

2003 Limahuli Reef Monitoring Project

Results and Discussion Section:

At the end of the season in early November 2003, a total of seven survey locations within the boundaries of the eastern Limahuli stream mouth to Kee beach were selected for study sites. These sites were chosen to adequately represent the diversity and abundance of inner reef organisms typical to the Limahuli area. Survey locations include areas existing on both sides of the two Limahuli stream mouths, within the 300m zone between the stream mouths and at Kee Beach, which has considerably higher anthropogenic impact when compared to the Limahuli sites. (Please see attached map)

Each site consisted of a 50 or 100 meter transect belt along which species of fish, invertebrates, percentage of coral and algae were recorded. Species richness and abundance exhibited variance between survey locations.

Transects (1a), (1b), and (5) are located in close proximity to the eastern and western Limahuli stream mouths, respectively. Under normal stream flow and current conditions, these transects will receive a moderate to high amount of freshwater runoff.

Transects (2), (3) and (4) are located within the 300 meter zone in between the two stream mouths. This area under normal stream flow and current conditions receive little or no freshwater runoff.

The Kee transect is located just off the sandy lagoon at Kee beach and about 500m from the most western Limahuli stream mouth. This transect receives no freshwater runoff but is highly impacted by human activity, namely snorkeling by inexperienced tourists and fish feeding.

Results:

A summary of results for the survey location is as follows:

Transect 1a (50 meter):

Algal coverage consists of approximately *Dictyota sp.* (6%), *Padina sp.* (8%) and turf algae (40%). Coralline algae were not recorded.

Substrate consists of approximately rock (55%), rubble (8%) and sand (8%). Coral coverage exhibits *Porites lobata* (lobe coral, 9%), *Montipora capitata* (rice coral, 3%), *Lepastrea purpurea* (crust coral, 5%), and *Montipora flabellata* (blue rice coral, 8%). Species richness for coral is 5.

Mobile invertebrates include: *H. atra* (black sea urchin, 3%), *E. mathaei* (white spine urchin, 23%), *T. gratilla* (collector urchin, 7%), and *E. diadema* (blue black sea urchin, 3%). Species richness for mobile invertebrates is 5.

The most abundant fish recorded include *A. triostegus* (manini, > 25 recorded), *Thalassoma duperrey* (saddle wrasse, 13), *S. balteata* (belted wrasse, 12), and *Coris venusta* (elegant wrasse, 5). Species richness for fish is 11.

Transect 1b (50 meter):

Algal coverage consists of turf algae (48%), *Padina sp.* (8%), and *Dictyospheria sp.*, *Microdictyon sp.*, *Dictyota sp.*, and *Galaxaura sp.* all recorded at 5% or less. Species richness for algae is 16.

Substrate consists of rock (60%), rubble (16%), and sand (15%). Coral coverage exhibits *M. flabellata* (5%), and less than 2% of *M. capitata*, and *Pavona duerdeni* (pork chop coral). Species richness for coral is 3.

Mobile invertebrates include an abundance of *E. mathaei* (30) and only a few other single species recorded including *T. gratilla*, *H. atra*, and *L. medusa* (spaghetti worm). Species richness for mobile invertebrates is 6.

The most abundant fish recorded include *S. balteata* (11), *A. triostegus* (11), and *T. duperrey* (7). Species richness for fish is 20.

Transect 5 (50 meter):

Algal coverage consists of turf algae (40%), coralline algae (15%), *Gracilaria sp.* (9%), *Dictyospheria sp.* (6%), and less than 5% each of *Dictyota sp.*, *Neomeris annulata*, *Melanamansia sp.*, and *Galaxaura sp.* Species richness for algae is 11.

Substrate coverage consists of rock (84%), sand (12%), and *M. capitata* (3%). Species richness for coral is 1.

Mobile invertebrates include an abundance of *E. mathaei* (31) and a few individuals of *E. oblonga* (oblong urchin), *H. mammillatus* (red pencil urchin), *T. gratilla*, and *L. medusa*. Species richness for mobile invertebrates is 5.

