



DATE:		Name:		Depth:					
Site name:		Buddy:		Time:					
				* = Reef Check					
Species	Name	0 - 20m	25 - 45m	Total	Species	Name	0 - 20m	25 - 45m	Total
Phylum Echinodermata									
<i>Sea cucumbers</i>									
<i>Holothuria atra</i>	Black Cuke				<i>Hermit crab spp.</i>	Hermit crabs			
<i>Holothuria whitmaei</i>	Teated				<i>Panulirus spp.</i>	*Lobster			
<i>Acanthopyga</i>	White Spotted				Phylum Annelida				
<i>A. obesa</i>	Plump (Red)				<i>Loimia medusa</i>	Spaghetti			
Urchins					<i>Sebelastarte</i>	Featherduster			
<i>Echinometra</i>	Rock Boring				Phylum Platyhelminthes				
<i>Echinodrx</i>	*Blue black				<i>Flatworm spp.</i>	Flatworm			
<i>Echinodrx</i>	*Banded				Phylum Mollusca				
<i>Diadema</i>	*Long spined				<i>Saccoglossans</i>	Sap Suckin Slug			
<i>Tripneustes</i>	*Collector				<i>Aplysia spp.</i>	Sea Hare			
<i>H. maunaliolatus</i>	*Red Pencil				<i>Conus spp.</i>	Cone shells			
STAR Echinoderms					<i>Morula spp.</i>	Morula			
<i>Ophiocoma spp.</i>	Brittle star				<i>Drupa spp.</i>	Drupa			
<i>Acanthaster</i>	*Crown of thorns				<i>Octopus spp.</i>	Octopus			
Comments:					<i>Nudibranch spp.</i>	Nudibranch			
					<i>Cypraea spp.</i>	*Cowry			
					<i>Charonia tritonis</i>	*Tritons Trumpet			
					TURTLES				
					TAG #				
					Description				



**THE CASE OF THE INVADED REEF****OBSERVATION SHEET**

TEAM NAME: _____

DATE: _____

WEATHER CONDITIONS: _____

- Lay out the transect line 50m in the area of the scene of the invaded reef. Have members of your team secure each end of the line.
- Identify suspects and record all species of fish and invertebrates that you find along the line. If you are unable to identify a species, record the basic Reef Check codes:
 - HC for hard coral
 - SD for sand
 - RC for rock
- Record what you see directly under each point on the transect line on your data sheet. Substrate type will be recorded at 0.5 m intervals along the line, i.e. at: 0.0m, 0.5m, 1.0m, 1.5m etc. up to 19.5m (40 data points per 20 m transect segment), and 25m to 44.5m.

Observations

Record your observations of the two sections of coral reef studied.



THE CASE OF THE INVADED REEF

EVIDENCE DATA SHEET 2

We will be measuring the concentration of phosphorus in the form of phosphates in the water. The concentration is measured in mg/l, which is equivalent to parts per million (ppm). Phosphorus is an element that living things need. It is usually present in the water as a compound called phosphate. Phosphates are released into the water when dead plants and animals decompose. Phosphates are also added to water from sewage and animal wastes. Soaps or detergents and lawn fertilizers are another source of phosphates. If phosphates in the water are too high, algae and phytoplankton grow rapidly. This upsets the balance of life on the reef.

The waters of 'Anini Reef are classified as Class 1 waters: to remain "in their natural state as nearly as possible with an absolute minimum of pollution from any human caused source". (*Chapter 54 of Title 11 of the Hawai'i Administrative Rules*). Class 1 waters are not as protected as other classifications because the flushing rate is so high. What does that mean? The open ocean waves and strong currents keep the water churning and mixing all the time. Nutrients and other pollution from runoff do not linger. Seasonal changes are evident. In summer on the North Shore when the water is calm, the flushing rate is lowered and we see increased levels of algae on the reef.

