Invasive alga removal accelerates sediment flushing in Maunalua Bay

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Figure 1. Paiko reef flat in Maunalua Bay, Oahu. Dashed box represents the 26 acre restoration area where ~3000 tons of the invasive mudweed *Avrainvillea amadelpha* was manually removed.

Background

Maunalua Bay, Oahu home to about 50,000 residents, is flanked by heavily developed watersheds. The resources in the Bay have deteriorated over time due to land-based stressors and overharvesting of the Bay's resources. Malama Maunalua (MM), a community-based group, led an effort to improve water and substrate quality in the Bay by engaging in restorative and educational activities through multiple key partnerships. MM, along with partners (TNC and NOAA), secured a 3.4 million dollar grant and manually removed >3000 tons covering 26 acres of *Avrainvillea amadelpha*, an invasive green alga, from Paiko reef flat.

Methods

A. amadelpha was initially removed in a series of 6 replicate, one acre plots; eventually the entire 26 acre project site was cleared. Data were collected at least once monthly for 14 months. Re-suspendable sediment concentrations were measured using a re-suspender box and turbidity probe (Figure 2c) at 60 randomly chosen, fixed points within cleared and uncleared areas. Suspended sediment concentrations (SSC) from both cleared and uncleared plots were averaged by sample day, and plotted over time. Linear regressions, averages, and 95% confidence intervals were calculated using Prism statistical software. Flushing times were calculated as the time it took for the average sediment concentration to decrease to 1/e of its original concentration.

Figure 2. a) aerial photo of Paiko reef flat (inset: algae and sediment, b) algal removal process (inset: bags o algae), c) collecting data with resuspender box and turbidity probe, d) *Avrainvillea amadelpha*

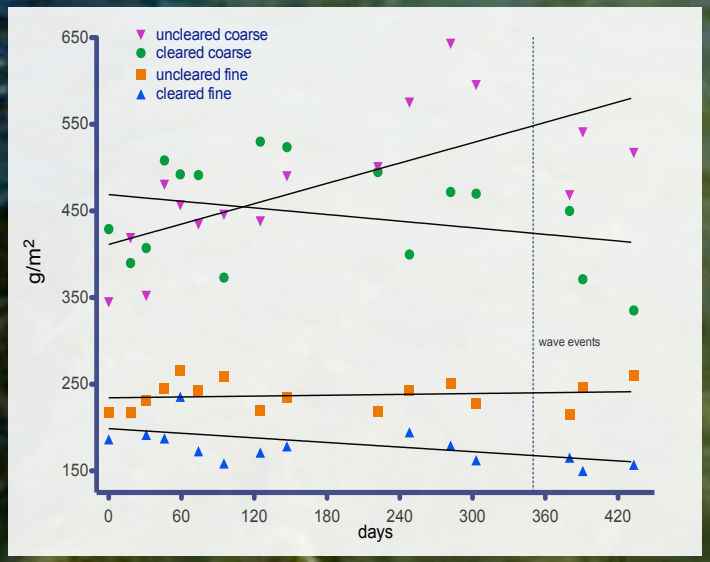

Figure 3. Trends of sediment concentrations observed in cleared and uncleared areas at Paiko reef flat. Day 0 represents August 11, 2010. – the start of data collection. Dashed line represents substantial south shore wave events. See table 1 for values.

Results

- Significantly more re-suspendable coarse sediment in both cleared and uncleared areas
- Significantly less re-suspendable fine sediment in cleared vs. uncleared areas
- In cleared areas, flushing times for fine and coarse sedments were 4 and 6.6 years respectively
- In uncleared areas, sediments were accumulating - not flushing

Table 1. Results		cleared	uncleared
fine	mean ± 95% CI	180.0 ± 9.1	236.7 ± 12.8
	linear regression eq.	y = -0.08872x + 198.8	y = 0.01638x + 234.3
	P value	0.0352	0.6025
	flushing time	4 years	accumulating
coarse	mean ± 95% CI	441.3 ± 23.6	459.7 ± 26.6
	linear regression eq.	y = -0.1275x + 468.8	y = 0.3912x + 411.4
	P value	0.2501	0.0025
	flushing time	6.6 years	accumulating

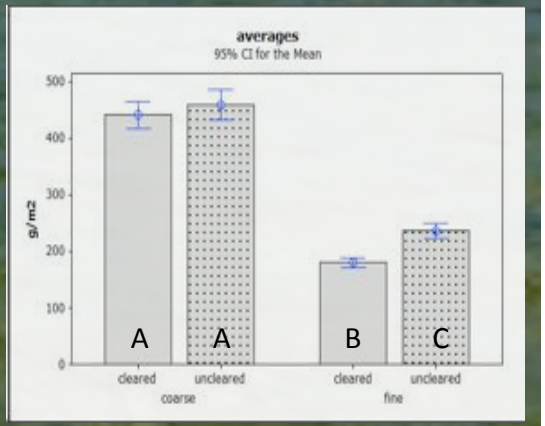

Figure 4. Coarse and fine sediment averages observed in cleared and uncleared areas. Different letters represent significant differences. See Table 1 for values.

Conclusions

- The removal of *A. amadelpha* is essential for the flushing of sediment out of Paiko reef flat
- The removal of *A. amadelpha* is a necessary step in improving water and substrate quality in Paiko reef flat
- Improved habitat quality increases the likehood for the re-establishment of corals and other reef organisms in Paiko reef flat
- Maunalua Bay is an exemplary model for community-based management
- The Great Huki – a great community success

**Much mahalo to Jorg Anson, Leinson Neth, Austin Shelton III, Andy Williams, Kaipo Perez III, Jon Martinez, Luc Rougee, and Leighton Taylor for their contributions and hours of help in the field. Many thanks to TNC-Hawaii and Malama Maunalua for taking the lead in rallying the community around environmental change and for creating a venue for the dissemination of information. Thanks to the Maunalua Bay and Paiko community for allowing this work to take place.