Impacts of alien algae on native seagrasses in Hawaiian benthic reef communities

Kim Peyton, Kim Ikemoto, Heather Spalding and Celia Smith
University of Hawaii - Manoa
Department of Botany

HCRI RESEARCH PROGRAM

U.S. FISH & WILDLIFE SERVICE

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

HCRI7 Priorities:

~Stressors on Coastal Reefs - Invasive Species

~ Status of Coastal Reefs

Research Objectives:

- **Invasive algae impact seagrass resources**
- **Baseline data on current distribution of these invasive algae and seagrass - depth ranges (Oahu & Kauai)**
- **Management strategies**

Seagrasses in Hawaii

Vascular plants

***3* species in Hawaii**

Halophila hawaiiana

Endemic species

17 m depth and counting

Builds perennial mounds **(den Hartog 1970)**

Blow-outs

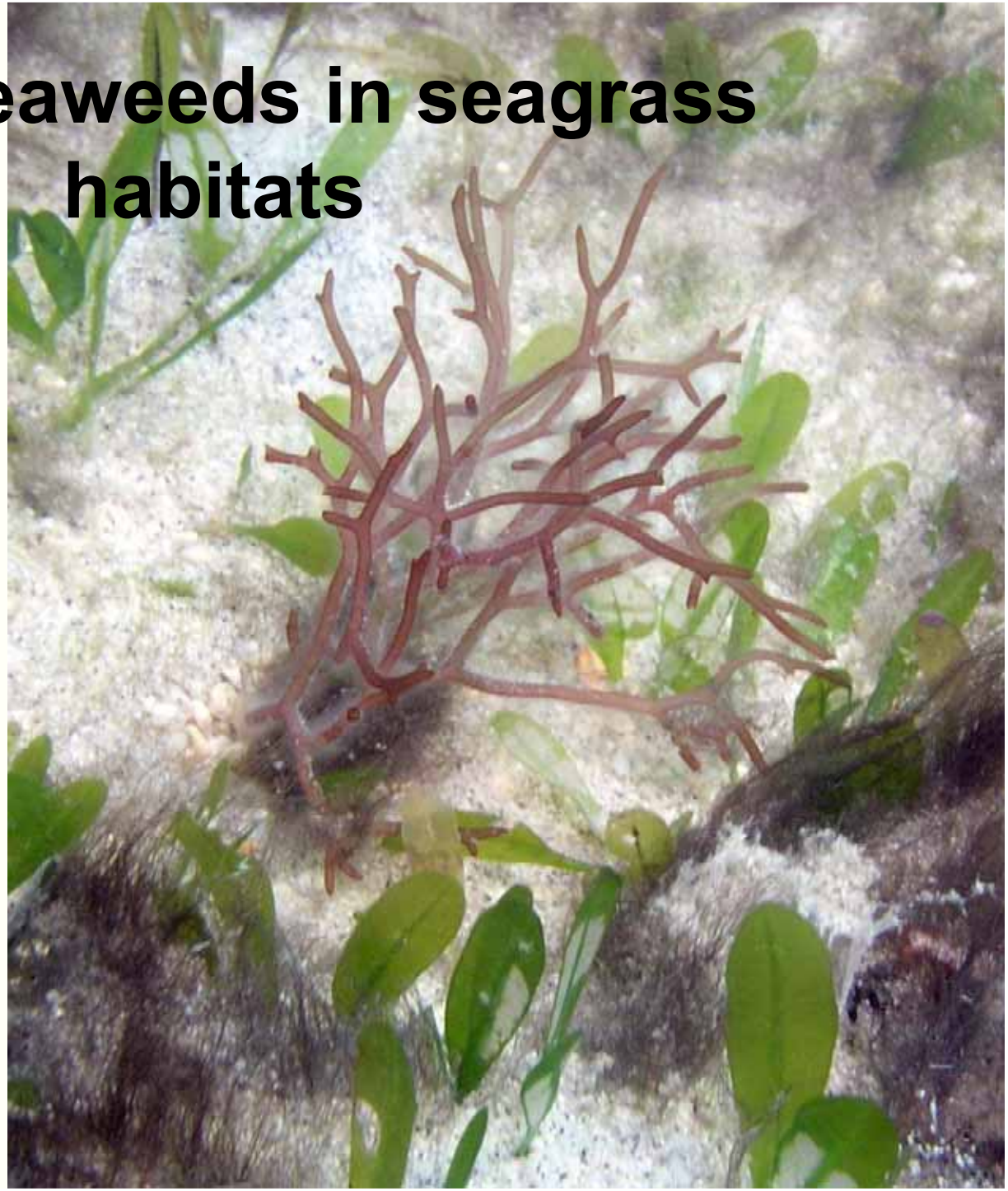
Food source for green turtles, endemic snail, fishes, urchins

Peyton

Macroalgae in seagrass habitats

- Vary in species number and abundance
- Contribute to biodiversity (Hanisak 1993)
- Serve in important processes (eg. sediment nutrient accumulation - Williams 1990)

Edible seaweeds in seagrass habitats



Endemic: *Gracilaria coronopifolia* = *Limu manauea*

Fisheries protection since 1988

$3 million harvested annually (Abbott 1999)

Halophila hawaiiana meadows

Invasive/nuisance macroalgae in seagrass meadows

The invasive red alga *Gracilaria salicornia* (unattached) in a *Halophila decipiens* bed in Hawaii

- Unattached macroalgal canopies fostered by eutrophication (UK - den Hartog 1994; MA - Hauxwell et al. 2001; FL; HI)
- Degradation of seagrass beds in the Mediterranean Sea by the introduced alga *Caulerpa taxifolia*
- Growth rates differ

Avrainvillea amadelpha in Hawaii

- Bryopsidales
- New record for genus 1981 (Brostoff 1989)
- Cryptogenic
- Long-lived fronds
- Dense epiphyte canopy
- Emergent holdfasts on rock

East Maunalua Bay (Hawaii Kai)

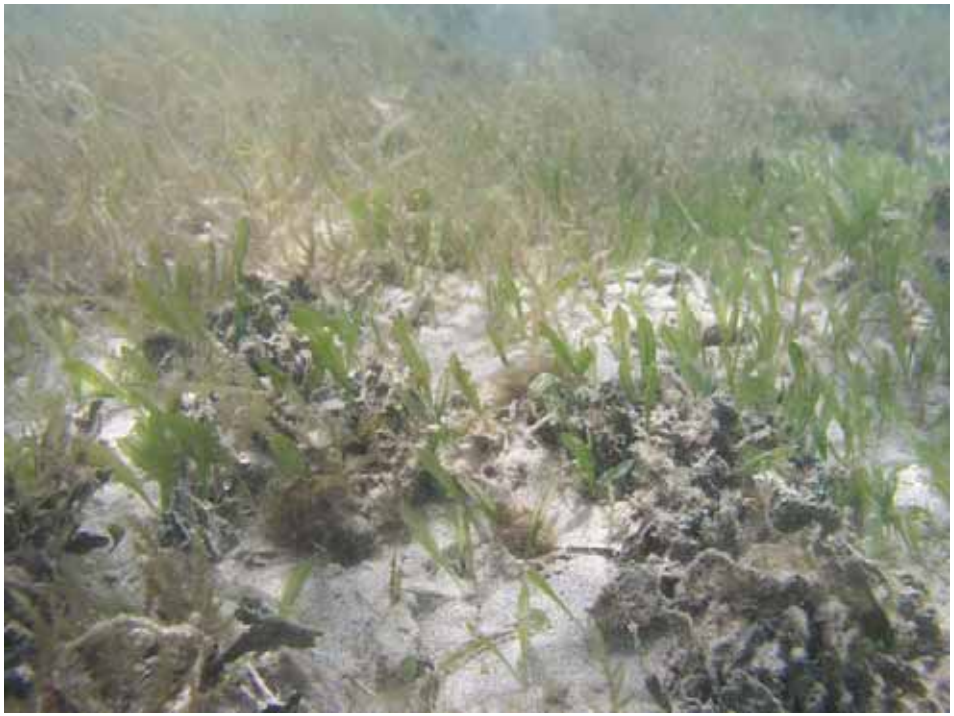
Objectives

To evaluate how the removal of the invasive alga *Avrainvilla amadelpha* affects the seagrass *Halophila hawaiiana* in Maunalua Bay

