# VARYING IMPACT OF HUMAN FEEDING ON PINK WHIPRAYS, *HIMANTURA FAI*, AT TWO SITES ON MO'OREA

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*Abstract*. This study was conducted on Mo'orea, French Polynesia to investigate and record the impacts of ecotourism on two populations of *Himantura fai*, pink whiprays or pink whiptail stingrays. Two sites were chosen each with varying impact to rays. Photographs and recordings were made and analyzed. 38 individual rays were identified, 29 from one site, 8 from the other. Five kinds of scarring were described and compared between the two. It was found the more dense ray population was more injured and impacted and habituated to humans. The higher frequency of injury suggests a lower quality of life and indeed a negative impact from ecotourism. A mock mark and recapture study was done using the Licoln-Peterson method. The population estimates were 30 and 8, suggesting the 29 and 8 rays identified are the entire populations. No rays were seen at both sites, which suggests site fidelity.

*Key words: Himantura fai; pink whiptail; pink whipray; stingray;, ecotourism*

## INTRODUCTION

People are fascinated with nature and its many ecosystems. As a result an entire industry of eco-tourism has developed, particularly in ideal vacation haunts and locations with unique and exotic flora and fauna. This rapidly growing industry is very controversial. It can be incredibly lucrative for the country or the village it occurs in, yet it also can alter natural behaviors to incredible degrees. This is particularly visible in the case of feeding wildlife. Feeding wildlife poses many risks both to the species and to the people feeding (Orams 2002). Feeding also causes changes in social structure, interspecies interactions and by increasing population densities in the location the species are being 2006). Marine ecosystems are particularly susceptible especially In the case of Dasyatids, the family containing rays, skates, sharks, and other cartilaginous fishes. Waters are chummed all over the world in order for boaters, snorkelers, and SCUBA divers a like to get a look at these fascinating creatures. the family containing rays, skates, sharks, and other cartilaginous fishes. Waters are chummed all over the world in order for boaters, snorkelers, and SCUBA divers a like to get a look at these fascinating creatures.

Feeding of Dasyatids is everywhere but is particularly concentrated along the coast of Latin and South America. The target species there is Dasaytis *americana,* commonly known as the Southern stingray. The vast amounts of feeding tours and operations there have led to a large population of rays altering their natural behaviors and becoming dependent on humans (Semenuik 2008). The results of other studies on the southern stingray have further solidified this result. This kind of tourism is spreading like wildfire internationally and the altered behavior is soon to follow.

One species *Himantura fai*, the pink whiptail stingray or pink whipray, which is found in Moorea, Fench Polynesia is a species that has not been studied in any detailed capacity, yet is being targeted by ecotourism.

The feeding of this species is leading to forced interactions with black tip reef sharks, *Carcharhinus melanopterus*, a predator of the pink whipray. Furthermore, the species, normally a solitary forager is being forced into dense populations as a response to the constant food source. Through lessons learned in the past and in the majority of papers on group living and tourism involving rays, and every species affected by ecotourism we can safely say that these populations are on their way to human dependence and decreased health. Through studying them we can match the detrimental signs documented on other species and show that there is reason to stop this kind of tourism, or at least adjust the methodology. In general the populations being fed are more injured, bare higher parasite loads, and lose natural cycles and their idea of seasonality for mating behaviors (Semeniuk 2008). By beginning to gather data on this specific species we can attempt to prevent the negatives of tourism and modify our human behavior in order to help keep this unique organism in its evolutionary role in the coral reef ecosystem. For the two populations I studied I would like to know 1) What explains the differences between scars/injuries found on *Himantura fai*? And 2) How large are the populations at each site and are there any individuals found at both sites? The individuals in the lagoon, Site 1, will have a higher frequency of injuries as well as a higher population. The higher incidence of injuries will be caused by the denser population and the also deeper water allows for more boats. There will no overlap between the populations.

## METHODS

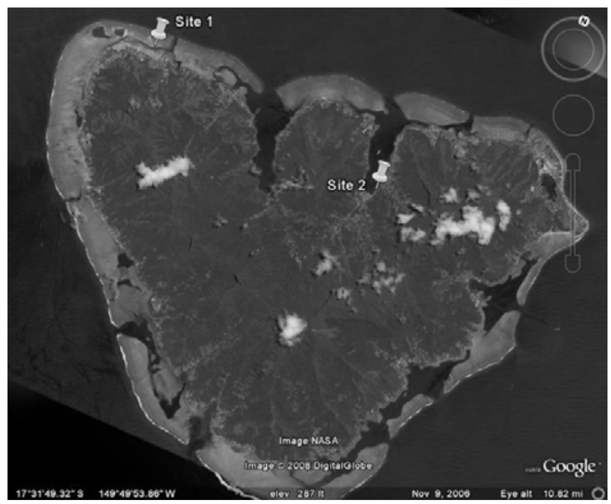


FIG. 1. Map with study sites labeled via Google Earth

To conduct this study two sites were used, one, a lagoon near the motu Tihura 17°29'15.94"S and 149°54'0.36"W and the other in Pao Pao/Cook's bay outside of the restaurant Te Honu Iti 17°30'17.96"S and 149°49'8.31"W. For this I used an underwater camera, standard camera, and an underwater video camera as well as a second person to help record data and as a safety measure.

### *Study organism*

*Himantura fai* (Jordan and Seale, 1906), or as commonly called the pink whiptail stingray or the pink whipray, was the focus of this study. It is part of the Family *Dasyatidae*, Order *Rajiformes*, and Class Elsamobranchii. This species tends to be found in sandy areas just outside reefs and that they are solitary bottom feeders with large home ranges, known prey are stumatopods. They are associated with tropical waters and coral reefs. They can be a variety of colors from brown, tan, pinkish, to dark grey. The largest recorded weight is 18.5 kg. They are venomous. The species is found primarily in the Indo-Pacific (Mould).

FIG. 2. *Himantura fia*

*Observations*

First, depth of each of site was measured by using a transect tape and taking three measurements at different, random areas in the site and then averaging the depths together. Each observation took place at the site for one hour on different days and at different times, which were dependent on transportation. Each sit was observed five times, for a total of ten observations. I broke down the hour by alternating photography and recording every fifteen minutes; however if there are no rays present during the first photography time period I did not record. After each observation I will uploaded the pictures and the film. Using the different types of scaring and injuries individuals were identified categorize them and then put them into a data table as well as the depth for each site. Furthermore I recorded the numbers of boats and the presence or absence sharks at the sites every fifteen minutes. Using the scars and injuries individuals were identified, numbered, and organized.

*Mark recapture*

To estimate the populations of rays at the two locations the Lincoln-Peterson method was used.

The equation for this is $N = \frac{MC}{R}$, where N=Population size, M=total numbers of animals captured and marked on first visit, C=total numbers of individuals captured on second visit, and R=number of individuals marked during visit one and recaptured during visit two. Only two observations were used to estimate populations. Unlike traditional mark recapture methods I neither marked nor recaptured individuals. I used the individuals identified using the scar and injuries. With these identifications I went through the film again and sample two observation hours. I will look at total numbers of rays for each visit. Furthermore, I compared the tapes for each site and looked for rays from Site 1 showing up at Site 2, which will lead to a general idea of site fidelity.

## RESULTS

### *Observations*

From analyzing the data from the 10 observations a total of 38 individual rays were identified, 29 from Site 1 and 9 from Site 2. The scars were split into 5 categories, wavy, thin scrape, scrape cluster, co-specific bite, and thick black. Examples of each can be found in Figures 3, 4, and 5. The scars were then counted for each individual ray and for respective sites. The site counts were put into graphical form, see fig. 6. Average number of scars per ray, most scars per ray, average depth of site, and Presence of boats and sharks were all acknowledged and placed into Table 1.

