

# A Field Study Comparing Kahalu'u and Kuki'o Bays



## Introduction

- ◆ Human development along the shoreline often results in sewage and fertilizer entering near shore water.
- ◆ Our class hypothesized that algal cover and growth would be associated with nutrient run-off from development.
- ◆ Our assumption was that Kahalu'u bay had more near shore development than Kuki'o bay .
- ◆ Does Kahalu'u have more algal cover than Kuki'o bay?
- ◆ Are nutrient levels in the bays associated with human development and algal cover?

# Experimental Design

(Kahalu'u vs. Kuki'o)

- ◆ The class set up transects at two sites with comparable substrate that differ in amount of development.
- ◆ At each site, 4 transects plotted parallel to a rocky coastline & conducted at depths in a narrow range of variation (3.5-7.5 ft.)
- ◆ 2 chemistry teams, 4 transect teams
- ◆ Transect teams recorded types of substrate found on ocean floor every 2 feet, at each beach.
- ◆ Chemistry teams ran multiple tests on the sample water from each transect.

## Experimental Design cont...

- ◆ Transect team substrates recorded;
  - sand, rock, rubble, coralline algae, turf algae, hard coral, and other.
- ◆ Tests ran by chemistry teams;
  - nitrate, phosphate, ammonia, salinity, pH, dissolved oxygen, temperature.



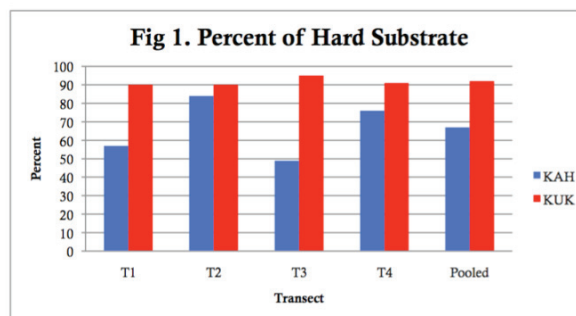
### Appendix 1. Hard Substrate vs Sand at Kahalu'u and Kuki'o

Table 2. Percent of Hard Substrate

	KAH	KUK
T1	57	90
T2	84	90
T3	49	95
T4	76	91
Pooled	67	92

Table 3. Chi-Square Analysis of Hard Substrate

	X <sup>2</sup>	df	p
T1	27.43	1	<.001
T2	1.10	1	NS
T3	51.52	1	<.001
T4	7.09	1	<.01
Σ X <sup>2</sup>	87.14	4	<.005
Pooled	75.82	1	<.001
Hetero	11.32	3	<.025



Notes:

- Kahalu'u has significantly less hard substrate (more sand) than Kuki'o
- Measure of heterogeneity showing significant inconsistency in samples
- Transect 3 contributing greatest to difference between sites

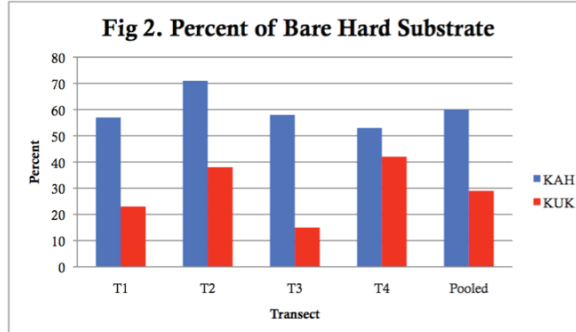
## Appendix 2. Bare vs. Covered Hard Substrate at Kahalu'u and Kuki'o

Table 4. Percent of Bare Hard Substrate

	KAH	KUK
T1	57	23
T2	71	38
T3	58	15
T4	53	42
Pooled	60	29

Table 5. Chi-Square Analysis of Bare Hard Substrate

	$\chi^2$	df	p
T1	16.47	1	<.001
T2	18.05	1	<.001
T3	26.47	1	<.001
T4	1.52	1	NS
$\Sigma \chi^2$	62.51	4	<.001
Pooled	60.23	1	<.001
Hetero.	2.28	3	NS



Notes:

- Kahalu'u has significantly more Bare Hard Substrate (less with Cover) than Kuki'o
- Measure of heterogeneity shows no inconsistency in samples
- Transect 3 contributing greatest to difference between sites

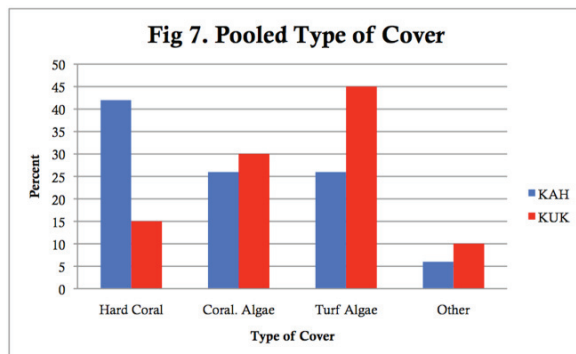
## Appendix 5. Type of Cover on Hard Substrate at Kahalu'u and Kuki'o

Table 10. Pooled Transects: Percent of Cover

	KAH	KUK
Hard Coral	42	15
Coral. Algae	26	30
Turf Algae	26	45
Other	6	10

Table 11. Chi-Square Analysis of Type of Cover

	$\chi^2$	df	p
T1	2.82	3	NS
T2	4.72	3	NS
T3	55.95	3	<.001
T4	3.59	3	NS
$\Sigma \chi^2$	67.08	12	<.001
Pooled	34.15	3	<.001
Hetero.	32.93	9	<.001



