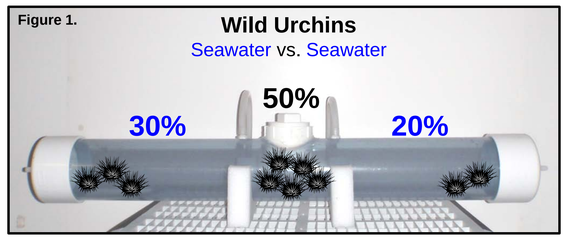


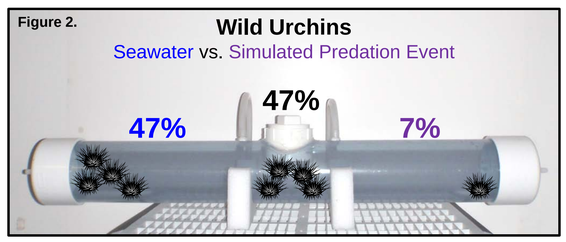
Experiment II:

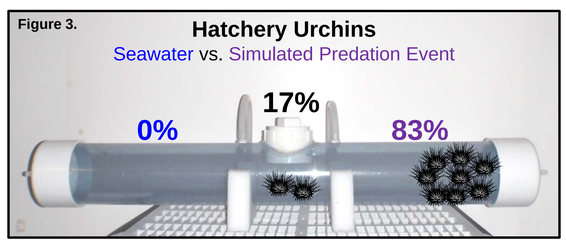
Do hatchery-raised juvenile *D. antillarum* exhibit the same predator avoidance behavior as reported in wild individuals?

- l-shaped choice tubes with two treatments flowing into either end
- the urchin was placed in the center; its position was recorded after 10 minutes
- one trial with seawater in both treatment containers (the grey boxes shown at right) to determine if inherent biases exist in the apparatus
- another set of trials with a seawater control and a treatment of seawater with a macerated conspecific

Results: Random movements for seawater in both treatment boxes (P = 0.497, Fig. 1); however, wild juveniles moved away from the simulated predation event, whereas hatchery juveniles moved towards the macerated conspecific (P = 0.005, Figs. 2-3).



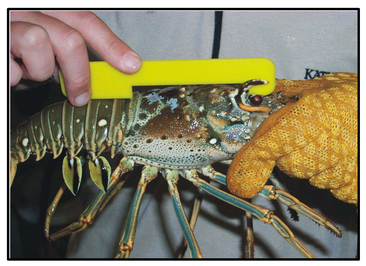




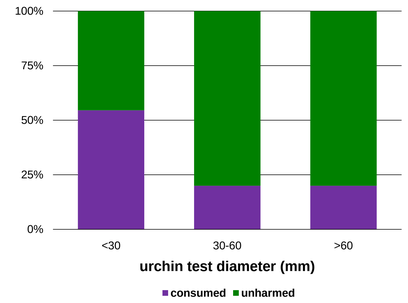
Experiment III:

Does *D. antillarum* attain size refuge from predation by Caribbean spiny lobster (*Panulirus argus*)?

- adult *P. argus* dwelling on the Florida Keys reef tract primarily forage in back reef rubble habitat where juvenile *D. antillarum* recruit
- a single urchin was introduced into a mesocosm that contained one *P. argus* (size range: 64.0 to 89.5 mm carapace length)
- the lobster was allowed to forage overnight
- the urchin's fate was noted after 24 hours



Results: Spiny lobsters were able to consume urchins in all size classes (P = 0.266); however, there may be a preference for smaller individuals.

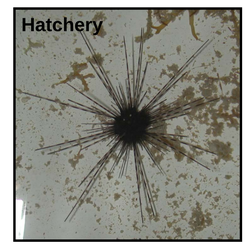


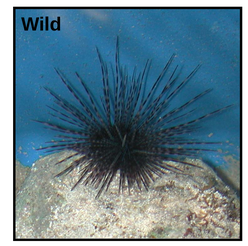
Preliminary Conclusions:

- Hatchery-raised *D. antillarum* did not exhibit the same diurnal sheltering behavior as wild juveniles.
- Additionally, hatchery urchins unexpectedly exhibited a diametrically opposite reaction to a simulated predation event.
- *D. antillarum* do not appear to have size refuge from predation by Caribbean spiny lobster.

Future Work:

- Evaluate if hatchery-reared *D. antillarum* can be conditioned to exhibit the appropriate sheltering and predator avoidance behaviors.
- Evaluate apparent morphological differences between hatchery-reared and wild juveniles and their ecological consequences
- Further evaluate trophic interactions between *D. antillarum* and potential predators.
- Examine *in situ* size-specific and seasonal survival rates of hatchery-reared urchins.
- Assess the use *in situ* artificial urchin shelters in coral reef restoration activities.





Acknowledgements

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