Comparing Kahalu'u Beach Park and Kuki'o Beach Park:

-Marine Water Quality (10 test parameters)

- Human Activity / Impact Survey

- 3 Snorkel Transect Surveys:

Reef Watchers Fish Count
Urchin Quadrant Count (3 species)
Coral Cover Quadrant Survey

By Students of Ms. Diaz's Class, Kealakehe Intermediate
Kailua Kona, Hawaii

Purpose:

To compare marine water quality, coral cover, urchin, coral reef fish species abundance and diversity at 2 popular West Hawaii public beach parks:

Kahalu'u: an open access public beach

Kukio: (Kikaua Point Park) a limited public access beach park.

Both are protected by Fish Replenishment Areas (FRA) where tropical fish aquarium collecting is not allowed. Spear and lay net fishing is allowed at both parks.

Hypotheses:

- Kukio will have higher coral cover due to limited entry and less human impact.
- Kukio will have more urchin and fish abundance due to limited entry and less human impact.
- Water quality will be lower at Kahalu'u due to greater human impact.

Background Research

Kahalu'u Beach Park:

- Over 500 years of human use of Kahalu'u reefs:
  - Large Ancient Hawaiian settlement
  - Ancient Hawaiians built ***Pa o ka menehune*** breakwater
  - ***Ku'emanu Heiau*** was used as a royal residence
  - Ancient Hawaiians built 2 fish ponds at site
  - County beach park established in 1954; Hotel built in 1970
  - Most popular West Hawaii snorkeling beach
  - Open Public Access: parking lot & pavilions open 7am-11pm
  - County sewage treatment within last 10 years

Background Research

Kukio Bay: Kikaua Point Beach Park:

- Smaller Ancient Hawaiian settlement visited by royalty
- Green sea turtle basking site
- Hualalai Resort built in 1996; Kukio Golf course built in 1999
- Over 100 private homes built since 2000; construction continues
- Kikaua Point Beach Park established 2004 as public access
- Limited Public Access control via security gate and car passes: 30 car maximum. Open 8am-7pm. Public restrooms
- Kukio Resort has new sewage treatment plant across highway
- Partially treated "gray" water is used on landscaping & golf course

Our Study Parameters:

- **10 Marine Water Quality Tests:**

  (Hanna Marine Test Kits)

  pH, Nitrate, Nitrite, Ammonia, Phosphate, Dissolved Oxygen, Salinity, TDS (Total Dissolved Solids), EC (Electrical Conductivity), & Temperature

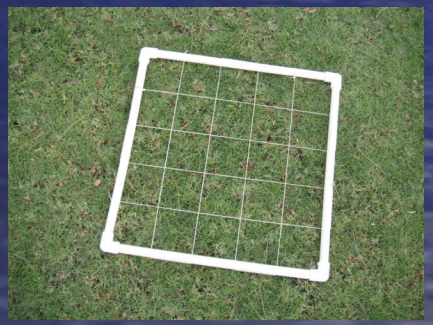
- **Human Activity Impact Surveys (3 per day)**

- **3 Snorkel Transect Surveys: (60 feet, 18 meter)**

  - Coral & Algae Cover Quadrant Surveys

  - Urchin Quadrant Counts (3 species)

  - Reef Watchers Fish Belt Transect Counts (25 target species)



Data Collected over 2 years, 2010 & 2011:

4 times annually each location

by 2 student groups

Main Coral Species in Our Study:

Antler Coral:
Popcillopora eydouxi

Cauliflower Coral:
Pocillopora meandrina

Finger Coral:
Porites compressa

Mound Coral:
Porites lueta

Lobe Coral: *Porites lobata*

Photos by Keoki & Yuko Stender

Coral Descriptions

- **Antler:** Brown antler-like branches; can grow to 90cm (3 ft)
- **Cauliflower:** Cauliflower head shaped; Gray to Pink color. Inhabits shallow water & surf zones.
- **Lobe:** Grayish-yellow, large colonies that appear lumpy. Colonies can form flat branches & mound structures.
- **Finger:** Porites corals have light colored finger-like branches that form large colonies, with some reaching eight meters high.
- **Mound:** Pale brown. Forms large mound-like colonies.

Corals are invertebrate animals in the *Cnidaria* phylum called polyps. **Coral Polyps** are soft tube-like animals that have stinging tentacles. Polyps use calcium carbonate from seawater to build a hard cup-like skeleton to protect themselves. Reef-building corals form colonies in warm, tropical water.

Coral coloration varies depending on colony genetics and the **zooxanthellae algae** coral polyps ingest. Zoozanthellae lives inside polyps, acting as photosynthesizers providing up to 90% of the colony's energy needs. Coral Polyps also feed on zooplankton with stinging tentacles.

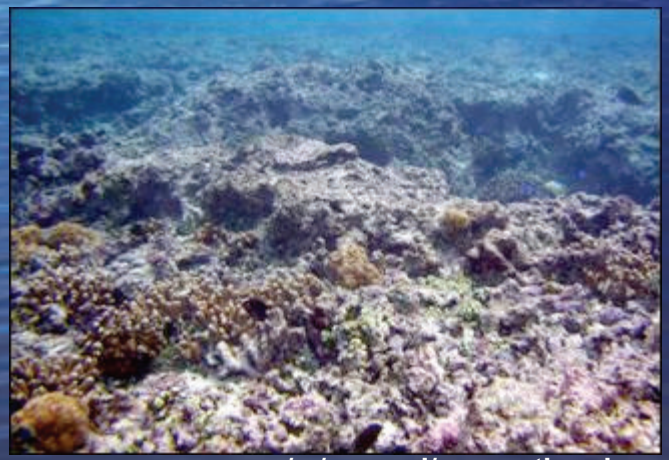
Coralline Algae

Coralline Algae uses seawater uses calcium deposits from seawater to harden it's cell walls.

It is a red algae that encrusts rocks & grows around coral reefs.

It looks like coral, but is really an algae that photosynthesizes. Coloration varies from red, pink, purple, blue, green, and gray.

Coralline Algae is very important for coral reef environments, because it provides structure and support acting like almost a glue that holds a reef system together.