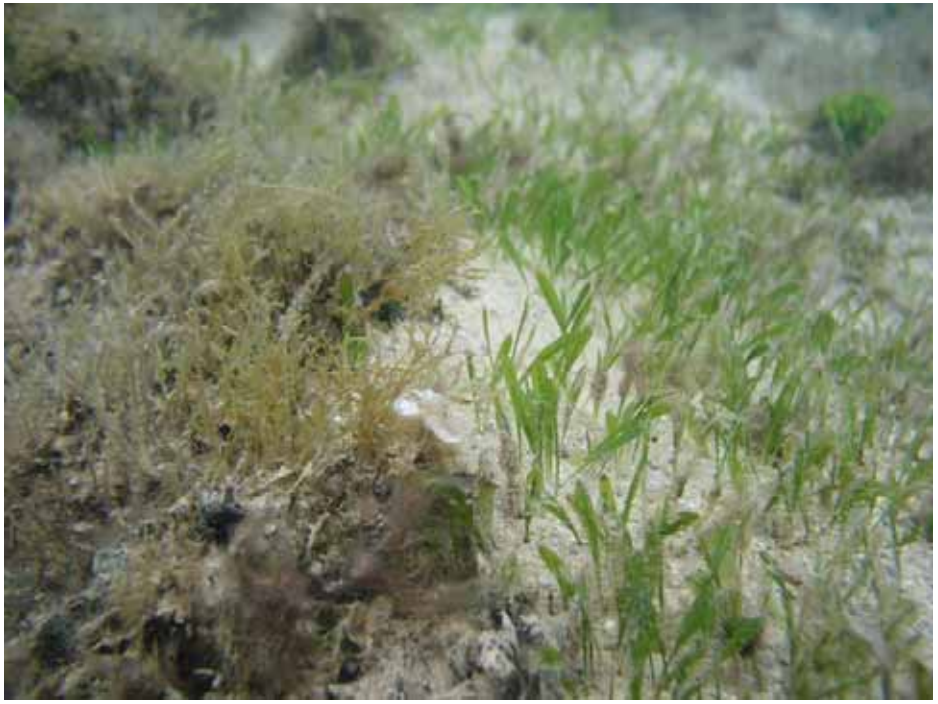
To examine biotic processes that may influence competitive interactions between these species

Approaches

- Removal experiment
- Vegetative fragmentation experiment

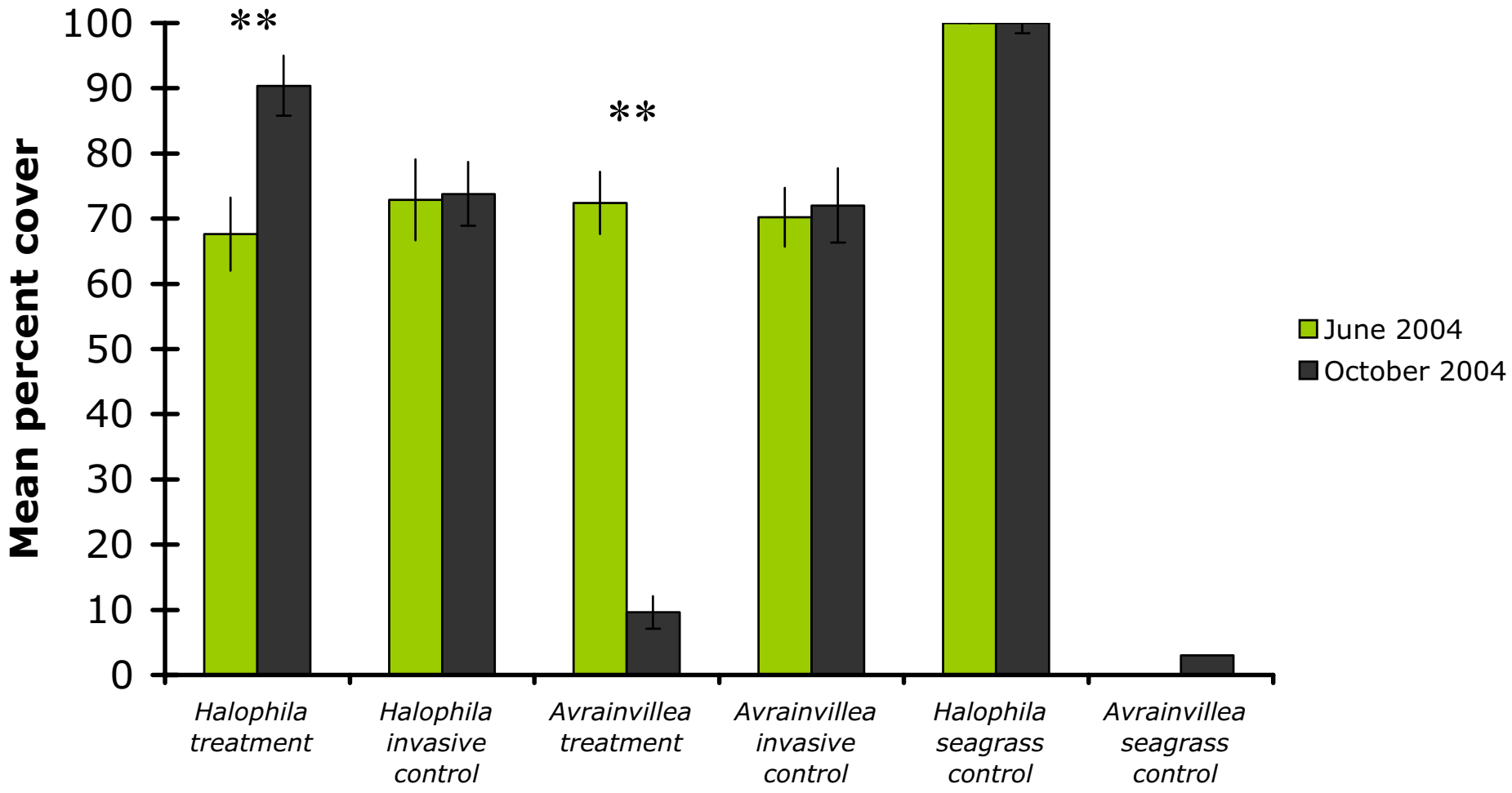


Methods - Removal Experiment

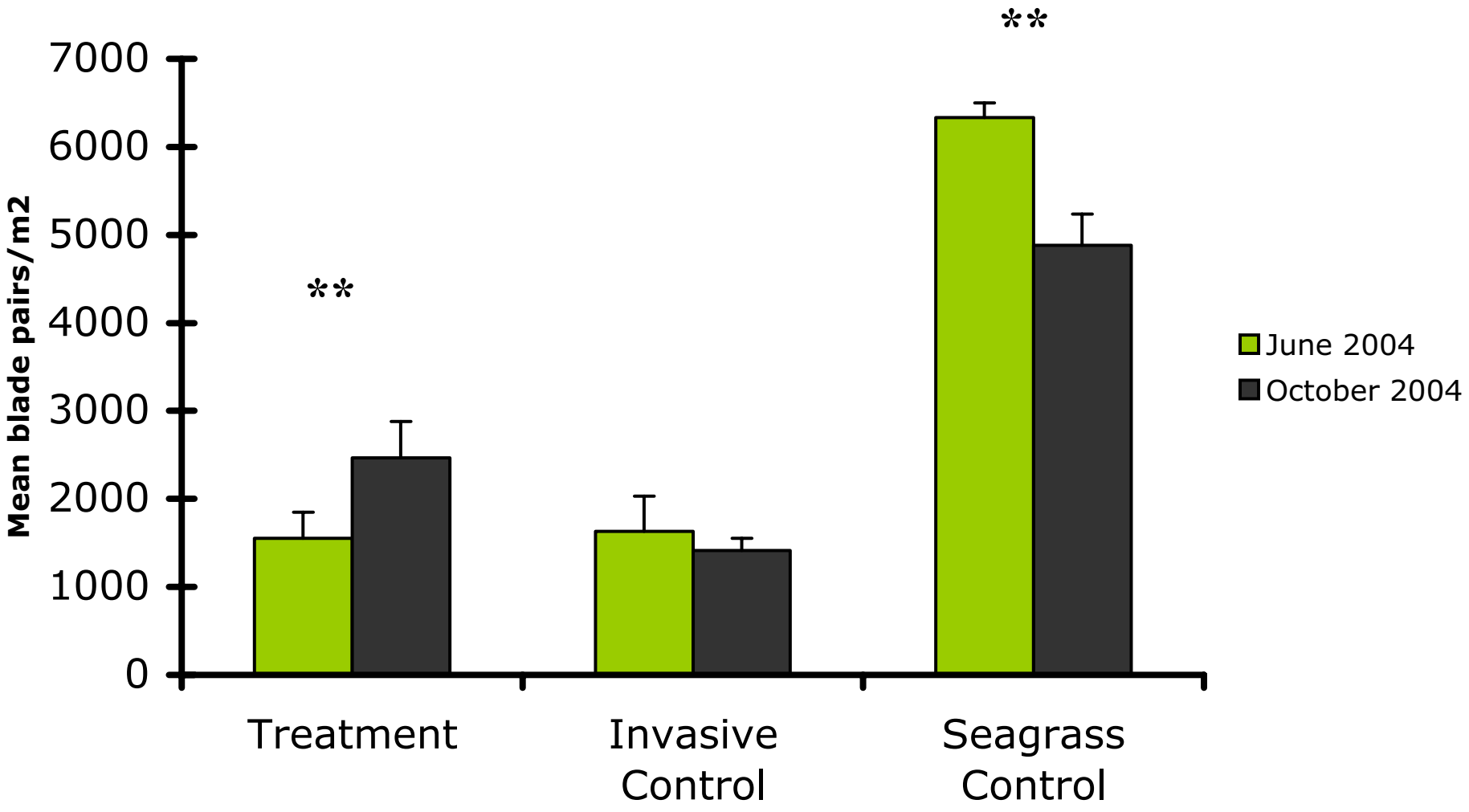


- Established 25 0.25 m^2 fixed plots with 10 treatments, 10 controls with alga & 5 controls without alga
- Treatments *Avrainvillea* is removed
- Quantified % cover and blade pairs densities (Morris *et al.* 2000)
- June and October 2004
- *t*-test or repeated measure *t*-test & SE