Notes:

- Mix of Cover on Hard Substrate significantly different between Kahalu'u and Kuki'o
- More Hard Coral at Kahalu'u - More Turf Algae at Kuki'o
- Measure of heterogeneity shows significant inconsistency in samples
- Transect 3 appears to bias results

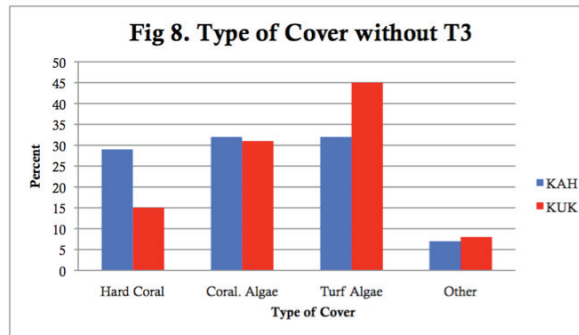
## Appendix 6. Type of Cover without Transect 3

Table 12. Pooled Transects:  
Percent of Cover without T3

	KAH	KUK
Hard Coral	29	15
Coral. Algae	32	31
Turf Algae	32	45
Other	7	8

Table 13. Chi-Square Analysis of  
Type of Cover without T3

	$\chi^2$	df	p
T1	2.82	3	NS
T2	4.72	3	NS
T4	3.59	3	NS
$\Sigma \chi^2$	11.13	9	NS
Pooled	7.87	3	<.05
Hetero.	3.26	6	NS

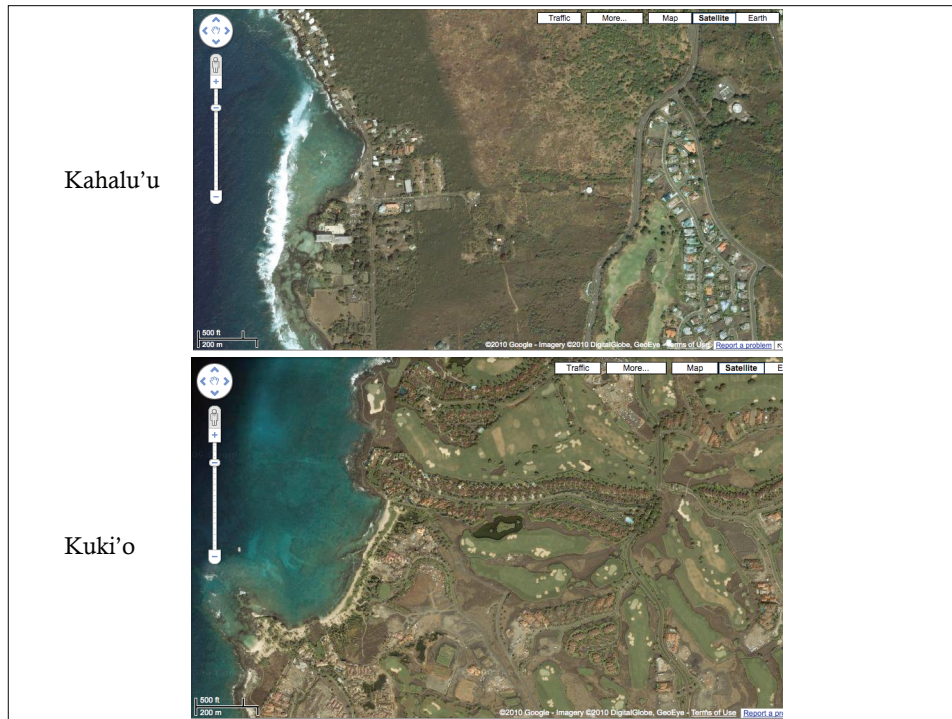


### Notes:

- Data from Transect 3 removed from analysis
- Pooled results still indicate that Kahalu'u may have more Hard Coral and Kuki'o may have more Turf Algae
- Measure of heterogeneity shows no significant inconsistency in samples

## Results Discussion

- ◆ Kuki'o has significantly more hard substrate than Kahalu'u. Kuki'o has more habitat for recruitment of algae and other cover than Kahalu'u.
- ◆ Kuki'o has significantly more cover on the hard substrate than Kahalu'u. Even though there is more hard substrate at Kuki'o, more of the hard substrate had some time cover.
- ◆ There is a tendency for the type of cover to differ between the base. Kuki'o tends to have more turf algae while Kahalu'u tends to have more hard coral.
- ◆ The attempt to associate nutrient levels with the two bays was unsuccessful. No information is available to like nutrient levels with the types of cover on hard substrate in the two bays.



## Conclusion

- ◆ Original hypothesis: Kahalu'u has higher nutrient levels because of more near shore development.
- ◆ Our original hypothesis may need to be questioned because Kahalu'u shows lower levels of turf algae than Kuki'o.
- ◆ Instruments used to measure nutrients were not sensitive enough to produce accurate results.
- ◆ Kuki'o shows more overall development in its watershed than Kahalu'u.
- ◆ In a follow up study, perhaps it is more important to look at overall watershed development than just near shore development.

# Acknowledgements

- ◆ This project was made possible because of a grant from The Kohala Center, working in partnership with The Kohala Watershed Partnership and is supported by NOAA B-WET funding.
- ◆ Thank you to Ms. Goodale for providing us with knowledge and skills that made this project even more interesting.
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