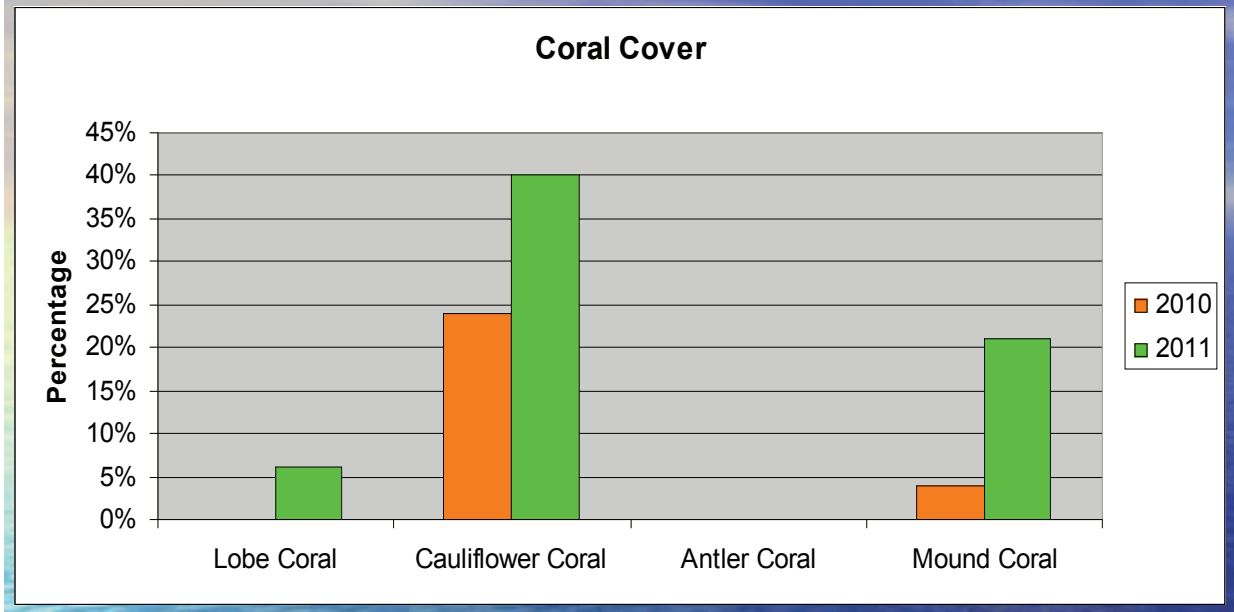


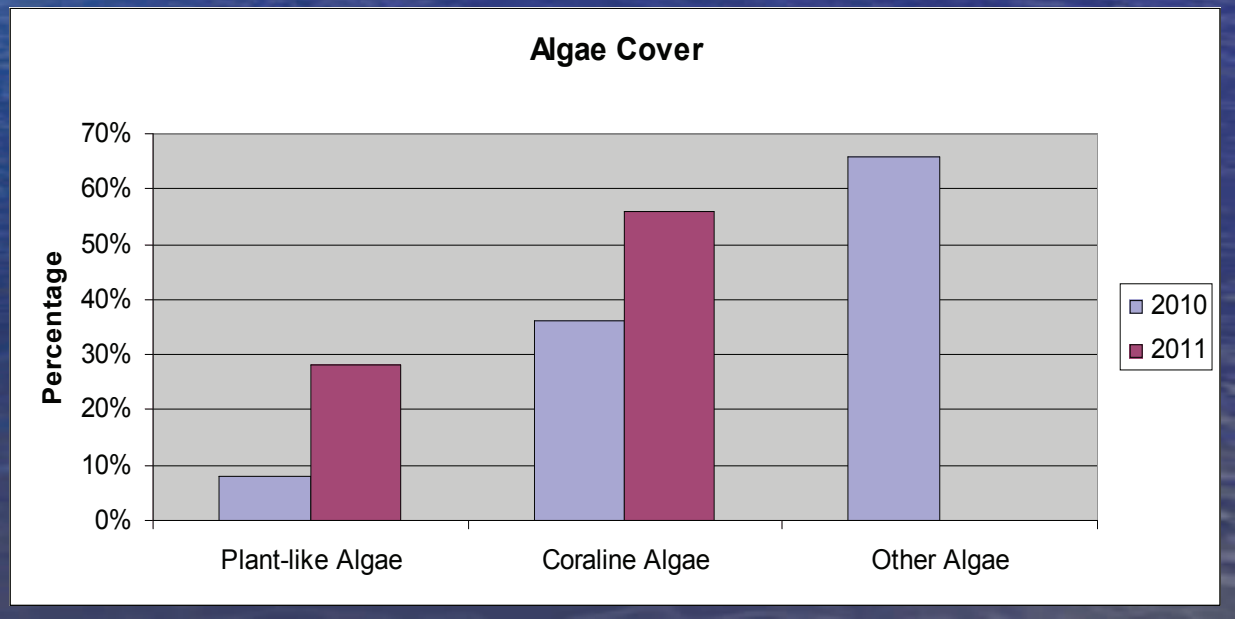
ccma.nos.noaa.gov/.../manual/encrustingalgae.jpg

www.botanyhawaii.edu

www.wetwebmedia.com

Kukio Example Coral/Algae Cover Quadrant Graphs:



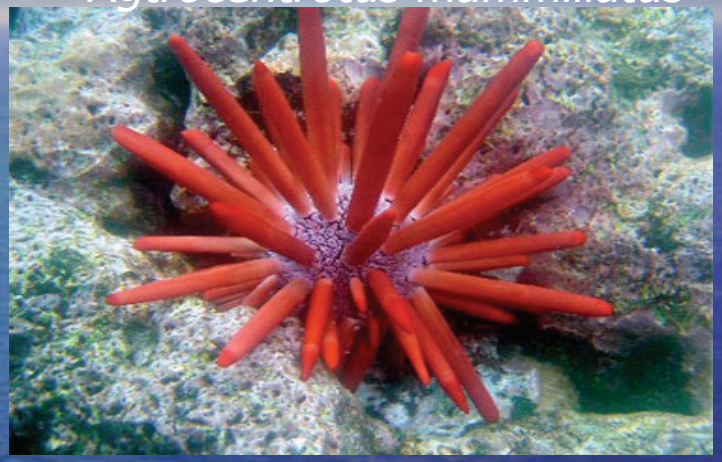


Urchin Quadrant Count:

Method: Quadrant laid on one side of transect every 5 feet

Pencil Urchin:

Agtrocentrotus mammillatus

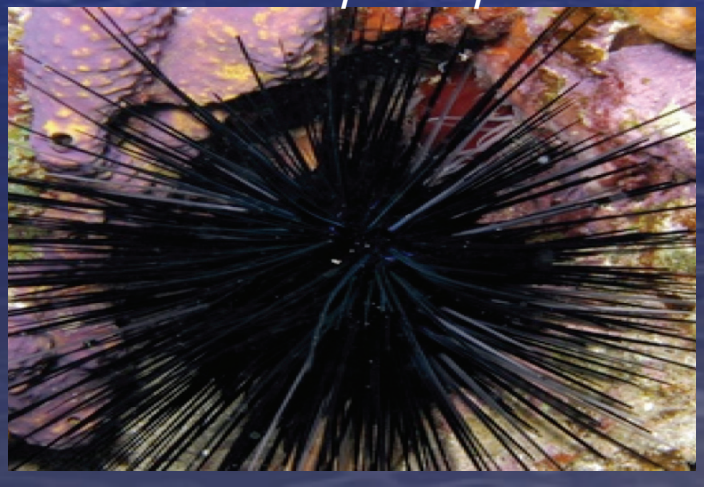


Collector Urchin:

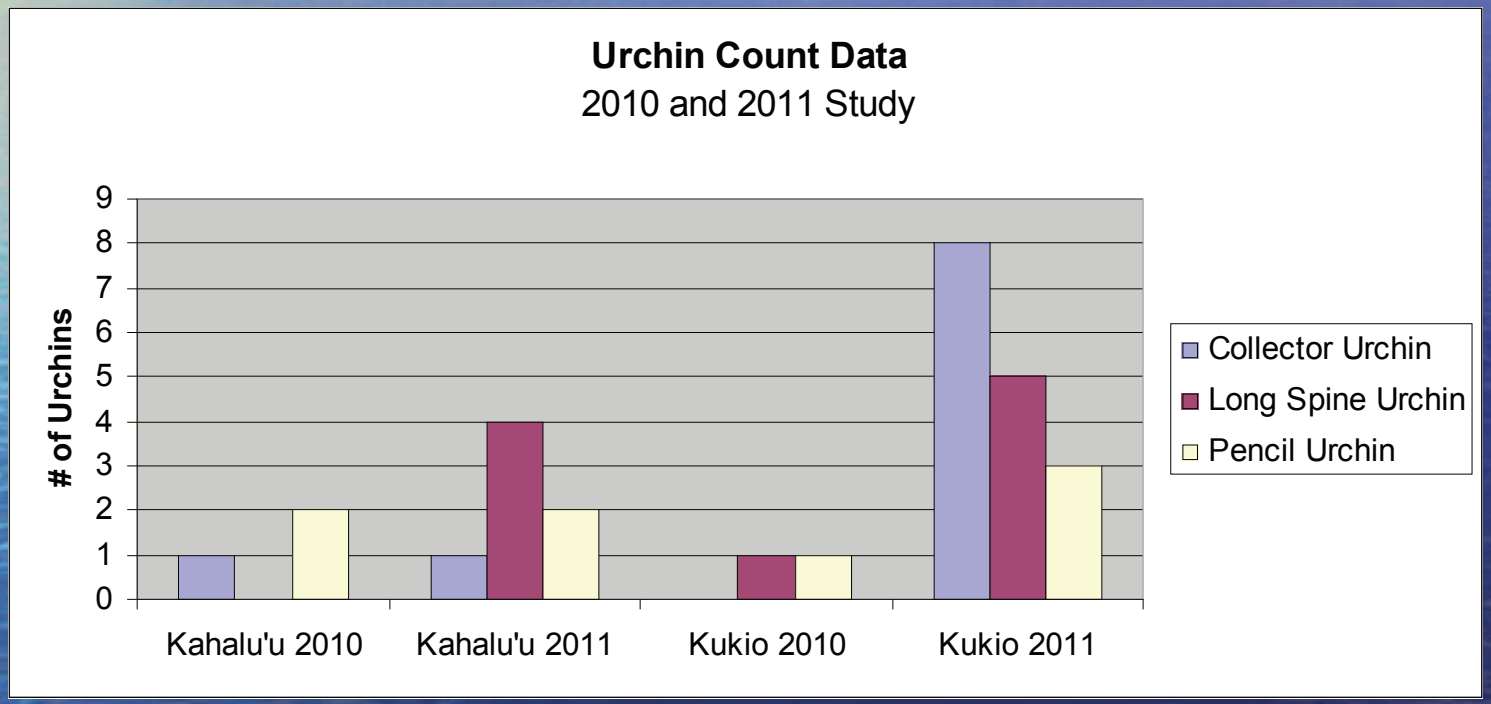
Tripneustes gratilla

Long-Spine Urchin:

Diadema paucispinum



Urchin Count Quadrant Data



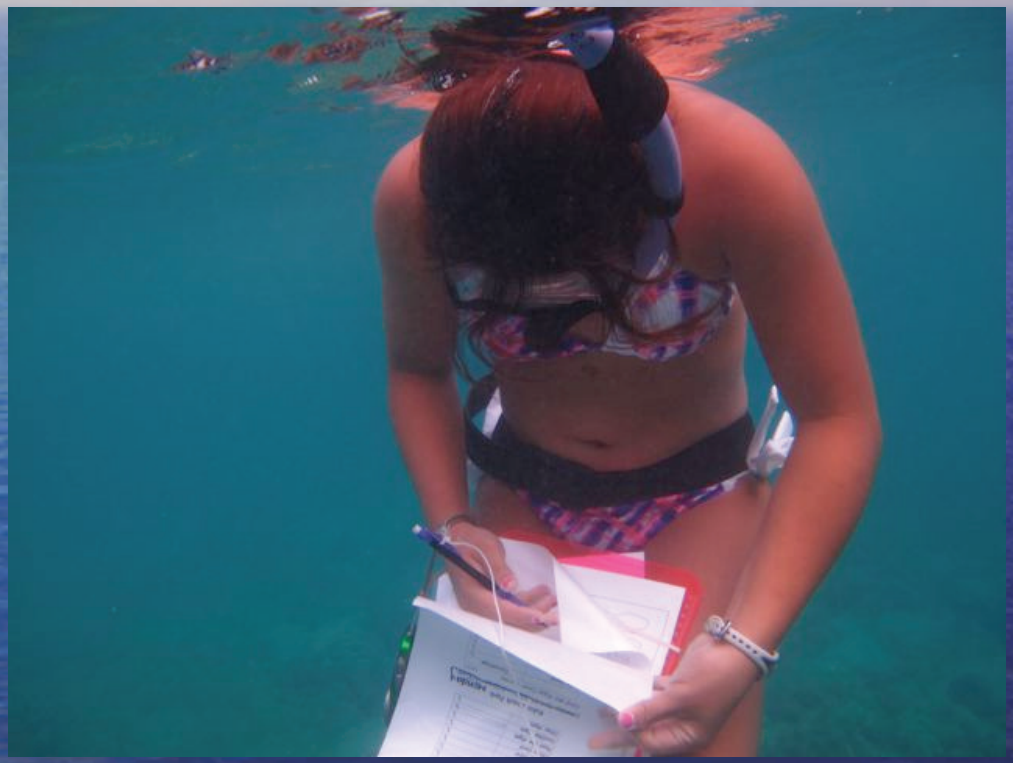
Saddle Wrasse Characteristics: ENDEMIC *Thalassoma duperrey*

- Length: 25 cm
- Color: It has a blue head, a green body, and lavender highlights on the edges of the fins.
- Females have a typical blue, red, green pattern.
- Juveniles have a greenish back and a pale belly.
- Shape: oval shape

