

Sea Cucumber Abundance Survey at Wai`opae Tidepools in Kapoho, Hawai`i

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Introduction

On June 26, 2015, the Hawai`i State Board of Land and Natural Resources enacted a 120-day emergency ban on the taking, possessing, or selling of sea cucumbers from Hawaiian waters. The ban was put in place in response to activities taking place on Maui and O`ahu, where it was discovered that 3,000 – 4,000 sea cucumbers had been harvested for export to China for food and medicinal purposes. Sea cucumbers are an important part of the reef ecosystem: they clean the sediments on the sea bed of excess organic matter and excrete clean sand. Therefore, the health of the reef ecosystem is dependent upon the health of the sea cucumber population

While the ban was in place, members of the Vacationland community in Kapoho, Hawai`i witnessed the harvest of sea cucumbers from the Wai`opae tidepools. Residents realized that they had no baseline data on sea cucumber populations to measure the impact of harvest in the area. Due to a longstanding relationship between Kapoho residents and UH Hilo (the result of years of research being conducted by UH professors in that area), UH Hilo professor Dr. Takabayashi was asked to conduct a baseline survey. Dr. Takabayashi requested the help of the Marine Option Program to provide students and equipment for the survey.

Wai`opae is a unique section of coastline that consists of a series of interconnected “pools” that extend several hundred yards seaward before dropping off rapidly to more open reef. Pools can be anywhere from less than a meter deep to several meters deep. At low tide, some pools are connected only by small gaps in the rock, while at high tide water washes over vast areas and flows more freely between the pools. Several coral species can be found in the pools, but most of the reef consists of Montiporids and Poritids. Habitat is complex due to large coral structures and many cracks and caves within the rock substrate. One important aspect to note about Wai`opae is that the southern portion of the site is designated as a Marine Life Conservation District (MLCD), where the taking of sea creatures is highly regulated. Specific rules for the Wai`opae MLCD can be found on the Hawai`i Department of Land and Natural Resources (DLNR) Division of Aquatic Resources (DAR) website.

This baseline survey will determine the abundance of sea cucumbers within and outside of the MLCD, and due to the nocturnal nature of some species, will consist of a daytime survey and a nighttime survey.

Materials and Methods

The following items were utilized for this research:

- slates with pencils attached
- Sea Cucumber Abundance Survey data sheet (attached)
- dive lights
- glow sticks weighted with lead fishing weights
- mesh bag
- camera

Each diver was required to have the following gear:

- full wetsuit
- felt-sole tabis
- strap fins
- mask and snorkel
- gloves (recommended)
- weight belt (recommended)

The species surveyed included: *Actinopyga mauritiana*, *Actinopyga obesa*, *Holothuria atra* / *Holothuria whitmaei* (black holothurians), *Holothuria difficilis*, *Holothuria edulis*, *Holothuria hilla*, *Holothuria impatiens*, *Holothuria pervicax*, *Stichopus horrens*, *Stichopus sp* (Hawaiian Yellow-tip Sea Cucumber), and *Euapta godeffroyi* / *Opheodesoma spectabilis* / *Polyplectana kefersteini* (Accordion Sea Cucumbers). One observer noted the presence of *H. c.f. hilla*, a species characteristically very similar to *H. hilla*, but not positively identified as such. Note: The c.f. is used in taxonomy when a specimen is very close to a known species, but there is some uncertainty as to whether it is in fact an individual of that species.

Four pools at Wai`opae were surveyed during both daytime and nighttime hours. Two of the pools were within the boundaries of the MLCD, while the other two were outside of the boundaries. Research teams consisted of three members. The group leader was a researcher familiar with the study site, while the remaining two team members were either new to the site, new to surveying, or were familiar but participating for more experience.

Teams were assigned to pools on site once conditions could be assessed. The pools have numbers that have been designated by Dr. Takabayashi's research lab (<http://maunaloa.uhh.hawaii.edu/~misaki/Welcome.html>). Pools 4 and 5 within the MLCD and pools 12 and 17 outside the MLCD were surveyed.

Teams began the daytime survey at approximately 15:30 local time, and designated the boundaries of the pool by deploying weighted glow sticks along the edge. Once boundaries were set, all sea cucumbers within the pool were counted. Care was taken to look for cucumbers in cracks and under rocks, all places where a harvester might look. Each team carried a camera in case there was a species that was difficult to identify. A picture could be taken and the individual identified later. However, no pictures needed to be taken for this purpose.

