Fertilization Ecology and Early Life Stages in Threatened Caribbean Acroporid Corals

Nicole D. Fogarty

Smithsonian Marine Station

Fort Pierce, Florida

Acropora palmata
Elkhorn coral

Acropora cervicornis
Staghorn coral

Acroporid decline

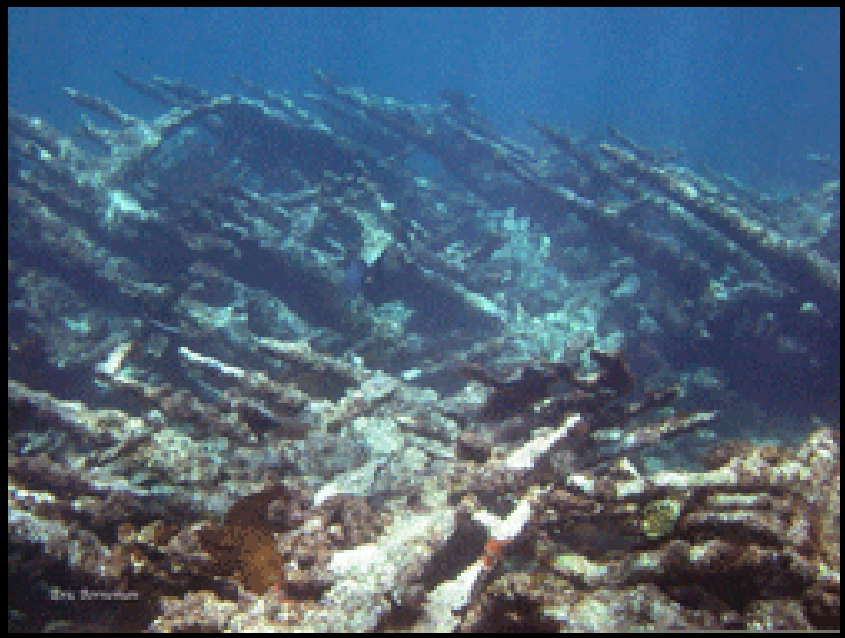


Photo credit: Eric Borneman

Photo credit: Eric Borneman

Threats to acroporids

Study species

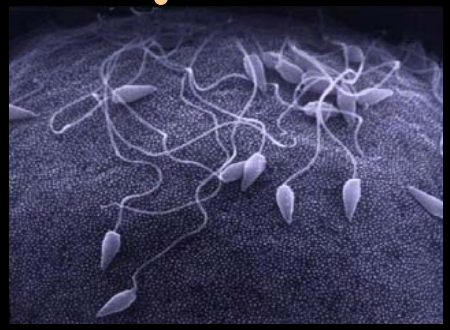
Acroporid restoration / natural recruitment

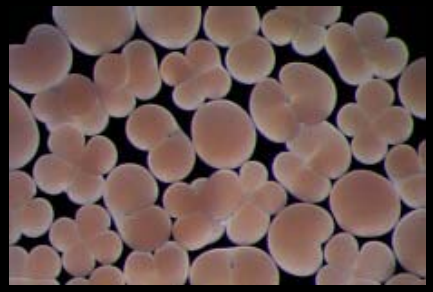
Asexual propagation

and

Natural Sexual recruitment

Caribbean acroporid life cycle

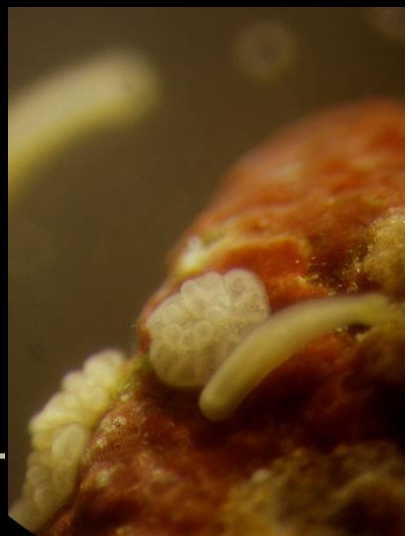




Development

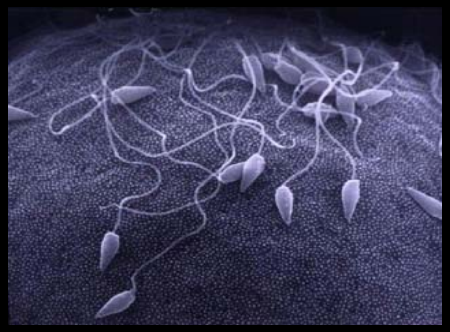
Larvae (2-3 days)

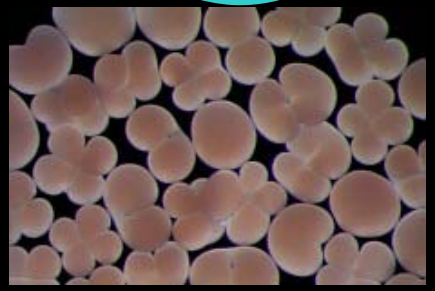
Settlement (4-7 days)