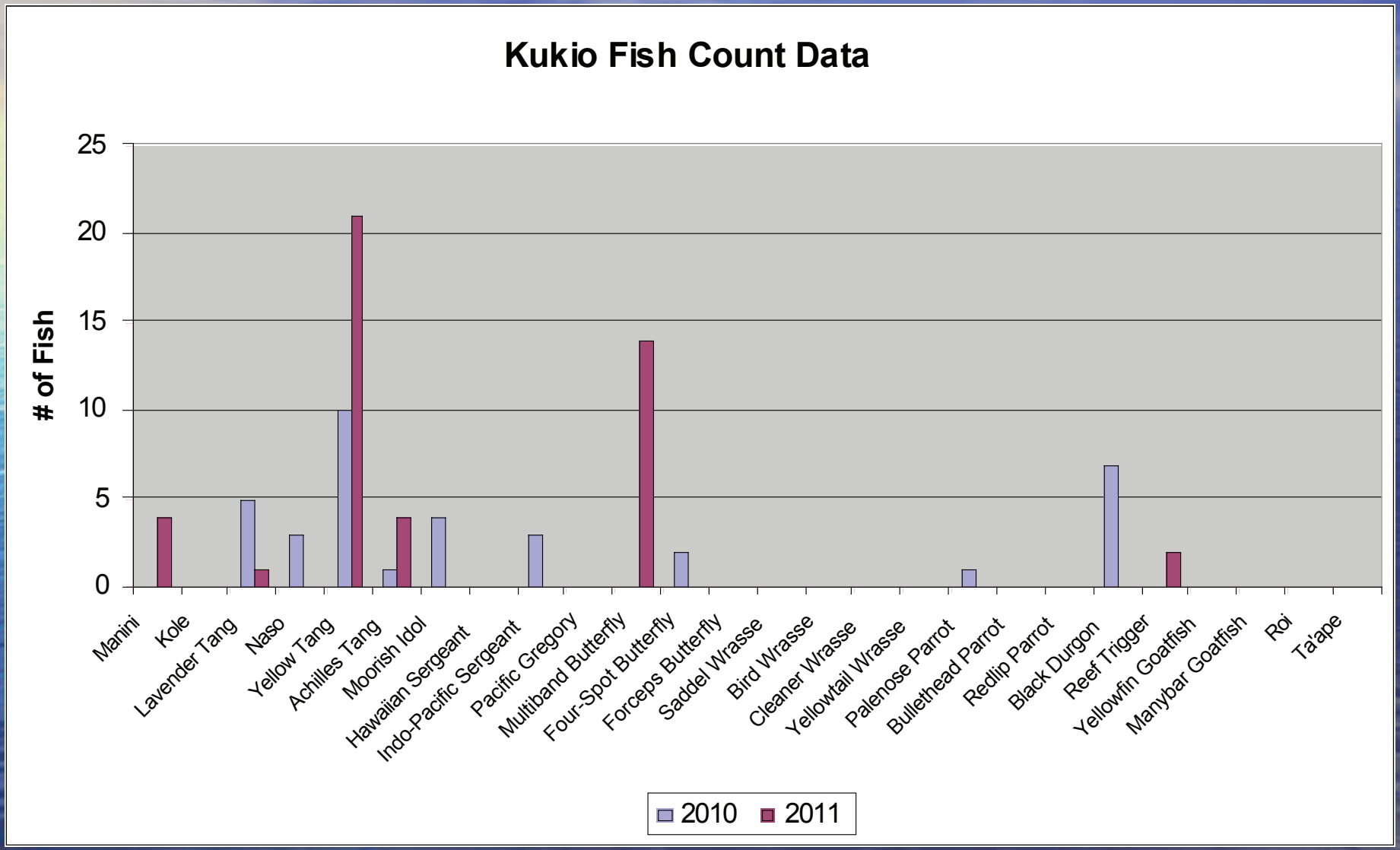
Yellowtail Coris Wrasse Characteristics
Anampses meleagrides

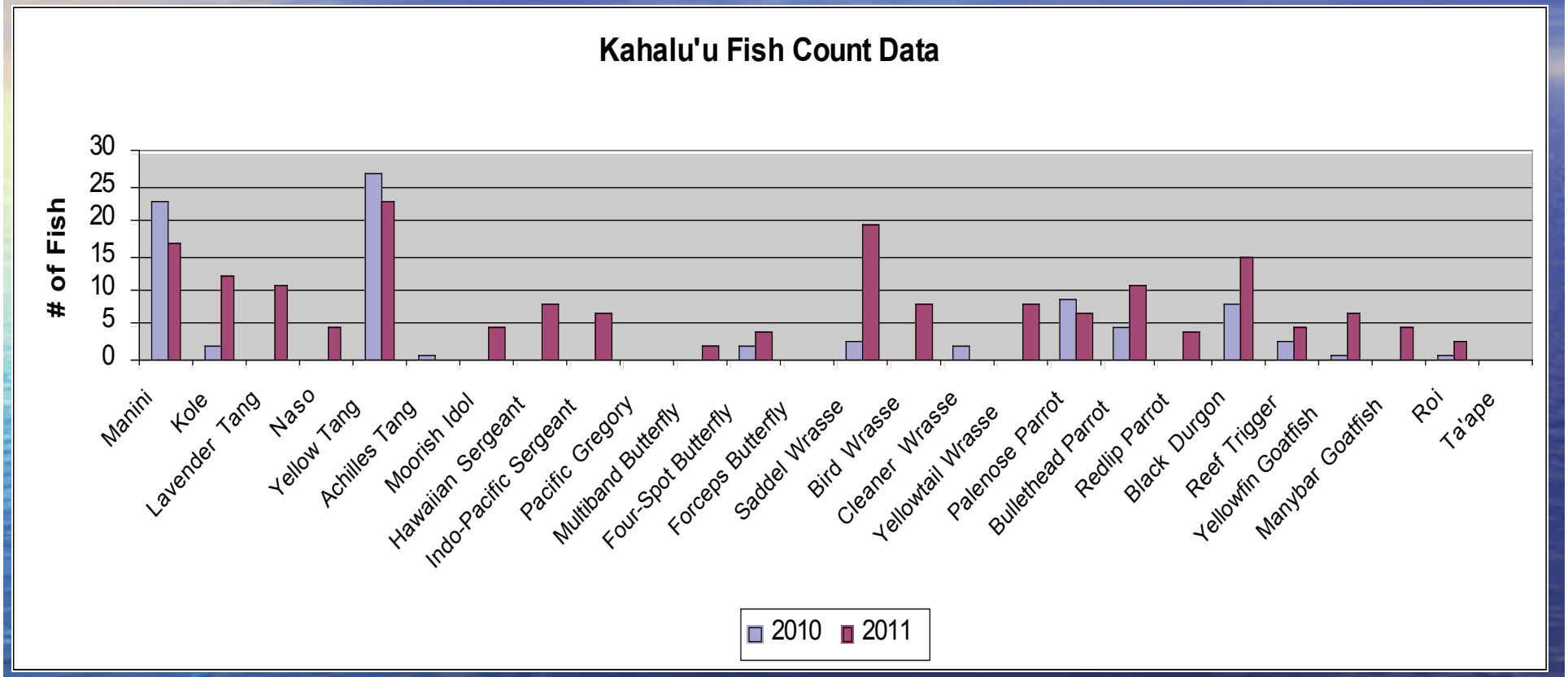
- Length: 30 cm
- Color: Males have a deep violet body. Adults has a red head with green-blue stripes, blue spots and a bright yellow tail.
- Females have a black body and white spots.
- Juveniles are bright red with five white spots.
- Shape: Oval shape

Recording Fish Count Data



Comparing Fish Counts 2011 to 2010




Kahalu'u Fish Count Data
# of Fish
30
25
20
15
10
5
0
Manini
Kole
Lavender Tang
Naso
Yellow Tang
Achilles Tang
Moorish Idol
Hawaiian Sergeant
Indo-Pacific Sergeant
Pacific Gregory
Multiband Butterfly
Four-Spot Butterfly
Forceps Butterfly
Saddel Wrasse
Bird Wrasse
Cleaner Wrasse
Yellowtail Wrasse
Palenose Parrot
Bullethead Parrot
Redlip Parrot
Black Durgon
Reef Trigger
Yellowfin Goatfish
Manybar Goatfish
Roi
Ta'ape
2010
2011

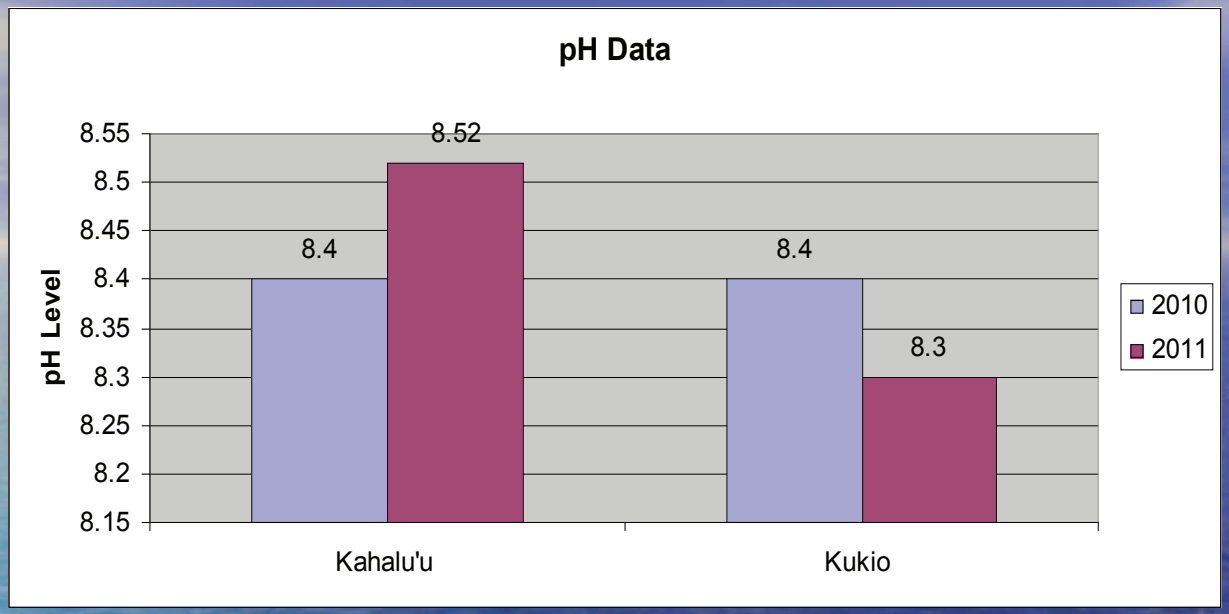
Marine Water Quality Tests:

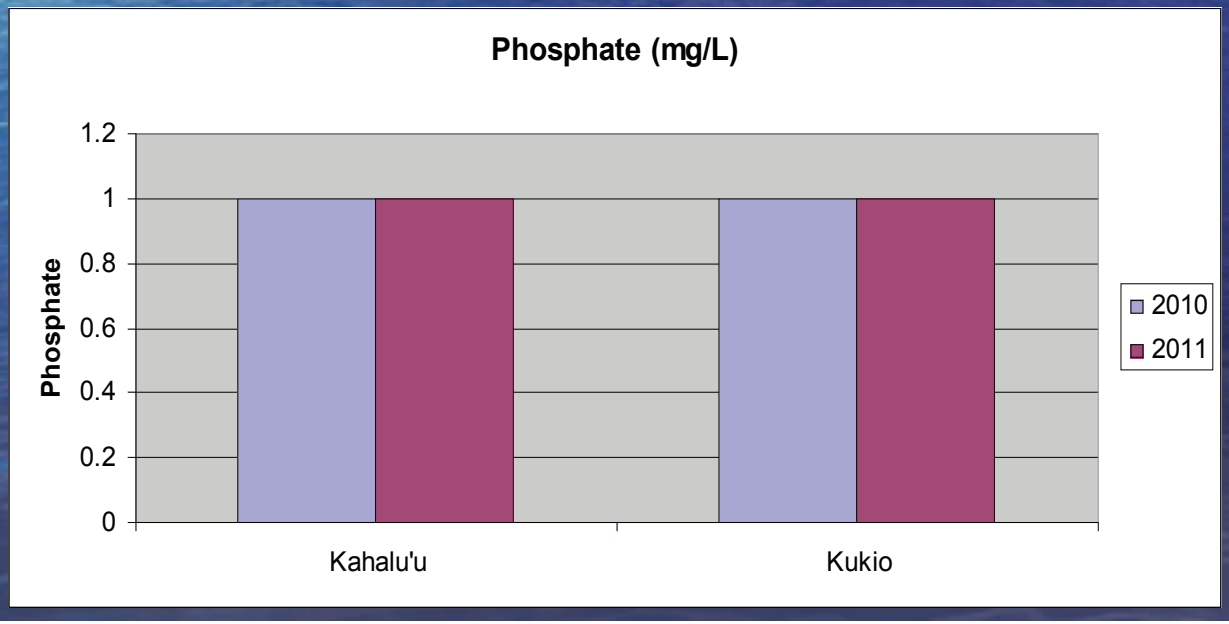
- **10 Marine Water Quality Tests:**

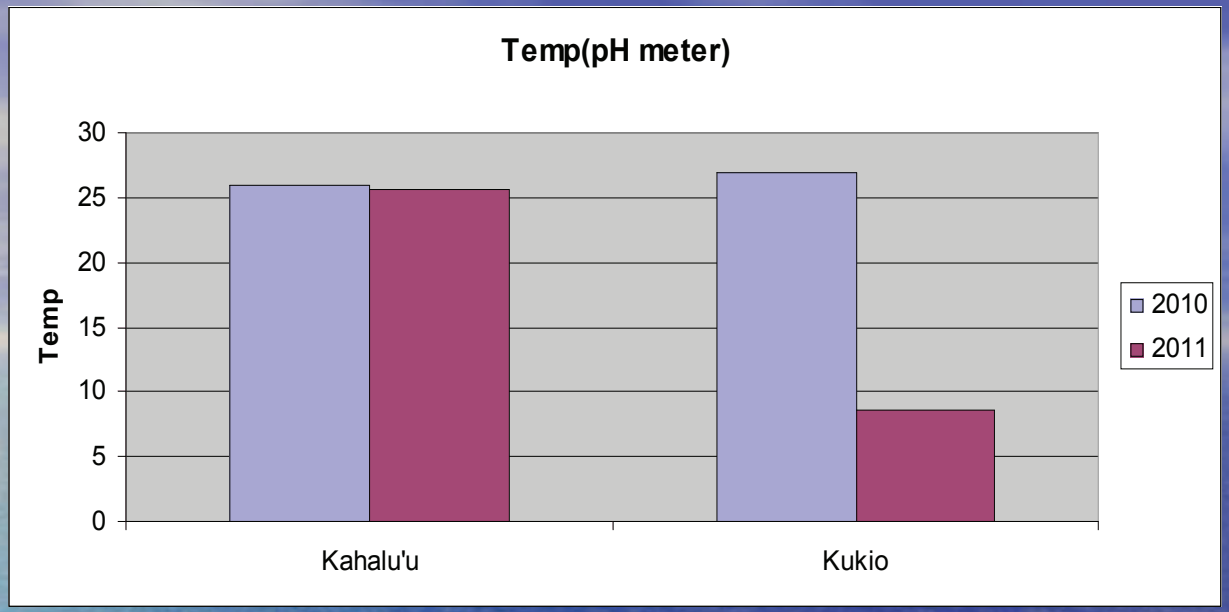
  (Hanna Marine Test Kits)

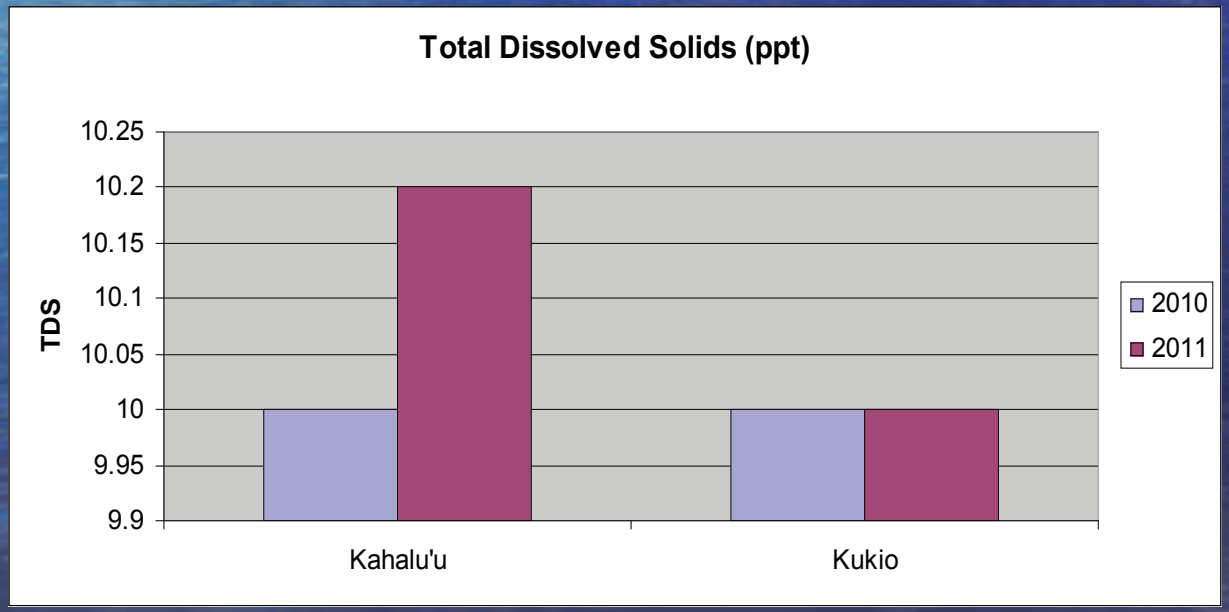
  - pH
  - Nitrate & Nitrite
  - Ammonia
  - Phosphate
  - Dissolved Oxygen
  - Salinity
  - TDS (Total Dissolved Solids)
  - EC (Electrical Conductivity),
  - Temperature