The most abundant fish recorded include *A. nigrofuscus* (dusky, 20), *M. flavolineatus* (yellow barred goatfish, 18), *A. adominalis* (hawaiian sergeant, 18), *P. sindonis* (rock damsel, 16), and *T. duperrey* (17). Species richness for fish is 26.

Transect 2 (100 meter):

A total of four surveys were taken within the 100m of transect (2). Algal and substrate results have been calculated into total percent; however, fish and invertebrates represent the actual numbers for all four surveys combined.

Algal coverage consists of turf algae (38%), coralline algae (7%), *Padina sp.* (10%), *Dictyosphaeria sp.* (8%), and less than 2% of *Microdictyon sp.*, *Galaxaura sp.*, and *Melamansia sp.* Species richness for algae is 18.

Substrate coverage consists of rock (43%), sand (10%), *P. lobata* (24%), *M. flabellata* (8%), *M. capitata* (6%), and less than 3% of *P. compressa*, *P. meandrina*, and *Pavona varians* (corrugated coral). Species richness for coral is 7.

Mobile invertebrates include *E. mathaei* (>60), *E. diadema* (12), *T. gratilla* (8), *A. mauritiana* (white spotted sea cucumber, 12), and *H. atra* (5). Species richness for mobile invertebrates is 6.

The most abundant fish species observed include *L. kasmira* (blue stripe snapper, 60), *A. triostegus* (58), *T. duperrey* (40), *A. nigrofuscus* (40), *P. bifasciatus* (doublebar goatfish, 23) and less than 20 individuals each of *F. comersonii* (cornet fish), *S. balteata*, *T. ballieui*, and *P. multifasciatus* (many bar goatfish).

Transect 3 (100 meter):

A total of three surveys were taken within the 100 m of transect (3). Algal and substrate results have been calculated into total percent, however, fish and invert results represent actual numbers of organisms for all three surveys combined.

Algal coverage consists of turf algae (35%), coralline algae (4%), *Padina. sp.* (6%), and less than 4% each of *Cladophora sp.*, *Dictyosphaeria sp.*, *Dictyota sp.*, and *Galaxaura sp.* Species richness for algae is 16.

Substrate coverage consists of rock (49%), sand (16%), rubble (8%), *P. lobata* (10%), and *M. flabellata* (9%). Species richness for coral is 7.

Mobile invertebrates recorded include *E. mathaei* (61), *E. diadema* (12), *T. gratilla* (8), *A. mauritiana* (12), and *H. atra* (5). Species richness for mobile inverts is 7.

The most abundant fish species recorded include *A. triostegus* (92), *A. nigrofuscus* (65), *T. duperrey* (52), *M. flavolineatus* (15), and *C. venusta* (14). Species richness for fish is 38.

Transect 4 (50 meter):

Algal coverage consists of turf algae (52%), coralline algae (9%), *Dictyospheria* sp. (10%), *Lyngbya* sp. (6%), *Pterocladia* sp. (5%), and *Melanamsia* sp. (5%). Species richness for algae is 15.

Coral coverage consists of *P. evermanii* (brown lobe coral, 3%), *M. capitata* (1.5%), *P. damicornis* (>1%) and *A. edmonsoni* (soft coral, 1%). A few varieties of zooanthids were also recorded at this location, including, *Polythoa caesa* (2%), and *zooanthus* sp. (6%). Species richness for hard and soft corals is 4. Species richness for immobile invertebrates is 3.

E. mathaei (3) was the only species of mobile invertebrate recorded.

The most abundant fish species recorded include *T. duperrey* (27), *A. adominalis* (20), *S. fasciolatus* (pacific Gregory, 20), *A. nigrofuscus* (15), and about 5 individuals each of *P. imparipennis* (bright eye damsel), *S. balteata*, and *A. triostegus*. Species richness for fish is 23.

Kee Lagoon Transect (50 meter):

Algal coverage consists of turf algae (30%), coralline algae (11%), *Melanamsia* sp. (14%), *Dictyota* sp. (11%), and 5% each of *Galaxaura* sp., *Jania* sp., and *Dictyospheria* sp. Species richness for algae is 14.

Substrate coverage includes rock (74%), *P. evermanii* (13%), *M. capitata* (4%), and *P. lobata* (5%). Species richness for coral is 6.