4-8 years to reach sexual maturity

Caribbean acroporid life cycle



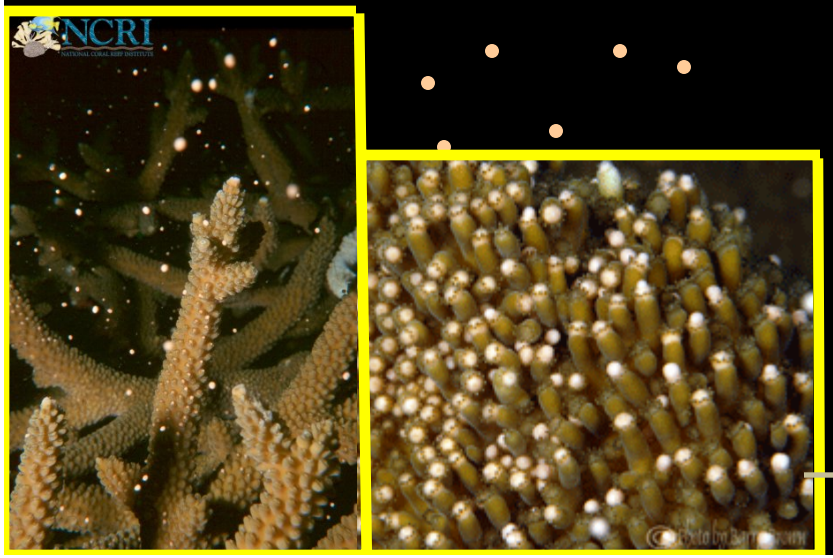


Development

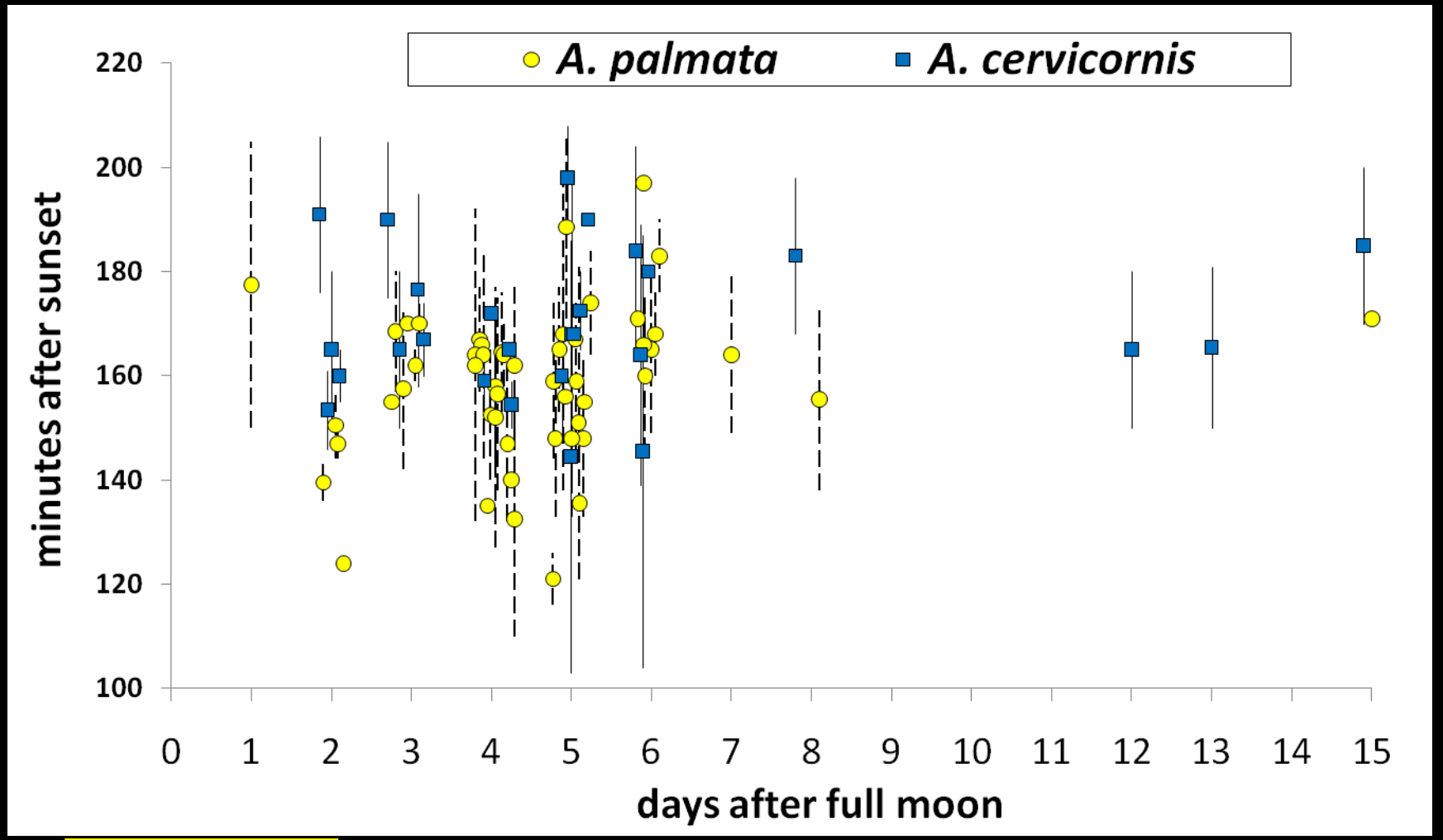
Larvae (2-3 days)

Settlement (4-7 days)

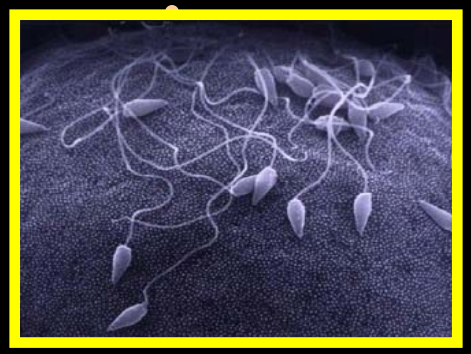
4-8 years to reach sexual maturity

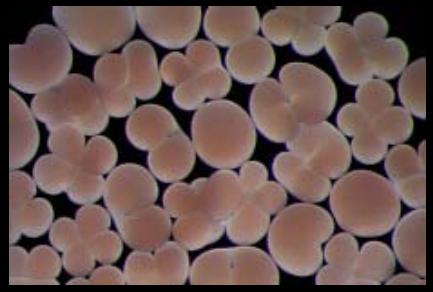


Spawning Times



Caribbean acroporid life cycle





Development

Larvae (2-3 days)