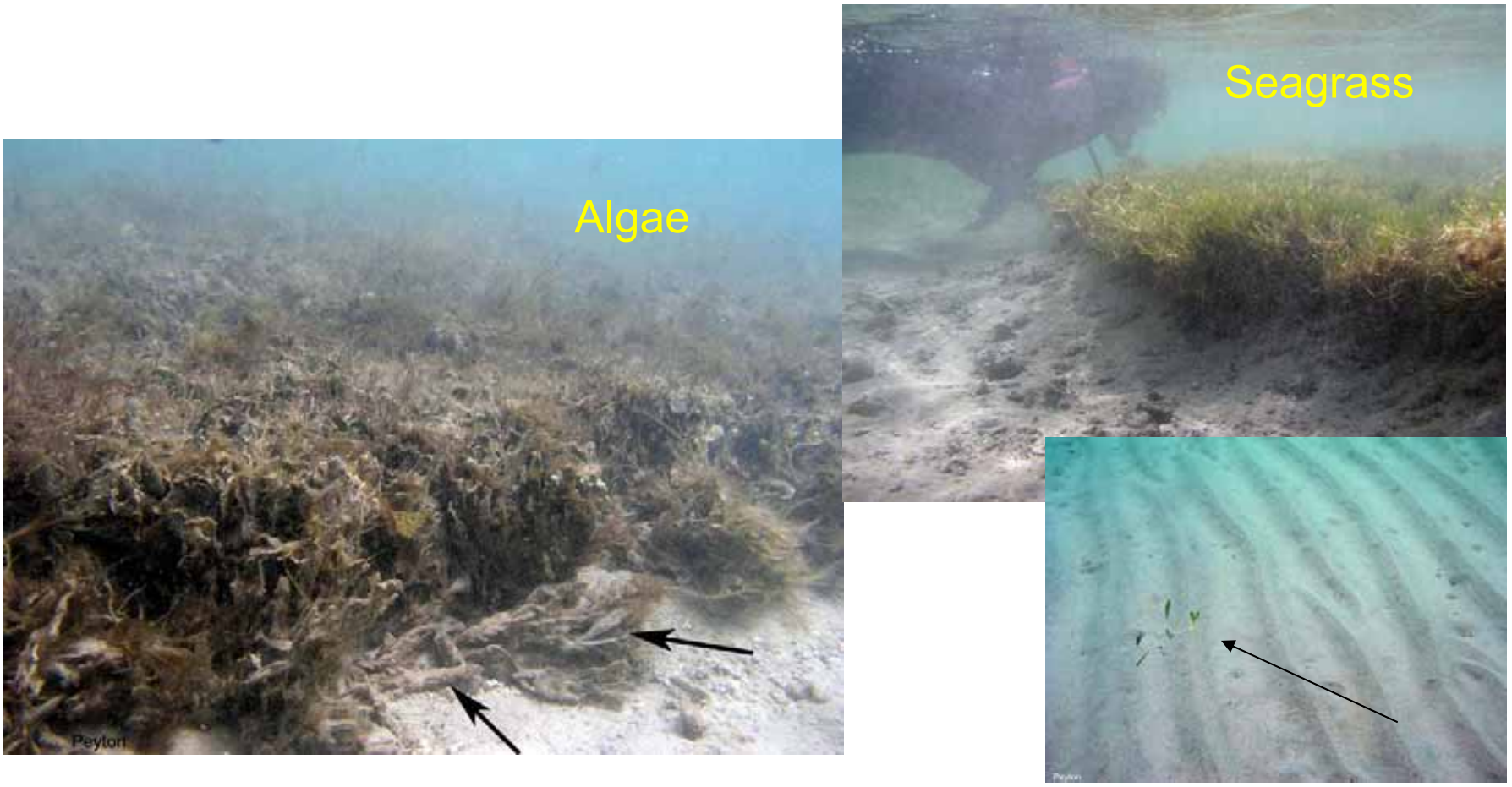
Macrophyte Cover



Seagrass Blade Pair Densities



Reproduction & Dispersal via Vegetative Fragments: Algae & Seagrass



Physical disturbances can generate vegetative fragments.

Vegetative Fragmentation: Fragment Types

1. Hawaii: *Avrainvillea amadelpha*
2. Guam: *Avrainvillea obscura*

Halophila hawaiiana

Vegetative Fragments: Methods

- Tethered fragments with raffia woven in ti lei-style
- Reciprocal transplant: 1)Seagrass; 2)Blow-out; 3) Algae
- Growth and/or attachment of the fragments
- Additional experiment in Guam

Results of Vegetative Fragmentation: Reciprocal Transplant Experiments

Hawaii

Guam

Species	Fragment Type	Locations		
		Seagrass Dominated	Blow-out	Macroalgae Dominated
Avrainvillea amadelpha	Whole	17%	0%	17%
	Holdfast	67%	33%	17%
	Fond	0%	0%	0%
Halophila hawaiiana	4 Nodes	33%	67%	33%
Avrainvillea obscura	Whole	0%		
	Holdfast	100%		
	Frond	0%		

n= 6

Halophila hawaiiana fragment: 14 days old

Avrainvillea amadelpha fragment: 49 days old

Avrainvillea obscura fragment: 5 days old

Resource Management Focus:

Tested: *Halophila hawaiiana* colonized areas when *Avrainvillea amadelpha* was removed

Avrainvillea amadelpha with dense epiphyte canopy

Remove “epiphytes only” in Hawaii
= light interception by the epiphytes

Competition for below ground nutrients

Tested: Vegetative fragmentation is a strategy used by both the alga and seagrass

Interview resource users