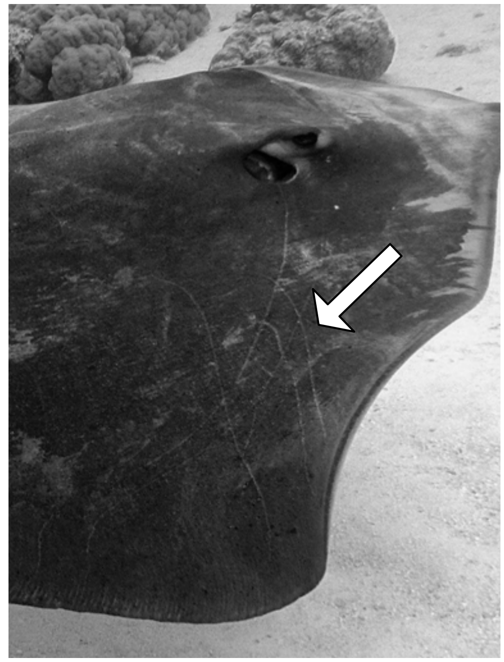

FIG. 4. Example of Thin Scrape

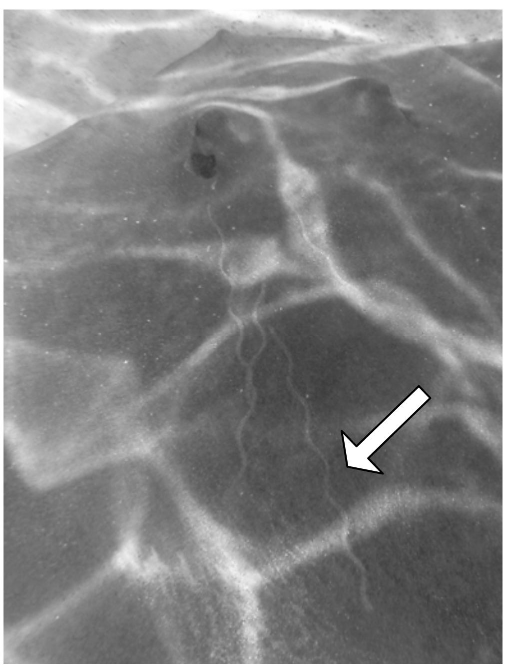

FIG. 3. Example of Wavy Scar

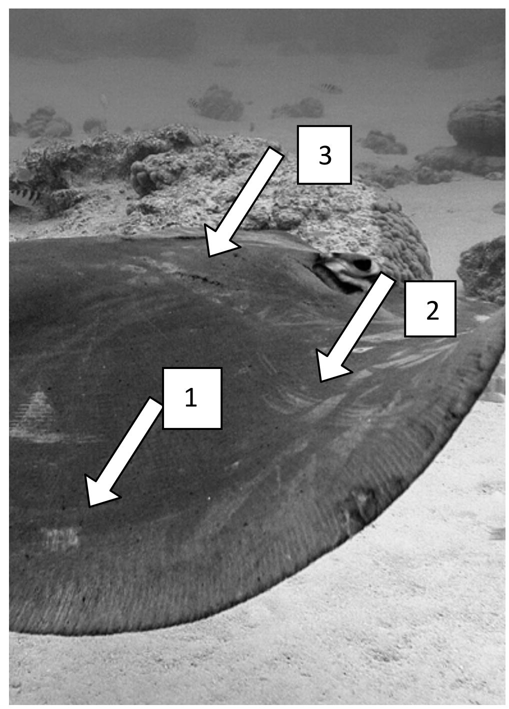


FIG. 5. Example of Cospecific Bite (1), Scrape Cluster (2), and Thick Black Scar

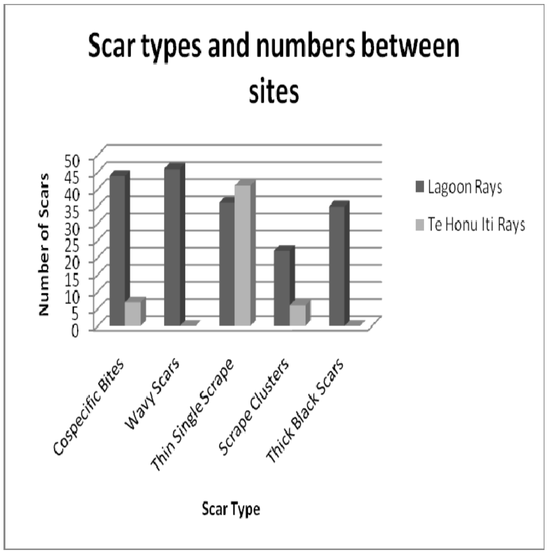


FIG. 6. Comparison of Scar Types at two locations

*Mark and recapture*

The Licoln-Peterson method was performed twice, once for each site. For site 1 the first observation used was October 13th, 2008 and the second November 10th, 2008. The first observation yielded 13 marked rays. The second observation yielded 10 rays, 6 of which were present in the first observation. Using the equation the population estimate for site 1 is 30 individuals.