Settlement (4-7 days)

4-8 years to reach sexual maturity

Methods

Photo: R. Ritson-Williams

Methods

Photo: R. Ritson-Williams

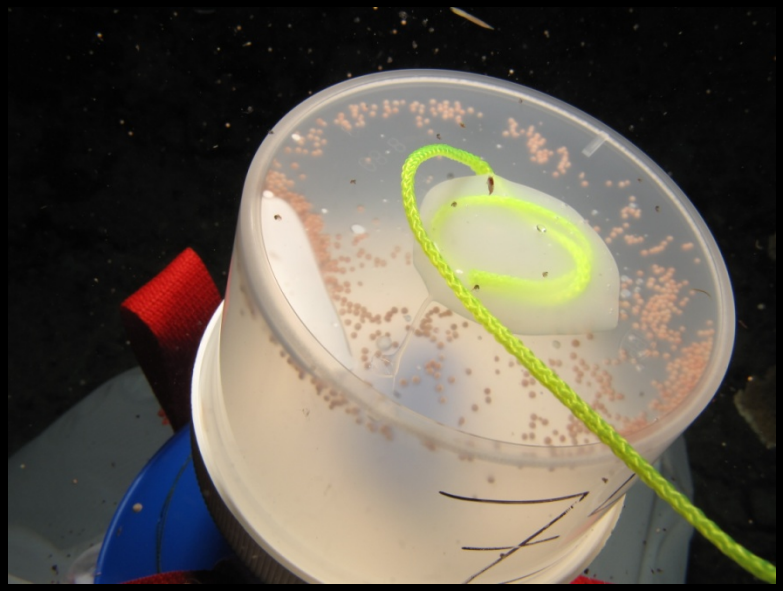
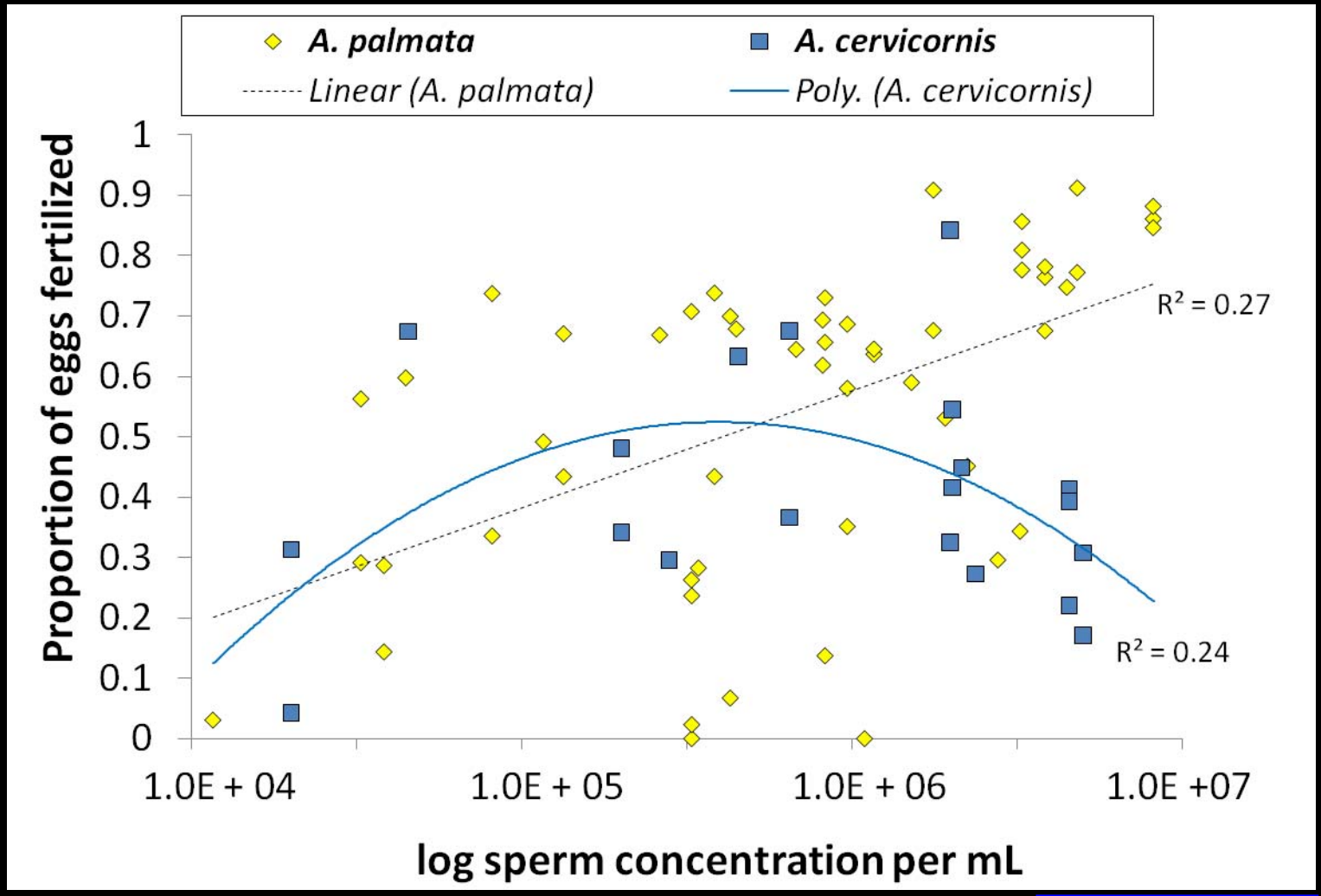
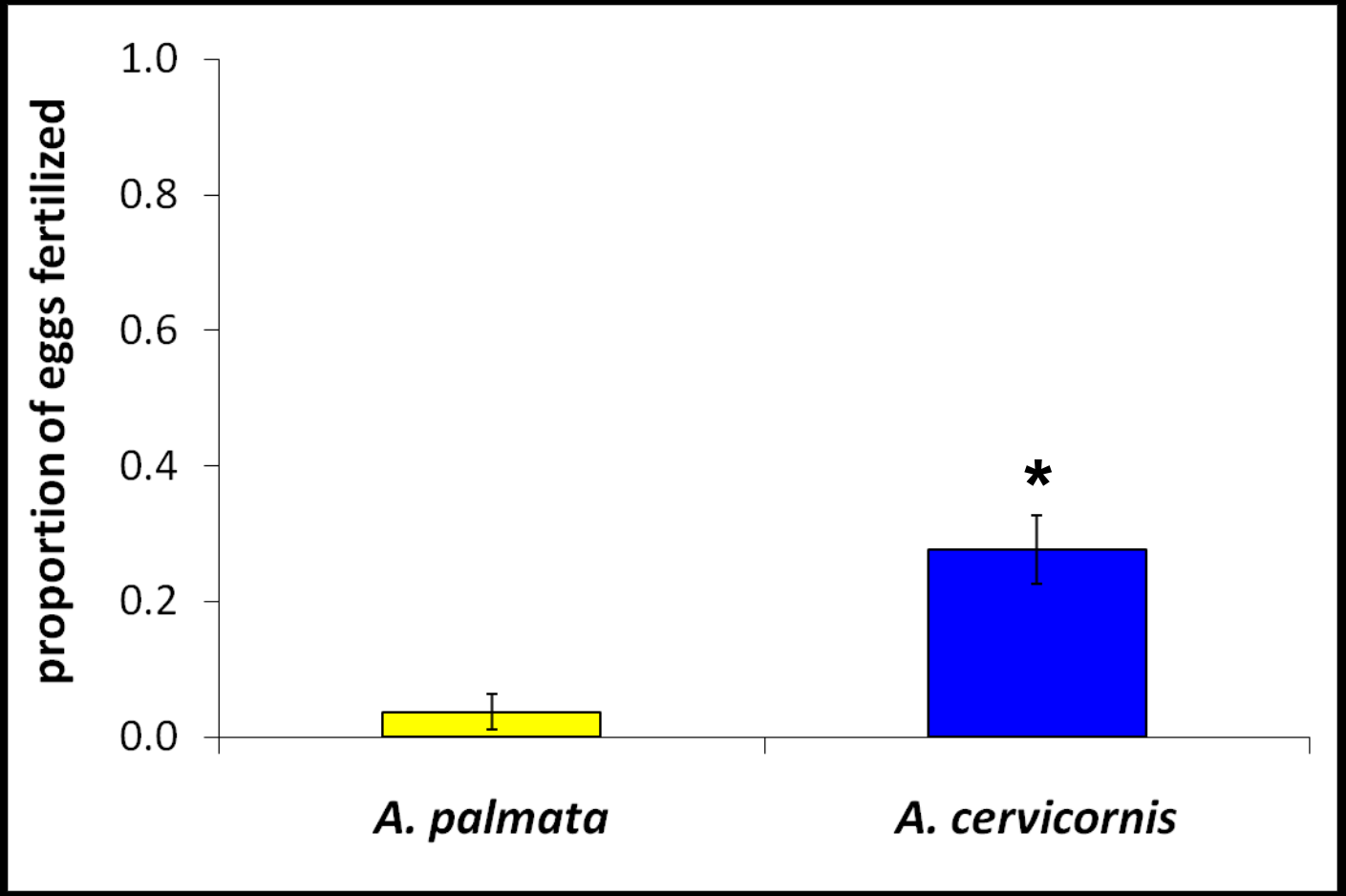


Photo: R. Ritson-Williams

Individual crosses

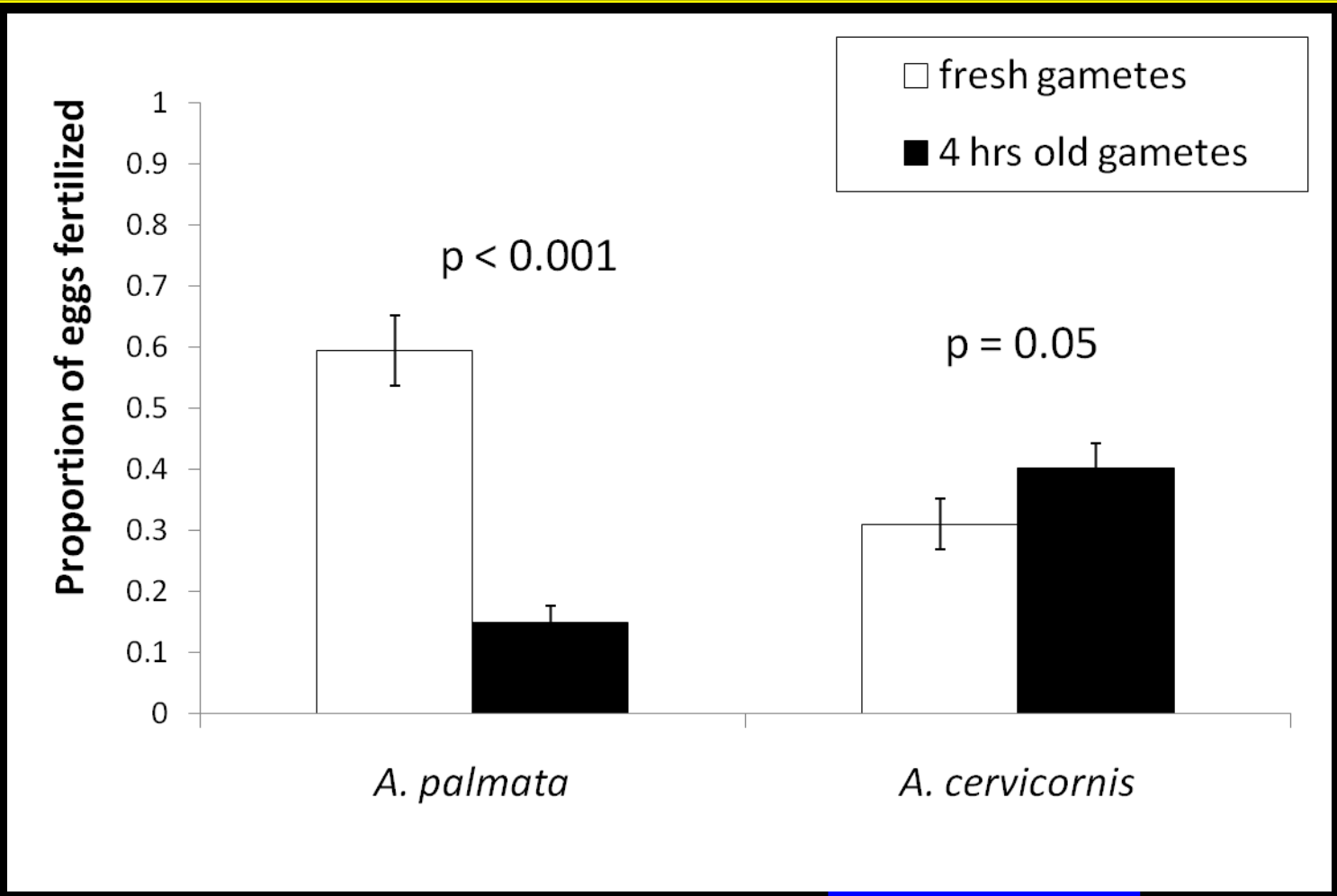


Selfing

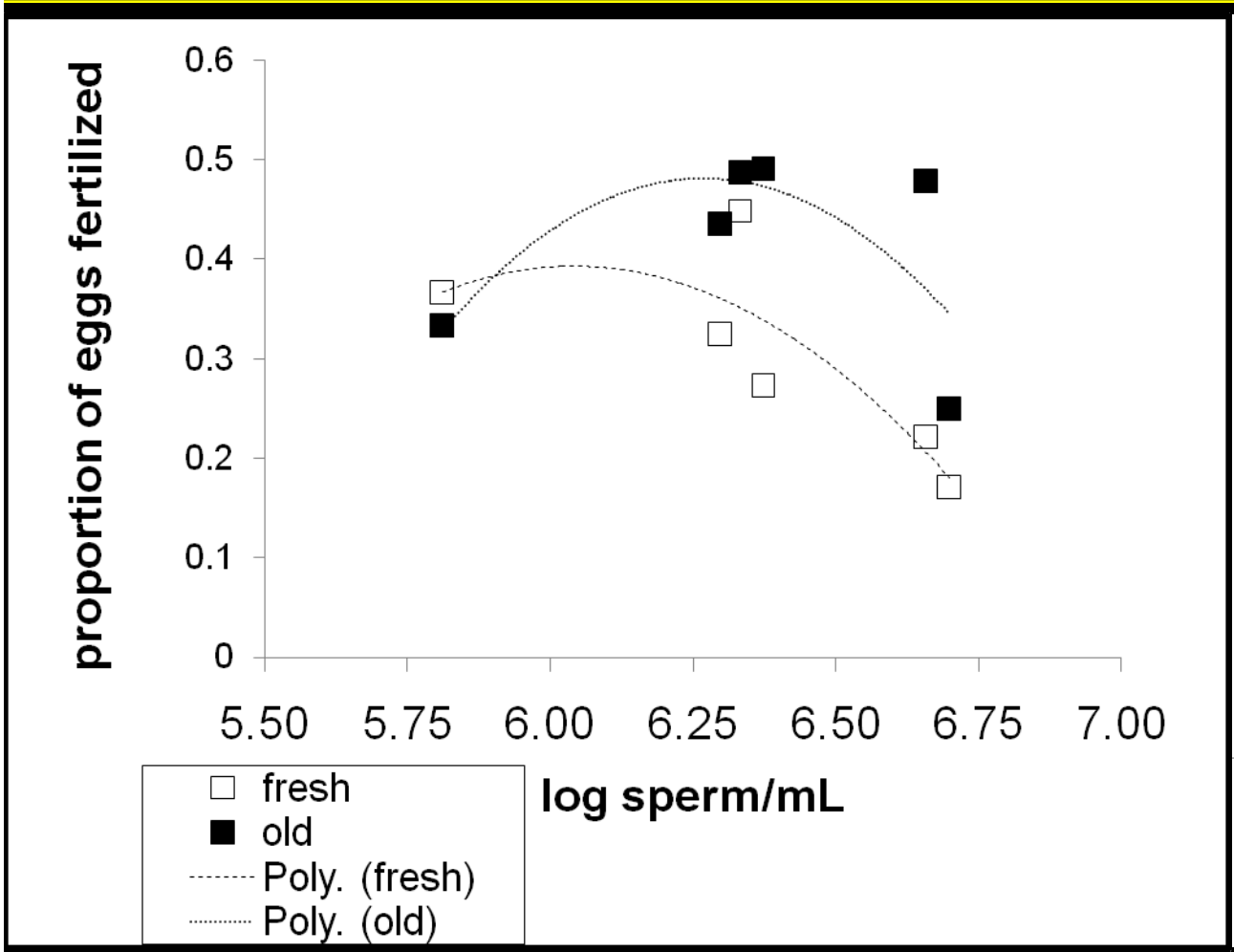


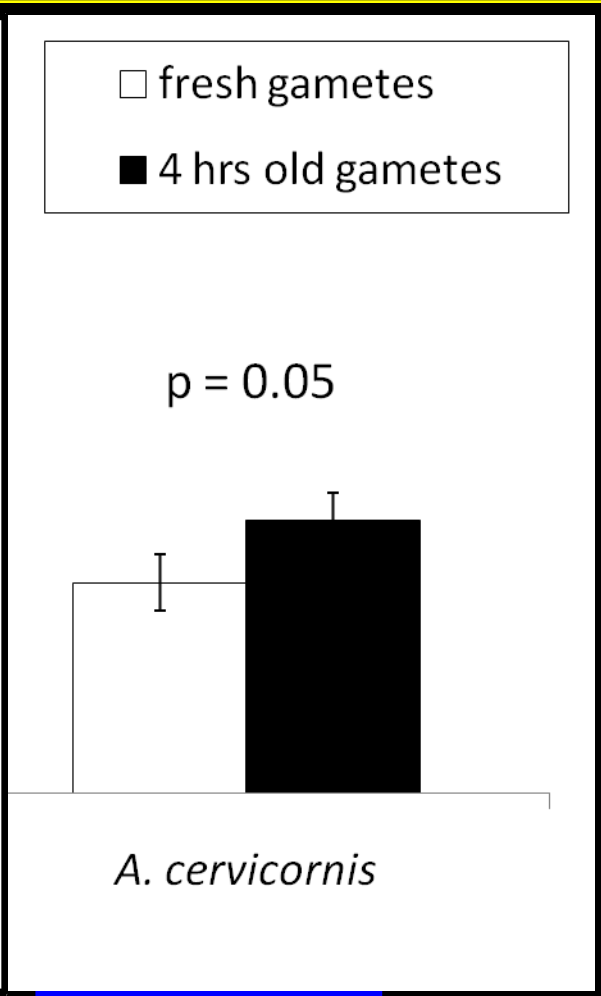
* T-test
p< 0.05

Gamete aging



Gamete aging



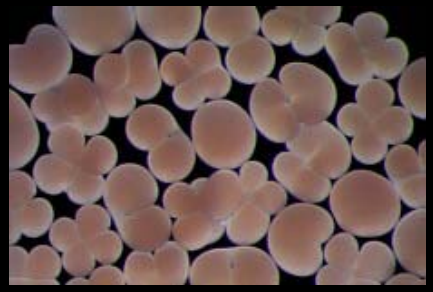


Conclusions

1) *A. cervicornis* eggs are easily fertilized making them susceptible to polyspermic and self fertilization, but this ease of fertilization allows them to remain viable for a longer period of time.

2) *A. palmata* eggs are more difficult to fertilize and fertilization decreases significantly when gametes age.

Caribbean acroporid life cycle



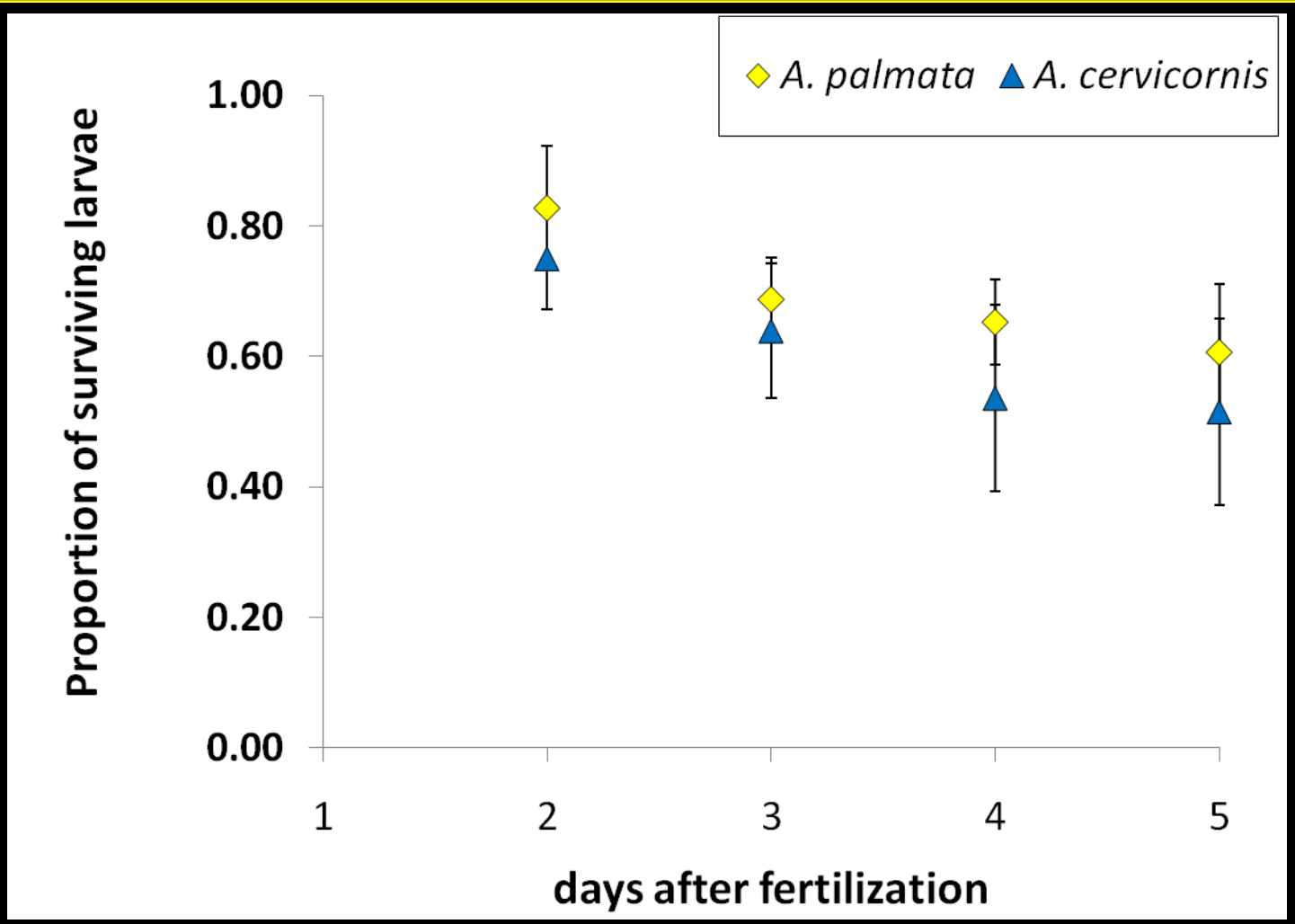
Development

Larvae (2-3 days)

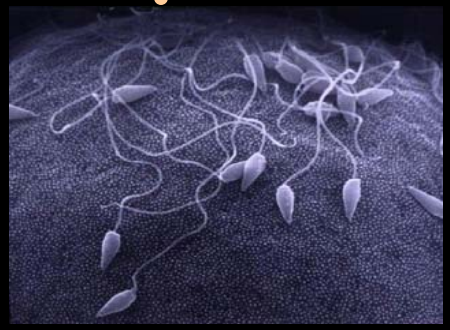
Settlement (5-7 days)

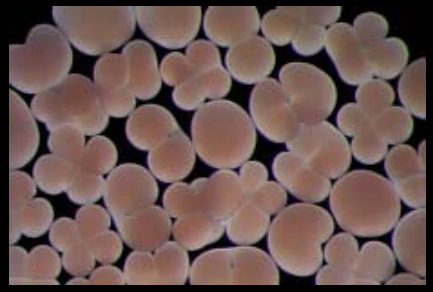
4-8 years to reach sexual maturity

Larvae Survival



Caribbean acroporid life cycle





Development

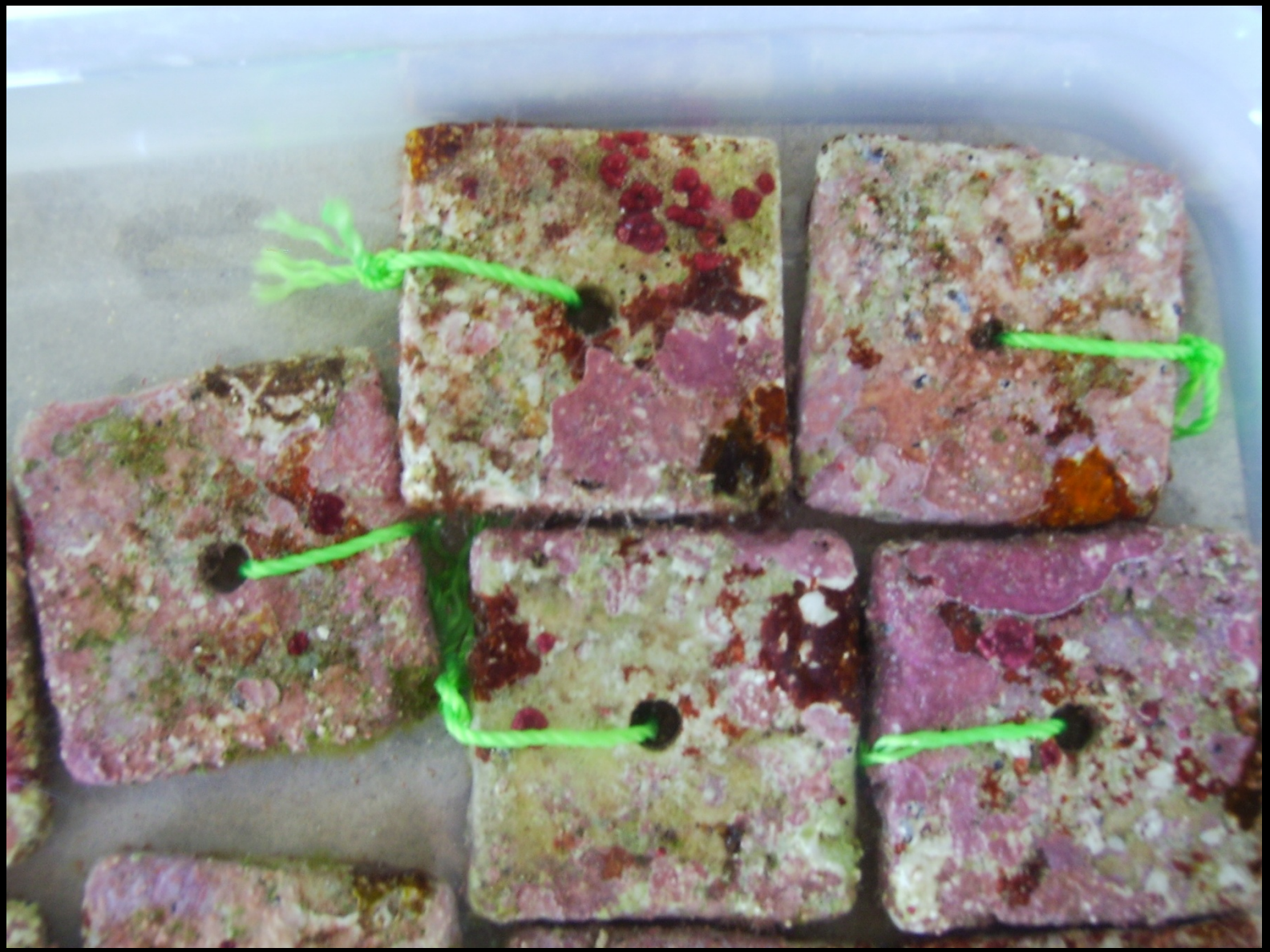
Larvae (2-3 days)

Settlement (4-7 days)

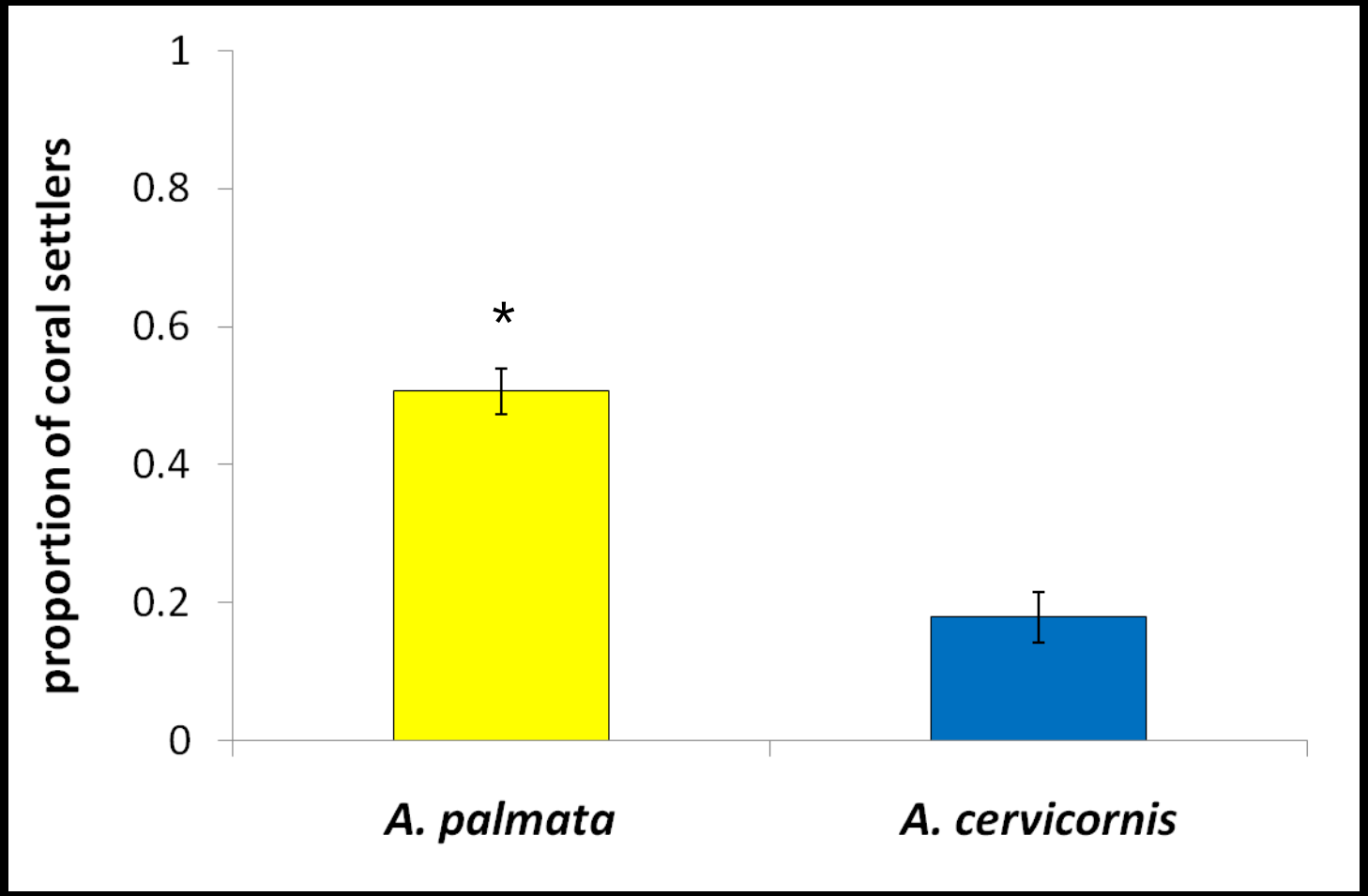
4-8 years to reach sexual maturity

Methods

Settlement



Settlement and Metamorphosis



T- test
* p < 0.001

Conclusions

1) *A. palmata* and *A. cervicornis* are very different at many of the early life history stages.

A. palmata

- **more difficult to fertilize**
- **fertilization decreases with age**
- **does not self**
- **slightly higher larval survival and significantly higher settlement rates**

A. cervicornis

- **easy to fertilize**
- **gametes viable after 4 hours**
- **can self fertilize**
- **susceptible to polyspermy**
- **low settlement rates**

Management Strategies

1) Protect existing stands of genotypically diverse *A. palmata*.

2) Focus on restoration efforts that use genotypically diverse asexual fragments to create thickets of *A. cervicornis* and strive to protect herbivores that clean the substrate to encourage natural recruitment.

Acknowledgements

Funding:

National Geographic Society
PADI Foundation
American Academy of Underwater Science
Lerner-Gray
Smithsonian Institute
FSU Short Fellowship
FSU Bennison Fellowship
FSU International Dissertation Research Fellowship

Folks that helped:

Don Levitan
Steve Vollmer
Val Paul
Raphael Williams
Susie Arnold
Bob Steneck
Margaret Miller
Alina Szmant
Carl Safina
Randi Rojan
Beth Stauffer
Jeanne Brown
Mike Carpenter
Brendan Biggs
Casey ter Horst
Wade Cooper
Dave Ferrell
Nate Jue
Peter Bouwma
Todd Hitchins
Levitan Lab