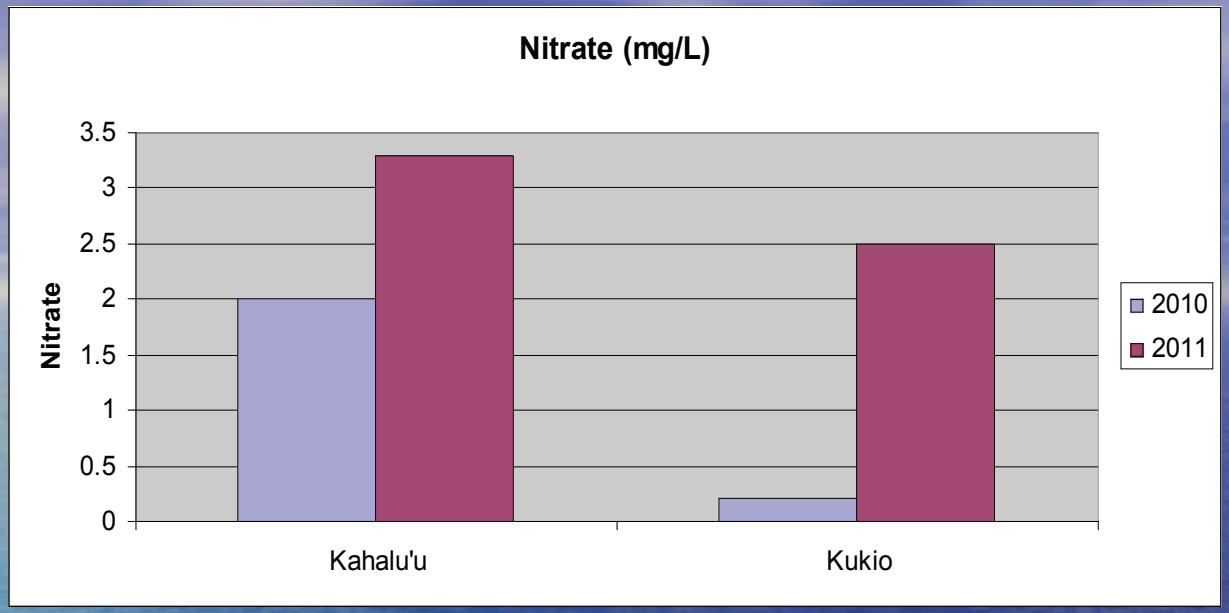
Marine Water Quality Sample Graphs

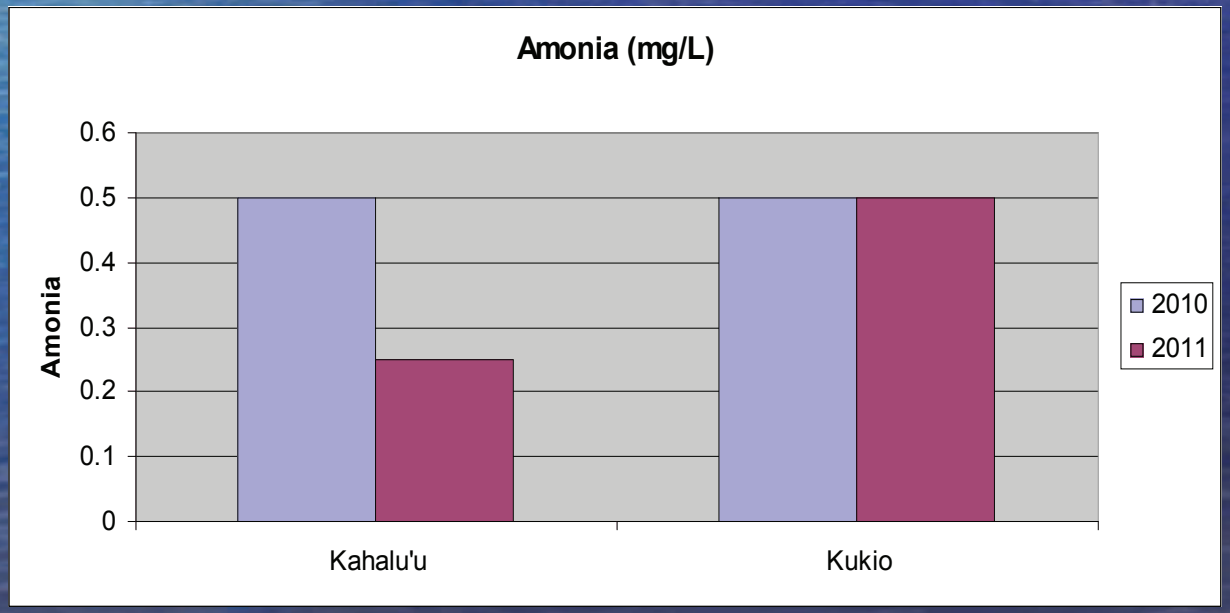




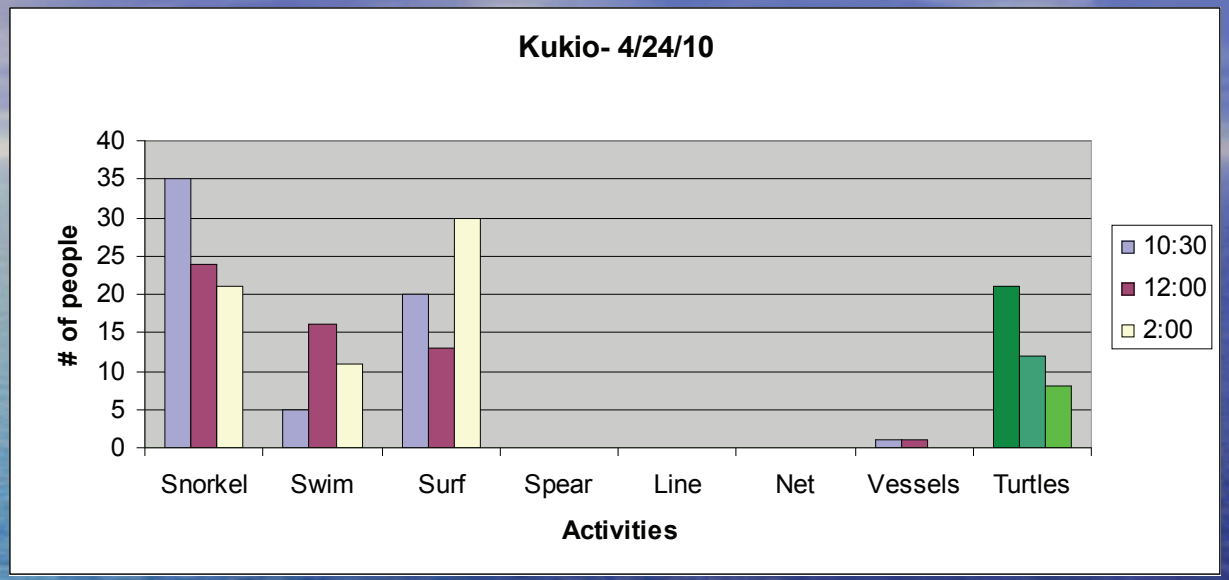

Temp(pH meter)
Temp
30
25
20
15
10
5
0
Kahalu'u
Kukio
2010
2011

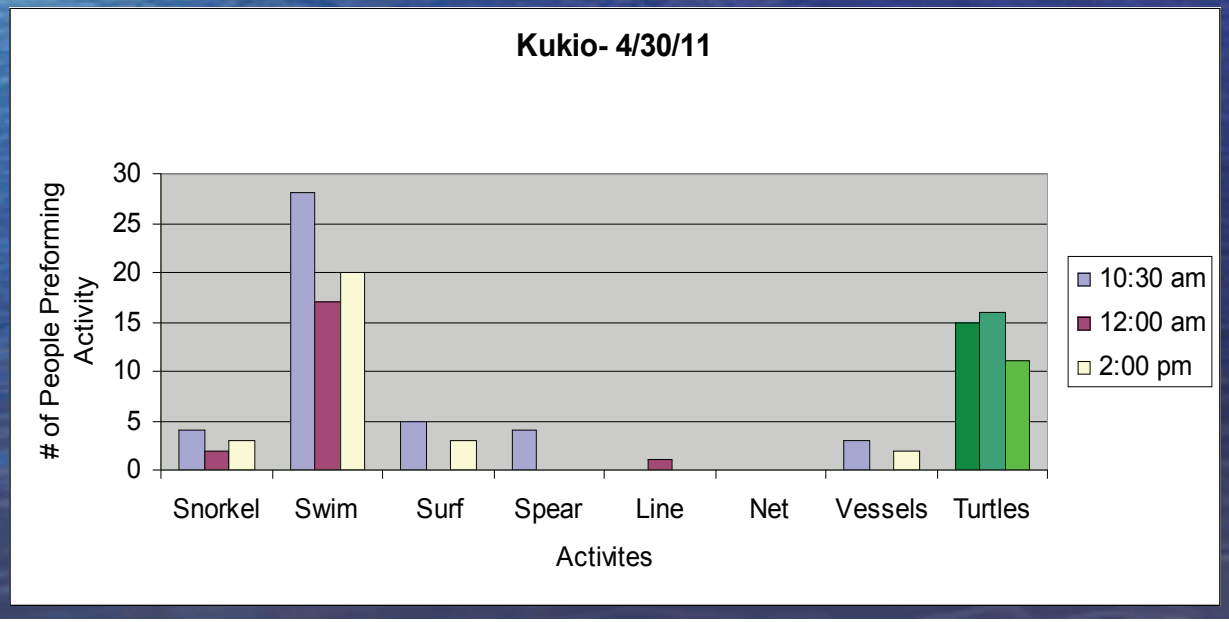

Total Dissolved Solids (ppt)
TDS
10.25
10.2
10.15
10.1
10.05
10
9.95
9.9
Kahalu'u
Kukio
2010
2011