Method: Collect seawater samples from one site along a transect line. We will also test water from a stream flowing into the sea. Follow the directions on the test kits. If instructed, use gloves and safety goggles when handling the chemicals in the test kits. Record your results below:

Data

	'Anini Transect A	'Anini Transect B (near restroom)	Stream	Other
Phosphates in ppm				

1. What can you conclude from this data? How does it relate to the Case of the Invaded Reef?
2. Where would you expect phosphate levels to be higher? Was your expectation correct?
3. What conditions might contribute to higher phosphate levels at different times?
4. What can we do to reduce the amount of phosphates that people add to the ocean?
5. Record the amounts salinity, turbidity, conductivity or other data if you have other tools to do so.



THE CASE OF THE INVADED REEF

LEARNING LOG - 6

INVESTIGATOR'S NAME: _____

DATE: _____

Your task:

- Find out who the invaders are!
- Gather evidence of what allowed this invasion to occur.

Hypothesis 1: Develop a hypothesis that addresses: a) which suspects are responsible for the invaded reef, and b) why they are responsible.

Method: Describe the method you will use to solve the case.

Summary of Evidence Gathered: Interviews: Summarize key points from interviews.



THE CASE OF THE INVADED REEF

CRIME SCENE REPORT

PRELIMINARY INVESTIGATOR: Dr. Pheelay O’Pheesh, SOS Marine Biologist

GEOGRAPHIC LOCATION: ANINI BOAT RAMP: 22° 13.759 ‘N, 159° 26.437 ‘W

Fringing Reefs – ‘Anini Reef, ‘Anini Beach Park (see map provided)

CRIME SCENE: Corals were found smothered and killed. Evidence gathered shows impacts most severe on reefs nearest to the bathrooms west of the boat ramp. The reef at ‘Anini is also “invaded.” Fish were less abundant west of the boat ramp in front the bathrooms. And many corals appear to be smothered.

INVESTIGATOR’S NOTES: HISTORY OF ‘ANINI:

‘Anini is Hawai‘i’s third largest fringing reef. It is one of the longest and widest fringing reefs in Hawai‘i at 2 miles long and 1,600 feet wide at its widest point. There is a narrow calcareous sand beach inshore of ‘Anini Reef. Early Hawaiians raised taro and fish in ponds constructed along the shoreline. Streams flowed into the fishponds and through the many *lo‘i kalo* (taro patches) that Hawaiians built to grow their staple food crop. Rice was also grown in this area in the early 1900s. One story speaks of “Anini (Wanini) at the seashore there are two stones, Pohaku Aweoweo (big), Pohaku ‘U‘u by the sand for fishing. “The stone called “Pohaku-alalauwa” lies in the sea between Kalihi-kai and Wanini. When the *alalauwa* fish was seen to swim partly around this rock it meant that schools of this fish were coming to the shores of this island, but, if they swim all around it then they will go to every island of the group...” Source: www.Kumupono.com

KEY EVENTS:

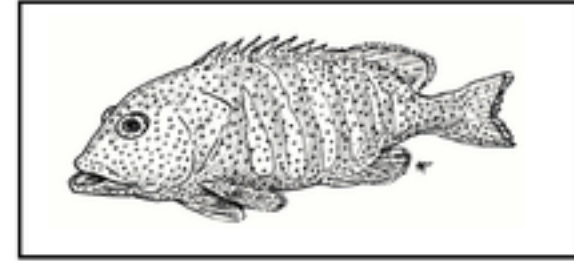
- 1940 - Sugar and pineapple plantations left exposed soil that washed into the ocean during heavy rains.
- 1959 – Konohiki (local fishing rights) change as Hawai‘i becomes a state of the union.
- Princeville Ranch obtains a lease of 2,500 acres of land near ‘Anini. Hills become severely eroded by cattle grazing, which causes more sediments to run off onto the reef.
- There is an old dump that drains into the first set of streams.
- To the east, Kalihiwai Valley and homes of Kalihiwai Ridge “drain” to Kalihiwai River.
- Cesspools dug during land development leach raw sewage into the surrounding watershed during heavy rainfall.
- The boat ramp has potential pollution impacts.
- When human population growth in the area increased, more land was cleared for houses and roads, causing more sedimentation.
- 1983 – Kaua‘i Polo Club began holding events at ‘Anini field (above ‘Anini Beach Park) that contributed to run-off of soil and nutrients such as nitrates and phosphates.
- 2000 – EPA issued nationwide ruling that outlawed cesspools in favor of septic tanks.