The two mobile invertebrates recorded include *E. mathaei* (3), and *E. oblonga* (1). Species richness for mobile invertebrates is 2.

The most abundant fish species recorded include *Fistularia comersonii* (42), *P. sindonis* (23), *A. triostegus* (19), *Naso unicornis* (kala, 16), *T. duperrey* (15), and *A. leucoparicus* (whitebar surgeonfish, 13). Species richness for fish is 21.

Discussion:

When comparing the species richness between the highly impacted Kee Lagoon and the less impacted Limahuli site it becomes apparent that there is little difference between the two locations. When visually observing the differences in both locations, however, there is notable evidence that there exists a higher percentage of damaged living coral and dead coral that has been smothered by

the fins of recreational snorkelers. Fish populations appear healthy at both locations but there exists higher numbers of surgeonfish and chubs at Kee lagoon, which indicate fish feeding by the tourists. A question comes into play, would there be such a variety and abundance of fish species if the tourists were not feeding them? Turtles are also sighted around the Kee lagoon area where they have not been observed around the inner Limahuli reef area. Algal populations appear healthy at the Kee Lagoon site as well. An invasive species, *Acanthopora speciosa*, has been recorded at Kee, with observations of turtles feeding on this alga. At this time it does not seem to be a concern, but should warrant warning and further observation in future studies.

Species richness for mobile invertebrates is the smallest at all of the survey locations when compared to coral, algae, and fish. Transect locations (4) and Kee lagoon shows the least amount of mobile invertebrate species with only one and two species recorded, respectively. The rest of the transect locations exhibit numbers between 5 –7, for species richness, with *E. mathaei* dominating in all of the locations. When conducting a survey, only the invertebrates that fall within the quadrant at a specific meter location are recorded. After conducting a transect belt survey, a presence/ absence survey of the immediate area follows. In many, if not all, cases an increased number of invertebrates, coral and algae are recorded in the vicinity. The presence/ absence surveys are not included when considering species richness for a transect belt survey.

The species richness of fish varies slightly between the survey locations with a range of 11 at transect (1a) to 38 at transect (3), with the rest of the transect locations exhibiting numbers in the 20's. Transect (1a) and (1b) receive the greatest amount of freshwater runoff when compared to the other survey locations. Due to current and tidal fluctuations, the amount of freshwater runoff between (1a) and (1b) will vary within each site at any given time during the day. The low number for fish species richness at (1a) is most likely indicative of a time of day where there was an abundance of freshwater passing through the transect belt.

Transect locations (2) and (3) exhibit the highest numbers for species richness in both coral and mobile invertebrate surveys. This location is a 200-meter stretch in which there is little to no freshwater runoff at any time during the year. Anthropogenic impact is minimal, with only a few local fishermen using the area. Water depth varies in this area from less than 1 m during extremely low tide, up to 2 m during periods of high tide. This is also the area in which the reef team conducted a majority of the surveys; 4 surveys within the 100 m of transect (2), and 3 surveys within the 100 m of transect (3). When comparing species richness of these two locations with the other survey locations, it must be considered that because of increased survey use, the amount of species of invertebrates and corals recorded will be higher, just as our presence/ absence surveys record a higher amount of species richness.

Transect locations (4) and (5) exhibit low numbers for species richness in both coral and mobile invertebrate surveys. This location lies on either side of the western Limahuli stream mouth with a deep channel (named poholokeiki) running in between the two survey sites. The freshwater runoff most likely has an effect on the amount of coral and invertebrate species existing in this area. Transect (4), however, has deep crevices and holes where there exists an abundance of interesting and unusual species, namely a few of the zooanthids recorded during that survey. Visually, it is one of the most intriguing and mysterious of all of the survey locations. Team members would routinely emerge from the water with an interesting algal specimen or notes of an unknown organism.

During previous surveys of transect (5) the amount of urchins recorded has been off the charts. This most likely has to do with the time of day the survey is conducted. Many of the high urchin observations have been made in the afternoon hours, where this year's transect belt survey was conducted in the morning. The accessibility of transect (5) is very much so dependent on certain specific ocean conditions, which make it a very difficult area to survey. It wasn't until the end of the summer that we had our window to survey this site.