The same procedure was done for site 2. The first observation used was October 19th, 2008 and the second November 10th, 2008. The first yielded 8 rays and the second 2, with the same two having been identified before. This gives a population estimate of 8 rays, again using the Lincoln-Peterson equation.

DISCUSSION

The results obtained support the main hypothesis. At site one, which is larger, has more human impact, and boat traffic the rays have more scars and a higher population. The Site 2 rays also have injuries and when looking at averages the two do not seem so different; however, there was one ray at Site 2 who was heavily injured that skewed the results, this ray is known as THI1. The rays at Site one were fairly equal in their injury numbers.

Five scar types were identified, but only three were found at both sites. Wavy and thick black scars were absent at Te Honu Iti. Although not thoroughly tested I believe the wavy scars are caused by anchor chains. The absence of boats at Te Honu Iti would fit this theory quite well. This also may suggest that the thick black scars may be caused by the increased boats, sharks, or human presence at Site 1 versus Site 2.

TABLE 1. Data from Observations

| | Lagoon | Te Honu Iti |
|---|---|---|
| Number of Individuals Identified | 29 | 9 |
| Average Number of Scars Per Ray | 6.31 | 6 |
| Highest Number of Scars on One Ray | 22 | 15 |
| Sharks | Present | Absent |
| Average Depth | 3.556 m | .69 m |
| Average Number of Boats Present | 3 | 0 |

Site 1 was incredibly impacted by humans. The rays at the site would swim up and onto you and they all responding to boat sounds and shadows. The waters were chummed and black tip reef sharks would compete for the food. The rays have no fear of humans and are getting food that does not fit their diet. A ray ate a fish head while I was watching, but it had to slam itself against the fish head and the ocean floor in order to get close to eating it. There is constant boat traffic and a constant stream of people. Co-specific bites, as defined in Semeniuk 2008, are caused by rays biting other rays when forced to live too close to one another. The incredible amount of co-specific bites at Site 1 is telling us that living in such close quarters with one another are negatively impacting them. The rays are definitely becoming habituated and my data reflects their body conditions are lowering because of it.

Site 2 also showed impact on the rays, but far less than 1. Te Honu Iti hand feeds the rays from outside the water and under lights so the guests are able to see them while they eat their dinners. Although there were injuries there are far less than at Site 1. Two categories of scars dropped out completely while two others are significantly less. Co-specific bites only accounted for 7 scars at site 2, while site one they accounted for 44. Furthermore, the rays at Site 2 left the site when it was not dinner hour at the restaurant. Te Honu Iti only feeds the rays once a night, except on Wednesdays when they are closed. I visited the site twice during the day and once on Wednesday at 7 pm and saw no rays. Even swimming and surveying the general area I saw nothing. To add to that I was only able to successfully photograph and videotape the rays from outside the water; these rays were so skittish that when I moved they dashed away from sight and did not return for some time. This leads me to believe that these rays still have some natural instinct left.

As for the population estimates I identified 29 rays at Site 1 and 8 at Site 2. The Licoln-Peterson method gave me estimations of 30 and 8 respectively. This reflects that I indeed captured most if not all of the rays at each site. Also, it proves there is no cross over between the two populations as no ray was seen at both sites.

This study had errors, the major one being a lack of consistency. Due to technology breaking down or simple availability conflicts I had to use different cameras. Each camera is unique and may have been clearer or less accurate depending. Furthermore, abiotic factors such as visibility or a heavy tourist day were not things I could control.

For future study a basic natural behavior study on *Himantura fai* would be incredibly useful and beneficial to ecology in general. No one has ever studied this species of sting ray and as our climate changes and coral reefs and ocean chemistry change it will be helpful to have as much information as possible on our current biodiversity. Also continued study on ecotourism impacts would allow us to stop a potential problem in its tracks. It would be more useful if vertebrate permits could be obtained and one could look at parasite loads and general medical health as added parts of the study. Ecotourism is something we have some control over and could prevent and potentially preserve a piece of biodiversity for future generations.

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