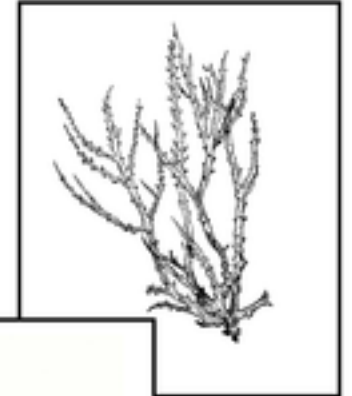
SUSPECTS: All of the following are suspected invaders!

Biotic (Living) Suspects

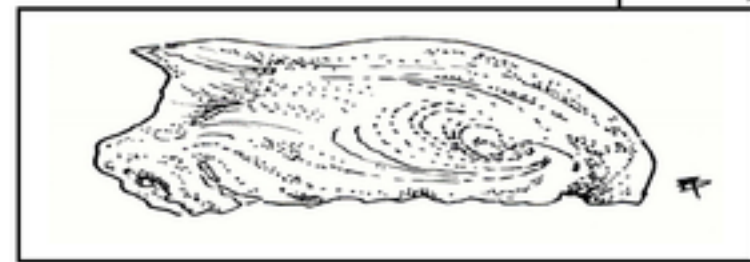
1 Blue Spotted Grouper (*Cephalopholis argus*) This introduced invasive species out-competes native fish for space on the reef. It is also known to carry a toxin called ciguatera that can make humans sick when they eat this fish.



2 Prickly seaweed (*Acanthophora spicifera*) is very aggressive and it is reported to be the most widespread alien *limu* in the Islands.



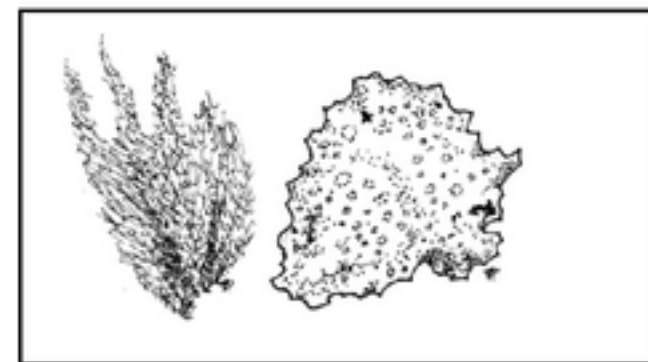
3 Cladophora (*Cladophora sericea*) Suspect first sited at 'Anini in 1970. This native *limu* has a reputation for competing with coral for light and nutrients, taking over in summer and smothering its victims.



4 Green bubble algae (*Dictyosphaeria cavernosa*) This native species at 'Anini is suspected of using its bubble-like pockets to hide something that might give it an advantage over other species. What might that be?



5 Cyanobacteria This algae has been sited in large numbers on some reefs in Hawai'i. It is known to cause swimmer's itch.



Abiotic (Nonliving) Suspects

6 Pollution: **Point source pollution** that comes from a single source, such as a factory or treatment plant, and **non-point source pollution** that comes from activities such as fertilizing a lawn, cesspools, or driving a car.

7. Sediments: Large amounts of sediments can wash onto the reef during a heavy rain. These particles physically damage coral polyps and minimize the available light required for photosynthesis.



CRIME SCENE REPORT

'ANINI MAP