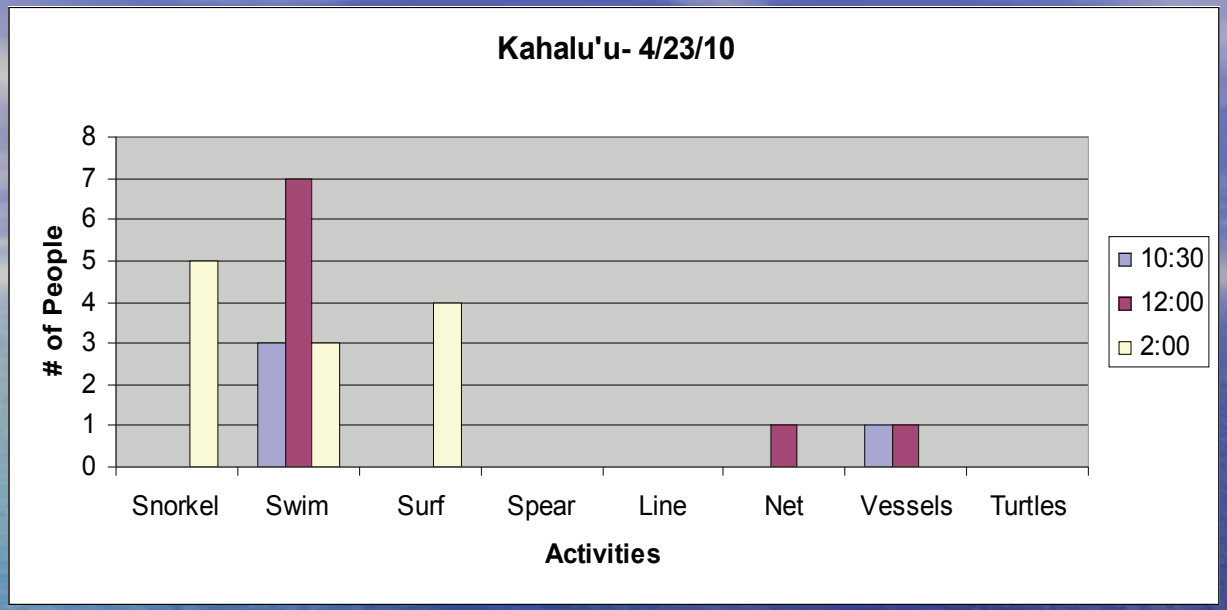

Nitrate (mg/L)
Nitrate
3.5
3
2.5
2
1.5
1
0.5
0
Kahalu'u
Kukio
2010
2011

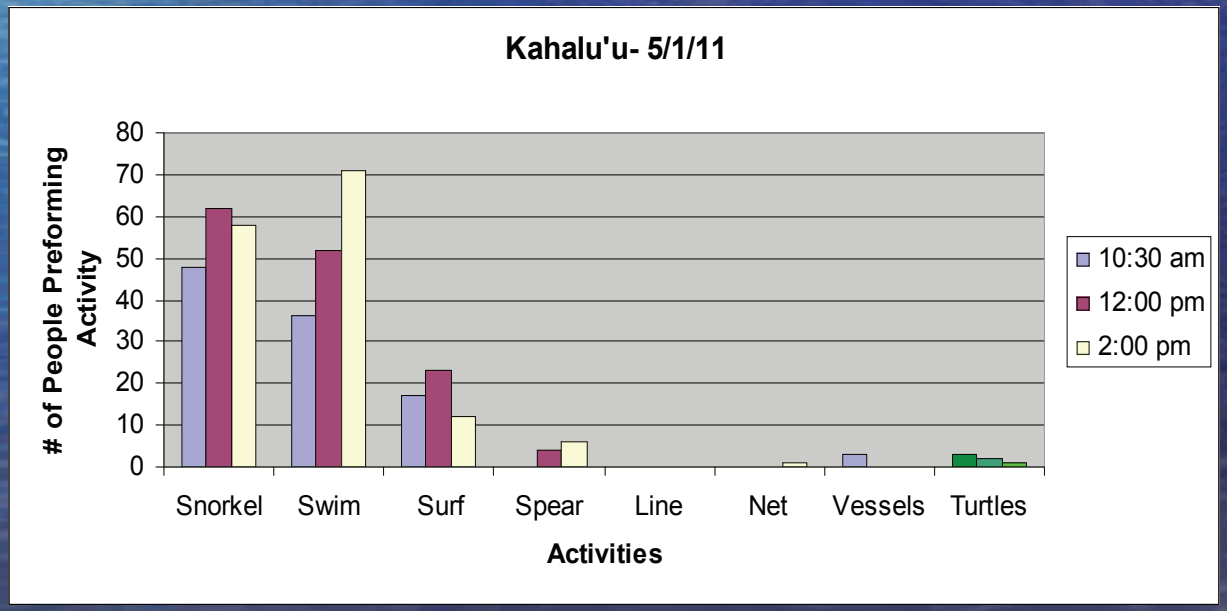

Amonia (mg/L)
Amonia
0.6
0.5
0.4
0.3
0.2
0.1
0
Kahalu'u
Kukio
2010
2011

Human Activity/ Impact Survey Data






Kahalu'u- 4/23/10
# of People
0
1
2
3
4
5
6
7
8
Snorkel
Swim
Surf
Spear
Line
Net
Vessels
Turtles
Activities
10:30
12:00
2:00


Kahalu'u- 5/1/11
# of People Preforming Activity
0
10
20
30
40
50
60
70
80
Snorkel
Swim
Surf
Spear
Line
Net
Vessels
Turtles
Activities
10:30 am
12:00 pm
2:00 pm

Conclusions:

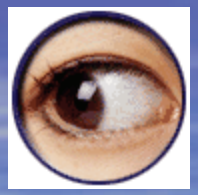
After comparing our 2010 & 2011 Data from both Kahalu'u & Kukio sites, we found:

- No significant difference in water quality:
  Both sites had good water quality ranges in all categories
- Kukio had more coral cover and urchins than Kahalu'u
- Reef fish abundance & diversity was much higher at Kahalu'u
- Kahalu'u hosts significantly more people than Kukio
  (250% more on weekend days)
- More green sea turtles were sighted at Kukio

Our Hypotheses were correct regarding urchin abundance coral cover, and human activity.

We were incorrect with our predictions on reef fish abundance. and water quality.

Observations:



- Fish at Kahalu'u were habituated to people & easier to count, where fish at Kukio were fearful.
- Kahalu'u has the appearance of more enforcement, as Life Guards and Reef Teach personnel are present.
- Neither site showed significant Tsunami damage to the reef substrate, per our pre & post tsunami data.

Acknowledgements:

Mahalo Nui Loa to Kohala Center for all their support and funding: Samantha Birch expertly coordinated resources & guided our field studies with assistance from Caroline Neary and Erica Perez.

Mahalo to NOAA for providing the B-Wet Grant to Kohala Center that allowed us to complete our field studies.

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We also wish to thank our science teacher, Ms. Diaz, and parents who made our field ecology studies at Kahalu'u and Kukio possible.