Teams began the nighttime survey at approximately 18:45 local time (sunset occurred at 18:17), and counted all sea cucumbers within the boundaries of the pool (designated by the glow sticks). Again, each team carried a camera in case there was a species that was difficult to identify. A picture could be taken and the individual identified later. However, no pictures were taken for this purpose.

Data were compiled into a table (see results section) and submitted to DLNR for their record.

Results

See Table 1 below. Note that *H. c.f. hilla* was counted by only one observer.

Time	Pool	<i>A. mauritiana</i>	<i>A. obesa</i>	<i>H. atra</i> / <i>H. whitmaei</i>	<i>H. difficilis</i>	<i>H. edulis</i>	<i>H. hilla</i>	<i>H. impatiens</i>	<i>H. pervicax</i>	<i>S. horrens</i>	<i>Stichopus sp.</i>	<i>E. godeffroyi</i> / <i>O. spectabilis</i> / <i>P. kefersteini</i>	<i>H. c.f. hilla</i>
15:30	4	0	0	8	3	0	0	0	0	0	0	1	-
15:30	5	17	54	46	1	0	0	0	0	0	0	1	-
15:30	12	3	1	4	0	0	0	0	0	0	0	5	-
15:30	17	2	10	13	0	0	0	0	0	0	0	0	-
18:45	4	1	0	11	4	0	1	5	43	4	5	14	-
19:00	5	6	21	37	2	0	2	20	8	72	0	13	24
18:45	12	2	2	3	0	0	0	0	6	3	0	17	-
18:45	17	0	8	13	1	0	1	0	4	7	0	9	-

Table 1. Abundance of sea cucumbers in Wai`opae tidepools 4, 5, 12, and 17 during daytime and nighttime on October 3, 2015

Discussion

Since the purpose of this survey was to create a baseline for the population of sea cucumbers in Wai`opae, it is difficult to say whether these results demonstrate a healthy population. However, if there are questions as to the impact of sea cucumber harvesting in the future, this research can be referenced for comparison. At the time of this writing, the ban on harvesting has expired.

It is important to comment on the methods used for this survey, as it will be difficult to replicate them in the future. The boundaries of the pools were left to be decided by the team members surveying each individual pool, and a future research team may not identify the same boundaries. Additionally, the sizes of the pools vary from one to the next, and due to the arbitrary boundaries, it would not be possible to determine the size of the defined area. This makes it difficult to determine the number of sea cucumbers that could be expected in a given area. This could be remedied in future studies by using belt transects or other benthic survey methods that look at well-defined areas.

Substrate type was a major factor in sea cucumber abundance between pools. Pools 12 and 17 had large amounts of pavement-type substrate, while pools 4 and 5 consisted mainly of rugose coral heads. Pools 4 and 5, especially at night, had a higher abundance of sea cucumbers than did 12 or 17. However, the degree of difference is hard to measure due to the difference in size of the pools. It is possible that the difference in abundance was due to pools 4 and 5 being within the MLCD boundaries, but given that sea cucumbers have not been historically harvested in high numbers in this region, that is not necessarily a reasonable conclusion.

Further studies, using more replicable methods and asking specific questions, may be able to tease out the causes of the patterns observed in this study. Additionally, further studies using more refined methods would be useful in creating a time series to identify any trends in sea cucumber populations in the area.

Acknowledgements

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Wai`opae Sea Cucumber Survey Data Sheet

Time:	Pool #:	Tide:	Weather:
Date:	Max Depth:	Surf:	
	White-spotted Cucumber <i>Actinopyga mauritiana</i>		Impatient Sea Cucumber <i>Holothuria impatiens</i>
	Plump Sea Cucumber <i>Actinopyga obesa</i>	 © Keoki Stender	Stubborn Sea Cucumber <i>Holothuria pervicax</i>
	Black Holothuria <i>H. atra / H. whitmaei</i>		Warty Sea Cucumber <i>Stichopus horrens</i>
 © Keoki Stender	Difficult Sea Cucumber <i>Holothuria difficilis</i>	 © Keoki Stender	Hawaiian Yellow Tip <i>Stichopus sp.</i>
 © Keoki Stender	Edible Sea Cucumber <i>Holothuria edulis</i>		Accordion Type <i>E. godeffroyi /</i> <i>O. spectabilis /</i> <i>P. kefersteini</i>
	Light Spotted Sea Cucumber <i>Holothuria hilla</i>		

Names of team members: